(1962). "ELAIDIC ACID AND ATHEROSCLEROSIS." Nutrition Reviews **20**(3): 79-79.

(1995). "TRANS-FATTY-ACIDS AND CORONARY HEART-DISEASE - MARGARINE NOT AS DANGEROUS AS BUTTER." Journal of the Royal Society of Health **115**(2): 73-73.

(2001). "Reduced trans fatty acid intake decreases the frequency of coronary heart disease in adults." European Journal of Pediatrics **160**(8): 516-517.

(2004). "Trans fatty acids - EFSA Panel reviews dietary intakes and health effects." Ernahrungs-Umschau **51**(10): 414-+.

The Scientific Panel on Dietetic Products, Nutrition and Allergies of the European Food Safety Authority published an opinion relating to the presence of trans fatty acids in foods and the effect on human health of the consumption of trans fatty acids. Trans fatty acids, like saturated fatty acids, raise LDL cholesterol levels in the blood, thereby increasing the risk of coronary heart disease. The panel concluded that at equivalent dietary levels, the effect of trans fatty acids on heart health may be greater than that of saturated fatty acids. However, current intakes of trans fatty acids are generally more than 10-fold lower than those of saturated fatty acids whose intakes in many European countries exceed dietary recommendations. The NDA panel also evaluated other health effects and concluded that scientific evidence with regards to a possible relationship of trans fatty acid intake with cancer, type 2 diabetes or allergies is weak or inconsistent. Finally, the panel advised that there are no analytical methods available to distinguish between trans fatty acids from natural sources and those formed during food processing.

Abilleira, E., et al. (2009). "Winter/Spring Changes in Fatty Acid Composition of Farmhouse Idiazabal Cheese Due to Different Flock Management Systems." Journal of Agricultural and Food Chemistry **57**(11): 4746-4753.

Typically, two different flock managements are employed by basque sheepherders in winter and spring. Thus, seasonal changes in the fatty acid (FA) composition of Idiazabal PDO farmhouse cheeses were studied. Ewe's raw milk cheeses elaborated in winter and spring were collected after 120 days of ripening from 10 Idiazabal PDO farmhouses. In winter, concentrate and conserved forages were fed, whereas a part-time grazing system was adopted from spring onward. Spring cheeses had less (P <= 0.05) saturated FA and higher (P <= 0.05) content of unsaturated FA, including trans-FA (mainly trans-vaccenic acid) and conjugated linoleic acid (CLA), branched-chain FA (BCFA), and n-3 FA. Principal component analysis (PCA) separated winter and spring cheeses into two groups by the combination of two principal components (84.2% of variance). Fresh pasture in the diet enhanced desirable FA and lowered atherogenicity index in cheeses, supporting the benefits of using a part-time grazing system for the consumer.

Abraham, R. A., et al. (2013). "Content of Trans Fatty Acids in Human Cheek Epithelium: Comparison with Serum and Adipose Tissue." Biomed Research International.

Studies pertaining to trans fatty acids (TFA), which have been implicated in development of chronic diseases, are more relevant in developing countries where nutrition transition is changing traditional habits and practices. Measuring TFA is an arduous task because of the need for fat biopsies. This study identifies a tissue, which can be easily accessed for analytical measurement of trans fatty acid. In this cross-sectional study, fatty acid in adipose tissue, cheek epithelium, and blood samples were assessed by gas chromatography. Spearman correlation coefficient was computed to study the correlation of fatty acid distribution among the three tissues. The correlation coefficient of total trans fatty acid between cheek epithelium and serum was 0.30(0.02) and between cheek epitheliumand adipose tissue was 0.33 (P< 0.019). This study is the first to report trans fatty acid profile in cheek epithelium giving scope for utilizing the cheek epithelium as a tissue for objective assessment of trans fatty acid intake.

AbuMweis, S. S., et al. (2006). "Intake of a single morning dose of standard and novel plant sterol preparations for 4 weeks does not dramatically affect plasma lipid concentrations in humans." Journal of Nutrition **136**(4): 1012-1016.

Recommendations for decreasing the risk of developing cardiovascular disease include increasing the intake of plant sterols and fish oil. The cholesterol-lowering action of plant sterols, when provided in a fish-oil fatty acids vehicle, remains to be investigated in humans. A randomized, crossover-feeding, single-blind trial was conducted in 30 subjects with mild-to-mode rate hypercholesterolemia to study the effects on plasma lipids of 2 novel forms of plant sterols: those combined with, or esterified to, fish-oil fatty acids. The treatments were margarine (control), free plant sterols, plant sterols esterified to fatty acids from sunflower oil, plant sterols esterified to very long-chained fatty acids from fish oil, and plant sterols combined with the same amount of very long-chained fatty acids from fish oil. Each sterol-containing food (1.0-1.8 g plantsterols/d) was consumed for 29 das a single dose with breakfast under staff supervision. Compared with the control treatment, none of the plant sterol preparations reduced plasma total cholesterol or LDL cholesterol, triacylglycerol, apolipoprotein A-I, apolipoprotein B, lipoprotein (a), or C-reactive protein concentration. Relative to the control phase, all plant sterols treatment increased the plasma HDL cholesterol concentration (P < 0.05) by similar to 8%. In conclusion, because standard forms of plant sterols did not reduce plasma cholesterol concentrations, the efficacy of the new formulation of plant sterols cannot be confirmed from the present study design, where plant sterols were given as a single morning dose.

Acar, N., et al. (2004). Metabolic and physiologic effects of trans fatty acids.

Trans fatty acids can be found in ruminant fats, in partially hydrogenated vegetable oils and in heat-treated vegetable oils. Following some data on the worldwide consumption of trans fatty acids, this paper reviews the studies carried out on the metabolic effects of trans fatty acids. Since trans fatty acids were shown to interfere with the metabolism of essential fatty acids and the oxidative metabolism of arachidonic acid, their physiological effects on platelet aggregation, lipoprotein metabolism and neuronal function are discussed.

Adhikari, P., et al. (2010). "Comparative study of trans fatty acid content in 2005 and 2008 processed foods from Korean market." Food Science and Biotechnology **19**(2): 335-341.

Trans fatty acids (t-FA) contents were analyzed in 26 food items that were collected from Korean grocery stores in 2005 and 2008. Lipid was extracted through Soxhlet and Mojonnier methods. Fatty acid profile, including t-FA and positional fatty acid composition was analyzed by gas chromatography. The comparative study of fatty acids composition including t-FA was employed in 2005 and 2008. Among the analyzed food items, most of the food items showed higher lipid content in 2005 than in 2008. Some food items such as biscuits (0.4-7.2 g/100 g of food), fried snacks (0.1-3.6 g/100 g of food), and cookies (0.4-2.4 g/100 g of food) contained relatively higher level of t-FA than other food groups (cracker, processed chocolate, and ice cream) in 2005. Comparing t-FA content in 2005, it was considerably decreased up to 91.5% in 2008 whereas saturated fatty acids (SFA) were increased up to 43.3% in the analyzed food items.

Akoz, M., et al. (2011). "The effects of trans-9 18:1 octadecenoic acid isomer on levels of sICAM-1, sVICAM-1 and IGF-1." Turkish Journal of Biochemistry-Turk Biyokimya Dergisi **36**(1): 1-5.

Objective: The effects of trans-9 18: 1 octadecenoic acid isomer from the fatty acid isomers taken with diet on soluble cell adhesion molecules (sICAM-1: Soluble intercellular adhesion molecule-1 and sVCAM-1: Soluble vascular cell adhesion molecule-1) and insulin like growth factor-1 (IGF-1) levels were investigated on rats. Method: The rats which were fed for two weeks by the same diet were separated into experimental and control groups. Fifty mg/day trans-9 18: 1 octadecenoic acid isomer was added to the diet of experimental group for 10 days. Following the completion of special diet, fatty acid composition in both groups was studied by gas chromatography analysis. Results: Trans-9 18: 1 fatty acid level in the experimental group was higher than control group (p<0.01). The soluble cell adhesion molecules (sICAM-1 and sVCAM-1) increased (p<0.01) and IGF-1 levels decreased (p<0.05) in rats fed with trans-9 18: 1 octadecenoic acid. Conclusion: Our results indicate that, high levels of dietary trans fatty acid isomers are a factor in the increasing of cell adhesion molecules (sICAM-1, sVCAM-1) levels and decreasing of IGF-1 levels. Hence, measurement of these parameters may be beneficial in patients with coronary artery disease and atherosclerosis, as well as in other pathological cases. We believe that these parameters may also be useful for early diagnosis.

Alavian, S. M., et al. (2008). "Hypertriglyceridemic waist phenotype and associated lifestyle factors in a national population of youths: CASPIAN study." Journal of Tropical Pediatrics **54**(3): 169-177.

The objectives of the current study, that is the first of its kind, were to determine the prevalence of the hypertriglyceridemic waist (HW) phenotype in a nationally representative sample of children, as well as the metabolic risk factors identified by HW, and to identify lifestyle habits related to this phenotype. This national survey was conducted on 4811 representative school-students. We assessed the sensitivity and specificity of the HW phenotype for abnormal anthropometric and biochemical factors by using receiver operator characteristic curves. We determined the association of dietary patterns (obtained by factor analysis), physical activity level and some environmental factors with the HW phenotype. Overall, 8.52% of participants had the HW phenotype. Those children with the HW phenotype were more likely to have cardiovascular risk factors, notably for overweight and hypercholesterolemia. The dietary pattern characterized by junk foods increased the odds of having the HW phenotype, OR = 1.426 (95% CI, 1.109, 1.892), whereas the other dietary pattern including healthy foods decreased this odds, OR = 0.874 (95% CI, 0.765, 0.998). The risk of the HW phenotype rose with the consumption of solid hydrogenated fat as well as white-flour bread. Low education of parents and a positive family history of diabetes mellitus, obesity and or premature cardiovascular disease were the other risk factors for the HW phenotype. Low levels of physical activity significantly increased the risk of having the HW phenotype. The HW phenotype can be used as an accurate and easy tool for screening children at metabolic risk in population-based studies.

Alcalde, S. M., et al. (2014). "TRANS FATTY ACID CONTENT IN FOODS MARKETED IN THE COMMUNITY OF MADRID (SPAIN)." Nutricion Hospitalaria **29**(1): 180-186.

Introduction: As a consequence of the scientific evidence which show that the high consumption of trans fatty acids is a risk factor of certain illnesses, sanitary authorities recommend less than 1% intake of trans fatty acids of the total energy intake. Moreover, the European Commission must present, by December 2014, a report about the presence of trans fatty acids in the aliments as well as in the diet of the European Union population. Thus, this study can provide useful information to reach this objective. Objectives: To determine trans fatty acid presence in some types of foods in the Community of Madrid. Methods: 170 samples of different foods commonly consumed by children and adolescents were selected and analized. All foods had been purchased in big shopping centers in the Community of Madrid during february of 2010. Results are shown as the percentage of each fatty acid compared to the total amount of fat in the aliment. Results: Only 33 products (19.4%) showed the presence of trans fatty acids over the method detection limit (>= 0.1g per 100g). The highest levels were found in dairy products, with an average content of 0,4%. Discusion/conclusiones: The trans fatty acid content of the analyzed foods can be considered low, compared with the amount reported by other authors in food products marketed in Spain and other countries in the past few years. Further studies should be undertaken to control nutrition security and diet quality of fat intake in the Spanish population, particularly among children and adolescents.

Aldamiz-Echevarria, L., et al. (2004). "Influence of diet on atherogenic risk in children with renal transplants." Pediatric Nephrology **19**(9): 1039-1045.

Cardiovascular disease is one of the main causes of morbidity and mortality in recipients of renal transplants. Although the risk for cardiovascular disease is in part genetically determined, it may also be influenced by diet. The aim of the present study was to analyze the cross-sectional association of dietary intake of nutrients with biochemical markers of atherogenic risk. The influence of diet on the plasma profile of fatty acids was specifically investigated. Twenty-nine children and adolescents (mean age 14 years, range 6-18 years) with stable renal transplants and on a normal diet recorded their food intake for a period of 3 days. The mean calorie intake was 40.6 kcal/kg per day (protein provided 16% of total calories, carbohydrates 45%, and fat 39%). Plasma levels of total cholesterol and low-density lipoprotein-cholesterol were significantly and positively related to intake of monounsaturated fatty acids ( r =0.66, P =0.007 and r =0.62, P =0.02, respectively) and to plasma levels of elaidic acid, a trans fatty acid ( r =0.43, P =0.02 and r =0.54, P =0.01, respectively). Insulin resistance, estimated from values of plasma glucose ( r =0.70, P =0.03), plasma insulin ( r =0.59, P =0.02), and HOMA index ( r =0.62, P =0.01), was also directly related to the intake of monounsaturated fatty acids. Plasma plasminogen activator inhibitor-1 activity correlated positively with total fat intake ( r =0.59, P =0.04). Plasma levels of homocysteine were negatively related to the intake of carbohydrates ( r =-0.62, P =0.02). We conclude that reasonable dietary recommendations to minimize the atherogenic risk in children with stable renal transplants should include a protein intake adjusted to the requirements for age, a large intake of carbohydrates leading to a low glycemic load, and a fat intake of less than 30% of the total calorie intake. The amount of monounsaturated and trans fatty acids in the diet should be especially limited. A sufficient intake of polyunsaturated fatty acids, with an adequate ratio between omega6 and omega3 components, should also be provided.

Alhassan, S., et al. (2006). "Blood lipid responses to plant stanol ester supplementation and aerobic exercise training." Metabolism-Clinical and Experimental **55**(4): 541-549.

The purpose of this study was to determine the independent and combined effects of plant stanol ester (PSE) margarine and aerobic exercise on blood lipid concentrations and related intravascular enzymes in 26 healthy sedentary, middle-aged men and postmenopausal women (age, 53 +/- 8 years; body mass index, 27 +/- 1.0, % fat, 28.5 +/- 2). In a stratified double-blind manner, participants were randomly assigned to either a PSE (n = 17) or a placebo (CON, n = 9) margarine group. Participants supplemented their daily diets with 42 g of margarine spread (PSE = 3 g; CON, PSE = 0 g, of approximately equal energy content) for 9 weeks. During the last 4 weeks of margarine supplementation (MS), participants expended 400 kcal on a treadmill 5 d/wk at 65% of <(V)over dot > O-2 reserve (2000 kcal/wk). Fasting blood samples were obtained before initiating and after 4 weeks of MS and after exercise training. All blood samples were analyzed for total cholesterol, low-density lipoprotein cholesterol, triglyceride, high-density lipoprotein cholesterol (HDL-C), hepatic lipase, lipoprotein lipase, and cholesterol ester transfer protein activities. Total cholesterol (-10%), low-density lipoprotein cholesterol (-13%). and triglyceride (-18%) concentrations decreased after 4 weeks of MS in the PSE group, but not in the CON group (P < .05 for all). Four weeks of aerobic exercise increased HDL-C by 21% in the CON group (P < .05) and by 4% in the PSE group (P > .05). Total cholesterol-HDL-C ratio decreased significantly (P < .05) in the PSE group, but not in the CON group. No other significant alterations were observed with either PSE or exercise. Our findings suggest that PSE is effective in reducing blood cholesterol concentrations and that exercise can increase HDL-C in middle-aged men and postmenopausal Women. Our findings also suggest that PSE supplementation may attenuate the exercise-induced increase in HDL-C. (c) 2006 Elsevier Inc. All rights reserved.

Ali, L. H., et al. (1997). "Comparison of capillary column gas chromatographic and AOAC gravimetric procedures for total fat and distribution of fatty acids in foods." Food Chemistry **58**(1-2): 149-160.

There is increasing interest in the fatty acid composition, including levels of trans fatty acids, of foods. The trans fatty acid content of American diets is increasingly studied because of reported adverse effects of trans fatty acids on risk of coronary heart disease. In this study, total fat content and fatty acid composition of 43 food products were determined after acid hydrolysis by gas chromatography using an SP-2560 flexible fused silica capillary column. Total fat content determined by the gas chromatographic method was compared with fat content determined by AOAC gravimetric method 922.06 for all food products. Total fat, saturated fat and unsaturated fat content of the foods determined by the gas chromatographic method ranged from 0.9 to 96.7, 0.2 to 16.8 and 0.5 to 89.3%, respectively. Trans fatty acids hexadecenoate (t-16:1), elaidic (t-18:1), and octadecadienoate (t,t-18:2) were identified by comparison of their retention times with those of known standards and quantitated. These fatty acids were present in foods at levels of 0.25 to 1.50 (t-16:1), 0.87 to 268.32 (t-18:1), and 0.23 to 7.92 (t,t-18:2) mg/g. Published by Elsevier Science Ltd

Allison, D. B., et al. (1999). "Estimated intakes of trans fatty and other fatty acids in the US population." Journal of the American Dietetic Association **99**(2): 166-174.

Objective To estimate mean level of trans fatty acid intakes using a representative sample of the US population. Design The study used food intake data from the 1989-1991 Continuing Survey of Food Intakes by Individuals (CSFII) and the trans fatty acid contents of specific foods calculated from a database compiled by the US Department of Agriculture (USDA) to estimate the mean level and deciles of tracts fatty acid intake of the representative US population. Subjects/setting Trans fatty acid intakes were estimated for each subject (N = 11,258) in the CSFII data who completed both a 24-hour recall and a 2-day food record. Statistical analyses performed Weights developed by USDA for the survey were used for all data analyses. The Technical Assessment Systems (TAS) International Diet Research System (TAS-DIET), software developed by TAS, was used to derive weighted estimates of the mean and percentiles of the intake distribution. PC CARP, software designed by Iowa State University, was used to estimate standard errors. Results Mean percentage of energy ingested as trans fatty acids was 2.6% and the mean percentage of total fat ingested as traits fatty acids was 7.4%. Across all age and gender groups examined, estimates ranged from 2.6% to 2.8% and 7.1% to 7.9%, respectively. Applications/conclusions Dietetics practitioners can use the representative data of this study to help clients achieve desired changes in consumption levels of trans fatty acids.

Allman-Farinelli, M. A., et al. (2005). "A diet rich in high-oleic-acid sunflower oil favorably alters low-density lipoprotein cholesterol, triglycerides, and factor VII coagulant activity." Journal of the American Dietetic Association **105**(7): 1071-1079.

Objective To compare concentrations of factor VII coagulant activity (factor VIIc), fibrinogen, plasminogen activator inhibitor-1, and blood lipids on a saturated fat-rich diet with one rich in monounsaturated fat. Design Subjects were randomly allocated to two groups. The study design was an ABB/BAA extra-period crossover. One group consumed a diet rich in saturated fatty acid (SFA) with fat making up 20.8% of total energy, for 5 weeks and then one rich in monounsaturated fatty acid (MUFA), with fat making up 20.3% of total energy for 10 weeks. The other group consumed the MUFA diet for 5 weeks followed by the SFA diet for 10 weeks. Subjects/setting Men and women aged 35 to 69 years who were nonsmokers with no chronic illness and not on any medication were recruited to participate. Eighteen subjects were recruited and 15 (5 men, 10 women) completed the community-based study. Intervention Blood was sampled at the beginning and end point of each 5-week diet period for analysis of coagulation and fibrinolysis factors and blood lipids. Subjects kept 3-day food diaries twice during each of the three diet periods and were weighed on each visit for blood collection. Analysis of plasma fatty acids was used to indicate dietary compliance. Main outcome measures Differences in fasting factor VIIc, fibrinogen, plasminogen activator inhibitor-1, insulin, low-density lipoprotein cholesterol, high-density lipoprotein cholesterol, triglycerides, apolipoproteins A-1 and B, and plasma oleic acid levels while receiving the SFA diet vs MUFA diet. Statistical analysis A general linear model allowing for the ABB/BAA extra-period crossover, was used for each of the outcome measures. Results Factor VIIc was lower on the MUFA diet (P < .05) but fibrinogen and insulin concentrations and plasminogen activator inhibitor-1 activity did not differ between diets. Low-density lipoprotein cholesterol (P < .001) and triglyceride (P < .01) levels were lower on the MUFA diet compared with the SFA diet. A significant increase in both plasma phospholipid and neutral lipid oleic acid (P < .0001) occurred on the MUFA diet. Conclusions Substitution of foods rich in saturated fat with foods rich in high-oleic-acid sunflower oil and margarine has favorable outcomes on blood lipids and factor VIIc. This oil presents another useful source of MUFA for diets aimed at prevention of heart disease.

Almendingen, K., et al. (1995). "EFFECTS OF PARTIALLY HYDROGENATED FISH-OIL, PARTIALLY HYDROGENATED SOYBEAN OIL, AND BUTTER ON SERUM-LIPOPROTEINS AND LP A IN MEN." Journal of Lipid Research **36**(6): 1370-1384.

We have compared the effects of partially hydrogenated fish oil (PHFO-diet), partially hydrogenated soybean oil (PHSO-diet), and butterfat (butter-diet) on serum lipids and lipoprotein[a] in 31 young men. The three test margarines, which contributed 78% of total fat in the diets, were produced from 70% of butterfat, PHSO, or PHFO, each with 30% of soybean oil. Fat provided about 35% of energy, and trans fatty acids 0.9%, 8.5%, and 8.0% of energy in the butter-, the PHSO-, and the PHFO-diet, respectively. Dietary cholesterol was balanced by the addition of dried egg powder to the PHSO-and the butter-diet; thus all diets contained 420 mg dietary cholesterol per 10 MJ per day. The subjects consumed all three test diets for 19-21 days in a random order (crossover design). The serum levels of total and LDL-cholesterol were significantly elevated on the PHFO-diet (mean values 5.42 and 3.94 mmol/L, respectively) compared to the PHSO-diet (5.11 and 3.58 mmol/L, respectively) but not different from those on the butter-diet (5.32 and 3.81 mmol/L, respectively). LDL-cholesterol was significantly reduced on the PHSO-diet compared to the butter-diet. The level of HDL-cholesterol was significantly lower on the PHFO-diet (0.98 mmol/L) when compared to the butter-diet (1.05 mmol/L) and with border-line significance compared to the PHSO-diet (1.05 mmol/L). The ratio of LDL- to HDL-cholesterol was significantly higher on the PHFO-diet (4.20) when compared to both other test diets (3.85 and 3.65, respectively). No significant differences in triglyceride values were observed. Lp[a] increased and apoA-I decreased significantly after consumption of both the PHSO-diet and the PHFO-diet, compared to the butter-diet. In conclusion, our results indicate that consumption of PHFO may unfavorably affect lipid risk indicators for coronary heart disease at least to the same extent as butterfat. To what extent the observed effects are due to the content of monoene trans, diene trans, or to the long chain saturated fatty acids in PHFO remains to be elucidated.

Almendingen, K., et al. (1996). "Effects of partially hydrogenated fish oil, partially hydrogenated soybean oil, and butter on hemostatic variables in men." Arteriosclerosis Thrombosis and Vascular Biology **16**(3): 375-380.

We have compared the effects of partially hydrogenated fish oil (PHFO diet), partially hydrogenated soybean oil (PHSO diet), and butterfat (butter diet) on fibrinolytic and coagulation variables in 31 young men. The three test margarines, which contributed 78% of total fat in the diets, contained 70% butterfat, PHSO, or PHFO, each with 30% of soybean oil. Far provided approximate to 35% of energy, and the content of trans-fatty acids was 0.9%, 8.5%, and 8.0% of energy in the butter diet, PHSO diet, and PHFO diet, respectively. All diets contained 420 mg cholesterol per 10 megajoules per day. All subjects consumed all three test diets for 3 weeks, in a random order (crossover design). The PHSO diet resulted in higher levels of plasminogen activator inhibitor type 1 antigen and plasminogen activator inhibitor type 1 activity than the two other test diets. Fibrinogen increased on the butter diet compared with the PHFO diet. No significant differences in the levels of factor VII, fibrinopeptide A, D-dimer, tissue plasminogen activator or beta-thromboglobulin were observed between the three test diets. The PHFO and the PHSO diets have previously been shown to result in higher levels of Lp(a) compared with the butter diet. The present findings indicate that PHSO has unfavorable antifibrinolytic effects relative to PHFO and butter and that butter may be procoagulant relative to PHFO. More controlled dietary studies are needed to assess definitely the impact of different hydrogenated Eats on risk of coronary heart disease.

Amundsen, A. L., et al. (2002). "Plant sterol ester-enriched spread lowers plasma total and LDL cholesterol in children with familial hypercholesterolemia." American Journal of Clinical Nutrition **76**(2): 338-344.

Background: Naturally occurring plant sterol esters (SEs) favorably affect serum cholesterol concentrations in humans and could aid in the treatment of children with familial hypercholesterolemia (FH). Objective: We studied the effect of SE-enriched spread on serum lipids, lipoproteins, carotenoids, fat-soluble vitamins, and physiologic variables in children with FH aged 7-12 y. Design: In a randomized, double-blind crossover study comprising two 8-wk interventions, 38 children with FH consumed 18.2 +/- 1.5 g SE spread/d, corresponding to 1.60 +/- 0.13 g SEs, or a control spread. Blood samples were analyzed at the start and end of each diet period. Results: Plasma LDL-cholesterol concentrations decreased by 10.2% (P = 0.003) during the SE period compared with the control period. Total cholesterol and apolipoprotein B concentrations were reduced by 7.4% (P = 0.007 and P = 0.020, respectively) during the SE period. No changes were observed in HDL cholesterol, triacylglycerol, or apolipoprotein A-I. Serum concentration of lipid-adjusted lycopene decreased by 8.1 % (P = 0.015) in the SE period, with no changes in the other carotenoids. Lipid-adjusted retinol and a-tocopherol concentrations increased by 15.6% (P < 0.001) and 7.1 % (P = 0.027), respectively. There was an increase (16.8%, P = 0.04) in alanine transaminase in the SE period, but this was explained by a significantly lower starting concentration in the SE period than in the control period. The children consumed a recommended American Heart Association Step I diet during both intervention periods. Conclusion: A daily intake of 1.6 g SEs induces an additional reduction in LDL-cholesterol concentrations in children with FH consuming a recommended diet.

Anadon, A., et al. (2011). "A 4-Week Repeated Oral Dose Toxicity Study of Dairy Fat Naturally Enriched in Vaccenic, Rumenic and alpha-Linolenic Acids in Rats." Journal of Agricultural and Food Chemistry **59**(14): 8036-8046.

Few studies have focused on the toxicological risks of dairy fat intake. A standard dairy fat (SDF) with a 70% SPA content and a naturally enriched dairy fat (EDF) in vaccenic, rumenic and a-linolenic acids and low in SPA (54%) have been examined in a 4-week repeated dose oral toxicity study as a daily dose of 2000 mg/kg bw by gavage in rats. Comparisons were established with a third group of rats (control) which did not receive fat administration. Both fats were well tolerated, and no adverse events or mortality were observed during the treatment nor after a 2-week observation period. EDF and SDF did not cause significant differences with respect to a control group in body weight gain, food consumption, clinical observations, organ weight ratios, histopathological findings and most of the hematological and biochemical parameters including total cholesterol and cholesterol fractions in plasma. In rats treated with SDF, a significant increase of triglycerides was observed as compared to the control group. By contrast, in rats treated with EDF, a significant decrease in triglycerides was detected. EDF orally administered to rats was safe, and no treatment-related toxicity was detected. The results also suggest that EDF could protect against the increase of triglyceride concentrations in plasma.

Anderson, A. K., et al. (2011). "Negative effect of industrial produced trans fatty acid (elaidic acid) on pregnancy outcome and early postpartum life." Agro Food Industry Hi-Tech **22**(5): 10-12.

This paper examines the effect of maternal intake of industrially produced trans fatty acid (elaidic acid) on the health of the fetus, pregnancy outcome, and risk of adiposity in early postpartum period. The evidence suggests that mothers who consume higher trans fatty acids during pregnancy may have an increased risk for negative pregnancy outcomes, such as small-for-gestational age, low birth weight and preterm delivery. In addition, breastfed infants of mothers with high trans fatty acid intake may have greater adiposity in the early postpartum period and have increased concentration of inflammatory markers, such as C-Reactive Protein, in their plasma, which may contribute to increased risk of obesity and cardiovascular disease later in life. A reduction in industrially produced trans fatty acid (elaidic acid) consumption by pregnant and nursing mothers may lead to improved pregnancy and infant health outcomes.

Anderson, A. K., et al. (2010). "Dietary trans fatty acid intake and maternal and infant adiposity." European Journal of Clinical Nutrition **64**(11): 1308-1315.

Background/Objectives: The fatty acid composition in maternal diet and in breastmilk during lactation may be a factor in the development of childhood overweight later in life. To investigate the association between trans fatty acid and adiposity, 96 mother-infant pairs (exclusive breastfed; mixed fed; and formula fed) at 3 months postpartum were interviewed; body composition was measured onsite using the BOD POD and PEA POD for mothers and infants, respectively. Subjects/Methods: This was a cross-sectional study. Participants were recruited via convenience sampling from Athens-Clarke and surrounding counties of the state of Georgia. Data were analyzed using chi(2), analysis of variance and regression. Results: There were no significant differences in maternal percent body fat by feeding group (32.70, 33.70, and 35.73%, for exclusive, mixed and formula feeding, respectively). Exclusively breastfed infants had higher percent body fat (24.87%) compared with their mixed-fed counterparts (22.15%) but not formula-fed infants (23.93). Mothers who consumed at least 4.5 g of trans fatty acids/day were 5.8 times more likely to have body fat >= 30% than those consuming less (odds ratio = 5.81; 95% confidence interval (CI), 1.05, 32.32), and their infants were over two times more likely (odds ratio = 2.13; 95% CI, 0.75, 6.01) to have body fat >= 24%. Conclusions: Trans fatty acid content of the maternal diet may be associated with both maternal and infant body composition in the early postpartum period. More research is warranted regarding maternal dietary and breastmilk fatty acid composition and their effects on maternal and infant body composition and the development of childhood overweight later in life. European Journal of Clinical Nutrition (2010) 64, 1308-1315; doi: 10.1038/ejcn.2010.166; published online 8 September 2010

Ando, A., et al. (2009). "Selective production of cis-9,trans-11 isomer of conjugated linoleic acid from trans-vaccenic acid methyl ester by Delacroixia coronata." Journal of Applied Microbiology **106**(5): 1697-1704.

Bio-process development for isomer selective and efficient production of cis-9,trans-11-octadecadienoic acid (CLA) from trans-vaccenic acid (t-VA, trans-11-octadecenoic acid) through microbial fatty acid Delta 9-desaturation reaction. A total of 550 strains of fungi and yeasts were screened for CLA production from t-VA through Delta 9 desaturation. Delacroixia coronata IFO 8586 was selected as a potent producer of CLA from t-VA. Efficient CLA production was observed during cultivation in medium supplemented with the methyl ester of t-VA (t-VAME). Under the optimal conditions with 33.3 mg ml(-1) of t-VAME as substrate, 10.5 mg ml(-1) CLA was produced by D. coronata IFO 8586 after 7 days of cultivation in the medium containing dextrin (5.0%), tryptone (2.0%) and thiourea (0.83 mu mol ml(-1)). The strain produced the cis-9,trans-11 isomer of CLA selectively (98% of total CLA), with a small amount of the trans-9,trans-11 isomer (2% of total CLA), mainly in the form of triacylglycerols (69% of total CLA). A practical bio-process for selective production of cis-9,trans-11 isomer of CLA using filamentous fungus D. coronata IFO 8586 was successfully established. Isomer selective bio-process for the practical production of cis-9,trans-11-CLA was first established. The process is benefitable for expanding the application of CLA for medicinal and nutraceutical purposes.

Andrushko, N., et al. (2010). "Highly Stereoselective Hydrogenations-As Key-Steps in the Total Synthesis of Statins." Chirality **22**(5): 534-541.

Statins are inhibitors of 3-hydroxy-3-methyl-glutaryl coenzyme A reductase (HMG-CoA reductase) and became the standard of care for treatment of hypercholesterolemia because of their efficacy, safety, and long-term benefits. They are administered as diastereo- and enantiomerically pure compounds. We summarize here two new approaches for the total synthesis of the most important representatives, atorvastatin, and rosuvastatin, based on highly stereoselective hydrogenations as key-steps. Chirality 22:534-541,2010. (C) 2009 Wiley-Liss, Inc.

Angelieri, C. T., et al. (2012). "Trans fatty acid intake is associated with insulin sensitivity but independently of inflammation." Brazilian Journal of Medical and Biological Research **45**(7): 625-631.

High saturated and trans fatty acid intake, the typical dietary pattern of Western populations, favors a proinflammatory status that contributes to generating insulin resistance (IR). We examined whether the consumption of these fatty acids was associated with IR and inflammatory markers. In this cross-sectional study, 127 non-diabetic individuals were allocated to a group without IR and 56 to another with IR, defined as homeostasis model assessment-IR (HOMA-IR) >2.71. Diet was assessed using 24-h food recalls. Multiple linear regression was employed to test independent associations with HOMA-IR. The IR group presented worse anthropometric, biochemical and inflammatory profiles. Energy intake was correlated with abdominal circumference and inversely with adiponectin concentrations (r = -0.227, P = 0.002), while saturated fat intake correlated with inflammatory markers and trans fat with HOMA-IR (r = 0.160, P = 0.030). Abdominal circumference was associated with HOMA-IR (r = 0.430, P < 0.001). In multiple analysis, HOMA-IR remained associated with trans fat intake (beta = 1.416, P = 0.039) and body mass index (beta = 0.390, P < 0.001), and was also inversely associated with adiponectin (beta = -1.637, P = 0.004). Inclusion of other nutrients (saturated fat and added sugar) or other inflammatory markers (IL-6 and CRP) into the models did not modify these associations. Our study supports that trans fat intake impairs insulin sensitivity. The hypothesis that its effect could depend on transcription factors, resulting in expression of proinflammatory genes, was not corroborated. We speculate that trans fat interferes predominantly with insulin signaling via intracellular kinases, which alter insulin receptor substrates.

Angell, S. Y., et al. (2012). "Change in Trans Fatty Acid Content of Fast-Food Purchases Associated With New York City's Restaurant Regulation A Pre-Post Study." Annals of Internal Medicine **157**(2): 81-+.

Background: Dietary trans fat increases risk for coronary heart disease. In 2006, New York City (NYC) passed the first regulation in the United States restricting trans fat use in restaurants. Objective: To assess the effect of the NYC regulation on the trans and saturated fat content of fast-food purchases. Design: Cross-sectional study that included purchase receipts matched to available nutritional information and brief surveys of adult lunchtime restaurant customers conducted in 2007 and 2009, before and after implementation of the regulation. Setting: 168 randomly selected NYC restaurant locations of 11 fast-food chains. Participants: Adult restaurant customers interviewed in 2007 and 2009. Measurements: Change in mean grams of trans fat, saturated fat, trans plus saturated fat, and trans fat per 1000 kcal per purchase, overall and by chain type. Results: The final sample included 6969 purchases in 2007 and 7885 purchases in 2009. Overall, mean trans fat per purchase decreased by 2.4 g (95% CI, -2.8 to -2.0 g; P < 0.001), whereas saturated fat showed a slight increase of 0.55 g (CI, 0.1 to 1.0 g; P = 0.011). Mean trans plus saturated fat content decreased by 1.9 g overall (CI, -2.5 to -1.2 g; P < 0.001). Mean trans fat per 1000 kcal decreased by 2.7 g per 1000 kcal (CI, -3.1 to -2.3 g per 1000 kcal; P < 0.001). Purchases with zero grams of trans fat increased from 32% to 59%. In a multivariate analysis, the poverty rate of the neighborhood in which the restaurant was located was not associated with changes. Limitation: Fast-food restaurants that were included may not be representative of all NYC restaurants. Conclusion: The introduction of a local restaurant regulation was associated with a substantial and statistically significant decrease in the trans fat content of purchases at fast-food chains, without a commensurate increase in saturated fat. Restaurant patrons from high-and low-poverty neighborhoods benefited equally. However, federal regulation will be necessary to fully eliminate population exposure to industrial trans fat sources.

Anselmi, C. V., et al. (2010). "Fatty acid percentage in erythrocyte membranes of atrial flutter/fibrillation patients and controls." Journal of Interventional Cardiac Electrophysiology **27**(2): 95-99.

Purpose Several epidemiological published data support the protective role of omega-3 consumption in coronary artery disease, sudden cardiac death and ventricular arrhythmias, but interestingly, this is not the case for atrial arrhythmias. The purpose of this study is to evaluate different fatty acid profile between AF/AFL subjects and healthy controls. Methods Gas chromatography was employed to determine fatty acid percentage of erythrocyte membranes from 40 idiopathic AFL/AF patients and 53 healthy control subjects. Results AFL/AF erythrocyte membranes had significantly lower percentage of saturated fatty acid (43.1 +/- SD2.2 versus 47.8 +/- SD9.6, p<0.001), monounsaturated fatty acid (18.2 +/- SD2.5 versus 22.6 +/- SD5.2, p<0.001) and total trans fatty acid (0.2 +/- SD0.1 vs 1.3 +/- SD1.1, p<0.001) than controls. Furthermore, fatty acid (FA) profiles of arrhythmic individuals showed an increased percent of total polyunsaturated fatty acid (PUFA) (36.7 +/- SD2.4 versus 26.4 +/- SD10.4, p<0.001), PUFA n-3 (5.3 +/- SD1.1 versus 2.8 +/- SD1.8, p<0.001) and n-6 (31.4 +/- SD2.2 versus 23.5 +/- SD9.9, p<0.001). Conclusion This study shows that the erythrocyte membranes FA composition of AF/AFL subjects differs from that of healthy controls

Armstrong, R. A., et al. (2000). "No effect of dietary trans isomers of alpha-linolenic acid on platelet aggregation and haemostatic factors in European healthy men: The TRANSLinE study." Thrombosis Research **100**(3): 133-141.

The aim of this study was to investigate the effect of trans alpha -linolenic acid on platelet aggregation and blood haemostasis. A randomized, double blind dietary intervention trial was carried out with healthy male volunteers (n=88) in three European centers. After a 6-week washout period where subjects avoided foods containing all trans fats, subjects either continued for 6 weeks with a low trans diet or a diet where trans alpha -linolenic acid provided 0.6% of energy (supplied as oil, margarine, cheese, muffins, and biscuits). At the end of the washout period the intake of trans polyunsaturated fats was 58+/-115 mg/day; this increased in patients on the high trans diet by +1344+/-328 mg/day, compared with +10+/-67 mg/day in patients on the low trans diet (p<0.01). The change in trans a-linolenic acid in plasma cholesteryl eaters was 0.26+/-0.20 on the high trans and 0.00+/-0.07% of fatty acids on the low trans diet (p<0.001). No effect of the high trans diet was observed on platelet aggregation: collagen ECS, high trans 157+/-100, low trans 152+/-90 ng/mL (NS); U44619 EC50 high trans 81+/-61, low trans 59+/-27 nM (NS). The high trans diet did not affect platelet thromboxane production, fibrinogen levels, factor VII, activated factor VIIa, or plasminogen activator inhibitor activity. There were no center-specific differences in response to the high traits diet. A relatively high amount of trans or-linolenic acid for 6 weeks does not increase the risk of coronary heart disease by promoting platelet aggregation and blood coagulation. (C) 2000 Elsevier Science Ltd. All rights reserved.

Aro, A. (1998). "Epidemiology of trans fatty acids and coronary heart disease in Europe." Nutrition Metabolism and Cardiovascular Diseases **8**(6): 402-407.

Trans fatty acids from partially hydrogenated vegetable and fish oils increase LDL-cholesterol and decrease HDL-cholesterol serum concentration when consumed in large amounts. Recent multi-center studies from Europe indicate that the average intake of trans fatty acids is reasonably low, and represents between 0.5 and 2.0% of the caloric intake In these amounts, trans fatty acids do not appear to have an affect on the risk of coronary heart disease. A considerably higher intake of trans fatty acids may be associated with a moderately increased risk of CHD, as suggested by a prospective cohort study from Finland Trans fatty acids from animal fats comprise 35 to 70% of trans fatty acid intake in Europe. Their effects have not been studied separately but it is known that the metabolism of the main trans isomer of animal fat, lit vaccenic acid, differs from the main isomers of partially hydrogenated vegetable and fish oils. In Mediterranean countries the consumption of both saturated and trans fatty acids is moderate and the risk of CHD is low. However, in central and northern European countries, the consumption of saturated fatty acids is ten-fold (12 to 18%) compared with that of trans fatty acids (1 to 2%). Further benefits can be achieved by reducing the consumption of foods high in C12-16 saturated fatty acids instead of focussing on trans fatty acids alone (C)1998, Medikal Press.

Aro, A., et al. (1997). "Stearic acid, trans fatty acids, and dairy fat: Effects on serum and lipoprotein lipids, apolipoproteins, lipoprotein(a), and lipid transfer proteins in healthy subjects." American Journal of Clinical Nutrition **65**(5): 1419-1426.

To compare the effects on serum lipoproteins of stearic acid, trans fatty acids, and dairy fat, 80 healthy subjects consumed a dairy fat-based (baseline) diet for 5 wk, then an experimental diet high in either trans fatty acids (8.7% of energy; n = 40) or stearic acid (9.3% of energy; n = 40) for another 5 wk. All diets provided 32.2-33.9% of energy as fat, 14.6-15.8% as saturated plus trans fatty acids, 11.4-12.5% as cis-monounsaturated fatty acids, 2.9-3.5% as polyunsaturated fatty acids, and 200-221 mg cholesterol/10 MJ. Compared with the dairy fat diet, stearic acid and trans fatty acids decreased serum total cholesterol concentrations similarly (by 13% and 12%, respectively, P < 0.001) but the trans fatty acid diet decreased HDL cholesterol (17%) and apolipoprotein (ape) A-I (15%) significantly more than did the stearic acid diet (11% and 12%, respectively). Stearic acid but not trans fatty acids reduced concentrations of LDL cholesterol and apo B significantly (P < 0.001). The trans fatty acid diet increased the ratio of LDL to HDL cholesterol (19%) and of apo B to apo A-I (16%) more than did the dairy fat diet (P < 0.001) but the stearic acid diet had no effect. Lipoprotein(a) concentrations increased with both experimental diets, significantly more with trans fatty acids (30%) than with stearic acid (10%). In conclusion, high amounts of trans fatty acids had more adverse effects on lipoproteins than did equal amounts of stearic acid and dairy fat. Stearic acid reduced LDL cholesterol, did not affect the ratio of LDL to HDL cholesterol, and increased lipoprotein(a), although to a lesser extent than did trans fatty acids. Dietary fats low in both saturated fatty acids and trans fatty acids should be favored.

Aro, A., et al. (1995). "ADIPOSE-TISSUE ISOMERIC TRANS-FATTY-ACIDS AND RISK OF MYOCARDIAL-INFARCTION IN 9 COUNTRIES - THE EURAMIC STUDY." Lancet **345**(8945): 273-278.

Dietary isomeric trans fatty acids-mainly produced by hydrogenation of oils-are suspected of increasing the risk of coronary heart disease. Dietary trans fatty acid intake in reflected in the fatty acid composition of adipose tissue. In an international multicentre study in eight European countries and Israel (EURAMIC), adipose tissue aspiration samples were obtained from 671 men with acute myocardial infarction (AMI), aged 70 years or less, and 717 men without a history of AMI (controls). The proportion of fatty acids, including isomeric trans monoenoic fatty acids with 18 carbon atoms (C18:1), was determined by gas chromatography. Although there were considerable differences between countries in mean (SD) proportion of adipose tissue C18:1 trans fatty acids, there was no overall difference between cases (1.61 [0.92]%) and the controls (1.57 [0.86]%). The risk of AMI did not differ significantly from 1.0 over quartiles of adipose C18:1 trans fatty acids: the multivariate odds ratio was 0.97 (95% CI 0.56-1.67) for the highest versus lowest quartile. After exclusion of subjects from Spanish centres because they had far lower proportions of adipose trans fatty acids than subjects from other countries, there was a tendency to increased risk of AMI in the upper quartiles of C18:1 trans; however, the trend was not statistically significant. Our results reflect considerable differences between countries in dietary intake of trans fatty acids but do not suggest a major overall effect of C18:1 trans fatty acids on risk of AMI. We cannot exclude the possibility that trans fatty acids have a significant impact on risk of AMI in populations with high intake.

Aryana, K. J. (2007). "Quality characteristics of low fat Cheddar cheese manufactured with margarine containing plant stanol ester." Milchwissenschaft-Milk Science International **62**(4): 418-421.

Milk fat is high in saturated fatty acids. Saturated fats contribute to a degenerative arterial disease,atherosclerosis that leads to the gradual blockage of the arteries and reduced blood flow. A polyunsaturated margarine containing plant stanol ester, which lowers serum concentrations of cholesterol, is commercially available. Objective was to study the effect of gradual replacement of milk fat with margarine containing plant stanol ester on the physico-chemical, microbiological and microstructural characteristics of low fat Cheddar cheese. Low fat Cheddar cheese was manufactured with Benecol (R) in the following milk fat: Benecol (R) ratios 100:0; 75:25; 50:50; 25:75 and 0: 100. There were no differences in the fracture stress and strain, color, pH, microbial counts, microstructure, flavor and body and texture scores among the low fat Cheddar cheeses. Low fat Cheddar cheese can successfully be manufactured with margarine containing plant stanol ester without any adverse effect on its quality.

Ascherio, A. (2006). "Trans fatty acids and blood lipids." Atherosclerosis Supplements **7**(2): 25-27.

Intake of trans-unsaturated fatty acids (TFA) has been consistently shown in multiple and rigorous randomized trials to have adverse effects on blood lipids, most notably on the LDL:HDL cholesterol ratio, which is a strong marker of cardiovascular risk. When a mixture of TFA isomers obtained by partial hydrogenation of vegetable oils is used to replace oleic acid, there is a dose-dependent increase in the LDL:HDL ratio. The relationship between amount of TFA as % of energy and the increase in the LDL:HDL ratio appears to be approximately linear, with no evidence of a threshold at low levels of intake, and with slope twice as steep as that observed by replacing oleic with saturated fats. The average impact of TFA induced changes in the LDL:HDL ratio correspond to tens of thousands premature deaths in the US alone. Although dramatic, this effect is substantially smaller than the increase in cardiovascular mortality associated with TFA intake in epidemiological studies, suggesting that other mechanisms are likely to contribute to the toxicity of TFA. (c) 2006 Elsevier Ireland Ltd. All rights reserved.

Ascherio, A., et al. (1994). "TRANS-FATTY-ACIDS INTAKE AND RISK OF MYOCARDIAL-INFARCTION." Circulation **89**(1): 94-101.

Background Concern that trans-fatty acids formed in the partial hydrogenation of vegetable oils may increase the risk of coronary disease has existed for several decades, but direct evidence on this relation in humans is limited. Methods and Results With a case-control design, we studied the association between intake of trans-fatty acids and a first acute myocardial infarction among 239 patients admitted to one of six hospitals in the Boston area and 282 population control subjects. Intake of trans-fatty acids was estimated using a previously validated food frequency questionnaire. After adjustment for age, sex, and energy intake, intake of trans-fatty acids was directly related to risk of myocardial infarction (relative risk for highest compared with lowest quintile, 2.44; 95% confidence interval, 1.42, 4.19; for trend P<.0001). This relation remained highly significant after adjustment for established coronary risk factors, multivitamin use, and intake of saturated fat, monounsaturated fat, linoleic acid, dietary cholesterol, vitamins E and C, carotene, and fiber. Intake of margarine-the major source of trans-isomers-was significantly associated with risk of myocardial infarction. Conclusions These data support the hypothesis that intake of partially hydrogenated vegetable oils may contribute to the risk of myocardial infarction.

Ascherio, A. and W. C. Willett (1997). "Health effects of trans fatty acids." American Journal of Clinical Nutrition **66**: S1006-S1010.

trans Fatty acids are formed during the process of partial hydrogenation in which liquid vegetable oils are converted to margarine and vegetable shortening. Concern has existed that this process may have adverse consequences because natural essential fatty acids are destroyed and the new artificial isomers are structurally similar to saturated fats, lack the essential metabolic activity of the parent compounds, and inhibit the enzymatic desaturation of linoleic and linolenic acid. In the past 5 y a series of metabolic studies has provided unequivocal evidence that trans fatty acids increase plasma concentrations of low-density-lipoprotein cholesterol and reduce concentrations of high-density-lipoprotein (HDL) cholesterol relative to the parent natural fat. In these same studies, trans fatty acids increased the plasma ratio of total to HDL cholesterol nearly twofold compared with saturated fats. On the basis of these metabolic effects and the known relation of blood lipid concentrations to risk of coronary artery disease, we estimate conservatively that 30 000 premature deaths/y in the United States are attributable to consumption of trans fatty acids. Epidemiologic studies, although not conclusive on their own, are consistent with adverse effects of this magnitude or even larger. Because there are no known nutritional benefits of trans fatty acids and clear adverse metabolic consequences exist. prudent public policy would dictate that their consumption be minimized and that information on the trans fatty acid content of foods be available to consumers.

Asgary, S., et al. (2009). "Evaluation of fatty acid content of some Iranian fast foods with emphasis on trans fatty acids." Asia Pacific Journal of Clinical Nutrition **18**(2): 187-192.

Although the disadvantages of trans fatty acids (TFAs) are widely mentioned, limited data are available on the TFAs contents of Iranian foods, including fast foods. The aim of this study was to quantify the amounts of common fatty acids in several fast foods in Iran, with specific focus on TFAs. The most commonly consumed fast foods in Iran: sausage, calbas, hamburgers and pizzas, were randomly selected seven times from products available in supermarkets and restaurants. Each time a 10 g sample was drawn and prepared for fatty acid analysis. Total and individual fatty acids were quantified according to standard methods by gas chromatography with 60 meter capillary column and flame ionization detector. The most common saturated fatty acids in Iranian fast foods is stearic acid (C18:0) which ranged from 14.0% to 20.9%. Saturated fatty acid content in calbas was significantly higher than that found in other groups. Trans fatty acids constitute almost 23.6% to 30.6% of total fatty acids of these products. The most common TFA in these fast foods was elaidic acid (C18:1 9t). Total cis unsaturated fatty acid content of tested fast foods varied from 25.3 %( in sausage) to 46.8(in calbas) with oleic acid (C18:1 9c) followed by linoleic acid (C18:2) being the most common fatty acids in these products. This study showed higher TFAs contents in commercially available fast foods compared to the amounts recommended by dietary guidelines in Iran. Further studies must assess the effects of these fatty acids on human health.

Athyros, V. G., et al. (2011). "Effect of a plant stanol ester-containing spread, placebo spread, or Mediterranean diet on estimated cardiovascular risk and lipid, inflammatory and haemostatic factors." Nutrition Metabolism and Cardiovascular Diseases **21**(3): 213-221.

Background and aims: Mediterranean diet is associated with a reduced risk for cardiovascular disease (CVD). Use of plant stanols decreases low density lipoprotein cholesterol (LDL-C) concentrations. We compared the effects of the Mediterranean diet and plant stanol esters on vascular risk factors and estimated CVD (eCVD) risk. Methods and results: In this prospective, randomized, placebo-controlled study, 150 mildly hypercholesterolaemic subjects were randomized to Mediterranean diet, a spread containing plant stanol esters (2 g/day) or a placebo spread. Vascular risk factors were assessed every month for 4 months and the eCVD risk was calculated using the PROspective- Cardiovascular-Munster (PROCAM), Framingham, and Reynolds risk engines. Placebo had no significant effect on risk factors or eCVD risk. Mediterranean diet gradually induced a significant reduction in total cholesterol (TC), LDL-C, triglycerides, high sensitivity C-reactive protein (hsCRP), blood pressure and eCVD risk (24-32%). The plant stanol ester spread reduced (by 1 month) TC (-14%), LDL-C (-16%), hsCRP (-17%), and estimated CVD risk (26-30%). eCVD risk reduction was sustained at 4th months when the gradual Mediterranean diet eCVD risk reduction became comparable to that of the stanol group. Conclusions: Plant stanol esters yielded an early, by 1st treatment month, reduction of eCVD risk that resulted from a TC, LDL-C, and hsCRP decrease. eCVD risk reduction on the Mediterranean diet resulted from a change in several CVD risk factors and equaled that of plant stanol at 4 months. The consumption of plant stanol esters by moderately hypercholesterolaemic patients may be a useful option to reduce CVD risk in those who do not adopt a Mediterranean diet. (C) 2009 Elsevier B.V. All rights reserved.

Atolani, O., et al. (2011). "CHEMICAL COMPOSITION AND ANTIOXIDANT POTENTIALS OF KIGELIA PINNATA ROOT OIL AND EXTRACTS." Excli Journal **10**: 264-273.

The chemical composition of Kigelia pinnata root oil extracted with n-hexane was analyzed by GC/GCMS. The antioxidant potential of the oil was compared to that of ethyl acetate and methanol extracts of the root. UV and IR spectroscopic techniques were used to carry out partial characterization of the oil and extracts. The free radical scavenging activity by spectrophotometric assay on the reduction of 1,1-diphenyl-2-picrylhydrazyl (DPPH) was examined while the total antioxidant activity (TAA) and relative antioxidant activity (RAA) were compared with standard antioxidant, a-tocopherol. The antioxidant activity (which correlated with the total phenolic content of the extracts) was assumed to be from the total phenolic content of the extracts. TAA was found to be higher in methanol extract (at 0.25 mg/mL). We hereby report for the first time the major component of the oil from the root of Kigelia pinnata to be elaidic acid (56.12%). It is a reported toxicant which thereby underscores the risk in the use of the plant in traditional therapies.

Attia-Skhiri, N., et al. (2009). "Trans fatty acids: effects on lipoprotein metabolism and cardiovascular risk." Annales De Biologie Clinique **67**(5): 517-523.

Baer, D. J., et al. (1997). "Effects of butter versus margarine on blood lipid profiles related to cardiovascular disease risk factors." Faseb Journal **11**(3): 967-967.

Bahrami, G. and Z. Rahimi (2005). "Fatty acid composition of human milk in Western Iran." European Journal of Clinical Nutrition **59**(4): 494-497.

Objective: To investigate the fatty acid composition of mature human milk in Western Iran with special focus on trans fatty acids. Design: Observational study. Methods: Milk samples were collected from 52 lactating mothers aging 19-39y, from Western Iran. Subjects were asked to complete a diet questionnaire. Milk fatty acids were measured as 2-nitrophenylhydrazide derivatives by high-performance liquid chromatography. Results: Saturated fatty acids were the main fraction of human milk (41.3%). Medium-chain fatty acids (C8:0-C14:0) constituted 24%, oleic acid (C18:1 omega 9) accounted for 30.9% and elaidic acid (C18:1T), the trans isomer of oleic acid, comprised 11.3% of the total milk fatty acids. Linoleic (C18:2 omega 6) and linolenic (C18:3 omega 3) acid contents were 13.8 and 1.1%, respectively. The level of the polyunsaturated fatty acids was 1.4% for arachidonic (C20:4 omega 6) and 0.2% for eicosapentaenoic (C20:5 omega 3) acid. Conclusions: The milk from Iranian lactating mothers, as compared to that from the American or European mothers, contained high levels of medium-chain and trans fatty acids. This difference may be attributed to the maternal diet with low animal protein and animal fat but with high carbohydrate and partially hydrogenated vegetable oils that carry large amounts of trans fatty acids. As the detrimental effects of trans fatty acids on blood lipids and cardiovascular diseases have been emphasized in the literature, a reduction of trans fatty acid content in the diet of Iranian mothers is suggested. Sponsorship: Kermanshah University of Medical Sciences.

Bamia, C., et al. (2005). "Dietary patterns among older Europeans: the EPIC-Elderly study." British Journal of Nutrition **94**(1): 100-113.

Overall dietary patterns have been associated with health and longevity. We used principal component (PC) and cluster analyses to identify the prevailing dietary patterns of 99 744 participants, aged 60 years or older, living in nine European countries and participating in the European Prospective Investigation into Cancer and Nutrition (EPIC-Elderly cohort) and to examine their socio-demographic and lifestyle correlates. Two PC were identified: PC1 reflects a 'vegetable-based' diet with an emphasis on foods of plant origin, rice, pasta and other grain rather than on margarine, potatoes and non-alcoholic beverages. PC2 indicates a 'sweet- and fat-dominated' diet with a preference for sweets, added fat and dairy products but not meat, alcohol, bread and eggs. PC1 was associated with a younger age, a higher level of education, physical activity, a higher BMI, a lower waist:hip ratio and never and past smoking. PC2 was associated with older age, less education, never having smoked, a lower BMI and waist:hip ratio and lower levels of physical activity. Elderly individuals in southern Europe scored positively on PC1 and about zero on PC2, whereas the elderly in northern Europe scored negatively on PC1 and variably on PC2. The results of cluster analysis were compatible with the indicated dietary patterns. 'Vegetable-based' and a 'sweet- and fat-dominated' diets are prevalent among the elderly across Europe, and there is a north-south gradient regarding their dietary choices. Our study contributes to the identification of groups of elderly who are likely to have different prospects for long-term disease occurrence and survival.

Barros, P. A. V., et al. (2013). "Nutritional quality and oxidative stability of butter obtained from cows fed sugar-cane supplemented with sunflower oil." Arquivo Brasileiro De Medicina Veterinaria E Zootecnia **65**(5): 1545-1553.

The objective of this study was to evaluate the fatty acid (FA) profile, nutritional quality and oxidative stability (OE) indexes of butter obtained from milk of cows fed sugar cane-based diets containing increasing levels of sunflower oil (SO): 0 (Control); 1.5; 3.0 and 4.5% of diet DM. The butter FA profile was analyzed by gas chromatography and OE was determined using the Rancimat (R) equipment (model 743) operated at 120 degrees C and air flow of 20 L/h. The concentrations of rumenic acid (cis-9 trans-11 CLA), vaccenic acid (trans-11 C18: 1) and oleic acid (cis-9 C18: 1) in butter fat were increased by 867, 687 and 148%, respectively, as the dietary SO level increased from 0 to 4.5%. In contrast, the concentrations of medium chain saturated FA were linearly reduced (P<0.05) in butter fat from cows fed increasing levels of SO. Regarding the butter nutritional quality, a linear decrease (P<0.0001) in atherogenicity and thrombogenicity indexes and a linear increase (P<0.0001) in the hypocholesterolemic/hypercholesterolemic ratio were observed compared to control, 1.5, 3.0 and 4.5% SO, respectively. Consistent with the increased (P<0.0001) concentration of mono and polyunsaturated FA, the OE of butter fat was linearly reduced (P<0.0001) as the dietary SO level increased. It was concluded that diet supplementation with SO improved the nutritional quality of butter fat of Holstein x Gir dairy cows as a result of positive changes in milk FA profile. However, these changes in milk FA composition were accompanied by a reduction in the SO of butter, which in turn is associated with a shorter shelf life.

Barton, P., et al. (2011). "Effectiveness and cost effectiveness of cardiovascular disease prevention in whole populations: modelling study." British Medical Journal **343**.

Objective To estimate the potential cost effectiveness of a population-wide risk factor reduction programme aimed at preventing cardiovascular disease. Design Economic modelling analysis. Setting England and Wales. Population Entire population. Model Spreadsheet model to quantify the reduction in cardiovascular disease over a decade, assuming the benefits apply consistently for men and women across age and risk groups. Main outcome measures Cardiovascular events avoided, quality adjusted life years gained, and savings in healthcare costs for a given effectiveness; estimates of how much it would be worth spending to achieve a specific outcome. Results A programme across the entire population of England and Wales (about 50 million people) that reduced cardiovascular events by just 1% would result in savings to the health service worth at least 30m pound ((sic)34m; $48m) a year compared with no additional intervention. Reducing mean cholesterol concentrations or blood pressure levels in the population by 5% (as already achieved by similar interventions in some other countries) would result in annual savings worth at least 80m pound to 100m pound. Legislation or other measures to reduce dietary salt intake by 3 g/day (current mean intake approximately 8.5 g/day) would prevent approximately 30 000 cardiovascular events, with savings worth at least 40m pound a year. Legislation to reduce intake of industrial trans fatty acid by approximately 0.5% of total energy content might gain around 570 000 life years and generate NHS savings worth at least 230m pound a year. Conclusions Any intervention that achieved even a modest population-wide reduction in any major cardiovascular risk factor would produce a net cost saving to the NHS, as well as improving health. Given the conservative assumptions used in this model, the true benefits would probably be greater.

Bassett, C. M. C., et al. (2010). "Dietary Vaccenic Acid Has Antiatherogenic Effects in LDLr(-/-) Mice." Journal of Nutrition **140**(1): 18-24.

Epidemiological evidence has associated dietary trans fatty acids (TFA) with heart disease. TFA are primarily from hydrogenated fats rich in elaidic acid, but dairy products also contain naturally occurring TFA such as vaccenic acid. Our purpose in this study was to compare the effects of consuming a commercially hydrogenated vegetable shortening rich in elaidic TFA (18:1t9) or a butter rich in vaccenic TFA (18:1t11) in the absence and presence of dietary cholesterol on atherosclerosis. LDL receptor deficient (LDLr(-/-)) mice were fed 1 of 8 experimental diets for 14 wk with the fat content replaced by: regular (pork/soy) fat (RG), elaidic shortening (ES), regular butter (RB), vaccenic butter (VB), or an atherogenic diet containing 2% cholesterol with RG (CH+RG), ES (CH+ES), RB (CH+RB), or VB (CH+VB). Serum cholesterol levels were elevated with cholesterol feeding (P < 0.001), whereas serum triglyceride levels were higher only in the CH+RB (P < 0.001) and CH+VB (P < 0.001) groups compared with the other 6 groups. Serum cholesterol and triglyceride levels were significantly lower in the CH+VB group than in the CH+RB group (P < 0.001). Atherosclerosis was stimulated by dietary ES compared with RG (P = 0.021), but CH+ES did not stimulate atherosclerosis beyond CH+RG alone. In contrast, VB did not induce an increase in atherosclerotic plaque formation compared with the RG and RB diets and the CH+VB diet reduced atherosclerosis compared with the other diets containing cholesterol (P < 0.01). In summary, consuming a hydrogenated elaidic acid-rich diet stimulates atherosclerosis, whereas a vaccenic acid-rich butter protects against atherosclerosis in this animal model. J. Nutr. 140: 18-24, 2010.

Baumgartner, S., et al. (2013). "Oxyphytosterol formation in humans: Identification of high vs. low oxidizers." Biochemical Pharmacology **86**(1): 19-25.

Animal studies suggest that oxyphytosterols are atherogenic. However, we have previously shown that plasma oxyphytosterol concentrations did not increase after consuming a diet enriched in plant sterol esters (3 g/day), while minor reductions were seen after consuming a plant stanol ester-enriched diet. Large variations in oxyphytosterol concentrations between individuals however existed. The aim of this study was to identify factors that may explain inter-individual differences in plasma oxyphytosterol concentrations. For this, 43 subjects consumed for 4 weeks in random order a plant sterol, stanol and control margarine. Plasma oxyphytosterol concentrations were determined in butylated hydroxytoluene (BHT)-enriched EDTA plasma via GC MS and serum oxidized low-density lipoprotein (oxLDL) concentrations were analyzed via ELISA. Trolox equivalent antioxidant capacity (TEAC) values, alpha-tocopherol concentrations and iron/copper status were determined to assess plasma oxidative and anti-oxidative capacity. Serum (non-oxidized) sitosterol and campesterol concentrations did not correlate with plasma oxysitosterol and oxycampesterol concentrations during any of the three dietary interventions. Moreover, plasma oxyphytosterol concentrations remained relatively stable overtime. Six subjects could be arbitrarily classified as having consistent low or high plasma oxyphytosterol concentrations, which was also reflected in oxLDL concentrations. However, oxidative and anti-oxidative capacity markers, such as iron/copper status, alpha-tocopherol concentrations and TEAC values, could not explain these differences. In conclusion, subjects seem to have consistent plasma oxyphytosterol concentrations, which resulted in the identification of low and high oxidizers'. Differences., however, could not be attributed to the oxidative and anti-oxidative capacity markers analyzed. (C) 2013 Elsevier Inc. All rights reserved.

Baumgartner, S., et al. (2013). "Effects of plant sterol-or stanol-enriched margarine on fasting plasma oxyphytosterol concentrations in healthy subjects." Atherosclerosis **227**(2): 414-419.

Background: Consumption of plant sterols and plant stanols reduces low-density lipoprotein cholesterol (LDL-C) concentrations. At the same time, plasma plant sterol concentrations will increase after plant sterol consumption, but decrease after plant stanol consumption. In contrast to plant stanols, plant sterols can undergo oxidation and form oxyphytosterols. Findings from in vitro and animal studies suggest that oxyphytosterols might be atherogenic. Objective: The objective was to examine whether plant sterol and stanol consumption changes fasting plasma oxyphytosterol concentrations. Design: A randomized, double blind, cross-over study was performed in which 43 healthy subjects (18-70 years) consumed for 4 weeks a plant sterol-enriched (3.0 g/d of plant sterols), a plant stanol-enriched (3.0 g/d of plant stanols), and a control margarine separated by wash-out periods of 4 weeks. Oxyphytosterol concentrations were determined in BHT-enriched plasma via GC-MS. Results: Compared to control, serum LDL-C concentrations were reduced after plant sterol (-8.1%; p < 0.001) and plant stanol consumption (-7.8%; p < 0.001). Plant sterol consumption did not change plasma oxyphytosterol concentrations. On the other hand, intake of the plant stanol margarine reduced 7 beta-OH-campesterol by 0.07 ng/mL (similar to 14%; p < 0.01) and by 0.07 ng/mL (similar to 15%; p < 0.01) compared with the control and sterol margarines, respectively. When standardized for serum cholesterol, effects on these oxyphytosterols were comparable. In addition, plant stanol intake reduced cholesterol-standardized 7-keto-campesterol levels compared with plant sterol intake (p < 0.05). Conclusions: Daily consumption of a plant sterol-enriched margarine does not increase oxyphytosterol concentrations, while plant stanol consumption may reduce the concentrations of the oxidative plant sterol metabolites 7 beta-OH-campesterol and 7-keto-campesterol. This trial is registered at clinicaltrials.gov as NCT01559428. (C) 2013 Elsevier Ireland Ltd. All rights reserved.

Baylin, A., et al. (2003). "High 18 : 2 trans-fatty acids in adipose tissue are associated with increased risk of nonfatal acute myocardial infarction in Costa Rican adults." Journal of Nutrition **133**(4): 1186-1191.

Trans-fatty acid intake is associated with coronary heart disease (CHD), but the atherogenic potential of individual trans-fatty acids (FA) from partially hydrogenated oils (18:1 and 18:2) or meat and dairy products (16:1 and 18:1) is unclear. Incident cases (n = 482) of a first nonfatal myocardial infarction (MI) were matched with population controls (n = 482) for age, gender and area of residence, all living in Costa Rica. Trans-FA in adipose tissue samples were assessed by gas chromatography. Odds ratios (OR) and 95% confidence intervals were calculated from conditional logistic regression models. Total adipose tissue trans-fat was positively associated with risk of MI. After adjusting for established risk factors and other confounders, the OR by quintiles of total trans-fat were 1.00, 1.34, 2.05, 2.22 and 2.94 (P-test for trend < 0.01). This association was attributed mainly to 18:2 trans-FA that were abundant in both adipose tissue and in partially hydrogenated soybean oil, margarines and baked products used by this population; OR = 1.00, 0.96, 2.09, 3.51 and 5.05 (P-test for trend < 0.001). Adipose tissue 16:1 trans-FA were also associated with MI; OR = 1.00, 1.57, 1.39, 1.34 and 2.58 (P-test for trend < 0.05). An association with 18:1 trans-FA was not detected. High 18:2 trans-FA in adipose tissue are associated with increased risk of MI. Because the use of hydrogenated oils is increasing worldwide, consumers should be aware of the harmful effects of products containing partially hydrogenated oils.

Baylin, A., et al. (2002). "Adipose tissue biomarkers of fatty acid intake." American Journal of Clinical Nutrition **76**(4): 750-757.

Background: Biomarkers can provide a more accurate measure of long-term intake than can dietary questionnaires. Objective: The objective was to identify which adipose tissue fatty acids are suitable biomarkers of intake as assessed with a validated food-frequency questionnaire. Design: Costa Rican men with a mean (+/- SD) age of 56 +/- 11 y (n = 367) and women aged 60 +/- 10 y (n = 136) completed a 135-item food-frequency questionnaire and provided art adipose tissue sample. Fifty fatty acids were identified by capillary gas chromatography. Correlation coefficients were calculated after adjustment for age, sex, body mass index, and smoking status. Results: The best adipose tissue marker for total intake of saturated fatty acids was 15:0 + 17:0 (r = 0.18). Both 15:0 and 17:0 were also the best correlates of dairy product intake (r = 0.31 for each). The diet-adipose tissue correlations for n-3 fatty acids were r = 0.34 for 18:3, r = 0.15 for 20:5, and r = 0.18 for 22:6, Fish intake correlated significantly with these adipose tissue n-3 fatty acids. Dietary and adipose tissue n-6 fatty acids were highly correlated: 18:2 (r = 0.58) and 18:3 (r = 0.24). The best indicators of total trans fatty acid intake were ct18:2n-6 and tc18:2n-6 (r = 0.58 for each); total 18:1 trans fatty acid (r = 0.45) and 16: 1 trans fatty acid (r = 0.16) were the next best indicators. Conclusions: Adipose tissue is a suitable biomarker of dietary fatty acid intake, particularly for n-3 and n-6 cis polyunsaturated fatty acids and trans fatty acids, Ideally, adipose tissue and dietary questionnaires should complement, rather than substitute for, each other in epidemiologic studies.

Baylin, A., et al. (2007). "Fatty acid composition of Costa Rican foods including trans fatty acid content." Journal of Food Composition and Analysis **20**(3-4): 182-192.

To further understand the fatty acid-disease relationships in an epidemiologic context, detailed composition tables are required. The composition of the major saturated, monounsaturated, and polyunsaturated fatty acids that are most abundant in the diet, is available for numerous foods in many countries, but data on the content of individual fatty acids with relative low abundance are scarce. We conducted a study to establish a fatty acid composition database that includes fatty acids with low relative abundance as well as trans fatty acids for the main sources of fat in the Costa Rican diet. Fatty acids were determined by gas chromatography. We present in-depth fatty acid composition tables for foods that are commonly used in Costa Rica. These analyses include information on alpha-linolenic, gamma-linolenic, arachidonic acid and trans fatty acids, which are important for health but where information is scarce. Of particular interest is the high content of trans fatty acids in partially hydrogenated soybean oil in Costa Rica, although decreasing over time. In a period of 10 years the amount of total trans fatty acids in Costa Rican soybean oil has decreased from an average of 20 to 1.5%, while alpha-linolenic has increased from an average of 1.87 to 6.06%. Our data will be of special interest for studies on Latin American countries requiring dietary information. (c) 2006 Elsevier Inc. All rights reserved.

Belin, R. J., et al. (2011). "Fish Intake and the Risk of Incident Heart Failure The Women's Health Initiative." Circulation-Heart Failure **4**(4): 404-+.

Background-Whether fish or the fatty acids they contain are independently associated with risk for incident heart failure (HF) among postmenopausal women is unclear. Methods and Results-The baseline Women's Health Initiative Observational Study cohort consisted of 93 676 women ages 50 to 79 years of diverse ethnicity and background, of which 84 493 were eligible for analyses. Intakes of baked/broiled fish, fried fish, and omega-3 fatty acid (eicosapentaenoic acid + docosahexaenoic acid, alpha-linolenic acid), and trans-fatty acid were determined from the Women's Health Initiative food frequency questionnaire. Baked/broiled fish consumption was divided into 5 frequency categories: <1/mo (referent), 1 to 3/mo, 1 to 2/wk, 3 to 4/wk, >= 5/wk. Fried fish intake was grouped into 3 frequency categories: <1/mo (referent), 1-3/mo, and >= 1/wk. Associations between fish or fatty acid intake and incident HF were determined using Cox models adjusting for HF risk factors and dietary factors. Baked/broiled fish consumption (>= 5 servings/wk at baseline) was associated with a hazard ratio of 0.70 (95% confidence interval, 0.51 to 0.95) for incident HF. In contrast, fried fish consumption (>= 1 serving/wk at baseline) was associated with a hazard ratio of 1.48 (95% confidence interval, 1.19 to 1.84) for incident HF. No significant associations were found between eicosapentaenoic acid + docosahexaenoic acid, alpha-linolenic acid, or trans-fatty acid intake and incident HF. Conclusions-Increased baked/broiled fish intake may lower HF risk, whereas increased fried fish intake may increase HF risk in postmenopausal women. (Circ Heart Fail. 2011; 4: 404-413.)

Belkacemi, K., et al. (2007). "Hydrogenation of sunflower oil over bimetallic supported catalysts on mesostructured silica material." International Journal of Chemical Reactor Engineering **5**.

Hydrogenation of vegetable oils using stable catalysts with satisfactory activity and selectivity as well as very low trans fatty acid (TFA) and saturated fatty acid (SFA) production is a challenging task. It is known that unhealthy TFA formation is the result of positional and conjugative isomerization side-reactions occurring during hydrogenation. From this standpoint, it is possible to formulate active, selective and stable catalysts which would minimize the production of TFA and SFA. Monometallic Pd and bimetallic Pd-Me (Me=Mo, Ni, Co, Ru, and Sr,) highly dispersed on mesostructured SBA-silica material with pore size ranging from 6 to 7 nm, BET-specific surface of 800-900 m(2)/g, and metal nominal total loading up to 1.0 % w/w, were comparatively investigated as catalysts for lowering the unhealthy trans (TFA) and saturated (SFA) fatty acids and maximizing the highly health-beneficial cis-monoenes production during the hydrogenation of sunflower oil at 110 degrees C under hydrogen pressure of 5 atm. The Pd-catalyst at nominal metal loading of 0.8 % supported on nanostructured support was active and selective for the hydrogenation of sunflower oil under mild process conditions. It produced less saturated acid and reached a good selectivity towards monoenes. In all cases, the consecutive impregnations of Pd and a second metal on the mesoporous silica support preserved the mesoporous structure of the support with slight modification of the textural characteristics in terms of BET surface area, pore size distribution and total pore volume. The addition of nominal 0.2 % Co, Sr or Ru to 0.8% Pd-catalyst enhanced its activity. However, the addition of nominal 0.2 % Ni or Mo dropped the activity of monometallic Pd-catalyst significantly. It is clearly shown that Ru had some promoting effect to inhibit further the formation of trans fatty acids. The addition of a second metal to Pd-catalyst had no significant effect on the formation of C18:0. High degree of metal-metal, metal-support as well as metal-oil interactions would greatly influence the reaction mechanisms of the vegetable oil hydrogenation.

Bemelmans, W. J. E., et al. (2002). "Effect of an increased intake of alpha-linolenic acid and group nutritional education on cardiovascular risk factors: the Mediterranean Alpha-linolenic Enriched Groningen Dietary Intervention (MARGARIN) study." American Journal of Clinical Nutrition **75**(2): 221-227.

Background: The effect of long-term increased intakes of alpha-linolenic acid (ALA; 18:3n-3) on cardiovascular risk factors is unknown. Objectives: Our objectives were to assess the effect of increased ALA intakes on cardiovascular risk factors and the estimated risk of ischemic heart disease (IHD) at 2 y and the effect of nutritional education on dietary habits. Design: Subjects with multiple cardiovascular risk factors (124 men and 158 women) were randomly assigned in a double-blind fashion to consume a margarine rich in either ALA [46% linoleic acid (LA; 18:2n-6) and 15% ALA; n = 114] or LA (58% LA and 0.3% ALA; n = 168). An intervention group (n = 110; 50% ALA) obtained group nutritional education, and a control group (n = 172; 34% ALA) received a posted leaflet containing the standard Dutch dietary guidelines. Results: Average ALA intakes were 6.3 and 1.0 g/d in the ALA and LA groups, respectively. After 2 y, the ALA group had a higher ratio of total to HDL cholesterol (+0.34; 95% CI: 0.12, 0.56), lower HDL cholesterol (-0.05 mmol/L; -0.10, 0), higher serum triacylglycerol (+0.24 mmol/L; 0.02, 0.46), and lower plasma fibrinogen (-0.18 g/L; -0.31, -0.04; after 1 y) than did the LA a cup (adjusted for baseline values, sex, and lipid-lowering drugs). No significant difference existed in 10-y estimated IHD risk. After 2 y, the intervention group had lower saturated fat intakes and higher fish intakes than did the control group. Conclusions: Increased ALA intakes decrease the estimated IHD risk to an extent similar to that found with increased LA intakes. Group nutritional education can effectively increase fish intake.

Bemelmans, W. J. E., et al. (2004). "Increased alpha-linolenic acid intake lowers C-reactive protein, but has no effect on markers of atherosclerosis." European Journal of Clinical Nutrition **58**(7): 1083-1089.

Objective: To investigate the effects of increased alpha-linolenic acid (ALA)-intake on intima-media thickness (IMT), oxidized low-density lipoprotein (LDL) antibodies, soluble intercellular adhesion molecule-1 (sICAM-1), C-reactive protein (CRP), and interleukins 6 and 10. Design: Randomized double-blind placebo-controlled trial. Subjects: Moderately hypercholesterolaemic men and women (55 +/- 10 y) with two other cardiovascular risk factors (n = 103). Intervention: Participants were assigned to a margarine enriched with ALA (fatty acid composition 46% LA, 15% ALA) or linoleic acid (LA) (58% LA, 0.3% ALA) for 2 y. Results: Dietary ALA intake was 2.3 en% among ALA users, and 0.4 en% among LA users. The 2-y progression rate of the mean carotid IMT (ALA and LA: + 0.05 mm) and femoral IMT (ALA: + 0.05 mm; LA: + 0.04 mm) was similar, when adjusted for confounding variables. After 1 and 2 y, ALA users had a lower CRP level than LA users (net differences -0.53 and -0.56 mg/l, respectively, P<0.05). No significant effects were observed in oxidized LDL antibodies, and levels of sICAM-1, interleukins 6 and 10. Conclusions: A six-fold increased ALA intake lowers CRP, when compared to a control diet high in LA. The present study found no effects on markers for atherosclerosis.

Bendsen, N. T., et al. (2011). "Effect of trans fatty acid intake on abdominal and liver fat deposition and blood lipids: a randomized trial in overweight postmenopausal women." Nutrition & Diabetes **1**.

Background: Intake of industrially produced trans fatty acids (TFAs) is, according to observational studies, associated with an increased risk of cardiovascular disease, but the causal mechanisms have not been fully elucidated. Besides inducing dyslipidemia, TFA intake is suspected to promote abdominal and liver fat deposition. Objective: We examined the effect of a high intake of TFA as part of an isocaloric diet on whole-body, abdominal and hepatic fat deposition, and blood lipids in postmenopausal women. Methods: In a 16-week double-blind parallel intervention study, 52 healthy overweight postmenopausal women were randomized to receive either partially hydrogenated soybean oil providing 15.7 g day(-1) of TFA or a control oil with mainly oleic and palmitic acid. Before and after the intervention, body composition was assessed by dual-energy X-ray absorptiometry, abdominal fat by magnetic resonance (MR) imaging, and liver fat by H-1 MR spectroscopy. Results: Compared with the control fat, TFA intake decreased plasma high-density lipoprotein (HDL)-cholesterol by 10%, increased low-density lipoprotein (LDL)-cholesterol by 18% and resulted in an increased LDL/HDL-cholesterol ratio (baseline adjusted mean (95% CI) difference between diet groups 0.41 (0.22; 0.60); P<0.001). TFA tended to increase the body fat (0.46 (-0.20; 1.17) kg; P = 0.16) and waist circumference (1.1 (-0.1; 2.4) cm; P = 0.08) more than the control fat, whereas neither abdominal nor liver fat deposition was affected by TFA. Conclusion: The adverse effect of dietary TFA on cardiovascular disease risk involves induction of dyslipidemia, and perhaps body fat, whereas weight gain-independent accumulation of ectopic fat could not be identified as a contributory factor during short-term intake. Nutrition and Diabetes (2011) 1, e4; doi: 10.1038/nutd.2010.4; published online 31 January 2011

Beninca, C., et al. (2009). "Trans fatty acids in margarines marketed in Brazil: Content, labeling regulations and consumer information." European Journal of Lipid Science and Technology **111**(5): 451-458.

A set of 46 different trademarks of margarines produced in Brazil by eight different companies was investigated in terms of the national labeling requirements for marts fatty acids (TFA). Experimental measurements of the content of total saturated fatty acids, cis-monounsaturated fatty acids, cis-polyunsaturated fatty acids and total TFA by gas chromatography showed the reliability of the data listed on the nutrition facts panel, which were used as reference for this analysis. The results revealed that 50% of the manufacturers and 13% of all the investigated trademarks of margarines violated the current Brazilian labeling regulations. A group of 200 consumers categorized by age, sex and years of formal education was also questioned about the importance of nutrition labeling information and TFA. Approximately 33% of the consumers interviewed were not informed about the possible detrimental effects of TFA on human health. Individuals with longer years of formal education and those affected by coronary heart diseases attributed to the intake of TFA were most interested in reading the nutrition labeling.

Benson, M. K., et al. (2008). "Studies on SFA/TFA (Saturated/Trans Fatty Acid) Rich Dietary Fats on Lipid Profile and Antioxidant Enzymes in Normal and Stressed rats." Pharmacognosy Magazine **4**(16): 320-328.

In many of the preparations instead of saturated fatty acids (SFA), trans fatty acid (TFA) produced by partial hydrogenation of unsaturated oils were advocated as the preferred fatty acid base for solid fats. The present study was designed to investigate the effects of dietary fats rich in SFA and TFA on lipid profile and endogenous antioxidant enzymes in normal and stressed rats. Twenty eight day old male Wistar rats were fed for duration of 45 days with fat enriched special diet (10% fat) prepared with coconut oil (CO), palm oil (PO) (SFA rich), Vanaspathi (VP) (TFA rich) and groundnut oil (control) respectively. Present study claims the protective role CO against atherogenic index and lipid peroxidation under normal and stress conditions. PO though contains SFA possesses less beneficial effect than CO, but safer than VP in causing atherogenicity. Whereas VP by virtue of its hyperlipidemic and oxidative stress generating ability exhibits deleterious effects in causing atherogenicity. Hence the consumption of high content of TFAs may aggravate the occurrence of cardiovascular disease, this effect being worse when accompanied with stress.

Berasategi, I., et al. (2011). "The inclusion of functional foods enriched in fibre, calcium, iodine, fat-soluble vitamins and n-3 fatty acids in a conventional diet improves the nutrient profile according to the Spanish reference intake." Public Health Nutrition **14**(3): 451-458.

Objective: The growing interest in maintaining good health status through optimal nutrition has boosted the launch of a number of functional foods on the market. The objective of the present study was to theoretically evaluate the nutritional relevance of incorporating selected enriched foods in the diet. Design: A 28 d dietary plan, designed to be balanced under the recommended macronutrients criteria, was used as a basal diet. Some conventional foods were exchanged with foods enriched in fibre, calcium, iodine, vitamins A, D, E or n-3 fatty acids. Setting: Nutritional composition of basal and modified diets was derived and compared to the Spanish recommended intakes (RI). Results: The basal diet covered the recommendations for fibre and calcium with mean intake of 28g and 1241 mg, respectively. The current intake of salt, if iodized, or bread elaborated with this salt, allowed reaching the daily intake of iodine every clay, with a mean supply of 216 mu g/d and 278 mu g/d, respectively. The deficient supply of vitamin E in the basal diet (mean = 8 mg/d) was covered by including enriched margarine and dairy products (mean = 15 mg/cp. The low n-3 fatty acids intake in the basal diet (1.1 g/d) increased up to 1.9 g/d after the use of enriched margarine, butter and biscuits and soya drink instead of milk. Conclusions: In order to improve the accomplishment of the RI iodine, vitamin E and n-3 fatty acids, interesting strategies dealing with the incorporation of enriched foods in the diet were successfully initiated.

Berra, B. (1993). "TRANS-FATTY-ACIDS IN INFANTILE NUTRITION." Nutrition Research **13**: S47-S59.

Trans fatty acids arise from hydrogenation in vivo and in vitro. Estimates of dietary intake of trans acids are available from a few countries and show an enormous variation from one population group to another and even within one food type. The impact of trans fatty acid consumption on cell membrane composition, growth and development, risk of cardiovascular disease, and occurrence of cancer is not clear. Published data have several inconsistencies and are open to different interpretation. Given the complexity of the situation, it is prudent to avoid making sweeping recommendations until more specific data are available. However, large intakes of trans fatty acids should be avoided.

Berry, S. E. E., et al. (2007). "The solid fat content of stearic acid-rich fats determines their postprandial effects." American Journal of Clinical Nutrition **85**(6): 1486-1494.

Background: The process of randomization is used commercially to harden fats as an alternative to partial hydrogenation, but its effects on cardiovascular disease risk factors are uncertain. Objective: The objective was to compare the chronic and acute effects of randomization of a fat rich in 1,3-distearyl, 2-oleyl glycerol on fasting and postprandial lipids, glucose, insulin, and activated clotting factor VII (FVIIa) concentrations. Design: A crossover design study in 16 men compared fasting and postprandial lipid, glucose, insulin, and FVIIa concentrations at baseline and after a 3-wk diet providing 30 g unrandomized or randomized shea butter and sunflower oil blends (SSOBs), both of which contained approximate to 50% stearic acid. Fecal fat excretion was measured during each dietary period. Postprandial changes were assessed after the consumption of meals providing 50 g test fat. A subsequent study compared postprandial changes after the consumption of an oleic acid-rich sunflower oil meal and an unrandomized SSOB meal. Results: Both SSOBs were well digested and absorbed. Randomization did not affect fasting or postprandial lipid, glucose, insulin, or FVIIa concentrations. Compared with the oleic acid-rich meal, the unrandomized SSOB resulted in 53% lower postprandial lipemia, 23% higher hepatic lipase activity, and a 25% lower postprandial increase in FVIIa concentration. The solid fat contents at 37 degrees C were 22%, 41%, and 0% with the unrandomized SSOB, randomized SSOB, and oleic acid-rich meals, respectively. Conclusions: Stearic acid-rich triacylglycerol in both unrandomized and randomized forms does not adversely affect lipid risk factors for cardiovascular disease. The high proportion of solid fat at 37 degrees C may explain the decreased postprandial lipemic response.

Bertram, M. Y., et al. (2012). "Reducing the sodium content of high-salt foods: Effect on cardiovascular disease in South Africa." Samj South African Medical Journal **102**(9): 743-745.

Background. Average salt intake in South African (SA) adults, 8.1 g/day, is higher than the 4 - 6 g/day recommended by the World Health Organization. Much salt consumption arises from non-discretionary intake (the highest proportion from bread, with contributions from margarine, soup mixes and gravies). This contributes to an increasing burden of hypertension and cardiovascular disease (CVD). Objectives. To provide SA-specific information on the number of fatal CVD events (stroke, ischaemic heart disease and hypertensive heart disease) and non-fatal strokes that would be prevented each year following a reduction in the sodium content of bread, soup mix, seasoning and margarine. Methods. Based on the potential sodium reduction in selected products, we calculated the expected change in population-level systolic blood pressure (SBP) and mortality due to CVD and stroke. Results. Proposed reductions would decrease the average salt intake by 0.85 g/person/day. This would result in 7 400 fewer CVD deaths and 4 300 less non-fatal strokes per year compared with 2008. Cost savings of up to R300 million would also occur. Conclusion. Population-wide strategies have great potential to achieve public health gains as they do not rely on individual behaviour or a well-functioning health system. This is the first study to show the potential effect of a salt reduction policy on health in SA.

Bhupathiraju, S. N. and K. L. Tucker (2011). "Coronary heart disease prevention: Nutrients, foods, and dietary patterns." Clinica Chimica Acta **412**(17-18): 1493-1514.

Diet is a key modifiable risk factor in the prevention and risk reduction of coronary heart disease (CHD). Results from the Seven Countries Study in the early 1970s spurred an interest in the role of single nutrients such as total fat in CHD risk. With accumulating evidence, we have moved away from a focus on total fat to the importance of considering the quality of fat. Recent meta-analyses of intervention studies confirm the beneficial effects of replacing saturated fat with polyunsaturated fatty acids on CHD risk. Scientific evidence for a detrimental role of trans fat intake from industrial sources on CHD risk has led to important policy changes including listing trans fatty acid content on the "Nutrition Facts" panel and banning the use of trans fatty acids in food service establishments in some cities. The effects of such policy changes on changes in CHD incidence are yet to be evaluated. There has been a surging interest in the protective effects of vitamin D in primary prevention. Yet, its associations with secondary events have been mixed and intervention studies are needed to clarify its role in CHD prevention. Epidemiological and clinical trial evidence surrounding the benefit of B vitamins and antioxidants such as carotenoids, vitamin E, and vitamin C, have been contradictory. While pharmacological supplementation of these vitamins in populations with existing CHD has been ineffective and, in some cases, even detrimental, data repeatedly show that consumption of a healthy dietary pattern has considerable cardioprotective effects for primary prevention. Results from these studies and the general ineffectiveness of nutrient-based interventions have shifted interest to the role of foods in CHD risk reduction. The strongest and most consistent protective associations are seen with fruit and vegetables, fish, and whole grains. Epidemiological and clinical trial data also show risk reduction with moderate alcohol consumption. In the past decade, there has been a paradigm shift in nutritional epidemiology to examine associations between dietary patterns and health. Several epidemiological studies show that people following the Mediterranean style diet or the Dietary Approaches to Stop Hypertension (DASH) diet have lower risk of CHD and lower likelihood of developing hypertension. Studies using empirical or data driven dietary patterns have frequently identified two patterns - "Healthy or Prudent" and "Western". In general, the "Healthy", compared to the "Western" pattern has been associated with more favorable biological profiles, slower progression of atherosclerosis, and reduced incidence. Evidence on changes in dietary patterns and changes in CHD risk is still emerging. With the emergence of the concept of personalized nutrition, studies are increasingly considering the role of genetic factors in the modulation of the association between nutrients and CHD. More studies of genetic variation and dietary patterns in relation to CHD are needed. (C) 2011 Elsevier B.V. All rights reserved.

Bialek, A. and A. Tokarz (2013). "Conjugated linoleic acid as a potential protective factor in prevention of breast cancer." Postepy Higieny I Medycyny Doswiadczalnej **67**: 6-14.

Cancers are the second leading cause of deaths in Poland, among both women and men. Breast cancer is the malignancy most frequently diagnosed in women. In 2008 mammary cancer was diagnosed in up to 14 500 patients. It is also the second most common cause of cancer deaths among women in our country. Although the etiology of most cases of this disease is not known, risk factors include a variety of nutritional factors. The amount of fat consumed in the diet and the quantity and quality of fatty acids are especially crucial. Among fatty acids to which great importance in modification of cancer risk is attributed are conjugated linoleic acid. Conjugated linoleic acids (CLA) are a group of positional and geometric isomers of linoleic acid, with a conjugated double bond system in the carbon chain. The main natural source of them is milk and dairy products and meat of different species of ruminants, in which cis-9, trans-11 octadecadienoic acid (rumenic acid) occurs in the largest quantities, constituting over 90% of the total pool of CLA. Another important isomer is trans-10, cis-12 octadecadienoic acid, which occurs with rumenic acid in dietary supplements, usually in the ratio 1:1. Surveys conducted show their possible health promoting effects in obesity, atherosclerosis, cardiovascular diseases, osteoporosis, diabetes, insulin resistance, inflammation, and various types of cancer, especially breast cancer.

Bilal, T., et al. (2012). "Effects of Dietary beta-Glucan on Serum Lipids and Performance Indices in Rats Fed a Diet Enriched with Cholesterol." Pakistan Veterinary Journal **32**(1): 97-100.

The aims of this study were to investigate effects of beta-glucan on body weight gain, food intake, food conversion ratio and serum total cholesterol, high-density lipoprotein cholesterol (HDL-cholesterol), low-density lipoprotein cholesterol (LDL-cholesterol) and triglyceride levels in female rats fed hypercholesterolemic diet. Female Sprague-Dawley rats (8-weeks-old) weighing 161.78 +/- 3.88 g were divided into three equal groups. Group 1 (control) was fed basal diet (2% liquid-vegetable oil, 0% cholesterol), group 2 was fed high-cholesterol diet (2% liquid-vegetable oil, 15% hydrogenated-oil and 1.5% cholesterol) and group 3 was fed high-cholesterol diet with 1% beta-glucan. The trial period was 30 days. Blood samples were withdrawn on days 0 and 30. Also, all rats were weighed on same days. Serum total cholesterol, HDL-cholesterol, LDL-cholesterol and triglyceride levels were detected with commercial kits by auto-analyzer. Body weight gain, food intake and food conversion ratio, and serum total cholesterol and LDL-cholesterol levels were significantly lower (P<0.05) in group 3 (the group fed fatty and added beta-glucan) than in the other two groups. Serum HDL-cholesterol and triglyceride levels were not significant between all groups at the end of the study. beta-glucan supplementation negatively affected food intake. However, beta-glucan effectively lowered serum LDL-cholesterol and total cholesterol concentrations without affecting HDL-cholesterol and triglyceride levels. Therefore, beta-glucan may decrease the cholesterol synthesizing ability of liver and the risk for atherosclerotic vascular disease. (C) 2011 PVJ. All rights reserved

Bilyeu, K., et al. (2011). "Novel FAD3 Mutant Allele Combinations Produce Soybeans Containing 1% Linolenic Acid in the Seed Oil." Crop Science **51**(1): 259-264.

Soybean [Glycine max (L.) Merr.] oil typically contains about 7% of linolenic acid, an oxidatively unstable fatty acid that is undesirable for many food applications. For cooking oil, reduction of the linolenic acid content by partial hydrogenation produces trans fatty acids, which are now known to increase the risk of coronary heart disease. Genetic reduction of linolenic acid was achieved decades ago, and recently the molecular genetic basis for both 3% and 1% linolenic acid soybean germplasm was revealed to be combinations of mutations in three independent members of the soybean omega-3 fatty acid desaturase (FAD3) genes that corresponded to the fan1, fan2, and fan3 loci. When the mutant GmFAD3A and GmFAD3C genes are found in combination in the breeding line CX1512-44, the linolenic acid content is reduced to approximately 3% of the of the seed oil. When the mutant GmFAD3A and GmFAD3B genes are in combination in the breeding line RG-10, a similar fatty acid profile is produced with approximately 3% linolenic acid. The objective of this work was to determine the ability of different combinations of mutant FAD3 alleles from CX1512-44 and an RG-10-derived soybean line to produce less than 3% linolenic acid in the seed oil. The results indicated that novel combinations of mutations in the three FAD3 genes are capable of producing soybean seeds containing only 1% linolenic acid in the seed oil.

Black, P. N. and S. Sharpe (1997). "Dietary fat and asthma: Is there a connection?" European Respiratory Journal **10**(1): 6-12.

The last two decades have seen an increase in the prevalence of asthma, eczema, and allergic rhinitis in developed countries. This increase has been paralleled by a fall in the consumption of saturated fat and an increase in the amount of polyunsaturated fat in the diet. This is due to a reduction in the consumption of animal fat and an increase in the use of margarine and vegetable oils containing od polyunsaturated fatty acids (PUFAs), such as linoleic acid. There is also evidence for a decrease in the consumption of oily fish which contain omega-3 PUFAs, such as eicosapentaenoic acid. In a number of countries, there are social class and regional differences in the prevalence of allergic disease, which are associated with differences in the consumption of PUFAs. Linoleic acid is a precursor of arachidonic acid, which can be converted to prostaglandin E(2) (PGE(2)), whereas eicosapentaenoic acid inhibits the formation of PGE(2). PGE(2) acts on T-lymphocytes to reduce the formation of interferon-gamma (IFN-gamma) without affecting the formation of interleukin-4 (IL-4). This may lead to the development of allergic sensitization, since IL-4 promotes the synthesis of immunoglobulin E (IgE), whereas IFN-gamma has the opposite effect. Changes in the diet may explain the increase in the prevalence of asthma, eczema and allergic rhinitis. The effects of diet may be mediated through an increase in the synthesis of prostaglandin E(2) which in turn can promote the formation of immunoglobulin E. (C)ERS Journals Ltd 1997.

Blewett, H. J., et al. (2009). "Vaccenic acid favourably alters immune function in obese JCR:LA-cp rats." British Journal of Nutrition **102**(4): 526-536.

Vaccenic acid (VA) is a ruminant-derived trans-fat and precursor of conjugated linoleic acid (CLA). The objective of the present study was to explore the effects of VA on immune function in a model of the metabolic syndrome, JCR:LA-cp rats. Lean (2:1 mix of +/cp and +/+) and obese (cp/cp) rats, aged 8 weeks, were fed a control (0% VA) or a VA diet (1.5% (w/w) VA) for 3 weeks (twenty rats per group). Splenocytes and mesenteric lymph node (MLN) immune cell phenotypes (flow cytometry), ex vivo cytokine production (ELISA) and phospholipid fatty acid concentrations were measured. Obese rats had higher proportions of splenic macrophages, total T-cells, helper T-cells (total and percentage CD25(+)), cytotoxic T-cells (total and percentage CD25+) and produced higher concentrations of IL-6 to concanavalin A (ConA) compared with lean rats. Obese rats had lower proportions of MLN T-cells, new T-cells (CD3(+)CD90(+)) and cytotoxic T-cells, but higher proportions of helper cells that were CD45RC(+), CD25(+) and CD4lo, and produced higher concentrations of IL-2, IL-10, interferon gamma and TNF alpha in response to ConA compared with lean rats. VA was higher in plasma phospholipids and both VA and CLA (cis-9, trans-11) were higher in MLN phospholipids compared with control-fed rats. Lean VA-fed rats had lower proportions of MLN and splenocyte CD45RC(+) helper cells, and helper T-cells. Splenocytes from VA-fed rats produced 16-23% less IL-2, IL-10 and TNF alpha compared with controls. VA normalised production of MLN IL-2 and TNF alpha in obese rats to levels similar to those seen in lean rats. These results indicate that dietary VA favourably alters the pro-inflammatory tendency of mesenteric lymphocytes from JCR:LA-cp rats.

Block, R., et al. (2012). "Cis-vaccenic acid and the Framingham risk score predict chronic kidney disease: The multi-ethnic study of atherosclerosis (MESA)." Prostaglandins Leukotrienes and Essential Fatty Acids **86**(4-5): 175-182.

Introduction: Data on the associations of fatty acids with chronic kidney disease (CKD) are sparse. Materials and methods: We performed a cross-sectional study of 2792 men and women from the MESA cohort of African-American, Caucasian, Chinese and Hispanic adults without known cardiovascular disease. Plasma phospholipid fatty acid proportions were associated with estimated glomerular filtration rate (eGFR) and the albumin/creatinine ratio. Results: Cis-vaccenic acid (18:1n-7), adjusted for other fatty acids using multivariate logistic regression (Cl: 1.0-1.4), and step-wise logistic regression (Cl: 1.02-1.42), was positively associated with reduced eGFR. The Framingham Risk Score, when adjusting for fatty acid proportions and demographic factors, was positively associated with CKD as measured by the eGFR and the albumin/creatinine ratio. Discussion and conclusions: Plasma phospholipid proportions of the 18 carbon monounsaturated cis-vaccenic acid (18:1n-7)) and the Framingham Risk Score are associated with kidney function. The potential role of 18:1n-7 in the development of CKD warrants further investigation. (C) 2012 Elsevier Ltd. All rights reserved.

Bochicchio, D., et al. (2005). "Effect of feeding partially hydrogenated lard on trans-fatty acid content of muscle and backfat of heavy pigs." Meat Science **71**(4): 651-656.

The incorporation of fat in diets for heavy pigs may be necessary in order to increase their energy intake in the finishing period. Lard may be a good lipid source but it contains 10-13% of linoleic acid, which makes the subcutaneous fat less suitable for long term curing of raw ham. Partial hydrogenation of lard decreases linoleic acid content, but increases trans-fatty acid content. This trial involved two groups of pigs of 114 kg live weight, fed for the last two months before slaughter with diets containing 3% lard (L) or 3% partially hydrogenated lard (PHL). The PHL contained about 10% trans-fatty acids and 2.5% linoleic acid. Rearing performance and carcass characteristics were unaffected by treatment. The group fed PHL showed a lower percentage of linoleic acid in the backfat (PHL 12.28% vs. L 13.04%) and a higher percentage of C18:1 trans-fatty acids both in backfat (0.5% vs. 0.06%) and in intramuscular fat (0.2% vs. 0.04%). (C) 2005 Elsevier Ltd. All rights reserved.

Boltonsmith, C., et al. (1991). "NUTRIENT SOURCES IN NON-MANUAL AND MANUAL OCCUPATIONAL GROUPS - RESULTS FROM THE SCOTTISH HEART HEALTH STUDY (SHHS)." Journal of Human Nutrition and Dietetics **4**(5): 291-306.

The food sources for the macro-nutrients and the antioxidant vitamins in the diets of non-manual and manual occupational groups were assessed. Nearly 10,000 men and women aged 40-59 years completed food frequency questionnaires as part of a study of risk factors for coronary heart disease (the Scottish Heart Health Study). Twenty-five food groups are identified and their percentage contribution to each of the nutrients are reported. Clear differences in the nutrient sources occur between both the sexes and the social class groups. Quantitatively, the top four food items for men are alcoholic drinks, milk, potatoes and bread, and for women are milk, bread, fresh fruit and potatoes. Meat products (as distinct from carcass meat) and hard margarines are responsible for most of the differences in total fat, and saturated fat intake between the social class groups. Key differences occur in the percentage of vitamin C and fibre from fruit juice, fresh fruit, green vegetables and potatoes. The importance of carrots to carotene intake varies by social class and, in the manual groups, a greater percentage of vitamin E is derived from eggs and hard margarine than from soft margarine and vegetable oils. These data complement the findings that nutrient intakes differ between social class groups by highlighting the foods which bring this about. The information is relevant to dietitians and health educators who may wish to bring about dietary change in populations.

BoltonSmith, C., et al. (1996). "Does dietary trans fatty acid intake relate to the prevalence of coronary heart disease in Scotland?" European Heart Journal **17**(6): 837-845.

Reports of the effects of trans fatty acids on coronary heart disease are inconsistent. Trans fatty acids may particularly influence coronary risk when linoleic acid levels are low, a situation which occurs in Scotland where prevalence of coronary heart disease is also very high. The link between trans fatty acid intake and prevalent coronary heart disease was therefore investigated in the Scottish Heart Health Study population. Trans fatty acid intakes were calculated from 10/359 sets of food-frequency questionnaire data obtained from the cross-sectional survey of men and women aged 40-59 years. Logistic regression analysis was used to calculate the odds ratios for prevalent coronary heart disease by fifths of dietary intake of total, natural and commercial hydrogenation-derived trans fatty acid. The group who had undiagnosed coronary heart disease at the time of survey was the pertinent group for examining the possible causative effects of trans fatty acid intake. After adjustment for the confounding factors (i.e. age, weight? height: smoking, level of physical activity, blood pressure, total energy intake and intakes of saturated fat, linoleic acid and the antioxidant vitamins) the odds of undiagnosed coronary heart disease for men,relative to the lowest intake fifth, did not differ significantly from unity by total or commercially derived trans fatty acid intake. Odds were around 35% smaller in the higher intake fifths of naturally-derived trans fatty acids. For women, the odds of undiagnosed coronary heart disease tended to be greater in the higher fifths of total (odds ratio 1.36 (95% confidence interval 0.94, 1.89)) and hydrogenated (1.26 (0.92, 1.72)) trans fatty acid relative to the lowest fifth, but only reached significance in the third fifth of total trans fatty acid (1.36 (1.01, 1.83)). Dietary total and commercially-derived trans fatty acids failed to influence the odds of coronary heart disease for men, even though a significant increase in the ratio of low density plus very low density lipoprotein to high density lipoprotein-cholesterol occurred with trans fatty acid intake. The results, therefore, do not support a major effect of dietary trans fatty acid from commercial hydrogenation on coronary heart disease risk in these Scottish men. The results for women are less clear, and the possibility remains that individuals at the high extreme of trans fatty acid intake, who may be essential fatty acid deficient, are at enhanced risk of coronary heart disease.

Boltonsmith, C., et al. (1995). "TRANS-FATTY-ACIDS IN THE SCOTTISH DIET - AN ASSESSMENT USING A SEMIQUANTITATIVE FOOD-FREQUENCY QUESTIONNAIRE." British Journal of Nutrition **74**(5): 661-670.

Trans fatty acids produced during hardening of oils have been associated with higher cholesterol levels and increased risk of heart disease. The potential risk from trans fatty acids may be greater in populations with relatively low intakes of essential fatty acids such as the Scots, who also have a high prevalence of heart disease. Means and ranges of trans fatty acid intakes are reported here for a Scottish population. A semi-quantitative food-frequency questionnaire was used to survey the diet of 10359 Scottish men and women aged 40-59 years in 1984-6 as part of the baseline Scottish Heart Health Study. Trans fatty acid levels were calculated for each food item on the questionnaire and the total subdivided into that which is derived naturally (primarily by bacterial fermentation in ruminants) and that which is produced during industrial hydrogenation (hardening) of vegetable and fish oils. Means and ranges of intakes of each trans fatty acid variable were calculated by sex, age, smoking and social class groups. Mean total trans fatty acid intakes for men were 7.1 (SD 3.1) g/d, 2.7 (SD 2.9)% energy and for women were 6.4 (SD 2.9) g/d, 3.3 (SD 3.0)% energy. Industrially hydrogenated trans fatty acids made up nearly 58% of the total intake for men and 61% for women, with about 60% coming from cakes, biscuits and sweets, and 20% coming from the cheaper hard margarines. The main sources of the naturally derived trans fatty acids were red meat (27%), milk (20%), butter (18-19%) and cheese (13-16%). Differences between age, smoking and social class groups were apparent. However, apart from the social class differences of up to 1 g/d, these were so small that they are unlikely to be of any biological significance unless compounded by other factors such as marginal essential fatty acid adequacy. The possibility of trans fatty acid intakes up to 48 g/d and 12% total energy (compared with the Department of Health (1991) recommendations of 5 g/d or 2% energy) highlights the need for careful monitoring of the health risks at these high levels of intake.

Booker, C. S. and J. I. Mann (2008). "Trans fatty acids and cardiovascular health: Translation of the evidence base." Nutrition Metabolism and Cardiovascular Diseases **18**(6): 448-456.

Background and aim: The recent interest in the development of evidence-based nutrition recommendations has resulted in the development of frameworks which enable a more structured evaluation of the Link between diet and chronic disease. This paper examines the application of the frameworks produced by the Scottish Intercollegiate Guidelines Network (SIGN) and the World Cancer Research Fund (WCRF), by using as a case study the association between trans unsaturated fatty acids (TFAs) and coronary heart disease. TFAs arise during industrial hydrogenation of vegetable or fish fats and oils and the natural digestion process in ruminant animals. Data synthesis: Numerous studies have examined the effects of TFA intake on serum lipids and lipoproteins and the association between TFA consumption and cardiovascular disease. Metabolic studies and meta-analyses show a clear and consistent association between increasing TFA intakes and an adverse lipid profile. Evidence from case-control and prospective cohort studies examining the association between TFA intakes and coronary heart disease is more heterogeneous and there are limitations in several of the studies. Conclusion: White the evidence is sufficient to suggest a probable positive association between TFAs and coronary heart disease, and thus to justify a firm recommendation for a reduction in dietary TFA intake, the evaluation of the data underlines the difficulties in extrapolating the principles of evidence-based medicine to evidence-based nutrition. Furthermore, there is a paucity of research into the effects of animal-derived TFAs in amounts typically consumed in a western diet and their association with adverse lipid profiles or cardiovascular outcomes. (C) 2008 Elsevier B.V. Alt rights reserved.

Booth, S. L. and M. A. Centurelli (1999). "Vitamin K: A practical guide to the dietary management of patients on warfarin." Nutrition Reviews **57**(9): 288-296.

Warfarin has been successfully used in the medical management of thromboembolic disease for nearly six decades. It is widely assumed that a dietary vitamin K-warfarin interaction exists. To avoid this potential interference with the efficacy of warfarin in stable anticoagulation, patients typically receive instructions to consume a constant dietary intake of Vitamin K. While dark, green vegetables are primary sources of dietary vitamin K, these foods are not commonly consumed on a daily basis in the United States. However, there still exists dietary resistance to warfarin that is attributable to vitamin K. Based on food analysis studies on vitamin K, it is now known that dietary Vitamin K is found in certain plant oils and prepared foods containing these plant oils, such as baked goods, margarines, and salad dressings. The preparation of foods with vitamin K-rich oils may also contribute to a diet-warfarin interaction, although this has yet to be confirmed in a clinical trial. A dose-response of vitamin K on the effect of warfarin anticoagulation has not yet been established. However, there are sufficient data to suggest that a constant dietary intake of vitamin K that meets current dietary recommendations of 65-80 mu g/day is the most acceptable practice for patients on warfarin therapy. Vitamin K composition data for commonly consumed foods are now available and may facilitate successful anticoagulation for patients being treated with warfarin.

Booyens, J. (1985). "CORONARY HEART-DISEASE, VITAMIN-B6, ESSENTIAL FATTY-ACIDS AND MARGARINE." South African Medical Journal **67**(23): 917-918.

Booyens, J. and C. F. Vandermerwe (1992). "MARGARINES AND CORONARY-ARTERY DISEASE." Medical Hypotheses **37**(4): 241-244.

In a previous paper we predicted that health effects of dietary fats in humans would require half a century or more to be understood, instead of the decade or so predicted during 1956 by an Editorial in The Lancet (1). It would seem that our prediction may have been optimistic since it has now been reported that trans unsaturated fatty acids present in high concentrations in margarines promote hypercholesterolemia in humans (2). Consequently, there has been a call for the reclassification of dietary fats upon the basis of their hypercholesterolemic properties (3). Using the latter criterion, therefore, many margarine brands would be classified as coronary artery disease risk foods. The primary adverse metabolic action of trans unsaturated fatty acids is the competitive inhibition of delta-6-desaturase, the hepatic enzyme responsible for the initial metabolic desaturation of the essential fatty acids cis linoleic and cis alpha-linolenic acid. In addition to margarines, many other common foods such as deep-fried foods, many convenience foods and bakery products contain relatively high levels of trans fatty acids. Therefore, since it has become virtually impossible to avoid a consistent, daily dietary intake of trans fatty acids, it would appear that a precautionary, preventative supplementation of the diet with supplements containing the direct metabolic products of delta-6-desaturation of the essential fatty acids, would be prudent. Such supplements are readily available.

Borges, C. F., et al. (2012). "Identification of Cardiovascular Risk Factors in Parents/Caregivers of Children with Heart Diseases." Arquivos Brasileiros De Cardiologia **99**(4): 936-943.

Background: Cardiovascular diseases are one of the major causes of morbidity and mortality worldwide. In Brazil, they are the major cause of death. Objective: To identify cardiovascular risk factors in parents/caregivers of children with heart diseases by assessing their nutritional status, health conditions, and life style. Methods: Cross-sectional study of 150 parents or caregivers of children with heart diseases who attended a cardiology outpatient clinic. Data on identification, lifestyle and health conditions were collected by means of a structured questionnaire. For the assessment of the eating habits, a questionnaire on eating frequency was used; for the assessment of the nutritional status, weight, height, and waist circumference were measured, and the body mass index (BMI) was calculated and classified. Results: A total of 155 parents of children with heart diseases, predominantly of the female gender (91.6%), were evaluated; their mean age was 35.0 +/- 10.6 years. The most prevalent risk factors were sedentary lifestyle (85.2%), obesity (28%) and hypertension (22.6%). As regards the eating habits, a high frequency of intake of red meat, margarine, vegetable oil, and sugar and low intake of fish were observed. Comparison between genders showed a significant difference in relation to obesity, as detected by BMI, and hypertension, both more frequent among women. Waist circumference measurement also showed a higher cardiovascular risk in women. Conclusion: Cardiovascular risk factors such as excess weight, sedentary lifestyle, and hypertension as well as inadequate eating habits such as a high frequency of intake of saturated fat and cholesterol and low intake of unsaturated fat were identified in the parents/caregivers assessed. (Arq Bras Cardiol 2012;99(4):936-943)

Bou, R., et al. (2005). "Increase of geometrical and positional fatty acid isomers in dark meat from broilers fed heated oils." Poultry Science **84**(12): 1942-1954.

Oxidation of polyunsaturated fatty acids leads to primary and secondary oxidation products. Compounds and amounts of these products vary, depending on the oxidative conditions. Because these oxidation products have different absorption and biological effects, we performed 2 different heating treatments on sunflower oil. The first was heating the oil at 190 to 195 degrees C for 28 h (i.e., very oxidized oil), and the other was heating at 60 degrees C for 12 d (i.e., peroxidized oil). In the frame of this study, we compared the fatty acid composition of a refined sunflower oil (fresh oil), peroxidized oil, very oxidized oil, and a mixture (1:1) of fresh and very oxidized oil (i.e., oxidized oil). Oil fatty acid compositions were affected by the heating treatments. In addition, different fatty acid isomers were formed during heating at 190 to 195 degrees C, and significant differences were found between their contents in the sunflower oils. We also studied the effect of feeding broilers with these oils and Zn and tocopherol supplements on the fatty acid composition of their raw dark meat. Various trans fatty acid isomers increased in dark meat from broilers fed oxidized and very oxidized oils. In addition, discriminant analysis showed that ditrans-conjugated linoleic acid content was able to distinguish dark chicken meat from chickens fed sunflower oils heated at 190 to 195 degrees C.

Boue, C., et al. (2000). "Trans fatty acids in adipose tissue of French women in relation to their dietary sources." Lipids **35**(5): 561-566.

This study reports the fatty acid composition of subcutaneous adipose tissue in French women with special emphasis on the content of trans fatty acids originating from two main dietary sources, ruminant fats and partially hydrogenated vegetable oils (PHVO). Adipose tissue trans fatty acid levels from 71 women, recruited between 1997 and 1998, were determined using a combination of capillary gas chromatography and silver nitrate thin-layer chromatography. Results indicate that on average cis monounsaturates accounted for 47.9% of total fatty acids, saturates for 32.2%, and linoleic acid for 14.4%. Cis n-3 polyunsaturates represented only 0.7%. Total content of trans fatty acids was 2.32 +/- 0.50%, consisting of trans 18:1 (1.97 +/- 0.49%), trans 18:2 (0.28 +/- 0.08%), and trans 16:1 (0.06 +/- 0.03%). Trans 18:3 isomers were not detectable. The level of trans fatty acids found in adipose tissue of French women was lower than those reported for Canada, the United States, and Northern European countries but higher than that determined in Spain. Therefore, trans fatty acid consumption in France appears to be intermediate between that of the United States or North Europe and that of Spain. Based on the equation of Enig et al., we estimated the mean daily trans 18:1 acid intake of French women at 1.9 g per person. The major trans 18:1 isomer in adipose tissue was Delta 11 trans, as in ruminant fats. Estimates of relative contribution of trans fatty acid intake were 55% from ruminant fats and 45% from PHVO. This pattern contrasts sharply with those established for Canada and the United States where PHVO is reported to be the major dietary source of trans fatty acids.

Boue, C., et al. (2000). "Research on a sample in Aquitaine of the effect of trans fatty acids in food on plasmatic fats and the profile of lipoproteins." Ocl-Oleagineux Corps Gras Lipides **7**(1): 35-39.

The objective of this study was to determine the effect of dietary trans fatty acids (TFA) on the risk of coronary heart disease (CHD) development, in 90 pregnant and 97 non-pregnant women, who were recruited between 1996 and 1999 in the South-West of France. The contents of TFA in total lipids, cholesteryl esters (CE) and total phospholipids (TPL) of the women's plasma, were determined using a combination of thin layer chromatography and capillary gas-liquid chromatography. Results indicate that the mean content of total TFA in plasma total lipids, expressed as proportion of all fatty acids, was 0.7%, with trans 18:1 being the most prevalent isomers (67%), followed by trans 18:2 (25%) and trans 16:1 (8%). Trans 18:3 isomers were undetectable. In TPL, the TFA accounted for 0.7% of total fatty acids, whereas in CE, the mean TFA level was twice (0.3%) as lower than in TPL. Moreover, these TFA were mainly represented by trans 18:1 isomers in TPL, and by trans 18:2 isomers in CE. Furthermore, there was no evidence of significant correlations between concentrations of low-density-lipoprotein (LDL) or high-density-lipoprotein (HDL) cholesterol and the TFA percentage in either adipose tissue or plasma. Overall, based on these results, it appears that the TFA intake level of French population does not induce an increase of CHD risk.

Bourque, C., et al. (2003). "Consumption of an oil composed of medium chain triacyglycerols, phytosterols, and n-3 fatty acids improves cardiovascular risk profile in overweight women." Metabolism-Clinical and Experimental **52**(6): 771-777.

Medium chain triacylglycerols (MCT) have been suggested as efficacious in weight management because they possess greater thermogenic qualities relative to long chain triacylglycerols; however, MCT may also increase cilrculating lipid concentrations, possibly increasing risk of cardiovascular disease (CVD). The present objective was to examine the effect of a diet supplemented with a functional oil (FctO) composed of energy expenditure-enhancing MCT (50% of fat), cholesterol lowering phytosterols (22 mg/kg body weight), and triacylglycerol-suppressing n-3 fatty acids (5% of fat), versus a beef tallow-based diet (BT), on plasma lipid and aminothiol concentrations. In a randomized, single-blind, crossover design, partially-inpatient trial, 17 overweight women consumed each oil as part of a controlled, supervised, targeted energy balance diet for 27 days, with 4 or 8 weeks of washout between phases. Mean plasma total cholesterol concentration was lower (P < .0001), by 9.1%, on FctO (4.37 +/- 0.20 mmol/L) versus BT (4.80 +/- 0.20 mmol/L). Mean plasma low-density lipoprotein (LDL) cholesterol was also lower (P < .0001) following FctO (2.39 +/- 0.15 mmol/L) versus BT (2.86 +/- 0.16 mmol/L), representing a 16.0% difference between diets. High-density lipoprotein (HDL) cholesterol and circulating triacylglycerol concentrations remained unaffected by treatment. Ratios of HDL:LDL and HDL:total cholesterol were higher (P < .01) by 22.0% and 11.0%, respectively, on FctO versus BT. Plasma total homocysteine remained unchanged with FctO, but decreased (P < .05) with control, hence higher (P < .05) end points were observed with FctO (6.95 +/- 0.33 mumol/L) versus BT (6.27 +/- 0.28 mumol/L). Plasma glutathione increased (P < .05) by 0.44 mumol/L with FctO supplementation. In conclusion, despite equivocal effects on homocysteine levels, consumption of a functional oil composed of MCT, phytosterols, and n-3 fatty acids for 27 days improves the overall cardiovascular risk profile of overweight women. (C) 2003 Elsevier Inc. All rights reserved

Brace, R. C., et al. (2011). "Agronomic and Seed Traits of Soybean Lines with High Oleate Concentration." Crop Science **51**(2): 534-541.

Soybean [Glycine max (L.) Merr.] lines with the transgenic event DP-305423-1 produce a high-oleate oil and those with the fan1(C1640) and fan3(RG10) alleles produce a low-linolenate oil. The objective of this study was to evaluate the agronomic and seed traits of high-oleate and low-linolenate (HOLL) lines, high-oleate and normal-linolenate (HONL) lines, and normal-oleate and normal-linolenate (NONL) lines selected from four single-cross populations segregating for the three genes. A minimum of 14 F(3:5) lines of each class in the four populations were evaluated in five environments during 2009. The mean fatty ester concentrations averaged across populations were 786 g kg(-1) oleate and 24 g kg(-1) linolenate for the HOLL lines, 784 g kg(-1) oleate and 56 g kg(-1) linolenate for the HONL lines, and 226 g kg(-1) oleate and 75 g kg(-1) linolenate for the NONL lines. The mean yield of the NONL lines was significantly greater than the HOLL lines by 4.5% and the HONL lines by 3.0%. Of the 10 highest yielding lines in each population, 60% were NONL, 25% HOLL, and 15% HONL, which indicated that it would be possible to select cultivars of both classes that yield as well as NONL cultivars. The overlap among the three classes in the distributions of lines for protein, oil, seed weight, maturity, height, and lodging indicated that it would be possible to develop HOLL and HONL cultivars comparable to NONL cultivars for those traits.

Brennan, P., et al. (2000). "A multicenter case-control study of diet and lung cancer among non-smokers." Cancer Causes & Control **11**(1): 49-58.

Objective: We have examined the role of dietary patterns and specific dietary nutrients in the etiology of lung cancer among non-smokers using a multicenter case-control study. Methods: 506 non-smoking incident lung cancer cases were identified in the eight centers along with 1045 non-smoking controls. Dietary habits were assessed using a quantitative food-frequency questionnaire administered by personal interview. Based on this information, measures of total carotenoids, beta-carotene and retinol nutrient intake were estimated. Results: Protective effects against lung cancer were observed for high consumption of tomatoes, (odds ratio (OR) = 0.5; 95% confidence interval (CI) 0.4-0.6), lettuce (OR = 0.6; 95% CI 0.3-1.2), carrots (OR = 0.8; 95% CI 0.5-1.1), margarine (OR = 0.7; 95% CI 0.5-0.8) and cheese (OR = 0.7; 95% CI 0.5-1.0). Only weak protective effects were observed for high consumption of all carotenoids (OR = 0.8; 95% CI 0.6-1.0), beta-carotene (OR = 0.8; 95% CI 0.6-1.1) and retinol (OR = 0.9; 95% CI 0.7-1.1). Protective effects for high levels of fruit consumption were restricted to squamous cell carcinoma (OR = 0.7; 95% CI 0.4-1.2) and small cell carcinoma (OR = 0.7; 95% CI 0.4-1.2), and were not apparent for adenocarcinoma (OR = 0.9; 95% CI 0.6-1.3). Similarly, any excess risk associated with meat, butter and egg consumption was restricted to squamous and small cell carcinomas, but was not detected for adenocarcinomas. Conclusions: This evidence suggests that the public health significance of increasing vegetable consumption among the bottom third of the population would include a reduction in the incidence of lung cancer among lifetime non-smokers by at least 25%, and possibly more. A similar protective effect for increased fruit consumption may be present for squamous cell and small cell lung carcinomas.

Bretillon, L., et al. (2003). "Might analysis, synthesis and metabolism of CLA contribute to explain the biological effects of CLA?" European Journal of Medical Research **8**(8): 363-369.

Conjugated Linoleic Acids (CLA) are of great interest for analysts since techniques have been developed to determine the dietary occurrence of CLA with a good accuracy. CLA is found in animal products from ruminant sources as the result of biohydrogenation of polyunsaturated fatty acids in the rumen and as the consequence of the delta-9 desaturation of vaccenic acid in animal tissues. CLA can also be obtained in the laboratory by isomerisation of linoleic acid or by total chemical synthesis. While the "natural" isomer is rumenic acid (9c,11t-18:2), synthetic mixtures contain mainly two isomers: the 9c,11t- and the 10t,12c-18:2. Although CLA have been shown to be metabolized into desaturated and chain elongated products, it remains unclear whether these so-formed conjugated metabolites may be involved in the effects of CLA on fatty acid metabolism. Experiments carried out on animal models with CLA have shown different health benefits: anticarcinogenic, antiatherosclerotic effects, modulation of body composition..., the "natural" CLA (9c,11t-18:2) being closely related to the protection against cancer and the 10t, 12c- 18:2 to the reduction of the fat mass. Nevertheless, recent findings have suggested adverse effects in mice. Most of the studies carried out on humans concern the influence of CLA on body composition and its possible inverse association with cancer. Since the results are still controversial and since very few data dealing with the safety of using CLA in long term feeding studies have so far been published, further works are warranted to consider the benefits of CLA for humans.

Briard-Bion, V., et al. (2008). "trans-C18:1 Isomers in Cheeses Enriched in Unsaturated Fatty Acids and Manufactured with Different Milk Fat Globule Sizes." Journal of Agricultural and Food Chemistry **56**(20): 9374-9382.

Increasing the knowledge on dietary fat composition, mainly the minor components, will improve the nutritional value of foods and their labeling. In this study, we examined the trans-octadecenoic acid (C18:1) composition of Emmental cheeses enriched in unsaturated fatty acids (FA) and manufactured with milks produced by cows selected to produce small and large fat globules. The FA composition of the milks was not significantly (P > 0.05) different from the FA composition of the corresponding Emmental cheeses. Increasing the unsaturated FA content of the cheeses using dietary manipulations lead to an increase in the trans-C18:1 and changed their isomeric profiles. In milk fat produced with the linseed-enriched diet, the trans-10 C18:1 concentration was greater than trans-11 C18:1 (vaccenic acid), which is classically the major trans-C-18:1 in milk fat. The content in trans-C18:1 and more particularly in trans-10 C18:1 was negatively correlated with the size of fat globules (r(2) = 0. 82 and 0.87, respectively) and related to milk fat depression. The trans-C18:1 content was negatively correlated with the saturated FA (slope = -0.35; r(2) = 0.81) and positively correlated with the unsaturated (slope = 0.29; r(2) = 0.85) and monounsaturated (slope = 0.32; r(2) = 0.81) FA. Focusing on the health-related considerations of fat in food products, further nutritional studies are needed to elucidate the role of trans-C18:1 isomers.

Brouwer, I. A., et al. (2013). "Effect of Alpha Linolenic Acid Supplementation on Serum Prostate Specific Antigen (PSA): Results from the Alpha Omega Trial." Plos One **8**(12).

Background: Alpha linolenic acid (ALA) is the major omega-3 fatty acid in the diet. Evidence on health effects of ALA is not conclusive, but some observational studies found an increased risk of prostate cancer with higher intake of ALA. We examined the effect of ALA supplementation on serum concentrations of prostate-specific antigen (PSA), a biomarker for prostate cancer. Methods: The Alpha Omega Trial (ClinicalTrials.govIdentifier: NCT00127452) was a double-blind, placebo-controlled trial of ALA and the fish fatty acids eicosapentanoic acid (EPA) and docosahexanoic acid (DHA) on the recurrence of cardiovascular disease, using a 262 factorial design. Blood was collected at the start and the end of the intervention period. The present analysis included 1622 patients with a history of a myocardial infarction, aged 60-80 years with an initial PSA concentration,4 ng/mL. They received either 2 g per day of ALA or placebo in margarine spreads for 40 months. T-tests and logistic regression were used to assess the effects of ALA supplementation on changes in serum PSA (both continuously and as a dichotomous outcome, cut-off point: >4 ng/mL). Findings: Mean serum PSA increased by 0.42 ng/mL on placebo (n = 815) and by 0.52 ng/mL on ALA (n = 807), a difference of 0.10 (95% confidence interval: 20.02 to 0.22) ng/mL (P = 0.12). The odds ratio for PSA rising above 4 ng/mL on ALA versus placebo was 1.15 (95% CI: 0.84-1.58). Interpretation: An additional amount of 2 g of ALA per day increased PSA by 0.10 ng/mL, but the confidence interval ranged from 20.02 to 0.22 ng/mL and included no effect. Therefore, more studies are needed to establish whether or not ALA intake has a clinically significant effect on PSA or prostate cancer.

Brouwer, I. A., et al. (2010). "Effect of Animal and Industrial Trans Fatty Acids on HDL and LDL Cholesterol Levels in Humans - A Quantitative Review." Plos One **5**(3).

Background: Trans fatty acids are produced either by industrial hydrogenation or by biohydrogenation in the rumens of cows and sheep. Industrial trans fatty acids lower HDL cholesterol, raise LDL cholesterol, and increase the risk of coronary heart disease. The effects of conjugated linoleic acid and trans fatty acids from ruminant animals are less clear. We reviewed the literature, estimated the effects trans fatty acids from ruminant sources and of conjugated trans linoleic acid (CLA) on blood lipoproteins, and compared these with industrial trans fatty acids. Methodology/Principal Findings: We searched Medline and scanned reference lists for intervention trials that reported effects of industrial trans fatty acids, ruminant trans fatty acids or conjugated linoleic acid on LDL and HDL cholesterol in humans. The 39 studies that met our criteria provided results of 29 treatments with industrial trans fatty acids, 6 with ruminant trans fatty acids and 17 with CLA. Control treatments differed between studies; to enable comparison between studies we recalculated for each study what the effect of trans fatty acids on lipoprotein would be if they isocalorically replaced cis mono unsaturated fatty acids. In linear regression analysis the plasma LDL to HDL cholesterol ratio increased by 0.055 (95% CI 0.044-0.066) for each % of dietary energy from industrial trans fatty acids replacing cis monounsaturated fatty acids The increase in the LDL to HDL ratio for each % of energy was 0.038 (95% CI 0.012-0.065) for ruminant trans fatty acids, and 0.043 (95% CI 0.012-0.074) for conjugated linoleic acid (p = 0.99 for difference between CLA and industrial trans fatty acids; p = 0.37 for ruminant versus industrial trans fatty acids). Conclusions/Significance: Published data suggest that all fatty acids with a double bond in the trans configuration raise the ratio of plasma LDL to HDL cholesterol.

Brouwer, I. A., et al. (2013). "Trans fatty acids and cardiovascular health: research completed?" European Journal of Clinical Nutrition **67**(5): 541-547.

This review asks the question if further research on trans fatty acids and cardiovascular health is needed. We therefore review the evidence from human studies on trans fatty acids and cardiovascular health, and provide a quantitative review of effects of trans fatty acid intake on lipoproteins. The results show that the effect of industrially produced trans fatty acids on heart health seen in observational studies is larger than predicted from changes in lipoprotein concentrations. There is debate on the effect of ruminant trans fatty acids and cardiovascular disease. Of special interest is conjugated linoleic acid (CLA), which is produced industrially for sale as supplements. Observational studies do not show higher risks of cardiovascular disease with higher intakes of ruminant trans fatty acids. However, CLA, industrial and ruminant trans fatty acids all raise plasma low-density lipoprotein and the total to high-density lipoprotein ratio. Gram for gram, all trans fatty acids have largely the same effect on blood lipoproteins. In conclusion, the detrimental effects of industrial trans fatty acids on heart health are beyond dispute. The exact size of effect will remain hard to determine. Further research is warranted on the effects of ruminant trans fatty acids and CLA on cardiovascular disease and its risk factors.

Bruckert, E. (2001). "The place of phytosterols in treating hyperlipidemic patients." Ocl-Oleagineux Corps Gras Lipides **8**(4): 312-316.

Bruckert, E. and D. Rosenbaum (2011). "Lowering LDL-cholesterol through diet: potential role in the statin era." Current Opinion in Lipidology **22**(1): 43-48.

Purpose of review A healthy diet should be rich in vegetables and fruits, whole-grain, high-fiber foods, and fish and should contain a small amount of saturated and trans fats. In addition to these recommendations, some food ingredients such as plant sterol/stanol soy protein and isoflavones may help reduce cholesterol levels. Increased dietary fiber intakes are associated with significantly lower prevalence of cardiovascular disease and lower LDL-cholesterol concentration of about 5-10%. Beyond LDL-cholesterol lowering effects, other benefits have been observed on hypertension, diabetes mellitus. In this review, we summarize the different dietary approaches proven to be associated with LDL-cholesterol decrease. Nutritional interventions that do not exert significant LDL-cholesterol decrease have not been included in this review. Recent findings On top of a 'classical' step 1 and step 2 diet, the cornerstone of dietary recommendations, recent findings confirm the deleterious effects of trans fatty acid or the beneficial effects of sterols/stanols and nuts. Summary Dietary recommendations may have an impressive impact on cardiovascular events because they can be implemented early in life and because the sum of the effect on LDL-cholesterol is far from being negligible: step 1 diet (-10%), dietary fibers (-5 to -10%), plant sterols/stanols (-10%), nut consumption (-8%), and soy protein (-3 to -10%).

Bruckner, J. (1995). "IMPACT OF TRANS-FATTY-ACIDS ON HUMAN HEALTH." Ernahrungs-Umschau **42**(4): 122-126.

Trans isomeric fatty acids are components of animal fats (especial ly of milk and adipose tissue fat of ruminants) and of partially hy drogenated oils (frying and baking fats, sometimes of margarine). The average daily intake in Germany is about 4 g. Concerning the effects on blood lipids, trans fatty acids behave like saturated fatty acids - increase of total and LDL cholesterol, decrease of HDL cholesterol. In contrast to saturated fatty acids, however, trans fatty acids increase the lipoprotein (a) level. Epidemiological studies have shown a significant correlation between trans fatty acid intake and coronary heart disease. Because of the relatively low dally intake trans fatty acids are no reason for concern. Patients with coronary heart disease or disorders of the lipid metabolism, pregnant or lactating women, and infants should reduce their daily intake, however.

Buonacorso, V., et al. (2007). "Macrophage cholesterol efflux elicited by human total plasma and by HDL subfractions is not affected by different types of dietary fatty acids." American Journal of Clinical Nutrition **86**(5): 1270-1277.

Burdge, G. C., et al. (2005). "Incorporation of cis-9, trans-11 conjugated linoleic acid and vaccenic acid (trans-11 18 : 1) into plasma and leucocyte lipids in healthy men consuming dairy products naturally enriched in these fatty acids." British Journal of Nutrition **94**(2): 237-243.

The present study investigated whether consuming dairy products naturally enriched in cis-9, trans-11 (c9,t11) conjugated linoleic acid (CLA) by modification of cattle feed increases the concentration of this isomer in plasma and cellular lipids in healthy men. The study had a double-blind cross-over design. Subjects aged 34-60 years consumed dairy products available from food retailers for 1 week and then either control (0.17 g c9,t11 CLA/d; 0.31 g trans-vaccenic acid (tVA)/d) or CLA-enriched (1.43 g c9,t11 CLA/d; 4.71 g tVA/d) dairy products for 6 weeks. After 7 weeks washout, this was repeated with the alternate products. c9,t11 CLA concentration in plasma lipids was lower after consuming the control products, which may reflect the two-fold greater c9,t11 CLA content of the commercial products. Consuming the CLA-enriched dairy products increased the c9,t11 CLA concentration in plasma phosphatidylcholine (PC) (38 %; P=0.035), triacylglycerol (TAG) (22 %; P < 0.0001) and cholesteryl esters (205 %; P < 0.0001), and in peripheral blood mononuclear cells (PBMC) (238 %; P < 0.0001), while tVA concentration was greater in plasma PC (65 %; P=0.035), TAG (98 %; P=0.001) and PBMC (84 %; P=0.004). Overall, the present study shows that consumption of naturally enriched dairy products in amounts similar to habitual intakes of these foods increased the c9,t11 CLA content of plasma and cellular lipids.

Butt, M. S. and M. T. Sultan (2009). "Levels of Trans Fats in Diets Consumed in Developing Economies." Journal of Aoac International **92**(5): 1277-1283.

Cardiovascular complications are a leading cause of mortality worldwide, and dietary patterns and lifestyle are key factors responsible for their progression. Sedentary lifestyle and transient changes in nutrition have led to drastic increases in such maladies during the last few decades, and dietary changes are significant, as they are coupled with high fat intake, especially trans fats. In developed countries, legislations and monitoring systems have resulted in reduced consumption of these metabolites. The developing world, especially South Asia, is also facing the menace of trans fats; lack of governmental interest and ignorance among consumers are the main reasons. In these regions, the use of hydrogenated vegetable oil (ghee) and shortening in deep-fat frying of culinary items, such as samosa, paratha, bhatura, poori, and tikkies, results in increased consumption of trans fats. Research investigations and cohort studies showed a positive correlation between consumption of trans fats and cardiovascular disorders. In this article, trans fats intake and its level in different products available in developing countries, particularly in South Asia, were reviewed along with information regarding processes involved in the production and possible reduction of trans fats.

Buttery, J. (2007). "Trans fats." Journal of Complementary Medicine **6**(3): 47-+.

Commercial trans fat [TF] is made from vegetable oil through partial hydrogenation TF can cause raised blood lipids, Leading to increased risk of coronary heart disease, diabetes, obesity, cancer and infertility TF is commonly found in commercial products such as pies, doughnuts, fried chips, cakes and biscuits Examine food Labels and avoid products with shortening, vegetable fat and hydrogenated vegetable oil, as these probably contain high TF content. Food manufacturers in Australia are not yet required to state TF content on Labels, however some do. If necessary, only choose products with TF content <1%.

Bysted, A., et al. (2009). "Substitution of trans fatty acids in foods on the Danish market." European Journal of Lipid Science and Technology **111**(6): 574-583.

Three surveys of the content of trans fatty acids (TFA) in foods on the Danish market were carried out before and after the Danish regulation,vas introduced in January 2004 restricting the use of industrially produced (IP)-TFA to a maximum of 2 g per 100 g fat in any food product. For this purpose, food samples were collected in 2002-3, 2004-5, and 2006-7. Of these, 60 paired samples (defined as samples included in two of the three investigations and with higher levels of IP-TFA in the first determination than in the second) were identified. Comparisons of the fatty acid profiles showed that, in 68% of the products (e.g. sweets, cakes and cookies as well as fast food such as pie and tortilla), IP-TFA were mainly substituted with saturated fatty acids (SFA). In some cases, the SFA source was coconut fat, whereas in other products, palm oil was added instead of partially hydrogenated oils. However, in important cases like frying fats, healthier fat substitutes with monounsaturated fatty acids were used. The surveys showed that the IP-TFA content has been reduced or removed from most products with originally high IP-TFA content, like French fries, microwave oven popcorn and various bakery products, so that IP-TFA are now insignificant for the intake of TFA in Denmark.

Cade, J. E. and B. M. Margetts (1991). "RELATIONSHIP BETWEEN DIET AND SMOKING - IS THE DIET OF SMOKERS DIFFERENT." Journal of Epidemiology and Community Health **45**(4): 270-272.

Study objective - The aim was to compare nutrient intakes of smokers, past smokers, and non-smokers. Design - The study was cross sectional and compared nutrient intake by smoking status using data obtained from a concurrent study of diet. Setting - The study took place in three towns in England: Ipswich, Wakefield, and Stoke on Trent. Participants - Food records were obtained from 1115 men and 1225 women aged 35 to 54 years, representing response rates of 84-86% in the three towns. Measurements and main results - Diet was assessed using a 24h food record in household measures. For both men and women vitamin C, total fibre, beta-carotene, and vitamin E intakes were lowest in the current smokers and highest in the nonsmokers with past smokers having intermediate values. Polyunsaturated/saturated fat ratio was lowest in the current smokers. Men who smoked had higher energy intakes than those who did not. The lower fat intakes of beta-carotene, vitamin C, fibre, and polyunsaturated fat in the smokers was due to fewer smokers eating a whole range of foods including fruit, wholemeal bread, cereals, and poly-unsaturated margarine. Current smokers had a lower body mass index than non-smokers or past smokers despite their higher energy intakes. Conclusions - Smokers have different nutrient and food intakes compared with past smokers or non-smokers.

Calpe-Berdiel, L., et al. (2009). "New insights into the molecular actions of plant sterols and stanols in cholesterol metabolism." Atherosclerosis **203**(1): 18-31.

Plant sterols and stanols (phytosterols/phytostanols) are known to reduce serum low-density lipoprotein (LDL)-cholesterol level, and food products containing these plant compounds are widely used as a therapeutic dietary option to reduce plasma cholesterol and atherosclerotic risk. The cholesterol-lowering action of phytosterols/phytostanols is thought to occur, at least in part, through competition with dietary and biliary cholesterol for intestinal absorption in mixed micelles. However, recent evidence suggests that phytosterols/phytostanols may regulate proteins implicated in cholesterol metabolism both in enterocytes and hepatocytes. Important advances in the understanding of intestinal sterol absorption have provided potential molecular targets of phytosterols. An increased activity of ATP-binding cassette transporter Al (ABCAl) and ABCG5/G8 heterodimer has been proposed as a mechanism underlying the hypocholesterolaemic effect of phytosterols. Conclusive studies using ABCAl and ABCG5/G8-deficient mice have demonstrated that the phytosterol-tnediated inhibition of intestinal cholesterol absorption is independent of these ATP-binding cassette (ABC) transporters. Other reports have proposed a phytosterol/phytostanol action on cholesterol esterification and lipoprotein assembly, cholesterol synthesis and apolipoprotein (apo) B100-containing lipoprotein removal. The accumulation of phytosterols in ABCG5/G8-deficient mice, which develop features of human sitosterolaemia, disrupts cholesterol homeostasis by affecting sterol regulatory element-binding protein (SREBP)-2 processing and liver X receptor (LXR) regulatory pathways. This article reviews the progress to date in studying these effects of phytosterols/phytostanols and the molecular mechanisms involved. (C) 2008 Elsevier Ireland Ltd. All rights reserved.

Candal, R. J. and M. L. Herrera (2009). Milk Fat/Sunflower Oil Blends as Trans Fat Replacers.

As a body of evidence suggests that dietary trans fatty acids raise blood cholesterol levels, thereby increasing the risk of coronary heart disease, on July 11, 2003, FDA issued a final rule requiring the mandatory declaration in the nutrition label of the amount of trans fat present in foods, including dietary supplements. The agency required that the declaration of trans fat be on a separate line immediately under the declaration for saturated fat. Since there was no scientific basis for establishing a DV for trans fat, the final rule did not require the listing of a % DV as is required for some of the other mandatory nutrients, such as saturated fat. However, a report from the World Health Organization (WHO) and the Food and Agricultural Organization (FAO) of the United Nations has recommended a very low intake of TFA, less than 1% of daily energy intake. Therefore, efforts have been made and are ongoing to decrease TFA in the food supply both in the U.S. and globally. There are many challenges that food manufacturers have faced during the development of new trans fat alternatives. Any replacement ingredient must provide the functional characteristics of the material being replaced. In other words, the alternative ingredient must provide the functionality of flakiness, firmess of texture, crispness or desired appearance in the finished product or it is likely to be rejected by the consumer. The stability or shelf life of the finished product must also be maintained to ensure consumer acceptability. In some applications, like baked goods, a certain amount of solids is crucial. Consumer concerns associated with the atherogenic effect of trans fatty acids limit the future of the hydrogenation process as a way of modifying the solid-to-liquid ratio in vegetable oils/fats. As an alternative to hydrogenated vegetable oils, modification of high melting point stearins by blending with vegetable oils is becoming important, since shortenings with appropriate physicochemical properties and good nutritional characteristics that are free of trans fatty acids and rich in PUFA can be obtained. Thus, it is of interest to discuss the potential of blends of a stearin such as a high-melting fraction of milk fat with a vegetable oil as trans fat replacer. In this chapter the physical chemical properties of milk fat-sunflower oil low-trans blends, that is, crystallization behavior, polymorphism, microstructure and the effect of addition of emulsifiers in bulk systems will be reviewed.

Cantwell, M. M. (2000). "Assessment of individual fatty acid intake." Proceedings of the Nutrition Society **59**(2): 187-191.

Dietary assessment of individual fatty acid intake is difficult due to a number of limitations. Information regarding the type, quantity and brand-name of fat used in cooking and at the table is required. In addition, margarine manufacturers may change the component oils used for reasons of cost, which changes the fatty acid composition of their products from season-to-season. Independent markers of fatty acid intake are required, therefore, to compensate for these limitations. Adipose tissue concentrations have been used as a measure of habitual intake of fatty acid groups and individual fatty acids in numerous studies. Saturated (SFA) and monounsaturated fatty acids (MUFA) are generally poorly correlated with adipose tissue concentrations, which can be explained partly by endogenous synthesis. In general, adipose tissue concentrations of exogenously-produced fatty acids (n-3 and n-6 polyunsaturated fatty acids (PUFA)) are well correlated with estimates of habitual intake. Correlations between dietary trans unsaturated fatty acids (TUFA) and adipose tissue concentrations vary between countries, which may be due to differences in dietary sources. Correlations may be affected by differences in bioavailability or selective retention of fatty acids in certain tissue lipids.

Cantwell, M. M., et al. (2005). "Contribution of foods to trans unsaturated fatty acid intake in a group of Irish adults." Journal of Human Nutrition and Dietetics **18**(5): 377-385.

Objective To assess fat intake with particular focus on trans unsaturated fatty acid (TUFA) intake and the major sources of TUFA among Irish individuals using a Fat Intake Questionnaire (FIQ), designed specifically for an Irish context. Subjects and methods A total of 105 healthy volunteers (43 females, 62 males; aged 23-63 years) were recruited from Dublin Airport Medical centre, Republic of Ireland. Dietary intake was assessed using an 88 food item/food group semi-quantitative FIQ, which was developed and validated for the Irish population. Results Mean energy intake was 10.6 MJ day(-1), and 34% was provided by fat. Saturated, monounsaturated, polyunsaturated, trans unsaturated fatty acids and linoleic acid contributed 13%, 10%, 6%, 2% and 5% of energy respectively. Mean TUFA intake was 5.4 g day(-1) (range 0.3-26). Margarine spreads provided the majority of TUFAs (1.93 g day(-1)), but the contribution was significantly greater for men compared with women (2.35 g day(-1) versus 1.33 g day(-1); P = 0.024). Milk and meat also contributed more to TUFA intake for men compared with women, but confectionery was a significantly greater contributor for women (8.6% versus 3.1% respectively, P = 0.01). Conclusions Although the mean TUFA intake of the total group was 5.4 g day(-1) and was within current dietary recommendations (2% energy intake), some individuals had intakes as high as 26 g day(-1). Public health efforts are therefore required to reduce TUFA intake in those individuals with high intakes.

Capita, R. and C. Alonso-Calleja (2003). "Trans-fatty acids in the Spanish diet." Agro Food Industry Hi-Tech **14**(4): 38-41.

Fatty acids containing trans unsaturated double bonds occur in Nature, but the most common dietary source are "man-treated" fats. Because of the possible link between trans-fatty acids (trans-FA) consumption and human disease (mainly cardiovascular disease and cancer), the health effects of trans-FA have been studied for over the last fifty years. This study aims at assessing the intake of trans-FA and their distribution throughout the day and during the week in a young adult Spanish population. The average trans-FA intake was 2.55+/-1.59 g/day (2.29+/-0.91% fat; 0.85+/-0.39% energy) in men and 2.49+/-1.84 g/day (2.64+/-1.25% fat; 0.96+/-0.48% energy) in women. Breakfast (8.00 a.m. approximately) followed by dinner (10.00 p.m. approximately) showed the highest trans-FA densities (g/1000 kcal), both in men and women. Higher (not significant) amounts of these fatty acids were found at the weekend rather than on weekdays. Average values in our study are lower than the upper limits established for European populations (2% energy) and than data found in other countries. However the high range of intakes observed (0.59 to 8.40 g/day in men and 0.39 to 12.80 g/day in women) makes it necessary for each case to be considered individually. Even though there is no evidence of risk at the low intake of trans-FA found in this study (further research into this whole area is needed), it is recommended that industry and individuals actively try to diminish the dietary trans-fatty acid levels in order to achieve an optimal diet so as to reduce the risk of chronic diseases.

Carta, G., et al. (2002). "Modulation of lipid metabolism and vitamin A by conjugated linoleic acid." Prostaglandins Leukotrienes and Essential Fatty Acids **67**(2-3): 187-191.

The term conjugated linoleic acid (CLA) refers to a collection of positional and geometrical isomers of octaclecadienoic acid with conjugated double bonds. CLA has been shown to posses several beneficial activities in different experimental models, however, out of 28 isomers only two, c9, t11 and t10, c12 have been thus far demonstrated to be biologically active. The discovery that it can be elongated and desaturated as a regular fatty acid in human and animal tissues brought a new possibility that its activity may be related to its properties as a peculiar unsaturated fatty acid. In fact, CLA is able to be incorporated in lipid classes as oleic acid, accumulating in those tissues rich in neutral lipids; to be metabolized as linoleic acid and so influencing linoleic acid desaturation and elongation; and to be beta oxidized in peroxisomes which may account for, through activation of PPARs, its ability to increase free retinol levels and influence gene expression. These activities are amplified where CLA accumulates more such as mammary and adipose tissues and may explain its peculiar beneficial properties, at relative low dietary concentrations, in these tissues. Furthermore, it has been demonstrated that CLA can be endogenously formed by delta 9 desaturation of vaccenic acid (t11 18:1) thus forming the isomer c9, t11. Either endogenously formed or through dietary intake, CLA showed to be metabolized in the same way and to exert the same biological properties. We may conclude that a regular intake of CLA, or/and vaccenic acid as its precursor, should work as an excellent preventive agent by modulating lipid metabolism in target tissues thus conferring protection against the attack of insults of different type. (C) 2002 Elsevier Science Ltd. All rights reserved.

Carvalho, E. O. and E. F. da Rocha (2011). "Consumption to feed of resident adult population in rural area of the city of Ibatiba (ES, Brazil)." Ciencia & Saude Coletiva **16**(1): 179-185.

It is a transverse study where a questionnaire of alimentary frequency was applied (QAF) in 150 adults resident of the rural area of the city of Ibatiba (ES, Brazil). QAF classified the alimentary consumption as: habitual (>= 4 times in the week), not habitual (< 4 times in the week) and rarely (1 time a month), with objective of correlating the alimentary consumption with the chronic-degenerative diseases. The results evidenced a habitual consumption of rice, breads, stalk, bean, cow milk, animal fat, margarine, sugar and coffee, and a non habitual consumption of cake, potato, cookies, manioc, sweet potato, chayote, carrot, beet, pumpkin, juice of fruits, banana, orange, guava, mango and tangerine. It can be concluded that the feeding habit presented by the studied population it can come to increase in a medium or long period the prevalence and occurrences of chronic-degenerative diseases as hypertension, diabetes, obesity and coronary diseases. The alimentary consumption of this population needs concern, because when compared with the national patterns, it is observed some inadequacies, and it is known that this picture comes to every day causing damages the public health.

Casas-Agustench, P., et al. (2012). "Effects of plant sterol esters in skimmed milk and vegetable-fat-enriched milk on serum lipids and non-cholesterol sterols in hypercholesterolaemic subjects: a randomised, placebo-controlled, crossover study." British Journal of Nutrition **107**(12): 1766-1775.

Plant sterol (PS)-supplemented foods are recommended to help in lowering serum LDL-cholesterol (LDL-C). Few studies have examined the efficacy of PS-enriched skimmed milk (SM) or semi-SM enriched with vegetable fat (PS-VFM). There is also insufficient information on factors predictive of LDL-C responses to PS. We examined the effects of PS-SM (0.1% dairy fat) and PS-VFM (0.1% dairy fat plus 1.5% vegetable fat) on serum lipids and non-cholesterol sterols in hypercholesterolaemic individuals. In a placebo-controlled, crossover study, forty-three subjects with LDL-C > 1300 mg/l were randomly assigned to three 4-week treatment periods: control SM, PS-SM and PS-VFM, with 500 ml milk with or without 3.4 g PS esters (2 g free PS). Serum concentrations of lipids and non-cholesterol sterols were measured. Compared to control, LDL-C decreased by 8.0 and 7.4% (P<0.015, both) in the PS-SM and PS-VFM periods, respectively. Serum lathosterol:cholesterol (C) ratios increased by 11-25%, while sitosterol:C and campesterol:C ratios increased by 70-120% with both the PS-fortified milk. Adjusted LDL-C reductions were variably enhanced in participants with basal low serum lathosterol/C or conversely high sitosterol/C and campesterol/C. Subjects with post-treatment serum PS:C ratios above the median showed mean LDL-C changes of -5.9 to -10.4%, compared with 1.7 to -2.9% below the median. In conclusion, consumption of 2 g/d of PS as PS-SM and PS-VFM lowered LDL-C in hypercholesterolaemic subjects to a similar extent. Basal and post-treatment changes in markers of cholesterol metabolism indicating low cholesterol synthesis and high cholesterol absorption predicted improved LDL-C responses to PS.

Castillo, J. A., et al. (2010). "Role of stearoyl CoA desaturase on conjugated Linoleic acid concentration in bovine milk: review." Revista Colombiana De Ciencias Pecuarias **23**(4): 493-500.

Interesting health benefits have been attributed to the intake of conjugated linoleic acid, CLA (C-18:2 cis-9, trans-11), which is the main isomer of linoleic acid, and is present in bovine milk. Among those benefits are: cancer prevention, diminished risk for the onset of type II diabetes and cardiovascular disease, modulation of the immune response, and reduction of preeclampsia risk in primigravid women. Although an adequate nutrition of cows has permitted to increase the amount of CLA in their milk, there is variation in CLA concentrations among cows consuming the same diet. It has been suggested that this variation is due either to changes in the activity of stearoyl CoA desaturase (SCD), changes in the gene expression, or to alterations in the ruminal process of biohydrogenation. Research conducted in semimembranosus muscle and subcutaneous adipose tissue of cattle suggests there are two isoforms of SCD.

Castro-Martinez, M. G., et al. (2010). "Dietary trans fatty acids and its metabolic implications." Gaceta Medica De Mexico **146**(4): 281-288.

Fats are important nun tents in our diet, they have wide chemical properties that drive diverse metabolic effects The trans fatty acids (77:A) are common compounds found in industrialized pod. and recent research has shown they should be avoided due 10 then increased risk of cardiovascular disease (CV,D) Sonic of the mechanisms Involved include reduction of c-HDL concentration, increase of low density lipoprotein, Lp (a). triglycerides, disturbance in prostaglandin balance and they may also pi mote insulin resistance Obese subjects are prone to increased CVD!) risk associated with a state of chronic inflammation that can be worsened by TFA intake The US population consumes approximately 5 3g 77:4 per day (2 6% of their total energy intake and 7 4% of their fat energy) Recently, WHO recommendations suggest the intake of TFA should he lower Man 1% of energy per day Current fast Pod industry products have to decrease the amount of TFA content , and the experience from different countries shows that the elimination of trans fatty acids is a cost effective and feasible public health intervention

Caviedes, J. M. L., et al. (2011). "Pasture traits and conjugated linoleic acid (CLA) content in milk." Revista Colombiana De Ciencias Pecuarias **24**(1): 63-73.

Functional foods (foods that have a beneficial effect in health) were usually referred to those of vegetable origin. Nowadays, interesting bioactive compounds have been also found in the fat of ruminants (milk and meat). Ruminant feeding systems based in grazing increase the presence of polyunsaturated fatty acids (i.e., conjugated linoleic acid) in milk, which reputedly prevents against certain diseases, such as diabetes, atherosclerosis and cancer. This could later represent a comparative marketing advantage for milk produced under grazing conditions. Most Colombian dairy cows graze on kikuyu grass and/ or ryegrass, but those pastures have a high demand for nitrogen, compromising the sustainability of those systems. A search for new pastures, selected for adaptation, compatibility and productivity has started. The association between Lotus uliginosus and kikuyu has interesting potential in terms of milk quality. The presence of legumes in the pasture allows to decrease the need for nitrogen fertilizer and increases the content of beneficial compounds in milk, such as secondary metabolites that modify biohydrogenation patterns and increase the production of CLA precursors. Pasture management factors that affect milk fatty acid composition (i.e., age, species, and nitrogen fertilization) are discussed.

Centritto, F., et al. (2009). "Dietary patterns, cardiovascular risk factors and C-reactive protein in a healthy Italian population." Nutrition Metabolism and Cardiovascular Diseases **19**(10): 697-706.

Background and aims: Dietary habits have been associated with cardiovascular disease (CVD) risk factors. This study aimed at evaluating the association of non-predefined dietary patterns with CVD risk profile and C-reactive protein (CRP). Methods and results: We analyzed 7646 healthy subjects from the Moti-sani project, an on-going cross-sectional cohort study of men and women aged >= 35, randomly recruited from a general Italian population. The Italian EPIC food frequency questionnaire was used. Food patterns were generated using principal factor analysis (PFA) and reduced rank regression (RRR). Three dietary patterns were identified by PFA. The "Olive Oil and Vegetables" pattern, characterized by high intake of olive oil, vegetables, legumes, soups, fruits and fish, was associated with relatively lower values of glucose, lipids, CRP, blood pressure and individual global CVD risk score. The "Pasta and Meat" pattern, characterized by high intake of pasta, tomato sauce, red meat, animal fats and alcohol, was positively associated with glucose, lipids, CRP and CVD risk score. The "Eggs and Sweets" pattern, characterized by positive loadings of eggs, processed meat, margarines, butter, sugar and sweets, was associated with high values of CRP. The first RRR pattern was similar to the "Pasta and Meat" pattern both in composition and association with CVD risk profile. Conclusions: In a large healthy Italian population, non-predefined dietary patterns including foods considered to be rather unhealthy, were associated with higher levels of cardiovascular risk factors, CRP and individual global CVD risk, whereas a "prudent-healthy" pattern was associated with tower levels. (C) 2008 Elsevier B.V. All rights reserved.

Chadban, S., et al. (2010). "Nutritional management of dyslipidaemia in adult kidney transplant recipients." Nephrology **15**: S62-S67.

Once graft is functioning: A diet rich in wholegrain, low glycaemic index and high fibre carbohydrates as well as rich sources of vitamin E and monounsaturated fat should be recommended to adult kidney transplant recipients with elevated serum total cholesterol, LDL- cholesterol and triglycerides. ( Level III - IV) Weight reduction in overweight or obese kidney transplant recipients should be encouraged and supported. ( Level IV) ( Refer to CARI Guideline: Nutritional management of overweight and obesity in adult kidney transplant patients) Kidney transplant recipients with dyslipidaemia should be advised to eat a diet which reflects the evidence described above while being in line with lipid management guidelines for the general population as follows: 1 Carbohydrate Carbohydrate should be consumed predominantly in the form of wholegrains and foods with a low energy density and/ or low glycaemic index, aiming for a daily fibre intake of 25 g for females and 30 g for males. The inclusion of the soluble fibre beta- glucan should be encouraged as it has been shown to lower LDLcholesterol in non- transplant populations. 1 - 4 2 Fat Total fat should contribute 30 - 35% of total energy intake. Saturated and trans fatty acids together should contribute no more than 8% of total energy intake. n- 6 polyunsaturated fat should contribute 8 - 10% of total energy. Monounsaturated fat may contribute up to 20% of total energy intake. n- 3 polyunsaturated fat should be included in the diet as both plant and marine sources. 1,2,5 3 Plant sterols and stanols Include plant foods which are naturally rich in phytosterols as well as 2 - 3 g phytosterol- enriched food products ( such as margarine, breakfast cereal, low fat yoghurt or milk enriched with phytosterols. Australian regulations allow a minimum of 0.8 g and a maximum

Chagan, L., et al. (2002). "Use of alternative pharmacotherapy in management of cardiovascular diseases." American Journal of Managed Care **8**(3): 270-285.

Objectives: To review use of alternative pharmacotherapy (AP) in patients with cardiovascular disease (CVD) and significant drug interactions between AP and traditional CVD medications. Study Design: A literature search of MEDLINE and the National Complementary and Alternative Medicine database was done using these search terms: supplements, vitamins, garlic, fish oil, L-arginine, soy, coenzyme Q10, herbs, phytosterols, chelation therapy, alternative medicine, and CVD. Patients and Methods: English human clinical trials measuring surrogate and clinical end points. Results: Antioxidants have not been consistently proven beneficial in reducing cardiovascular mortality. Fish oils may be beneficial in patients with hypertension and hypercholesterolemia, but therapeutic doses need to be defined. Use of coenzyme Q10 in patients with heart failure has not demonstrated consistent benefits. Garlic may lower blood pressure and cholesterol levels, but also may increase bleeding, so its use in CVD patients should be monitored. Clinical studies with small sample sizes have demonstrated that L-arginine may be useful to prevent and treat CVD, The Food and Drug Administration recommends 25 g/day of soy protein as part of a diet low in saturated fats for cholesterol reduction, Plant sterols are recommended by the American Heart Association and the National Cholesterol Education Program Expert Panel as adjunct therapy to reduce low-density lipoprotein. No data support use of chelation therapy. Some APs interact with common prescription CVD medications (eg, gingko and ginseng with warfarin, St. John's Wort with digoxin), Conclusions: The benefits of APs as part of the treatment for CVD are controversial. Routine use is not recommended.

Chajes, V., et al. (2008). "Association between serum trans-monounsaturated fatty acids and breast cancer risk in the E3N-EPIC study." American Journal of Epidemiology **167**(11): 1312-1320.

The authors assessed the association between serum phospholipid fatty acids as biomarkers of fatty acid intake and breast cancer risk among women in the E3N Study (1989-2002), the French component of the European Prospective Investigation into Cancer and Nutrition. During an average of 7 years of follow-up, 363 cases of incident invasive breast cancer were documented among 19,934 women who, at baseline (1995-1998), had completed a diet history questionnaire and provided serum samples. Controls were randomly matched to cases by age, menopausal status at blood collection, fasting status at blood collection, date, and collection center. Serum phospholipid fatty acid composition was assessed by gas chromatography. Adjusted odds ratios for risk of breast cancer with increasing levels of fatty acids were calculated using conditional logistic regression. An increased risk of breast cancer was associated with increasing levels of the trans-monounsaturated fatty acids palmitoleic acid and elaidic acid (highest quintile vs. lowest: odds ratio = 1.75, 95% confidence interval: 1.08, 2.83; p-trend = 0.018). cis-Monounsaturated fatty acids were unrelated to breast cancer risk. A high serum level of trans-monounsaturated fatty acids, presumably reflecting a high intake of industrially processed foods, is probably one factor contributing to increased risk of invasive breast cancer in women.

Chardigny, J. M. (2008). "An update on trans fatty acids." Sciences Des Aliments **28**(1-2): 24-28.

There are debates regarding Trans fatty acids (FFA): While the TFA effects, of industrial origin are well documented, the impact of consumption of TFA, of natural origin (produced from ruminants) remains little known.

Chardigny, J. M., et al. (2007). "Metabolism of trans and conjugated fatty acids." European Journal of Lipid Science and Technology **109**(9): 930-934.

Trans fatty acids (FA) enter all the metabolic pathways of bioconversion, oxidation and lipid storage and are incorporated into all tissues. They also interfere with the polyunsaturated FA metabolic pathways. Among trans FA, major attention is paid to elaidic and vaccenic acids. The latter is bioconverted into rumenic acid, a conjugated linoleic acid (CLA) isomer, through the Delta 9 desaturase pathway. Considering CLA isomers, they are also bioconverted by desaturases and the elongation pathway, but the significance of this conversion is not fully understood. This review considers these different aspects, with particular attention to human data.

Chardigny, J. M., et al. (2007). "Impact of trans fatty acids on cardiovascular risk." Sang Thrombose Vaisseaux **19**(4): 198-202.

The trans fatty acids present in our diet have two sources: the first is natural from bio-dehydrogenation in ruminants and the second, synthetic, from partial dehydrogenation of fats and oils. The major difference between the two types is the position of the double bonds on the carbon chain of the fatty acids. Several interventional studies have clearly shown that synthetic trans fatty acids have adverse effects on cardiovascular risk factors (increased LDL-cholesterol and decreased HDL-cholesterol). These findings are supported by most epidemiological surveys. However, these deleterious effects have not been observed with the natural trans fatty acids. The scarcity of epidemiological data would suggest a lack of effect but interventional trials are required to confirm this fact.

Chardigny, J. M., et al. (2006). "Rationale and design of the TRANSFACT project phase I: A study to assess the effect of the two different dietary sources of trans fatty acids on cardiovascular risk factors in humans." Contemporary Clinical Trials **27**(4): 364-373.

Background: Detrimental effects of consumption of industrial trans fatty acids (TFA) from partially hydrogenated vegetable oils (PHVO) on cardiovascular disease (CVD) risk factors are well documented. However, very little information is available on the effect of natural sources of TFA coming from milk fat, dairy products and ruminant meat. In fact, due to the naturally low level of TFA in milk fat, it is almost impossible to conduct a clinical trial with a limited number of subjects (< 200). Methodology: To compare the effects of industrial and natural dietary sources of TFA, two specific test fats have been designed and produced. A substantial amount of milk fat (130 kg) enriched in TFA has been produced by modification of the cow's diet and selection of cows with the highest TFA content. The level obtained was approximately 4- to 7-fold higher than typically present in milk fat (similar to 20 instead of 3-6 g/100 g of total fatty acids). The control fat is composed of PHVO balanced in saturated fatty acids (lauric, myristic and palmitic). Both experimental fats contain about 20-22% of monounsaturated TFA and the volunteers' daily experimental fat intake (54 g), will represent about 12.0 g/day of TFA or 5.4% of the daily energy (based on 2000 kcal/day). These two test fats have been incorporated into food items and will be provided to 46 healthy subjects under a randomised, double blind, controlled, cross-over design. The primary outcome is high-density lipoprotein cholesterol (HDL-C), which is an independent risk factor for CVD. Other parameters such as low-density lipoprotein cholesterol (LDL-C), very low-density lipoprotein cholesterol (VLDL-C), and HDL-C level and subclasses will be also to be evaluated. Conclusion: We have shown that it is technically feasible to perform a clinical trial on the comparative effects of natural and industrial sources of TFA isomers on CVD risk factors. Results are expected by mid-2006. (c) 2006 Elsevier Inc. All rights reserved.

Chavarro, J. E., et al. (2008). "A prospective study of trans-fatty acid levels in blood and risk of prostate cancer." Cancer Epidemiology Biomarkers & Prevention **17**(1): 95-101.

Background: Previous studies suggest a positive association between markers of trans-fatty acid intake and prostate cancer. We therefore prospectively evaluated the association between blood trans-fatty acid levels and risk of prostate cancer. Methods: We conducted a nested case-control study among 14,916 apparently healthy men who provided blood samples in 1982. Blood fatty acid levels were determined for 476 men diagnosed with prostate cancer during a 13-year follow-up and their matched controls. Controls were individually matched to cases according to age and smoking status at baseline. Conditional logistic regression was used to estimate the relative risk and 95% confidence interval of total, nonaggressive (stage A/B and low grade), and aggressive (stage C/D, high grade, subsequent distant metastasis or death) prostate cancer associated with blood levels of specific trans-fatty acids. Results: Blood levels of all the trans-fatty acids examined were unrelated to total prostate cancer risk. When results were divided according to tumor aggressiveness, blood levels of 18:1n-9t, all the 18:2t examined, and total trans-fatty acids were positively associated to nonaggressive tumors. The relative risks (95% confidence intervals; P trend) comparing top with bottom quintile trans-fatty acid levels were 2.16 (1.12-4.17, 0.11) for 18:1n-9t, 1.97 (1.03-3.75; 0.01) for total 18:2t, and 2.21 (1.14-4.29; 0.06) for total trans-fatty acids. None of the trans fats examined was associated with aggressive prostate tumors. Conclusion: Blood levels of trans isomers of oleic and linoleic acids are associated with an increased risk of nonaggressive prostate tumors. As this type of tumors represents a large proportion of prostate cancer detected using prostate-specific antigen screening, these findings may have implications for the prevention of prostate cancer.

Chen, J. T., et al. (2005). "Meta-analysis of natural therapies for hyperlipidemia: Plant sterols and stanols versus policosanol." Pharmacotherapy **25**(2): 171-183.

Study Objective. To compare the efficacy and safety of plant sterols and stanols as well as policosanol in the treatment of coronary heart disease, as measured by a reduction in low-density lipoprotein cholesterol (LDL) levels. Design. Systematic review and meta-analysis of randomized controlled trials. Patients. A total of 4596 patients from 52 eligible studies. Measurements and Main Results. We searched MEDLINE, EMBASE, the Web of Science, and the Cochrane Library from January 1967-June 2003 to identify pertinent studies. Reduction of LDL levels was the primary end point; effects on other lipid parameters and withdrawal of study patients due to adverse effects were the secondary end points. Weighted estimates of percent change in LDL were -11.0% for plant sterol and stanol esters 3.4 g/day (range 2-9 g/day [893 patients]) versus -2.3% for placebo (769 patients) in 23 eligible studies, compared with -23.7% for policosanol 12 mg/day (range 5-40 mg/day [1528 patients]) versus -0.11% for placebo (1406 patients) in 29 eligible studies. Cumulative p values were significantly different from placebo for both (p<0.0001). The net LDL reduction in the treatment groups minus that in the placebo groups was greater with policosanol than plant sterols and stanols (-24% versus -10%, p<0.0001). Policosanol also affected total cholesterol, high-density lipoprotein cholesterol (HDL), and triglyceride levels more favorably than plant sterols and stanols. Policosanol caused a clinically significant decrease in the LDL:HDL ratio. Pooled withdrawal rate due to adverse effects and combined relative risk for patients who withdrew were 0% and 0.84, respectively (95% confidence interval [CI] 0.36-1.95, p=0.69), for plant sterols and stanols across 20 studies versus 0.86% and 0.31, respectively (95% CI 0.20-0.48, p<0.0001), for policosanol across 28 studies. Conclusion. Plant sterols and stanols and policosanol are well tolerated and safe; however, policosanol is more effective than plant sterols and stanols for LDL level reduction and more favorably alters the lipid profile, approaching antilipemic drug efficacy.

Chen, M., et al. (2011). "Efficient and practical asymmetric synthesis of isopropyl (R)-3-(3 ',4 '-dihydroxyphenyl)-2-hydroxypropanoate and its enantiomer." Tetrahedron-Asymmetry **22**(1): 4-7.

The highly enantioselective synthesis of (R)-isopropyl 3-(3',4'-dihydroxyphenyl)-2-hydroxypropanoate and its enantiomer has been achieved starting from 3,4-dihydroxybenzaldehyde. The stereogenic centers were established through asymmetric dihydroxylation of (E)-isopropyl 3,4-bis(benzyloxy) cinnamate. A convenient manipulation in selective catalytic hydrogenation and deprotection was also accomplished in HCl-(PrOH)-Pr-i employing 10% Pd/C catalyst. (C) 2010 Elsevier Ltd. All rights reserved.

Chevallier, L. (2003). "From the Foods of today to those of the future." Archives Des Maladies Du Coeur Et Des Vaisseaux **96**: 35-42.

The prevention of cardiovascular diseases, and more generally of metabolic syndrome, goes with a well chosen diet. However, faced with a raft of often contradictory information, many patients can become disorientated. The role of the practitioner is to supply adapted, personalised and scientifically consensual advice. The consumption of certain types of foods naturally concentrated in protective elements should be favoured, such as those rich in folates, omega 3 fatty acids, and potassium, and low in sodium chloride. Furthermore, some new foodstuffs are appearing which have been subjected to modifications in their composition: enriched with certain nutrients or micronutrients, low in sugar and certain fats... Thus, for example, margarines rich in phytosterols appear interesting despite limitations in their use; similarly, precautions of usage should accompany the consumption of products enriched with omega 3, sweeteners... These attractive appearing and "gustatively correct" foods of the future will have more and more pronounced health claims. But alimentary innovation, relying on this basis in order to conquer new sections of the market, risks causing new nutritional imbalances. The practitioner must therefore remain sensible with nutritional advice and take account of economic and regional aspects by adapting it for each patient.

Chiang, M. T. and Y. S. Lu (1996). "Variation of plasma cholesterol levels in rats fed trans fatty acids or Cis fatty acids." International Journal for Vitamin and Nutrition Research **66**(3): 263-269.

To investigate the effect of dietary trans fatty acids on plasma and liver lipids, 16 Sprague Dawley male rats fed the hydrogenated soybean oil (Trans fat) or Cis fat from olive oil with two similar dietary fatty acid ratios for 9 weeks were studied. Higher plasma total cholesterol and LDL (low density lipoprotein) cholesterol levels were observed in rats fed trans fat diet when compared with rats fed the cis fat diet after 2 weeks of feeding. However, no significant changes in plasma total cholesterol and LDL cholesterol levels were found in rats of both dietary groups at 4-weeks of feeding. Rats fed trans fatty acids had lower plasma total cholesterol, LDL and VLDL (very low density lipoprotein) cholesterol levels at the end of the experimental period. Although significantly (p <0.05) lower liver triacylglycerol contents were found in rats fed trans fat diet, no significant (p >0.05) changes in liver cholesterol and phospholipids contents were observed in rats after trans fatty acids treatment. It is interesting that lower saturated to polyunsaturated ratios in fatty acid composition of plasma VLDL total lipids were found in rats fed trans fat diet. Results from this study suggest that the changes in plasma lipo-protein cholesterol to the long or the short term study, and dietary trans fatty acids may alter the plasma lipoprotein metabolism in rats.

Chisholm, A., et al. (1996). "Effect on lipoprotein profile of replacing butter with margarine in a low fat diet: Randomised crossover study with hypercholesterolaemic subjects." British Medical Journal **312**(7036): 931-934.

Objective-To examine the effect on lipid and lipoprotein concentrations when butter or an unsaturated margarine is used for cooking or spreading in a reduced fat diet. Design-Randomised crossover study with two intervention periods of six weeks' duration separated by a five week washout. Setting-Community setting in New Zealand. Subjects-49 volunteers with polygenic hypercholesterolaemia and baseline total cholesterol concentration in the range 5.5-7.9 mmol/l. Main outcome measures-Concentrations of total and low density lipoprotein, Lp(a) lipoprotein, high density lipoprotein, apolipoprotein B 100, and apolipoprotein A I. Results-Concentrations of low density lipoprotein cholesterol and apolipoprotein B were about 10% lower with margarine than with butter. Lp(a) lipoprotein and high density lipoprotein cholesterol concentrations were similar with the two diets. Conclusion-Despite concerns about adverse effects on lipoproteins of trans fatty acids in margarines, the use of unsaturated margarine rather than butter by hypercholesterolaemic people is associated with a lipoprotein profile that would be expected to reduce cardiovascular risk.

Chisholm, A., et al. (1996). Improved lipoprotein profile when margarine replaces butter in a low fat diet: A randomised crossover study with hypercholesterolaemic subjects. Proceedings of the Nutrition Society of New Zealand, Vol 21. **21:** 69-74.

To examine the effect on lipids and lipoproteins of the use of butter or an unsaturated margarine as the only cooking and spreading fat in a reduced fat diet we conducted a randomised crossover study with two intervention periods of six weeks duration, separated by a five week washout. Forty nine volunteers with polygenic hypercholesterolaemia and baseline total cholesterol in the range 5.5-7.9 mmol/l took part. Total and low density lipoprotein, lipoprotein (a), high density lipoprotein, apolipoprotein B-100 and apolipoprotein A(1) were the main outcome measures. Low density lipoprotein cholesterol and apolipoprotein B levels were approximately ten % lower on margarine than on butter. Lipoprotein(a) and high density lipoprotein cholesterol levels were similar on the two diets. Therefore the results indicate that when total fat is reduced to levels recommended for individuals at high risk of coronary heart disease, the use of unsaturated margarine rather than butter by hypercholesterolaemic individuals is associated with a lipoprotein profile which would be expected to be associated with reduced cardiovascular risk.

Cho, Y. Y., et al. (2009). "Low trans structured fat from flaxseed oil improves plasma and hepatic lipid metabolism in apo E-/- mice." Food and Chemical Toxicology **47**(7): 1550-1555.

The objective of this study was to explicate the effects of feeding low trans structured fat from flaxseed oil (LF) on plasma and hepatic lipid metabolism involved in apo E-/- mice. The animals were fed a commercial shortening (CS), commercial low trans fat (CL) and LF diet based on AIN-76 diet (10% fat) for 12 weeks. LF supplementation exerted a significant suppression in hepatic lipid accumulation with the concomitant decrease in liver weight. The LF significantly lowered plasma total cholesterol and free fatty acid whereas it significantly increased HDL-C concentration and the HDL-C/total-C ratio compared to the CS group. Reduction of hepatic lipid levels in the LF group was related with the suppression of hepatic enzyme activities for fatty acid and triglyceride synthesis, and cholesterol regulating enzyme activity compared to the CS and CL groups. Accordingly, low trans structured fat from flaxseed oil is highly effective for improving hyperlipidemia and hepatic lipid accumulation in apo E-/- mice. (C) 2009 Elsevier Ltd. All rights reserved

Chong, E. W. T., et al. (2006). "Facts on fats." Clinical and Experimental Ophthalmology **34**(5): 464-471.

Cardiovascular disease and age-related macular degeneration (AMD) may share common risk factors in their causal pathways. Decades of research from the cardiovascular sciences on fats have led investigators to focus on specific types of fats rather than total fat as a whole. They have established that saturated and trans-unsaturated fats (trans fats) are damaging to cardiovascular health while polyunsaturated fats, particularly the marine omega 3 fatty acids appear protective. This has led to a number of studies investigating the associations of fat and AMD. Though the causal relationship between fats and AMD remain unproven, some studies suggest that an association may be present. To be able to understand and interpret the study results and their implications, an understanding of the fats in the diet is important. This review aims to give an overview of fatty acids, particularly the trans-unsaturated fatty acids, and the relevant food groups.

Chorfa, N., et al. (2012). "Conjugated linoleic acid formation by hydrogenation/isomerisation of safflower oil over bifunctional structured catalyst Rh/SBA-15." Canadian Journal of Chemical Engineering **90**(1): 41-50.

Directed isomerisation of safflower oil under very low hydrogen partial pressure of 7 psi over a novel bifunctional highly structured rhodium-based catalyst (Rh/SBA-15), having narrow pore size distribution ranging from 4 to 8 nm, and BET-specific surface of approximate to 1,000m(2) g(-1), was investigated as a new chemocatalytic approach for vegetable oil hardening and simultaneously producing health-beneficial conjugated linoleic acids (CLA). Time course profiles of (cis-9, trans-11)-; (cis-10, trans-12)-; (trans-10, cis-12)-; (cis, cis)-and (trans, trans)-octadecadienoic isomers (CLAs) as well as the other fatty acids traditionally encountered during the hydrogenation of vegetable oils are presented and discussed under selected process conditions. Preliminary results show that it is possible to tailor characteristics of the hydrogenation catalyst in such way to confer its bi-functional activity: hydrogenation and conjugation isomerisation.

Chorfa, N., et al. (2010). "Conjugated linoleic acid formation via heterogeneous hydrogenation/isomerization of safflower oil over mesostructured catalysts." Applied Catalysis a-General **387**(1-2): 75-86.

Aluminum-containing SBA-15 mesoporous molecular sieves with different nominal molar ratios Si/Al = 5, 10, 20, 50 and 100 were prepared via direct synthesis by adjusting the pH of gel synthesis just below the isoelectric point of silica (pH = 1.9 < 2). The aluminum incorporation yield in all of those materials is about 80% which is one of the highest ever reported. The calcined materials were characterized by XRD, N(2) physisorption, TEM, and (27)Al NMR methods. These investigations confirm that the 2-D hexagonal mesoporous structure is maintained for all Si/Al ratios, and (27)Al NMR analysis indicates that aluminum is almost in tetrahedral coordination. Among metals investigated, rhodium in metallic state, highly dispersed on ALSBA-15(1 0 0) with a pore size ranging from 4 to 7 nm, BET-specific surface of 1000 m(2) g(-1), and metal nominal total loading of 1% w/w, was revealed as a new active catalyst for the chemocatalytic vegetable oils modification inducing health-beneficial conjugated linoleic acids (CLA) formation by hydrogenation/isomerization. Time course profiles of (9-cis, 11-trans)-: (10-cis, 12-trans)-octadecadienoic CLA isomers as well as the other fatty acids traditionally encountered during the hydrogenation of vegetable oils are presented and discussed for the Rh-catalyst supported on AL\_SBA-15 using Si/Al ratio of 100 under selected process conditions. The results show that it is possible to tailor characteristics of the hydrogenation catalyst in such a way to confer it bifunctional activity: hydrogenation and conjugated isomerization. (C) 2010 Elsevier B.V. All rights reserved.

Chulich, V. I. G., et al. (2005). "Margarine's trans-fatty acid composition: modifications during the last decades and new trends." Archivos Latinoamericanos De Nutricion **55**(4): 367-373.

Margarine's trans-fatty acid composition: modifications during the last decades and new trends. Trans fatty acids isomers are formed during the hydrogenation process used in the food industry to harden oils. In the last decades there has been a great controversy about the consumption of margarine due to the levels of trans fatty acids they contain. While in the eighties consumption of margarines was considered healthy, during the nineties several studies indicated that consumption of 18: 1 t increased LDL-cholesterol levels and decreased HDL-cholesterol level, and was related with an increased risk of coronary heart disease. The publicity about the unfavourable effects of trans fatty acid consumption seems to have influenced margarine producers to reduce the trans fatty acid content of margarines. Meanwhile USA has adopted a new legislation about trans fatty acid labelling. In Europe, Dinamarca has limited the maximum level of trans fatty acids allowed in food products.

Clevidence, B. A., et al. (1997). "Plasma lipoprotein (a) levels in men and women consuming diets enriched in saturated, cis-, or trans-monounsaturated fatty acids." Arteriosclerosis Thrombosis and Vascular Biology **17**(9): 1657-1661.

Studies that have shown adverse effects of transunsaturated fatty acids on plasma lipoprotein (a) [Lp(a)] levels have used levels of trans-fatty acid that are higher than those in the average U.S. diet. This study was conducted to clarify the effects on Lp(a) of trans-fatty acids levels commonly found in U.S. diets. Lp(a) levels were measured in a double-blind study of 29 men and 29 women who ate 4 controlled diets in random order for 6 weeks each. Fatty acids represented 39% to 40% of energy. The diets were: (1) Oleic (16.7% of energy as oleic acid); (2) Moderate trans (3.8% of energy as trans-monoenes, approximately the trans content of the U.S. diet); (3) High trans (6.6% of energy as trans-monoenes); (4) Saturated (16.2% of energy as lauric plus myristic plus palmitic acids). The Saturated diet lowered Lp(a) levels significantly (by 8% to 11%). Compared to the Oleic diet, the trans diets had no adverse effect on Lp(a) levels when all subjects were considered collectively. A subset with initially high levels of Lp(a) (greater than or equal to 30 mg/dL), however, responded to the High trans diet with a slight (5%) increase in Lp(a) levels relative to the Oleic and Moderate trans diets. Thus, in amounts commonly found in the typical U.S. diet, saturated fatty acids consistently decrease Lp(a) concentrations. The adverse effects of replacing cis-with trans-fatty acids are only suggestive and are restricted to high trans intakes in subjects with high Lp(a) levels.

Clifton, P. M., et al. (2004). "Trans fatty acids in adipose tissue and the food supply are associated with myocardial infarction." Journal of Nutrition **134**(4): 874-879.

Metabolic studies have clearly shown that trans fatty acids (TFAs) elevate LDL and lower HDL cholesterol. Epidemiologic studies showed a relation between TFA intake and the risk of myocardial infarction (MI), but studies examining adipose tissue TFAs have not uniformly confirmed this. We performed a case control study examining both adipose tissue levels and dietary intake of TFAs and first MI. Between 1995 and 1997, 209 cases of first MI completed a 300-item FFQ and 79 had an adipose tissue biopsy; 179 matched controls completed the FFQ and 167 had a biopsy. During the course of the study (mid-1996), TFAs were eliminated from margarines sold in Australia. Cases biopsied before mid-1996 had greater levels of trans 18:1(n-9) (32% P < 0.03) and trans 18:1 (n-11) (23%, P < 0.001) than controls biopsied before mid-1996. After June 1996, there were no differences between cases and controls in any of the adipose tissue TFAs measured. Logistic regression showed that trans 18:1 (n-11) (P = 0.03) was an independent predictor of a first MI. Cases consumed 0.5 g/d (P = 0.002) more TFAs than controls. Subjects in the highest quintile of TFA intake had an OR for first MI of 2.1 (95% CI, 1.1-4.3), which was not independent of saturated fat intake. Apparent TFA intake from margarine was related to adipose tissue 18:1t[(n-9) and (n-10)] in 1995 (r = 0.66, 0.66, respectively). We conclude that TFAs in adipose tissue are associated with an increased risk of coronary artery disease and rapidly disappear from adipose tissue when not included in margarines.

Clifton, P. M. and M. Noakes (1999). "Adipose tissue trans fatty acid levels and first myocardial infarction." Circulation **100**(18): 116-116.

Clifton, P. M., et al. (2004). "High dietary intake of phytosterol esters decreases carotenoids and increases plasma plant sterol levels with no additional cholesterol lowering." Journal of Lipid Research **45**(8): 1493-1499.

The objective of this study was to measure the effects on serum lipids and plasma phytosterols of 6.6 g/day phytosterols from three foods (bread, breakfast cereal, and spread) consumed for 12 weeks compared with a diet that was not enriched with phytosterols. Thirty-five subjects undertook a nonrandomized, single-blind study consisting of a 2 week baseline period, 6 weeks on high-phytosterol intake, 6 weeks on high-phytosterol intake plus increased fruit and vegetable intake, and a final 2 week washout period. Serum total cholesterol decreased by 8.3% from 6.59 to 6.04 mmol/l, and LDL cholesterol decreased by 12.6% from 4.44 to 3.88 mmol/l. Plasma phytosterol levels increased by 45% (sitosterol) and 105% (campesterol). Cholesterol-adjusted plasma alpha- and beta-carotene levels decreased by 19-23%, lutein by 14%, and lycopene by 11 %. Levels of alpha-carotene and lutein increased with extra fruit and vegetables. Only lycopene failed to increase during the washout phase. There were no significant changes in biochemical parameters.square Serum LDL cholesterol lowering with 6.6 g/day ingested phytosterols was in the range seen with 1.6-3.2 g/day phytosterols. Lowering of plasma carotenoids was greater than that seen with lower phytosterol intake and was partially reversed by increased fruit and vegetable intake.-Clifton, P. M., M. Noakes, D. Ross, A. Fassoulakis, M. Cehun, and P. Nestel. High dietary intake of phytosterol esters decreases carotenoids and increases plasma plant sterol levels with no additional cholesterol lowering.

Cobiac, L. J., et al. (2012). "Which Interventions Offer Best Value for Money in Primary Prevention of Cardiovascular Disease?" Plos One **7**(7).

Background: Despite many decades of declining mortality rates in the Western world, cardiovascular disease remains the leading cause of death worldwide. In this research we evaluate the optimal mix of lifestyle, pharmaceutical and population-wide interventions for primary prevention of cardiovascular disease. Methods and Findings: In a discrete time Markov model we simulate the ischaemic heart disease and stroke outcomes and cost impacts of intervention over the lifetime of all Australian men and women, aged 35 to 84 years, who have never experienced a heart disease or stroke event. Best value for money is achieved by mandating moderate limits on salt in the manufacture of bread, margarine and cereal. A combination of diuretic, calcium channel blocker, ACE inhibitor and low-cost statin, for everyone with at least 5% five-year risk of cardiovascular disease, is also cost-effective, but lifestyle interventions aiming to change risky dietary and exercise behaviours are extremely poor value for money and have little population health benefit. Conclusions: There is huge potential for improving efficiency in cardiovascular disease prevention in Australia. A tougher approach from Government to mandating limits on salt in processed foods and reducing excessive statin prices, and a shift away from lifestyle counselling to more efficient absolute risk-based prescription of preventive drugs, could cut health care costs while improving population health.

Cohen, J. F. W., et al. (2011). "Maternal trans fatty acid intake and fetal growth." American Journal of Clinical Nutrition **94**(5): 1241-1247.

Background: It is unclear from previous studies whether total or common subtypes of trans fatty acids are associated with fetal growth. Objective: We examined associations of maternal trans fatty acid intake during pregnancy with fetal growth. Design: We studied 1369 mother-child pairs participating in Project Viva-a prospective cohort study of pregnant women and their offspring. We assessed trans fatty acid consumption by using a validated semiquantitative food-frequency questionnaire in each of the first and second trimesters of pregnancy. We estimated fetal growth as the birth-weight-for-gestational-age (BW/GA) z value in infants born at term. Results: We observed no associations of first-trimester trans fatty acid consumption with fetal growth. In the second trimester, the estimated mean (+/-SD) total trans fatty acid intake was 2.35 +/- 1.07 g/d, of which 0.11 g was 16: 1(n27t), 1.78 g was 18: 1 (n-9t), 0.13 g was 18: 2(n-6tt), 0.33 g was 18: 2(n-6tc), and 0.12 g was 18: 2(n-6ct). The mean (6SD) BW/GA was 0.24 +/- 0.95 z score units. Total trans fatty acid consumption during the second trimester was positively associated with the fetal growth z score (0.29 units; 95% CI: 0.07, 0.51 units) for each 1% increment in energy from trans fatty acids as a replacement for carbohydrates. The associations were limited to the trans fatty acids 16:1t (0.12 units; 95% CI: 0.02, 0.22 units) and 18: 2tc (0.53 units; 95% CI: 0.09, 0.96 units). Conclusion: A higher maternal intake of trans fatty acids, especially 16: 1t and 18: 2tc, during the second trimester of pregnancy was associated with greater fetal growth. Am J Clin Nutr 2011;94:1241-7.

Colgan, H. A., et al. (2004). "Increased intake of fruit and vegetables and a low-fat diet, with and without low-fat plant sterol-enriched spread consumption: effects on plasma lipoprotein and carotenoid metabolism." Journal of Human Nutrition and Dietetics **17**(6): 561-569.

Background Regular intake of plant sterol (phytosterol)-enriched foods enhances the cholesterol lowering effect of diets. One side effect associated with plant sterol consumption is a modest reduction in plasma carotenoid concentrations. This study investigated the effect of consuming a low-fat National Cholesterol Education Programme (NCEP) Step 1 diet, including a low-fat plant sterol ester (PSE)-enriched spread on cholesterol metabolism to determine if specific dietary advice to increase daily fruit and vegetable intake could prevent reduced plasma carotenoid concentrations. Materials and methods In this randomised, crossover double-blind trial, 48 hypercholesterolaemic men received 21 g day(-1) of a low-fat PSE-enriched spread or placebo for 3 weeks, interrupted by 3 weeks washout. Individuals also adhered to a NCEP Step 1 diet and repeated 3-day food diaries monitored adherence. Specific advice was provided to increase dietary fruit and vegetable intakes. Fasting blood samples were collected at pre- and post-intervention for lipoprotein and carotenoid analysis. Results Plasma total and low-density lipoprotein (LDL) cholesterol concentrations were significantly (P<0.05) reduced, by 4.6 and 7.1%, respectively, after the PSE-enriched low-fat spread. Plasma apo B concentrations were significantly (P<0.0005) lower after the PSE spread. PSE consumption was also associated with significantly (P<0.05) lower total plasma &beta;-carotene concentrations, but this change was not significant after lipid standardisation. PSE consumption had no effect on retinol, &alpha;-carotene, &gamma;-tocopherol, cl-tocopherol, lutein, zeaxanthin, &beta;-crypyoxanthin or lycopene concentrations. Conclusion Dietary advice to increase daily fruit and vegetable consumption may be effective in preventing a reduction in plasma carotenoid concentrations previously associated with PSE consumption. Further, PSE incorporated in a low-fat spread and consumed as part of a NCEP Step 1 diet are effective in reducing total and LDL cholesterol.

Collison, K. S., et al. (2011). "Sex-dimorphism in Cardiac Nutrigenomics: effect of Trans fat and/or Monosodium Glutamate consumption." Bmc Genomics **12**.

Background: A paucity of information on biological sex-specific differences in cardiac gene expression in response to diet has prompted this present nutrigenomics investigation. Sexual dimorphism exists in the physiological and transcriptional response to diet, particularly in response to high-fat feeding. Consumption of Trans-fatty acids (TFA) has been linked to substantially increased risk of heart disease, in which sexual dimorphism is apparent, with males suffering a higher disease rate. Impairment of the cardiovascular system has been noted in animals exposed to Monosodium Glutamate (MSG) during the neonatal period, and sexual dimorphism in the growth axis of MSG-treated animals has previously been noted. Processed foods may contain both TFA and MSG. Methods: We examined physiological differences and changes in gene expression in response to TFA and/or MSG consumption compared to a control diet, in male and female C57BL/6J mice. Results: Heart and % body weight increases were greater in TFA-fed mice, who also exhibited dyslipidemia (P < 0.05). Hearts from MSG-fed females weighed less than males (P < 0.05). 2-factor ANOVA indicated that the TFA diet induced over twice as many cardiac differentially expressed genes (DEGs) in males compared to females (P < 0.001); and 4 times as many male DEGs were downregulated including Gata4, Mef2d and Srebf2. Enrichment of functional Gene Ontology (GO) categories were related to transcription, phosphorylation and anatomic structure (P < 0.01). A number of genes were upregulated in males and downregulated in females, including pro-apoptotic histone deacetylase-2 (HDAC2). Sexual dimorphism was also observed in cardiac transcription from MSG-fed animals, with both sexes upregulating approximately 100 DEGs exhibiting sex-specific differences in GO categories. A comparison of cardiac gene expression between all diet combinations together identified a subset of 111 DEGs significant only in males, 64 DEGs significant in females only, and 74 transcripts identified as differentially expressed in response to dietary manipulation in both sexes. Conclusion: Our model identified major changes in the cardiac transcriptional profile of TFA and/or MSG-fed mice compared to controls, which was reflected by significant differences in the physiological profile within the 4 diet groups. Identification of sexual dimorphism in cardiac transcription may provide the basis for sex-specific medicine in the future.

Colon-Ramos, U., et al. (2006). "The relation between trans fatty acid levels and increased risk of myocardial infarction does not hold at lower levels of trans fatty acids in the Costa Rican food supply." Journal of Nutrition **136**(11): 2887-2892.

Data on the effects of recent industrial modifications that reduced the trans fatty acid (TFA) content in food supplies are scarce. In this study, incident cases (n = 1797) of a first nonfatal myocardial infarction (MI) were matched with population controls (n = 1797) for age, sex, and area of residence in Costa Rica. Odds ratio (OR) and 95% CI were calculated from conditional logistic regressions before and after a reduction of TFA in Costa Rican foods. Initially, the median quintiles of total adipose tissue TFA were 1.85, 2.47, 2.99, 3.58, and 4.40 g/100 g; total TFA was positively associated with increased MI risk after adjusting for established risk factors (OR by quintiles of total TFA: 1.00, 1.37, 1.91, 1.86, 3.28; P for trend < 0.001). This association was mostly due to 18:2 trans. In contrast, after industrial modification, median quintiles of total adipose tissue TFA were 1.84, 2.26, 2.57, 2.88, and 3.42 g/100 g; the association with MI was no longer significant (OR by quintiles of total TFA: 1.00, 0.78, 1.03, 0.88, and 1.03; Pfor trend = 0.65). Adipose tissue 18:1 trans fatty acids were not associated with risk of MI before or after the modification. Although to date there are no TFA regulations in Costa Rica, it appears that indirect international influence has led to a TFA reduction in the food supply and, consequently, to a reduction in the risk of nonfatal MI. The public health sector of Costa Rica should regulate food labeling and content to ensure very low levels of TFA intake.

Colon-Ramos, U., et al. (2007). "Translating research into action: a case study on trans fatty acid research and nutrition policy in Costa Rica." Health Policy and Planning **22**(6): 363-374.

Mounting epidemiologic evidence worldwide has fostered policy regulation of industrially made trans fatty acids (TFA) in several developed countries. Despite country-specific evidence about the effects of TFA on cardiovascular disease in Costa Rica, policy regulation has yet to occur. This qualitative study uses a conceptual framework to identify factors that may impede or promote the process of translation of scientific evidence about TFA into policy in the specific context of Costa Rica. We used single case-study methodology to integrate two sources of data: review of relevant internal documents and in-depth, semi-structured interviews with 21 respondents purposively sampled from three sectors: the cooking oil and food industries, research and academia, and government entities. Content analysis, guided by a conceptual framework of research utilization, revealed 68 emergent themes divided across four categories of analysis. In brief, study participants perceived the political context suitable for discussing policies related to healthy fats. Nevertheless, TFA regulation was not part of the Costa Rican political agenda. Barriers perceived by respondents that impede knowledge translation included: (1) lack of awareness of in-country scientific studies on health effects of TFA; (2) lack of consensus or information about policy options (nutrition labelling, dietary guidelines, legislative mandates); (3) perceived distrust and disparate attitudes between sectors, believed by study participants to result in (4) limited collaboration across sectors. Commissioned task forces and other mechanisms to foster research engagement and facilitate sustained interaction and systematic collaboration among government, food industry and researcher sectors appear crucial in the consideration and adoption of nutrition policy in Costa Rica and other emerging economies.

Combe, N., et al. (2000). "Consumption of trans fatty acids and cardiovascular risks: Aquitaine survey." Ocl-Oleagineux Corps Gras Lipides **7**(1): 30-34.

This report addresses firstly the controversy about possible health hazards of dietary trans fatty acids (TFA) stemmed from many studies performed since the 90's. Dietary TFA ore supposed to increase the risk of coronary heart disease (CHD). From the first data, a positive relationship was found between the energy intake from 9t-18:1 (range: 3.7 to 10.9%) and LDL-cholesterol concentrations. This trans isomer, in some cases, can also lower HDL-cholesterol concentrations. Epidemiological studies on associations between TFA intake and risk of CHD are still not conclusive. Moreover, methods of assessing TFA intake have certain weak points. It would be desirable to combine dietary survey methods with biochemical indicators of long term fatty acid intake such as the adipose tissue, Results of a French study ore reported in the second part The aims of this study were to assess the TFA intake in Aquitaine and to examine the relationship between the presence of TFA in adipose tissue and blood plasma, and LDL- and HDL-cholesterol concentrations in plasma of non-pregnant (n = 97) and pregnant (n = 90) women. Through dietary 7-days records, the mean TFA consumption was 2.7 g/d/pers., which represented 1.3% of energy intake. The TFA level was 2.3 +/- 0.5% of total fatty acids in adipose tissue. Based on the 18:1 trans content of adipose tissue, the population trans consumption was clearly lower than those of the other European countries, USA and Canada. The composition of adipose tissue TFA was analyzed relative to the dietary sources of TFA, ruminant fats and partially hydrogenated oils (PHVO). The Delta 11t 18:1 isomer was the most prevalent in adipose tissue like in ruminant fats. Estimates of relative contribution to TFA intake were 60% from ruminant fats and 40% from PHVO. This pattern contrasts sharply with those established for Canada and the United States where PHVO is reported to be the major dietary source of TFA.

Combe, N., et al. (1998). "Trans fatty acid composition of the adipose tissue of a French population and the alimentary origins of these acids." Ocl-Oleagineux Corps Gras Lipides **5**(2): 142-148.

The composition of trans monoenoic, dienoic and trienoic fatty acids in the subcutaneous adipose tissue was analyzed relative to the dietary sources of trans fatty acids, ruminant fats and partially hydrogenated oils. Adipose tissue trans fatty acids from 71 adults were determined using a combination of capillary gas-liquid chromatography and silver nitrate thin-layer chromatography The mean total trans fatty acid content of adipose tissue was 2. 38 +/- 0.77 % in 43 non-pregnant women, 2. 77 +/- 0.51 % in 18 pregnant women and 1.77 +/- 0.23 % in IO men. Total 18:1 trans isomers were 75-85 % of total trans fatty acids versus 16-18 % for total 18:2, 2-5 % for 16:1 and 0.9-1.4 % for 18:3 isomers. Based on the 18:1 trans content of adipose tissue, the population trans consumption is clearly lower than those of the other European countries, USA and Canada. The dietary trans fatty acids were supplied by ruminant fats and partially hydrogenated oils. Of the 18:1 trans positional isomers, the Delta 11 t is the most prevalent in adipose tissue like in ruminant fats, suggesting that these ones are an important dietary source of these trans fatty acids.

Connor, W. E., et al. (2005). "Dietary sitostanol and campestanol: Accumulation in the blood of humans with sitosterolemia and xanthomatosis and in rat tissues." Lipids **40**(9): 919-923.

Dietary sitostanol has a hypocholesterolemic effect because it decreases the absorption of cholesterol. However, its effects on the sitostanol concentrations in the blood and tissues are relatively unknown, especially in patients with sitosterolemia and xanthomatosis. These patients hyperabsorb all sterols and fail to excrete ingested sitosterol and other plant sterols as normal people do. The goal of the present study was to examine the absorbability of dietary sitostanol in humans and animals and its potential long-term effect. Two patients with sitosterolemia were fed the margarine Benecol (McNeill Nutritionals, Ft. Washington, PA), which is enriched in sitostanol and campestanol, for 7-18 wk. Their plasma cholesterol levels decreased from 180 to 167 mg/dL and 153 to 113 mg/dL, respectively. Campesterol and sitosterol also decreased. However, their plasma sitostanol levels increased from 1.6 to 10.1 mg/dL and from 2.8 to 7.9 mg/dL, respectively. Plasma campestanol also increased. After Benecol withdrawal, the decline in plasma of both sitostanol and campestanol was very sluggish. In an animal study, two groups of rats were fed high-cholesterol diets with and without sitostanol for 4 wk. As expected, plasma and liver cholesterol levels decreased 18 and 53%, respectively. The sitostanol in plasma increased fourfold, and sitostanol increased threefold in skeletal muscle and twofold in heart muscle. Campestanol also increased significantly in both plasma and tissues. Our data indicate that dietary sitostanol and campestanol are absorbed by patients with sitosterolemia and xanthomatosis and also by rats. The absorbed plant stanols were deposited in rat tissues. Once absorbed by sitosterolemic patients, the prolonged retention of sitostanol and campestanol in plasma might increase their atherogenic potential.

Corl, B. A., et al. (2003). "cis-9, trans-11 CLA derived endogenously from trans-11 18 : 1 reduces cancer risk in rats." Journal of Nutrition **133**(9): 2893-2900.

The present study was designed to examine the effects of increasing dietary levels of vaccenic acid (VA) and cis-9, trans-11 conjugated linoleic acid (CLA) on chemically induced mammary carcinogenesis in rats. Both fatty acids were provided as a natural component in butter fat. The conversion of VA to CLA by Delta9-desaturase was documented previously in several species, including rats and humans. Specifically, our objective was to determine the relative contribution of dietary VA and CLA to the tissue concentration of CLA and its ability to inhibit the development of mammary carcinomas. A total of 7 diets were formulated with varying levels of CLA and VA. The overall dietary treatment scheme was designed to evaluate the modulation of mammary cancer risk by 1) small increases of CLA in the presence of a low level of VA and 2) more substantial increases of VA against a background of low levels of CLA. As expected, small increases in dietary CLA at the low end of the CLA dose-response range did not reduce tumorigenesis. In contrast, there was a distinct and marked inhibitory response to VA that was dose dependent. The effect of VA was magnified in this experiment because the dose range of VA tested was much broader than that of CLA. Fatty acid analysis showed that the conversion of dietary VA to CLA resulted in a dose-dependent increase in the accumulation of CLA in the mammary fat pad, which was accompanied by a parallel decrease in tumor formation in the mammary gland. The finding confirms that the conversion of VA to CLA is as important for cancer prevention as the dietary supply of CLA. Thus, VA is also anticarcinogenic, and VA and CLA represent functional food components that are present in ruminant fat.

Costa, A. G. V., et al. (2006). "Trans fatty acids: foods and effects on health." Archivos Latinoamericanos De Nutricion **56**(1): 12-21.

Trans fatty acids can be found in foods derived from ruminant animals and foods that contain partially hydrogenated fat such as fast foods. The consumption of trans fatty acids is larger in the United States, Canada, and some European countries than in Japan and Mediterranean countries. The incidence of coronary heart diseases is higher in countries where the consumption of trans fatty is high. Studies show that trans fatty acids can contribute to increase LDL and lipoprotein [a], and to reduce the levels of HDL. In addition, trans isomeric seems to inhibit the action of desaturase enzymes of essential fatty acids (A5- and A6-desaturase) by holding back the biosynthesis of important fatty acids such as arachidonic acid and docosahexaenoic acid (DHA). With respect to pregnant women's and infant's health, concentrations of trans fatty acids ingested by the mother are associated to concentrations found in the maternal milk. Besides the milk, the trans fatty acids can be transferred to the newly born through the placenta. Studies suggest that trans fatty acids can affect intrauterine growth due to the inhibition of the conversion of essential fatty acids by desaturase enzymes. The inhibition of DHA can also cause early atherosclerosis lesion. However, studies on the effects of trans fatty acids on health are still inconclusive and there are no current recommendations on their consumption. Additionally, in Brazil, studies to determine the composition of trans isomeric in foods are still incipient, which indicates a great need of research in this area.

Counil, E., et al. (2009). "Association between trans-fatty acids in erythrocytes and pro-atherogenic lipid profiles among Canadian Inuit of Nunavik: possible influences of sex and age." British Journal of Nutrition **102**(5): 766-776.

Dietary exposure to trans-fatty acids (TFA) is likely to be high among Canadian Inuit; yet no data are available on the physiological effects of TFA in this population. The purpose of the present study was to assess the association between TFA and plasma lipid profiles in Inuit men and women living in Nunavik (Quebec, Canada). In a cross-sectional, population-based survey, a total of 795 Nunavik Inuit eligible participants gave a blood sample. Exposure to TFA was assessed by their relative proportion in erythrocyte membrane. We performed multiple regression analysis using plasma lipids or their linear combinations as the dependent variables and TFA as the main predictor, adjusting for potential confounders. The associations varied markedly between the sexes and according to age. In men (n 357, aged 36.3 (So 14.3) years, TFA 1.24 (SD 0.54) %), TFA tended to be negatively associated with HDL-cholesterol (HDL-C), apoA1 and LDL particle size, and positively associated with non-HDL-C, LDL-cholesterol (LDL-C), apoB100, the apoB]00:apoA] ratio and the ratios of total cholesterol (TC), LDL-C and TAG to HDL-C. No such trends were observed in women (it 438, aged 37.0 (So 14.1) years, TFA 1.16 (SD 0.54) %), except for HDL-C and apoA1 in women aged 50 years and more. These results suggest that TFA could raise the risk of CHD in Inuit men at least through their physiological effects on plasma lipids. The differential associations reported in pre- and postmenopausal women need to be reproduced in other populations and in experimental studies addressing the influence of sex hormones in response to dietary fats.

Craig-Schmidt, M. C. (2001). "Isomeric fatty acids: Evaluating status and implications for maternal and child health." Lipids **36**(9): 997-1006.

"Isomeric fatty acids" is a term that refers to the trans- and positional isomers formed during hydrogenation of naturally occurring oils. The purposes of this paper are as follows: (i) to summarize potential exposure of infants to isomeric fatty acids by reviewing estimates of isomeric fatty acids in the maternal diet, in human milk, and in infant formula/infant foods, and (ii) to evaluate the evidence for adverse effects of isomeric fatty acids on infant development with respect to growth, and essential fatty acid status. Estimates of the intake of trans-fatty acids vary widely both within and across populations. Current estimates of trans-fatty acids in the North American population are 4-11% of total fatty acids or 3-13 g/(person(.)d), whereas in Mediterranean countries in which olive oil is the primary fat and in Far Eastern countries in which little commercially hydrogenated fat is consumed, per capita consumption of trans-fatty acids is <1-2 g/d. The trans-fatty acid content of human milk reflects the cross-cultural variation in the maternal diet, with trans-fatty acids in human milk samples ranging from 6 to 7% in North America to <0.5% in Hong Kong. Trans-fatty acids are transferred from the maternal diet through the placenta to the developing fetus or through milk to the breast-fed infant. In some studies, plasma trans-fatty acids are inversely related to birth weight and head circumference. The hypothesis that dietary trans-fatty acids could inhibit biosynthesis of long-chain polyunsaturated fatty acids with 20 and 22 carbon atoms and thus affect infant development is supported by studies demonstrating an inverse correlation of plasma trans-fatty acids with n-3 and n-6 long-chain polyunsaturated fatty acids in infants. However, no such relationship has been observed in human milk. A definitive answer concerning a potentially adverse effect of dietary trans-fatty acids on infant development awaits future studies.

Crupkin, M. and A. Zambelli (2008). "Detrimental impact of Trans fats on human health: Stearic acid-rich fats as possible substitutes." Comprehensive Reviews in Food Science and Food Safety **7**(3): 271-279.

Strong evidence demonstrated the negative effect of trans fatty acid (TFA) intake on cardiovascular diseases (CVD), diabetes, systemic inflammation, and hemostasis. As a consequence, different regulatory actions have been developed around the world, aiming to reduce human consumption of TFA. Replacement for TFA functionality requires incorporation of plastic and stable saturated fats; the present options are palm or fully hydrogenated oils. Palm oil has been described as responsible for negative biological effects on serum cholesterol levels and CVD risk. Different epidemiological and clinical studies recommend reduction of saturated fatty acid (SFA) intake, mainly myristic and palmitic acids. Experimental evidence strongly suggests that stearic acid is a wholesome substitute for TFAs and other SFAs in food manufacturing. In this article, biological effects of stearic acid on human health are reviewed in comparison to TFAs, SFAs, and unsaturated fatty acids. Current revised understanding on dietary intake, digestion, and absorption is also covered.

Cruz-Hernandez, C., et al. (2004). "Methods for analysis of conjugated linoleic acids and trans-18 : 1 isomers in dairy fats by using a combination of gas chromatography, silver-ion thin-layer chromatography/gas chromatography, and silver-ion liquid chromatography." Journal of Aoac International **87**(2): 545-562.

Conjugated linoleic acids (CLA) are octadecadienoic acids (18:2) that have a conjugated double-bond system. Interest in these compounds has expanded since CLA were found to be associated with a number of physiological and pathological responses such as cancer, metastases, atherosclerosis, diabetes, immunity, and body fat/protein composition. The main sources of these conjugated fatty acids are dairy fats. Rumen bacteria convert polyunsaturated fatty acids, especially linoleic and linolenic acids, to CLA and numerous trans-containing mono- and diunsaturated fatty acids. It has been established that an additional route of CLA synthesis in ruminants and monogastric animals, including humans, occurs via Delta9 desaturation of the trans-18:1 isomers. To date, a total of 6 positional CLA isomers have been found in dairy fats, each occurring in 4 geometric forms (cis,trans; trans,cis; cis,cis; and trans,trans) for a total of 24. All of these CLA isomers can be resolved only by a combination of gas chromatography (GC), using 100 m highly polar capillary columns, and silver-ion liquid chromatography, using 3 of these 25 cm columns in series. Complete analysis of all the trans-18:1 isomers requires prior isolation of trans monoenes by silver-ion thin-layer chromatography (TLC), followed by GC analysis using the same 100 m capillary columns operated at low temperatures starting from 120degreesC. These analytical techniques are required to assess the purity of commercial CLA preparations, because their purity will affect the interpretation of any physiological and/or biochemical response obtained. Prior assessment of CLA preparations by TLC is also recommended to determine the presence of any other impurities. The availability of pure CLA isomers will permit the evaluation and analysis of individual CLA isomers for their nutritional and biological activity in model systems, animals, and humans. These techniques are also essential to evaluate dairy fats for their content of specific CLA isomers and to help design experimental diets to increase the level of the desired CLA isomers in dairy fats. These improved techniques are further required to evaluate the CLA profile in monogastric animals fed commercial CLA preparations for CLA enrichment of animal products. This is particularly important because absorption and metabolism will alter the ingested-CLA profile in the animal fed.

Czernichow, S., et al. (2005). "Intake of added oils and fats among middle-aged French adults: Relationships with educational level and region of residence." Journal of the American Dietetic Association **105**(12): 1889-1894.

Objective To describe the relative contribution of 10 created food groups to total fat intake in middle-aged subjects. The relationship of added oil and fat intake with region of residence and educational level was also assessed. Design Cross-sectional study. Subjects/setting Participants of the French Supplementation en Vitamines et Mineraux Antioxydants study who completed at least six 24-hour dietary records after inclusion into the study (N=6,572). Results Added oils and fats were the main source of total fat intake. Animal fat and margarine intakes showed a significant inverse association with educational level, whereas oils with monounsaturated fatty acids (MUFA) were positively associated with education level. Animal fat intake was significantly higher in the western and northern parts of France (54.2% and 50.4%) and lower in the Mediterranean Coast (39.0%). A significant inverse gradient was found with oils with polyunsaturated fatty acids or MUFA in the southwest and the Mediterranean Coast compared with the northern part of France. Conclusions We showed a north to south gradient for animal fat intake and the opposite for oils with MUFA and polyunsaturated fatty acid in France. This gradient parallels the known disparities for cardiovascular mortality in this country. This should contribute to adapting dietary guidelines for dietary change in a public health perspective.

Dalainas, I. and H. P. Ioannou (2008). "The role of trans fatty acids in atherosclerosis, cardiovascular disease and infant development." International Angiology **27**(2): 146-156.

The process of partial hydrogenation converts vegetable oils in semisolid fats, like margarines, that contain high concentrations of trans fatty acids (TFA) and are commonly used in bakery, as well as for deep frying in fast food chains and other restaurants. Initially, these fats were considered the healthy solution, because they substituted butter and other cholesterol fats. However, in the last decades there has been continuing accumulation of evidence that TFA have potential harmful action in blood lipid metabolism, atherosclerosis development and cardiovascular disease, as well as in infant development. Consequently, many countries have enacted in order to reduce total TFA percentage in the daily fat intake, while others are waiting strongest evidence to enact. This article reviews the evidence of the effects of TFA, in relation to atherosclerosis, cardiovascular disease, inflammation and diabetes, and infant development.

Daley, C. A., et al. (2010). "A review of fatty acid profiles and antioxidant content in grass-fed and grain-fed beef." Nutrition Journal **9**.

Growing consumer interest in grass-fed beef products has raised a number of questions with regard to the perceived differences in nutritional quality between grass-fed and grain-fed cattle. Research spanning three decades suggests that grass-based diets can significantly improve the fatty acid (FA) composition and antioxidant content of beef, albeit with variable impacts on overall palatability. Grass-based diets have been shown to enhance total conjugated linoleic acid (CLA) (C18:2) isomers, trans vaccenic acid (TVA) (C18:1 t11), a precursor to CLA, and omega-3 (n-3) FAs on a g/g fat basis. While the overall concentration of total SFAs is not different between feeding regimens, grass-finished beef tends toward a higher proportion of cholesterol neutral stearic FA (C18: 0), and less cholesterol-elevating SFAs such as myristic (C14:0) and palmitic (C16:0) FAs. Several studies suggest that grass-based diets elevate precursors for Vitamin A and E, as well as cancer fighting antioxidants such as glutathione (GT) and superoxide dismutase (SOD) activity as compared to grain-fed contemporaries. Fat conscious consumers will also prefer the overall lower fat content of a grass-fed beef product. However, consumers should be aware that the differences in FA content will also give grass-fed beef a distinct grass flavor and unique cooking qualities that should be considered when making the transition from grain-fed beef. In addition, the fat from grass-finished beef may have a yellowish appearance from the elevated carotenoid content (precursor to Vitamin A). It is also noted that grain-fed beef consumers may achieve similar intakes of both n-3 and CLA through the consumption of higher fat grain-fed portions.

Dashti, N., et al. (2000). "Long-term effects of cis and trans monounsaturated (18 : 1) and saturated (16 : 0) fatty acids on the synthesis and secretion of apolipoprotein A-I- and apolipoprotein B containing lipoproteins in HepG2 cells." Journal of Lipid Research **41**(12): 1980-1990.

The objective of this study was to compare the long-term effects of oleic (cis 18:1), elaidic (trans 18:1), and palmitic (16:0) acids on hepatic lipoprotein production, using HepG2 cells as an experimental model. The net accumulation in the medium of apolipoprotein A-I (apoiA-I) was not significantly altered by fatty acids, whereas that of apoB was increased with oleic and elaidic acids. Oleic acid, and to a lesser extent elaidic and palmitic acids, increased the mass of triglycerides in the medium and the incorporation of [H-3]glycerol into secreted triglycerides. The incorporation of [C-14]acetate into cellular and secreted total cholesterol was stimulated by 96% and 83%, respectively, with elaidic acid but was not significantly modified by oleic or palmitic acid. Relative to oleic acid, the secretion of C-14-labeled phospholipids and triglycerides was decreased 28% to 31% with elaidic and palmitic acids whereas that of free cholesterol and cholesteryl esters was enhanced 93% and 73%, respectively, with elaidic acid but remained unchanged with palmitic acid. Compared with oleic acid, elaidic acid stimulated the secretion of very low density lipoprotein cholesterol (VLDL-Chol), low density lipoprotein cholesterol (LDL-Chol), and high density lipoprotein cholesterol (HDL-Chol) by 43%, 70%, and 34%, respectively, whereas palmitic acid decreased VLDL-Chol but had no significant effect on LDL-Chol and HDL-Chol. The ratios of total cholesterol to HDL-Chol were 3.17, 3.60, and 3.25 with oleic, elaidic, and palmitic acids, respectively; the corresponding ratios of LDL-Chol to HDL-Chol were 0.87, 1.10, and 0.93, respectively. Compared with oleic and palmitic acids, the LDL and HDL particles secreted in the presence of elaidic acid contained higher levels of free cholesterol and cholesteryl esters and a lower content of phospholipids. The phospholipid-to-total cholesterol ratios of HDL were 1.05, 0.40, and 0.76 with oleic, elaidic, and palmitic acids, respectively. Our results indicate that in comparison with cis monounsaturated and saturated fatty acids, trans fatty acids have more adverse effects on the concentration and composition of lipoproteins secreted by HepG2 cells.

Dayal, B., et al. (1997). "Rapid hydrogenation of unsaturated sterols and bile alcohols using microwaves." Steroids **62**(5): 451-454.

This paper describes an operationally simple, rapid hydrogenation of unsaturated sterols and bile alcohols in a domestic microwave oven. This has been achieved by the addition of catalytic amounts of Pd/C in methylene chloride/propylene glycol solvents in the presence of ammonium formate followed by microwave irradiation. It is suggested that this methodology will be helpful in the identification of saturated and unsaturated sterols with different side-chain structures in rare diseases: sitosterolemia, cerebrotendinous xanthomatosis (CTX), as well as atherosclerosis and diabetes mellitus. Sterols, such as cholesterol, campesterol, sitosterol, and bile alcohols with unsaturated side chains, were converted to their reduced congeners with high yield and purity. (C) 1997 by Elsevier Science Inc.

de Almeida, M. E. F., et al. (2011). "Serum lipids and hepatic morphology of rats fed different lipid sources (soybean oil, fish fat and lard, margarine and butter)." Revista De Nutricao-Brazilian Journal of Nutrition **24**(1): 143-152.

Objective This study analyzed serum lipids and hepatics morphological changes in rats fed different lipid sources (soybean oil, fish fat and lard, margarine and butter). Methods Fifty Wistar rats were divided into five groups. They were given semi-synthetic diets with different lipid sources for 28 days: soybean oil, lard, butter, margarine and fish fat. Body weight, food intake, food efficiency coefficient, lipoprotein lipase activity, serum concentrations of total cholesterol and high density lipoprotein-cholesterol, triacylglycerols and albumin were assessed. The heart and liver tissues underwent histological assessment. Results The type of lipid source did not influence food intake, weight gain or food efficiency coefficient. The activity of the lipoprotein lipase was also unaffected; however, there were changes in the serum concentration of total cholesterol, high density lipoprotein-cholesterol, triacylglycerols and albumin. All groups presented lipid droplets on the coronary walls and heart capillaries. The fat deposition on the liver of animals given soybean oil, fish fat and lard, and butter was characterized as steatosis. Conclusion The lipid source that presented the best results was soybean oil. Fish fat affected the serum and tissues similarly to other lipid sources (lard, butter and margarine). This may contribute to the onset and progression of cardiovascular diseases.

de Castro, M. A., et al. (2009). "Trans fatty acid intake among the population of the city of Sao Paulo, Southeasthern Brazil." Revista De Saude Publica **43**(6).

OBJECTIVE: To analyze the monounsaturated and polyunsaturated trans fatty acid intake among the general population. METHODS: A cross-sectional study was conducted in Sao Paulo, Southeastern Brazil, in 2003, on a representative sample of 2,298 male and female subjects, including 803 adolescents (12 to 19 years), 713 adults (20 to 59 years) and 782 elderly people (60 years or over). Food intake was measured using 24-hour recall. Mean trans fatty acid intake was described according to gender and age group. RESULTS: The mean trans fatty acid intake was 5.0 g/day (SE = 0.1), accounting for 2.4% (SE = 0.1) of total energy and 6.8% (SE = 0.1) of total lipids. The adolescents had the highest mean intake levels (7.4 g/day; 2.9% of energy) while the adults and the elderly had similar intake (2.2% of energy for both; 6.4% of lipids and 6.5% of lipids, respectively). The mean trans fatty acid intake among adult and elderly women (approximately 2.5% of energy and 7.0% of lipids) was higher than among men in the same age group. The food item with the highest contribution towards trans fatty acids was margarine, accounting for more than 30% of total intake, followed by filled cookies among adolescents and meat among adults and the elderly. CONCLUSIONS: The trans fatty acid intake is above the level recommended by the World Health Organization. Replacement of the trans fatty acids in manufactured food items may be an effective measure for reducing trans fatty acid intake in Brazil.

De Jong, A., et al. (2008). "Effects of plant sterol and stanol ester consumption on lipid metabolism, antioxidant status and markers of oxidative stress, endothelial function and low-grade inflammation in patients on current statin treatment." European Journal of Clinical Nutrition **62**(2): 263-273.

Objective: The present study was designed to examine for the first time, side-by-side, the effects of plant sterol and stanol consumption on lipid metabolism and markers of antioxidant status, oxidative stress, endothelial dysfunction and low-grade inflammation in subjects on stable statin-treatment. Design: Double-blind, randomized, placebo-controlled, intervention trial. Setting: University. Subjects: Forty-five patients on current statin treatment were recruited via newspaper advertisements. Data of 41 patients were used in statistical analysis. Intervention: Subjects consumed margarine with no added plant sterols or stanols for 4 weeks and were then divided into three groups of 15 subjects. For the next 16 weeks, one group continued with the control margarine and the other two groups with either a plant sterol- or stanol (2.5 g/day)-enriched margarine. Blood was sampled at the end of the run-in and intervention periods. Results: Plant sterol and stanol consumption significantly (P = 0.026) reduced low-density lipoprotein (LDL) cholesterol by 0.34 mmol/l (95% confidence interval (CI), -0.67 to -0.04 mmol/l). No effects were shown on enzymatic and non-enzymatic antioxidants and markers of oxidative modification of lipids and DNA. In addition, no effect was found on soluble adhesion molecules, C-reactive protein and monocyte chemotactic protein-1 concentrations. Conclusions: We conclude that 16 weeks of plant sterol or stanol consumption did not affect markers of antioxidant status, oxidative stress, endothelial dysfunction and low-grade inflammation in patients on stable statin treatment, despite a significant reduction of LDL cholesterol.

de Jong, N., et al. (2008). "A general postlaunch monitoring framework for functional foods tested with the phytosterol/-stanol case." Trends in Food Science & Technology **19**(10): 535-545.

The regulations and/or directives in force for functional foods primarily focus on the warrant of safety before the particular foods reach the consumer. Aspects that come into the picture after marketing are not structurally and/or regulatory dealt with at this moment. This absence of clear guidelines about responsibility, timing and contents of a postlaunch monitoring (PLM) system hamper the establishment of an internationally standardized and stakeholder-adopted framework. The current paper describes a proposal for PLM and is illustrated with a case study on phytosterols/-stanols.

de Jongh, S., et al. (2003). "Plant sterols lower LDL cholesterol without improving endothelial function in prepubertal children with familial hypercholesterolaemia." Journal of Inherited Metabolic Disease **26**(4): 343-351.

In adults with familial hypercholesterolaemia (FH), cholesterol lowering with statins has been shown to improve the endothelial function, a hallmark of early atherogenesis. Currently, therapeutic options for treating high cholesterol levels in FH children are limited. Plant sterols safely and effectively reduce serum cholesterol concentrations by inhibiting cholesterol absorption. Therefore, we evaluated the effect of plant sterols on cholesterol and vascular function in prepubertal children with FH. We included 41 children (5-12 years old) with FH in a double-blind crossover trial using spreads containing 2.3 g of plant sterols (mainly sitosterol and campesterol) per 15 g spread and a placebo spread for a 4-week period, separated by a 6-week washout period. Lipid levels and endothelial function were assessed after both 4-week treatment periods. Endothelial function was assessed as flow-mediated dilation (FMD) of the brachial artery using a wall tracking system. Data were compared to those of 20 healthy controls. Intake of 2.3 g plant sterols per day decreased total cholesterol (-11%) and low-density cholesterol (-14%) as compared to placebo spread in FH children. FH children treated with placebo spread were characterized by an impaired FMD compared to healthy control children (7.2%+/-3.4% versus 10.1%+/-4.2%, p<0.005). However, the reduction of LDL in FH children did not improve FMD (placebo: 7.2%&PLUSMN;3.4% versus plant sterols: 7.7%&PLUSMN;4.1%). In conclusion, the present study shows a clear reduction of LDL cholesterol by plant sterol treatment. However, short-term plant sterol treatment does not improve the endothelial function in FH children.

de Lorgeril, M. and P. Salen (2004). "Alpha-linolenic acid and coronary heart disease." Nutrition Metabolism and Cardiovascular Diseases **14**(3): 162-169.

Aim: To summarize our present knowledge about vegetable omega-3 fatty acids. Data synthesis: Alpha-linolenic acid (ALA) is one of the two essential fatty acids in humans. Epidemiological studies and dietary trials strongly suggest that this fatty acid is important in relation with the pathogenesis (and prevention) of coronary heart disease. Like other n-3 fatty acids from marine origin, it may prevent cardiac arrhythmias and sudden cardiac death. The optimal dietary intake of alphalinolenic acid seems to be about 2 g per day or 0.6 to 1% of total energy intake. Obtaining an optimal ratio of the two essential fatty acids, linoleic and alpha-linolenic acids - ie a ratio of less than 4 to 1 in the diet - is a major issue. The main sources of alpha-linolenic acid for the European population should be canola oil (and canola-oil based margarine if available), nuts (English walnut), ground linseeds and green leafy vegetables such as purslane. Conclusions: Epidemiological studies and dietary trials in humans suggest that alpha-linolenic acid is a major cardioprotective nutrient. (C) 2004, Medikal Press.

de Lorgeril, M. and P. Salen (2006). "The Mediterranean-style diet for the prevention of cardiovascular diseases." Public Health Nutrition **9**(1A): 118-123.

Objectives: To discuss present knowledge about Mediterranean diet and cardiovascular diseases. Design: Review of existing literature. Setting and Results: Epidemiological studies as well as randomised dietary trials suggest that Mediterranean diet may be important in relation to the pathogenesis (and prevention) of CHD. For instance, a striking protective effect of an ALA-rich Mediterranean diet was reported in the Lyon Diet Heart Study with a 50 to 70% reduction of the risk of recurrence after 4 years of follow-up in CHD patients. According to our current knowledge, dietary ALA should represent about 0.6 to 1% of total daily energy or about 2 g per day in patients following a Mediterranean diet, whereas the average intake in linoleic acid should not exceed 7 g per day. Supplementation with very-long-chain omega-3 fatty acids (about 1 g per day) in patients following a Mediterranean type of diet was shown to decrease the risk of cardiac death by 30% and of sudden cardiac death by 45% in the GISSI trial. Conclusions: In the context of a diet rich in oleic acid, poor in saturated fats and low in omega-6 fatty acids (a dietary pattern characterising the traditional Mediterranean diet), even small doses of omega-3 fatty acids (about 1 g EPA+DHA the form of fish oil capsules or 2 g alpha-linolenic acid in canola oil and margarine) might be very protective. These data underline the importance of the accompanying diet in any dietary strategy using fatty acid complements.

de Lorgeril, M., et al. (2001). "Rapeseed oil and rapeseed oil-based margarine for the prevention and treatment of coronary heart disease." European Journal of Lipid Science and Technology **103**(7): 490-495.

de Roos, B., et al. (2005). "Response of apolipoprotein E\*3-Leiden transgenic mice to dietary fatty acids: combining liver proteomics with physiological data." Faseb Journal **19**(3): 813-+.

Dietary fatty acids have a profound impact on atherosclerosis, but mechanisms are not fully understood. We studied the effects of a saturated fat diet supplemented with fish oil, trans10,cis12 conjugated linoleic acid (CLA), or elaidic acid on lipid and glucose metabolism and liver protein levels of APOE\*3 Leiden transgenic mice, a model for lipid metabolism and atherosclerosis. Fish oil lowered plasma and liver cholesterol and triglycerides, plasma free fatty acids, and glucose but increased plasma insulin. CLA lowered plasma cholesterol but increased plasma and liver triglycerides, plasma beta-hydroxybutyrate, and insulin. Elaidic acid lowered plasma and liver cholesterol. Proteomics identified significant regulation of 65 cytosolic and 8-membrane proteins. Many of these proteins were related to lipid and glucose metabolism, and to oxidative stress. Principal component analysis revealed that fish oil had a major impact on cytosolic proteins, and elaidic acid on membrane proteins. Correlation analysis between physiological and protein data revealed novel clusters of correlated variables, among which a metabolic syndrome cluster. The combination of proteomics and physiology gave new insights in mechanisms by which these dietary fatty acids regulate lipid metabolism and related pathways, for example, by altering protein levels of long-chain acyl-CoA thioester hydrolase and adipophilin in the liver.

de Roos, B., et al. (2011). "A high intake of industrial or ruminant trans fatty acids does not affect the plasma proteome in healthy men." Proteomics **11**(19): 3928-3934.

Consumption of industrial trans fat raises the risk of cardiovascular disease, but it is unclear whether cis9, trans11-conjugated linoleic acid (CLA) - a trans fatty acid in dairy products modulates disease development. We investigated the effects of complete diets providing 7% of energy as industrial trans fat or cis9, trans11 CLA, compared with oleic acid, on regulation of plasma proteins in 12 healthy men. Diets were provided for 3 wk each, in random order. Plasma was collected at the end of each 3 wk intervention period, depleted of its 12 most abundant proteins and analyzed by 2-DE. Principal component analysis of protein spot intensity values revealed that the nature of the dietary intervention did not significantly affect the plasma proteome. The intervention provided in the 1st period produced a significant treatment effect compared with the interventions provided in the other two periods, and there was a significant subject effect. In conclusion, the nature of an extreme dietary intervention, i.e. 7% of energy provided by industrial trans fat or cis9, trans11 CLA, did not markedly affect the plasma proteome. Thus plasma proteomics using 2-DE appears, by and large, an unsuitable approach to detect regulation of plasma proteins due to changes in the diet.

de Roos, N. M., et al. (2001). "Consumption of a solid fat rich in lauric acid results in a more favorable serum lipid profile in healthy men and women than consumption of a solid fat rich in trans-fatty acids." Journal of Nutrition **131**(2): 242-245.

Solid fats are used in food manufacturing to provide texture and firmness to foods. Such fats are rich in either saturated or trans-fatty acids, both of which increase the risk of coronary heart disease. Epidemiological and experimental studies suggest that trans-fatty acids increase risk more than do saturates because they lower serum high density lipoprotein (HDL) cholesterol. However, there appear to be differences between saturates in their effect on HDL cholesterol. We investigated whether the consumption of a solid fat rich in lauric acid (C12:0) would result in a more favorable blood lipid profile than the consumption of a solid fat rich in trans-fatty acids. We fed 32 healthy men and women two controlled diets in a 2 x 4-wk randomized crossover design. The diets consisted of a background diet supplemented with margarines. In the trans-diet, 9.2% of energy was provided by trans-fatty acids and 12.9% by saturated fatty acids. In the Sat-diet, energy intake was 0% from trans-fatty acids and 22.9% from saturated fatty acids. Lauric acid composed one third of all saturates in the Sat-diet. Serum HDL cholesterol was 0.36 mmol/L lower at the end of the trans-diet than at the end of the Sat-diet (95% confidence interval, -0.46 to -0.26), whereas serum low density lipoprotein cholesterol and triglyceride concentrations remained stable. Serum total cholesterol was 0.31 mmol/L (95% confidence interval, -0.48 to -0.14) lower at the end of the trans-diet than at the end of the Sat-diet. Consumption of a solid fat rich in lauric acid gives a more favorable serum lipoprotein pattern than consumption of partially hydrogenated soybean oil rich in trans-fatty acids. Thus, solid fats rich in lauric acids, such as tropical fats, appear to be preferable to trans-fats in food manufacturing, where hard fats are indispensable.

Dehaan, L. H. J., et al. (1994). "EFFECT OF LIPIDS AND ALDEHYDES ON GAP-JUNCTIONAL INTERCELLULAR COMMUNICATION BETWEEN HUMAN SMOOTH-MUSCLE CELLS." Carcinogenesis **15**(2): 253-256.

Inhibition of intercellular communication is an important feature in the tumour promotion phase of a multistage carcinogenesis model. In atherosclerosis inhibition of cell-cell communication by atherogenic compounds, e.g. low density lipoproteins (LDL), also seems to be important. For testing atherogenic compounds we used an atherosclerosis relevant cell type, namely human smooth muscle cells. In order to investigate which part of the LDL particle would be involved in inhibition of metabolic co-operation between human smooth muscle cells in culture we tested several fatty acids and their breakdown products, namely aldehydes. Unsaturated C-18 fatty acids markedly influenced gap-junctional intercellular communication (GJIC), whereas saturated (C18:0, C16:0) and unsaturated fatty acids with >20 carbon atoms did not inhibit GJIC. In the case of oleic and elaidic acid, orientation seemed important; however, after exposure to palmitoleic and palmitelaidic acid no differences were found. The most potent inhibitor of GJIC was linoleic acid, which inhibited GJIC by 75%. No correlation was found between degrees of unsaturation and ability to inhibit GJIC. Of the tested aldehydes, hexanal, propanal, butanal and 4-hydroxynonenal did significantly inhibit GJIC, while pentanal had no effect. Since modification of LDL was shown to be important in order for LDL to inhibit GJIC, these results show that fatty acids and their oxidative breakdown products may be of importance for the inhibition of GJIC by LDL.

Derdemezis, C. S., et al. (2010). "Effects of Plant Sterols and Stanols Beyond Low-Density Lipoprotein Cholesterol Lowering." Journal of Cardiovascular Pharmacology and Therapeutics **15**(2): 120-134.

Consumption of foods and supplements enriched with plant sterols/stanols (PS) may help reduce low-density lipoprotein cholesterol (LDL-C) levels. In this review, we consider the effects of PS beyond LDL-C lowering. Plant sterols/stanols exert beneficial effects on other lipid variables, such as apolipoprotein (apo) B/apoAI ratio and, in some studies, high-density lipoprotein cholesterol (HDL-C) and triglycerides (TG). Plant sterols/stanols may also affect inflammatory markers, coagulation parameters, as well as platelet and endothelial function. Evidence also exists about a beneficial effect on oxidative stress, but this does not seem to be of greater degree than that expected from the LDL-C lowering. Many of these effects have been demonstrated in vitro and animal models. Some in vitro effects cannot be seen in vivo or in humans at usual doses. The epidemiological studies that evaluated the association of plasma PS concentration with cardiovascular disease (CVD) risk do not provide a definitive answer. Long-term randomized placebo-controlled studies are required to clarify the effects of supplementation with PS on CVD risk and progression of atherosclerosis.

Devaraj, S., et al. (2004). "Plant sterol-fortified orange juice effectively lowers cholesterol levels in mildly hypercholesterolemic healthy individuals." Arteriosclerosis Thrombosis and Vascular Biology **24**(3): E25-E28.

Objective - Hypercholesterolemia is a major risk factor for coronary artery disease. Therapeutic lifestyle changes include dietary modifications such as inclusion of phytosterols, which effectively lowers low-density lipoprotein (LDL) cholesterol in margarines and other fats. Their effectiveness in nonfat moieties is not yet established. The aim of this study was to examine if phytosterols alter the plasma lipoprotein profile when incorporated into nonfat orange juice. Methods and Results - After a 2-week run-in phase with orange juice, 72 mildly hypercholesterolemic healthy subjects were randomized to receive either placebo orange juice ( placebo OJ) or plant sterol-fortified orange juice ( sterol OJ) (2g/d) for 8 weeks. Fasting blood was obtained at baseline, after 2 weeks of OJ, and after 8 weeks of placebo/sterol-OJ supplementation. Sterol OJ supplementation significantly decreased total (7.2%), LDL (12.4%), and non-high-density lipoprotein (HDL) cholesterol (7.8%) compared with baseline and compared with placebo OJ ( P < 0.01). Apolipoprotein B levels were significantly decreased (9.5%) with sterol OJ. There were no significant changes in HDL cholesterol or triglycerides with the sterol OJ. While folate and B12 levels significantly increased, homocysteine levels were unchanged. Conclusions - Orange juice fortified with plant sterols are effective in reducing LDL cholesterol and could easily be incorporated into the therapeutic lifestyle changes dietary regimen.

Devilliers, L. S. (1994). "MARGARINE AND CORONARY HEART-DISEASE." South African Medical Journal **84**(1): 46-46.

Devilliers, L. S. (1994). "MARGARINE AND CORONARY HEART-DISEASE." South African Medical Journal **84**(10): 699-700.

Dhaka, V., et al. (2011). "Trans fats-sources, health risks and alternative approach - A review." Journal of Food Science and Technology-Mysore **48**(5): 534-541.

Trans fatty acids have the presence of one or more double bonds in the trans configuration instead of the usual cis configuration. They are desired by Vanaspati industry as they impart firmness to margarines and plasticity as well as emulsion stability to shortenings. Research has proved the direct connection of trans fatty acids with cardiovascular diseases, breast cancer, shortening of pregnancy period, risks of preeclampsia, disorders of nervous system and vision in infants, colon cancer, diabetes, obesity and allergy. In light of these new findings trans fatty intake should be zero and new technology of hydrogenation of oils is to be developed which produce zero trans fatty acids at the same time preserve the desirable properties contributed by trans fatty acids to the hydrogenated oils. Presently in India there is no system to monitor and regulate the amount of trans fats in processed foods and hence a stringent food law is immediately required.

Dhibi, M., et al. (2011). "The intake of high fat diet with different trans fatty acid levels differentially induces oxidative stress and non alcoholic fatty liver disease (NAFLD) in rats." Nutrition & Metabolism **8**.

Background: Trans-fatty acids (TFA) are known as a risk factor for coronary artery diseases, insulin resistance and obesity accompanied by systemic inflammation, the features of metabolic syndrome. Little is known about the effects on the liver induced by lipids and also few studies are focused on the effect of foods rich in TFAs on hepatic functions and oxidative stress. This study investigates whether high-fat diets with different TFA levels induce oxidative stress and liver dysfunction in rats. Methods: Male Wistar rats were divided randomly into four groups (n = 12/group): C receiving standard-chow; Experimental groups that were fed high-fat diet included 20% fresh soybean oil diet (FSO), 20% oxidized soybean oil diet (OSO) and 20% margarine diet (MG). Each group was kept on the treatment for 4 weeks. Results: A liver damage was observed in rats fed with high-fat diet via increase of liver lipid peroxidation and decreased hepatic antioxidant enzyme activities (superoxide dismutase, catalase and glutathione peroxidase). The intake of oxidized oil led to higher levels of lipid peroxidation and a lower concentration of plasma antioxidants in comparison to rats fed with FSO. The higher inflammatory response in the liver was induced by MG diet. Liver histopathology from OSO and MG groups showed respectively moderate to severe cytoplasm vacuolation, hypatocyte hypertrophy, hepatocyte ballooning, and necroinflammation. Conclusion: It seems that a strong relationship exists between the consumption of TFA in the oxidized oils and lipid peroxidation and non alcoholic fatty liver disease (NAFLD). The extent of the peroxidative events in liver was also different depending on the fat source suggesting that feeding margarine with higher TFA levels may represent a direct source of oxidative stress for the organism. The present study provides evidence for a direct effect of TFA on NAFLD.

Dictenberg, J. B., et al. (1995). "HYPERLIPIDEMIC EFFECTS OF TRANS-FATTY-ACIDS ARE ACCENTUATED BY DIETARY-CHOLESTEROL IN GERBILS." Journal of Nutritional Biochemistry **6**(7): 353-361.

Trans isomers of dietary fatty acids, generated during the commercial hydrogenation of unsaturated fats, may contribute to coronary heart disease (CHD) in humans by interfering with lipid metabolism. To examine this possibility in a fat-sensitive model, the Mongolian gerbil (Meriones unguiculatus) was used to compare the cholesterolemic and triglyceridemic potential of modest increments of trans fatty acids from partially hydrogenated soybean oil with other saturated fatty acids in the presence and absence of dietary cholesterol. Age-, dose-, and time-dependent effects were examined in weanling, 6-month-old, and 1-year-old gerbils. Although lipoprotein metabolism in weanling gerbils was initially refractory to trans fat, even as perturbations by saturated fatty acids were demonstrable, these gerbils eventually (after 16 weeks) developed a trans-induced hypercholesterolemia that was intermediate between the response to 16:0 and 12:0 + 14:0. The hepatic and plasma 18:1/18:2 cholesteryl ester (CE) ratio was depressed by trans in a manner similar to saturated fatty acids. The 6-month-old gerbils readily developed hypertriglyceridemia but not hypercholesterolemia, again revealing a decrease in the plasma 18:1/18:2 CE ratio. The 1-year-old gerbils revealed a dose-related (0, 5, 10%en as trans) elevation in total cholesterol (TC), and especially triglycerides (TG), that was accentuated by 0.04% dietary cholesterol. Increases in plasma lipids were again accompanied by a significant decrease in the mass of hepatic esterified cholesterol, particularly 18:1-cholesteryl esters. Thus, dietary trans-fatty acids induce age-, time-, and dose-dependent modulations in gerbil plasma lipids associated with decreased 18:1 cholesteryl esters. Further investigation with gerbils may reveal mechanisms by which trans fat consumption disturbs lipoprotein metabolism.

DiRienzo, M. A., et al. (2008). "Effect of substitution of high stearic low linolenic acid soybean oil for hydrogenated soybean oil on fatty acid intake." Lipids **43**(5): 451-456.

High stearic, low alpha-linolenic acid soybean oil (HSLL) has been developed via traditional breeding to serve as a substitute for partially hydrogenated soybean oils used in food manufacturing. The purpose of this study was to estimate the impact on fatty acid intake in the United States if HSLL were substituted for partially hydrogenated soybean oils used in several food categories, including baked goods, shortenings, fried foods, and margarines. Using National Health and Nutrition Examination Survey (NHANES) data (1999-2002), baseline intakes of five fatty acids and trans fatty acids (TFA) were determined at the mean and 90th percentile of fat consumption. Then intakes of these fatty acids were determined after HSLL was substituted for 100% of the partially hydrogenated soybean oils used in these four food categories. The results show that baseline intake of stearic acid is 3.0% energy at the mean and 3.3% energy at the 90th percentile. Use of HSLL could increase stearic acid intake to about 4-5% energy. Mean intakes of TFA could decrease from 2.5 to 0.9% energy, and intake of palmitic acid would remain unchanged. Use of HSLL as a substitute for partially hydrogenated soybean oils would result in changes in the fatty acid composition of the US diet consistent with current dietary recommendations.

Dixit, S. and M. Das (2012). "Fatty Acid Composition Including Trans-Fatty Acids in Edible Oils and Fats: Probable Intake in Indian Population." Journal of Food Science **77**(10): T188-T199.

The susceptibility of trans-fat to the human health risk prompted the Food and Agriculture Organization (FAO) and World Health Organization (WHO) to prepare regulations or compulsory claims for trans-fatty acids (TFA) in edible oils and fats. In this study, analysis of fatty acid composition and TFA content in edible oils and fats along with the possible intake of trans-fat in Indian population was carried out. The analysis was carried out as per the Assn. of Official Analytical Chemists (AOAC) methodology and the results were statistically analyzed. The average TFA content in nonrefined mustard and refined soybean oils exceeded by 1.16- to 1.64-fold as compared to the Denmark limit of 2% TFA in fats and oils destined for human consumption. In branded/nonbranded butter and butter oil samples, average TFA limit exceeded by 4.2- to 9.5-fold whereas hydrogenated vegetable oil (HVO) samples exceeded the limit by 9.8-fold, when compared to Denmark standards. The probable TFA intake per day through different oils in Indian population were found to be less than WHO recommendation. However Punjab having highest consumption of HVO (15 g/d) showed 1.09-fold higher TFA intake than the WHO recommendation, which is alarming and may be one of the factors for high cardiovascular disease mortality rate that needs further elucidation. Thus there is a need to prescribe TFA limit for edible oil, butter, and butter oil in India and to reduce the already proposed TFA levels in HVO to safeguard the health of consumers. Practical Application: The probable daily intake of trans-fatty acid (TFA) especially through hydrogenated vegetable oil (HVO) was assessed. In absence of any specification for TFA and fatty acid composition for edible oils, butter, and butter samples, a pressing need was felt to prescribe TFA limit in India. The study indicates that TFA intake through HVO consumption is higher in States like Punjab than the recommended daily intake prescribed by WHO. Hence, strategies should be adopted to either decrease the consumption of HVO or to modify the industrial processing method of HVO with less content of TFA to safeguard the health of consumers.

Djousse, L., et al. (2012). "Red Blood Cell Membrane Concentration of cis-Palmitoleic and cis-Vaccenic Acids and Risk of Coronary Heart Disease." American Journal of Cardiology **110**(4): 539-544.

Although previous studies have suggested associations between plasma palmitoleic acid and coronary heart disease (CHD) risk factors, including blood pressure, inflammation, and insulin resistance, little is known about the relation of pahnitoleic acid and CHD. This ancillary study of the Physicians' Health Study was designed to examine whether red blood cell (RBC) membrane cis-pahnitoleic acid and cis-vaccenic acid-2 fatty acids that can be synthesized endogenously-are associated with CHD risk. We used a risk set sampling method to prospectively select 1,000 incident CHD events and 1,000 matched controls. RBC membrane fatty acids were measured using gas chromatography. The CHD cases were ascertained using an annual follow-up questionnaire and validated by an End Point Committee through a review of the medical records. In a conditional logistic regression analysis adjusting for demographics, anthropometric, lifestyle factors, and co-morbidity, the odds ratios and 95% confidence intervals (CIs) for CHD were 1.0 (referent), 1.29 (95% CI 0.95 to 1.75), 1.08 (95% CI 0.78 to 1.51), 1.25 (95% CI 0.90 to 1.75), and 1.48 (95% CI 1.03 to 2.14) across consecutive quintiles of RBC membrane cis-palmitoleic acid (p for trend = 0.041). The odds ratio associated with each SD higher RBC membrane cis-palmitoleic acid level was 1.19 (95% CI 1.06 to 1.35) in a multivariate-adjusted model. Finally, RBC membrane cis-vaccenic acid was inversely associated with CHD risk (odds ratio 0.79, 95% CI 0.69 to 0.91, per SD increase). In conclusion, our data showed a positive association between RBC membrane cis-pahnitoleic acid and CHD risk in male physicians. Furthermore, RBC membrane cis-vaccenic acid was inversely related to CHD. Published by Elsevier Inc. (Am J Cardiol 2012;110:539-544)

Djousse, L., et al. (2012). "Plasma Phospholipid Concentration of Cis-Palmitoleic Acid and Risk of Heart Failure." Circulation-Heart Failure **5**(6): 703-709.

Background-Although plasma palmitoleic acid has been positively associated with blood pressure, inflammation, and insulin resistance, its association with heart failure has not been investigated. We assessed whether plasma phospholipid cis-palmitoleic acid was associated with heart failure risk. Methods and Results-This ancillary study of the Physicians' Health Study used a risk set sampling method to select 788 matched pairs. For each case of incident heart failure, we randomly selected a control among subjects that were free of heart failure and alive at the time of index case diagnosis and matched on age, year of birth, race, and time of blood collection. Plasma phospholipid fatty acids were measured using gas chromatography. Heart failure was ascertained using annual follow-up questionnaire and validated in a subsample. In a multivariable conditional logistic regression, odds ratios (95% CI) for heart failure were 1.0 (ref), 1.06 (0.75-1.48), 1.20 (0.85-1.68), and 1.58 (1.11-2.25) across consecutive quartiles of cis-palmitoleic acid (P for trend 0.009). Each SD increase in plasma cis-palmitoleic acid was associated with 17% higher odds of heart failure (95% CI: 2% to 33%) in a multivariable model. In a secondary analysis, each SD increase of log-stearoyl-coA desaturase activity (16:1n-7/16:0 ratio) was positively associated with the risk of heart failure (odds ratio: 1.14 [95% CI: 1.00 to 1.29]), whereas oleic acid and cis-vaccenic acid concentrations were not related to heart failure risk. Conclusions-Our data showed a positive association between plasma phospholipid cis-palmitoleic acid and heart failure risk in male physicians. (Circ Heart Fail. 2012;5:703-709.)

Dlouhy, P., et al. (2003). "Higher content of 18 : 1 trans fatty acids in subcutaneous fat of persons with coronarographically documented atherosclerosis of the coronary arteries." Annals of Nutrition and Metabolism **47**(6): 302-305.

Aim:To identify the total content of trans fatty acid (TFA) isomers and C18:1 trans isomers in subcutaneous fat samples from persons with atherosclerosis of the coronary arteries, as an indicator of dietary exposure. Methods: Using capillary gas chromatography, the authors determined total content of TFA isomers and C18:1 trans isomers in the subcutaneous fat of 34 patients with ischemic heart disease who had undergone aortocoronary bypass surgery and in 46 patients with no sign of coronary disease. Results: On average, the total TFAs in cardiac patients were 2.88 +/- 1.19% of all fatty acids, in noncardiac patients 2.56 +/- 0.89%. However, the difference is not statistically significant. The average concentration of C18:1 trans in cardiac patients (2.31 +/- 1.09%) was statistically significantly higher (p = 0.05) than in the noncardiac group (1.95 +/- 0.77%). Conclusions: The results obtained indicate a lower TFA load in comparison with previous studies in other countries. A higher concentration of 18:1 TFAs in the subcutaneous fat of patients with coronary disease might be an impulse to correct the dietary habits of this very high-risk population.

Do, K., et al. (2011). "Soybean (Glycine max L. Merr.) Hexane Extracts Inhibit Cellular Fatty Acid Uptake by Reducing the Expression of Fatty Acid Transporters." Food Science and Biotechnology **20**(1): 237-242.

Intake of saturated and trans-fatty acids is a strong risk factor for coronary heart disease. We investigated the inhibitory effects of 2 hexane extracts from white (WBE) and black soybeans (BBE) on cellular fatty acid uptake in vitro. Transcellular uptake of elaidic acid (t18:1), a major trans-fatty acid present in processed foods, in Caco-2 monolayers was significantly reduced by 28.3 and 16.7% 60 min after WBE and BBE treatment, respectively. Results of flow cytometry (FACS) analysis showed significant reductions in boron-dipyrromethene (BODIPY) fluorescence-labeled fatty acid uptake by 35.4 and 40.2% with WBE and BBE treatment, respectively. BBE treatment significantly reduced the expression of fatty acid transport protein-4 and CD36 in Caco-2 cells, as determined by quantitative real time-polymerase chain reaction (qRT-PCR). Similar trends were found in WBE treatment, although to a lesser degree. These observations suggest that soybean extract may reduce fatty acid uptake and cellular fat accumulation by altering fatty acid transporter expression.

Doggrell, S. A. (2011). "Lowering LDL cholesterol with margarine containing plant stanol/sterol esters: Is it still relevant in 2011?" Complementary Therapies in Medicine **19**(1): 37-46.

Recommendations about the use of plant stanol/sterol esters have not been updated since 2001. There have been many developments in medicines for lipid-lowering since 2001. In this review, the use of margarines containing stanol or sterol esters, to lower LDL cholesterol is considered in the 2011 setting. Firstly, there is a brief overview of the effects of the stanols/sterols on LDL cholesterol, which shows that these agents have a modest ability to lower LDL cholesterol, and are not effective in all conditions. Secondly, the relevance of the stanols/sterols in 2010/1 is questioned, given they have not been shown to reduce clinical endpoints, and have no effects on HDL cholesterol or triglyceride levels. Finally, there is a section comparing the stanols/sterols with the present day prescription lipid lowering medicines. Prescription drugs (statins, ezetimibe, and niacin) have a much greater ability to lower LDL cholesterol than the stanol/sterol esters, and also increase levels of HDL cholesterol and decrease levels of triglycerides. The statins and niacin have been shown to reduce cardiovascular clinical endpoints. Except in borderline normo/hypercholesterolemia, prescription drugs should be preferred to stanol/sterol esters for lowering LDL cholesterol in 2011. (C) 2011 Published by Elsevier Ltd.

Dong, C. N., et al. (2009). "Asymmetric synthesis and biological evaluation of Danshensu derivatives as anti-myocardial ischemia drug candidates." Bioorganic & Medicinal Chemistry **17**(9): 3499-3507.

The synthesis and bioactivities of Danshensu derivatives (R)-methyl 2-acetoxy-3-(3,4-diacetoxyphenyl) propanoate (1a), (R)-methyl 2-acetoxy-3-(3,4-methylenedioxyphenyl) propanoate (1b) and their racemates 7 and 10 were reported in this paper. These derivatives were designed to improve their chemical stability and liposolubility by protecting Danshensu's phenolic hydroxyl groups with acetyl or methylene which could be readily hydrolyzed to release bioactive Danshensu. The asymmetric synthesis of 1a and 1b were achieved by catalytic hydrogenation of (Z)-methyl 2-acetoxy-3-(3,4-diacetoxyphenyl)-2-propenoate (6a) and (Z)-methyl 2-acetoxy-3-(3,4-methylenedioxyphenyl)-2-propenoate (6b) in excellent enantiomeric excesses (92% ee and 98% ee, respectively) and good yields (>89%). An unexpected intermediate product, (Z)-2-acetoxy-3-(3,4-dihydroxyphenyl) acrylic acid (4c) was obtained with high chemoselectivity in 86% yield by keeping the reaction temperature at 60 degrees C and its structure was identified by Xray single crystal diffraction analysis. 1a, 1b and their racemates 7, 10 as well as 4c exhibited potent protective activities against hypoxia-induced cellular damage. The in vitro test showed that all these compounds could increase cell viability, and inhibit lipid hyperoxidation. Furthermore, 1a and 4c could inhibit apoptosis by regulating the expression of apoptosis-related molecule in gene and protein levels, up-regulating the expression of bcl-2 and down-regulating bax and caspase-3. The in vivo test indicated that 4c exhibited anti-myocardial ischemic effects featured by reducing infarction size and increasing the level of the intracellular enzymes detectable in serum. Therefore, these Danshensu derivatives may be good drug candidates for anti-myocardial ischemia therapy and merit further investigation. (C) 2009 Elsevier Ltd. All rights reserved.

Doreau, M., et al. (2011). "Enhancing fatty acid composition of milk and meat through animal feeding." Animal Production Science **51**(1): 19-29.

In ruminants, extensive ruminal biohydrogenation of unsaturated fatty acids (FA) results in numerous cis and trans isomers of 18:1 and of conjugated and non-conjugated 18: 2, the incorporation of which into ruminant products depends on the composition of the diet (forage vs concentrate) and of dietary lipid supplements. The low amount of 18:3n-3 (alpha-linolenic acid) absorbed explains its limited incorporation in meat and milk lipids. Its protection against hydrogenation has been an objective for several decades, but only encapsulation in a protein matrix is efficient. In non-ruminants, the FA composition of products is determined by dietary FA, despite minor differences in digestibility and in metabolic activity. Physicochemical differences in intestinal absorption processes between ruminants and non-ruminants can explain the lower FA digestibility in non-ruminants, especially for saturated FA. Unlike in non-ruminants, FA digestibility in ruminants does not depend on FA intake, except for 18:0. The decrease in cow butterfat, especially with concentrate diets, is generally attributed to t10-18:1 or t10, c12-18:2, but the regulation is probably more complex. Differences in terms of butterfat content and FA composition of milk between cow, ewe and goat responses to the amount and composition of ingested lipids are due to between-species variations in mammary metabolism. In animals bred for meat production, dietary 18: 3n-3 results in increases in this FA and in n-3 long-chain polyunsaturated FA (20:5n-3, 22:5n-3) in muscles. The extent of this increase depends both on animal and nutritional factors. Grass is a source of 18:3n-3, which contributes to increased 18:3n-3 in muscle of ruminants as well as of pigs. Conjugated linoleic acids are mainly present in fat tissues and milk due to t11-18:1 desaturation. Their concentration depends on tissue type and on animal species. Non-ruminants fed synthetic conjugated linoleic acids incorporate them in significant amounts in muscle, depending on the isomer. All dietary manipulations favouring polyunsaturated FA incorporation in milk and meat lipids increase the risk of lipoperoxidation, which can be efficiently prevented by use of dietary combined hydro-and lipophilic antioxidants in the diet. Putative effects on organoleptic and technological quality of products deserve further studies.

Dorfman, S. E., et al. (2009). "Metabolic Implications of Dietary Trans-fatty Acids." Obesity **17**(6): 1200-1207.

Dietary trans-fatty acids are associated with increased risk of cardiovascular disease and have been implicated in the incidence of obesity and type 2 diabetes mellitus (T2DM). It is established that high-fat saturated diets, relative to low-fat diets, induce adiposity and whole-body insulin resistance. Here, we test the hypothesis that markers of an obese, prediabetic state (fatty liver, visceral fat accumulation, insulin resistance) are also worsened with provision of a low-fat diet containing elaidic acid (18: 1t), the predominant trans-fatty acid isomer found in the human food supply. Male 8-week-old Sprague-Dawley rats were fed a 10% trans-fatty acid enriched (LF-trans) diet for 8 weeks. At baseline, 3 and 6 weeks, in vivo magnetic resonance spectroscopy ((1)H-MR) assessed intramyocellular lipid (IMCL) and intrahepatic lipid (IHL) content. Euglycemic-hyperinsulinemic clamps (week 8) determined whole-body and tissuespecific insulin sensitivity followed by high-resolution ex vivo (1)H-NMR to assess tissue biochemistry. Rats fed the LF-trans diet were in positive energy balance, largely explained by increased energy intake, and showed significantly increased visceral fat and liver lipid accumulation relative to the low-fat control diet. Net glycogen synthesis was also increased in the LF-trans group. A reduction in glucose disposal, independent of IMCL accumulation was observed in rats fed the LF-trans diet, whereas in rats fed a 45% saturated fat (HF-sat) diet, impaired glucose disposal corresponded to increased IMCL(TA). Neither diet induced an increase in IMCL(soleus). These findings imply that trans-fatty acids may alter nutrient handling in liver, adipose tissue, and skeletal muscle and that the mechanism by which trans-fatty acids induce insulin resistance differs from diets enriched with saturated fats.

Dorfman, S. E., et al. (2005). "Dietary fatty acids and cholesterol differentially modulate HDL cholesterol metabolism in golden-Syrian hamsters." Journal of Nutrition **135**(3): 492-498.

Dietary fatty acids alter HDL cholesterol concentrations, presumably through mechanisms related to reverse cholesterol transport. The effect of dietary fats (coconut oil, butter, traditional stick margarine, soybean oil, canola oil) differing in fatty acid profile on this antiatherogenic process was assessed with respect to plasma lipids; exogenous and endogenous lecithin-cholesterol acyltransferase (LCAT), cholesterol ester transfer protein (CETP), phospholipid transfer protein (PLTP) activities; and LCAT, apolipoprotein (apo) A-I and scavenger receptor B class-1 (SR-B1) mRNA abundance. Golden-Syrian hamsters were fed a nonpurified (6.25 g/100 g fat) diet containing an additional 10 g/100 g experimental fat and 0.1 g/100 g cholesterol for 6 wk. Canola and soybean oils significantly lowered serum HDL cholesterol concentrations relative to butter. Canola oil, relative to butter, resulted in higher exogenous LCAT activity, and both soybean and canola oils significantly increased hepatic apo A-I and SR-B1 mRNA abundance. Butter, relative to margarine, coconut and soybean oils, significantly increased serum non-HDL cholesterol concentrations. Endogenous and exogenous LCAT, CETP, and PLTP activities did not differ in hamsters fed margarine or saturated fat diets, despite lower hepatic LCAT, apo A-I, and SR-B1 mRNA abundance, suggesting that changes in available substrate and/or modification to the LCAT protein may have been involved in lipoprotein changes. These results suggest that lower HDL cholesterol concentrations, as a result of canola and soybean oil feeding, may not be detrimental due to increases in components involved in the reverse cholesterol transport process in these hamsters and may retard the progression of atherosclerosis.

Downs, S. M., et al. (2013). "The effectiveness of policies for reducing dietary trans fat: a systematic review of the evidence." Bulletin of the World Health Organization **91**(4): 262-269.

Objective To systematically review evidence for the effectiveness of policies, including self-regulation, aimed at reducing industrially produced trans fatty acids (TFAs) in food. Methods The Medline, Embase and Cinahl databases were searched to identify peer-reviewed articles examining the effect of TFA policies. In addition, the first 20 pages of Google searches were examined for articles from the grey literature. A study was included if: (i) it was empirical and conducted in a "real-world" setting (i.e. modelling studies were excluded); (ii) it examined a TFA policy involving, for example, labelling, voluntary limits or bans; and (iii) it examined a policy's effect on TFA levels in food, people's diets, blood or breast milk. Findings Twenty-six articles met the inclusion criteria: 5 involved voluntary self-regulation; 8, labelling alone; 4, labelling and voluntary limits; 5, local bans and 4, national bans. Overall, the TFA content of food decreased with all types of policy intervention. In general, saturated fat levels increased or decreased, depending on the product type, and total fat content remained stable. National and local bans were most effective at eliminating TFAs from the food supply, whereas mandatory TFA labelling and voluntary TFA limits had a varying degree of success, which largely depended on food category. Conclusion Policies aimed at restricting the TFA content of food were associated with significant reductions in TFA levels, without increasing total fat content. Such policies are feasible, achievable and likely to have an effect on public health.

Drevon, C. A., et al. (1995). "OMEGA-3-FATTY-ACIDS - NUTRITIONAL ASPECTS." Canadian Journal of Cardiology **11**: G47-G54.

Omega-3 fatty acids contain a double bond in the third position from the methyl group. The very long-chain (20 or 22 carbon atoms) omega-3 fatty acids are mostly found in fatty fish and fish oils. The omega-3 fatty acids are essential and may act as precursors for eicosanoids, altering membrane fluidity or binding to transcription factors. Dietary intake of omega-3 fatty acids reduces plasma concentration of triglycerides, probably by decreasing hepatic secretion of very low density lipoprotein (VLDL) and by increasing catabolism of chylomicrons. In addition, lipid peroxidation of omega-3 fatty acids may take place, with good and bad consequences. As the number of double bonds is high, the omega-3 fatty acids may easily react with oxygen radicals. We performed studies where 5 g/day of very long-chain omega-3 fatty acids was given as a supplement for four months along with vitamin E, whereas control groups received similar amounts of other oils. The unsaturation index was higher in fatty acids of LDL from individuals exposed to omega-3 fatty acids, and the amounts of cholesteryl esters and total lipids were lower compared with control LDL, whereas similar electrophoretic mobility and apolipoprotein B structure were observed. There was a decrease in the melting temperature of cholesteryl esters in omega-3 fatty acid-enriched LDL, but no change in the susceptibility of LDL to Cu2+ catalyzed lipid peroxidation, as measured by changes in amounts of lipid peroxides or in the uptake of LDL im macrophages. These data have been verified by others, whereas three publications reported that fish oil supplementation was associated with increased sings of lipid peroxidation. Recently it has been shown that peroxidation of LDL by white blood cells might be reduced by increased cellular content of omega-3 fatty acids. In conclusion, the susceptibility of LDL to in vitro peroxidation may be increased with dietary intake of omega-3 fatty acids, unless adequate amounts of antioxidants are provided. Reduced intake of foods with high content of saturated fatty acids (fatty milk products, meat, hard margarines) and increased intake of foods providing high amounts of omega-3 fatty acids (fatty fish) and antioxidants (fruits, vegetables) are recommended. These precautions will most likely promote reduced incidence of coronary artery disease, inflammatory diseases and certain forms of cancer.

Drogan, D., et al. (2007). "A food pattern predicting prospective weight change is associated with risk of fatal but not with nonfatal cardiovascular disease." Journal of Nutrition **137**(8): 1961-1967.

Recently, a food pattern predictive for prospective weight change was identified within the European Prospective Investigation into Cancer and Nutrition-Potsdam cohort. Given the possible impact of weight change on cardiovascular disease (CVD) risk, we examined the association between the above mentioned food pattern and risk of CVD. The analyzed food pattern was defined by a high consumption of whole-grain bread, fruits, fruit juices, grain flakes and/or cereals, and raw vegetables, and a low consumption of processed meat, butter, high-fat cheese, margarine, and meat other than poultry. The associations between quartiles of the food pattern score and CVD morbidity and mortality were examined in 26,238 subjects of the European Prospective Investigation into Cancer and Nutrition-Potsdam cohort using a Cox's Proportional Hazards model for competing risks. During 6.4 y of follow-up, 379 incident cases of CVD were identified, of which 68 were fatal Events. The food pattern was not associated with risk of nonfatal CVD. After adjusting for cardiovascular risk factors, the hazard ratios for fatal CVD across increasing quartiles of the score were 1.00, 0.85, 0.31, and 0.47, respectively (P for trend = 0.016). The association of the food pattern with CVD risk differed between fatal and nonfatal events (P for difference = 0.05). These findings from a large German cohort indicate that a food pattern predicting prospective weight change may be associated with the risk of fatal CVD.

Du, Z. Y., et al. (2010). "Dissimilar Properties of Vaccenic Versus Elaidic Acid in beta-Oxidation Activities and Gene Regulation in Rat Liver Cells." Lipids **45**(7): 581-591.

Vaccenic acid (trans-11-C(18:1)) chemically resembles elaidic acid (trans-9-C(18:1)) which is assumed to increase the risk of cardiovascular diseases, and thus could exert similar effects. Possible different oxidation rates of vaccenic versus elaidic acid were checked in muscles and liver, and through related gene expression in normal rat liver cells. In hepatic mitochondria, carnitine palmitoyltransferase (CPT) I exhibited comparable activity rates with both trans-isomers. CPT II activity was 30% greater (P < 0.05) with vaccenic than with elaidic acid as nonesterified fatty acids (NEFAs) or acyl-CoAs. Activity of the first beta-oxidation step was similar between the isomers in all the tissue slices and liver extracts assayed. Respiration rates were comparable with both trans-isomers as NEFAs in various liver extracts, but were 30% greater (P < 0.05) with vaccenoyl-CoA than with elaidoyl-CoA in liver mitochondria. Vaccenic acid was oxidised 25% more (P < 0.05) by liver peroxisomes than elaidic acid. In hepatocytes cultured with trans- and corresponding cis-C(18:1) isomers, gene expression of CPT I, hydroxyacyl-CoA dehydrogenase and hydroxymethylglutaryl-CoA synthase was at least 100% increased (P < 0.05), but was unchanged with vaccenic acid, relative to controls. In conclusion, the position and geometry of the double bonds in acyl chains are suggested to confer on vaccenic and elaidic acid specific biochemical properties that might differently affect their fates in tissues.

Du, Z. Y., et al. (2011). "Vaccenic and Elaidic Acid Equally Esterify into Triacylglycerols, but Differently into Phospholipids of Fed Rat Liver Cells." Lipids **46**(7): 647-657.

Elaidic acid (trans-9-C-18:1 or trans-9) is assumed to exert atherogenic effects due to its double bond configuration. The possibility that trans-9 and vaccenic acid (trans-11-C-18:1 or trans-11), its positional isomer, were biochemically equivalent and interchangeable compounds, was investigated by reference to their cis-isomers through esterification-related activities using rat liver cells and subcellular fractions. In hepatocytes, both trans-C-18:1 were incorporated to the same extent in triacylglycerols, but trans-9 was more esterified than trans-11 into phospholipids (P < 0.05). Glycerol-3-phosphate acyltransferase activity in microsomes was lower with trans-11 than with trans-9, while this activity in mitochondria was similar to 40% greater with trans-11 than with trans-9 (P < 0.05). Activity of 2-lysophosphatidic acid acyltransferase in microsomes was of comparable extent with both trans isomers, but activity of 2-lysophosphatidylcholine acyltransferase was significantly greater with trans-9 than with trans-11 at P < 0.01. Lipoproteins secreted by hepatocytes reached equivalent levels in the presence of any isomers, but triacylglycerol production was more elevated with trans-11 than with trans-9 at P < 0.05. Cholesterol efflux from previously labelled hepatocytes was lower with trans-11 than with trans-9. When these cells were exposed to either trans-C-18:1, the gene expression of proteins involved in fatty acid esterification and lipoprotein synthesis was unaffected, which indicates that the biochemical differences essentially depended on enzyme/substrate affinities. On the whole, vaccenic and elaidic acid were shown to incorporate cell phospholipids unequally, at least in vitro, which suggests they can differently affect lipid metabolic pathways in normal cells.

Dugan, M. E. R., et al. (2011). "Review: Trans-forming beef to provide healthier fatty acid profiles." Canadian Journal of Animal Science **91**(4): 545-556.

Dugan, M. E. R., Aldai, N., AaLthus, J. L., Rolland, D. C. and Kramer, J. K. G. 2011. Review: Trans-forming beef to provide healthier fatty acid profiles. Can. J. Anim. Sci. 91: 545-556. Trans fatty acids are found naturally in foods, particularly in those derived from ruminant animals, such as beef and dairy cattle. Over the past few decades, human consumption of trans fatty acids has increased, but this has been mainly from products containing partially hydrogenated vegetable oils. The correlation of trans fatty acid consumption with diseases such as coronary heart disease has been cause for concern, and led to recommendations to reduce their consumption. Trans fatty acids, however, have differing effects on human health. Therefore, in foods produced from ruminant animals, it is important to know their trans fatty acid composition, and how to enrich or deplete fatty acids that have positive or negative health effects. This review will cover the analysis of trans fatty acids in beef, their origin, how to manipulate their concentrations, and give a brief overview of their health effects.

Dugan, M. E. R., et al. (2008). "Subcutaneous fat composition of youthful and mature Canadian beef: emphasis on individual conjugated linoleic acid and trans-18:1 isomers." Canadian Journal of Animal Science **88**(4): 591-599.

Dugan, M. E. R., Rolland, D. C., Aalhus, J. L., Aldai, N. and Kramer, J. K. G. 2008. Subcutaneous fat composition of youthful and mature Canadian beef: emphasis on individual conjugated linoleic acid and trans-18:1 isomers. Can. J. Anim. Sci. 88: 591-599. A comprehensive evaluation of the fatty acid composition of subcutaneous adipose tissue from beef cattle produced in western Canada was undertaken to determine if the current Canadian grading system is able to distinguish classes of animals with value added potential due to their fatty acid composition. Grades included youthful Canadian Yield Grade 1 A/AA beef, under (YUTM) and over (YOTM) 30 mo of age and the four mature grades (D 1, D2, D2 and 134). Subcutaneous fat between the l2th and 13th ribs over the longissimus muscle was obtained from 18-21 animals per grade. Fatty acids were analyzed using a combination of silver-ion HPLC and GC with a highly polar 100 In column. There were no differences in total trans-18:1 content amongst grades, but adipose tissue from grade D1, D2 and D4 had more 11t-18:1 than YUTM (P < 0.05), whereas adipose tissue from YUTM carcasses had more 10t-18:1 than all other grades (P < 0.05). Adipose tissue from YUTM carcasses also had less total CLA (P < 0.05) than the D grades, mainly due to a lower level of 9c,11t-CLA, but they had slightly more 7t,9c-CLA and 10t,12c-CLA (P < 0.05). Adipose tissue from YOTM and D grades contained more n-3 fatty acids relative to YUTM (0.56% vs. 0.29%; P < 0.05) and lower n-6:n-3 ratios (P < 0.05). Overall, older animals (YOTM and D grades) had adipose tissue compositions with higher levels of fatty acids with reported health benefits. Taken together, these higher levels may provide opportunities for value added marketing if regulatory authorities allow claims for their enrichment based on demonstrated health benefits. Higher concentrations of beneficial fatty acids, however, need to be considered within the context of the complete fatty acid profile and it would be important to demonstrate their advantages in the presence of relatively high levels of saturated fatty acids.

Eady, S., et al. (2011). "Consumption of a plant sterol-based spread derived from rice bran oil is effective at reducing plasma lipid levels in mildly hypercholesterolaemic individuals." British Journal of Nutrition **105**(12): 1808-1818.

fTo establish the effectiveness of a new phytosterol-containing spread derived from rice bran oil (RBO), a randomised, double-blind, crossover human clinical trial was conducted over 12 weeks. A total of eighty mildly hypercholesterolaemic (total blood cholesterol level >= 5 and <= 7.5 mmol/l with a serum TAG level of <= 4.5 mmol/l) individuals were randomised into two groups (n 40). Group 1 consumed spread only daily for 4 weeks. They were randomised to consume 20 g RBO spread (RBOS), 20 g standard spread (SS) or 20 g phytosterol-enriched spread (PS). After a 4-week period, individuals changed to the next randomised treatment until all three treatments had been consumed. Group 2 consumed spread plus oil daily for 4 weeks. They consumed 20 g RBOS plus 30 ml RBO, 20 g SS plus 30 ml sunflower oil or 20 g RBOS. Blood samples were collected for the analysis of lipid parameters, and 3 d diet records were collected. Compared with SS, RBOS significantly reduced total cholesterol by 2.2% (P=0.045), total cholesterol: HDL by 4.1% (P=0.005) and LDL-cholesterol by 3.5% (P=0.016), but was not as effective overall as PS, which reduced total cholesterol by 4.4% (P=0.001), total cholesterol: HDL by 3.4% (P=0.014) and LDL-cholesterol by 5.6% (P=0.001). In group 2, the addition of RBO to the RBOS produced no differences in cholesterol levels. These results confirm that RBOS is effective in lowering serum cholesterol when consumed as part of a normal diet.

Eckel, R. H., et al. (2007). "Understanding the complexity of trans fatty acid reduction in the American diet - American heart association trans fat conference 2006 - Report of the trans fat conference planning group." Circulation **115**(16): 2231-2246.

A 2-day forum was convened to discuss the current status and future implications of reducing trans fatty acids without increasing saturated fats in the food supply while maintaining functionality and consumer acceptance of packaged, processed, and prepared foods. Attendees represented the agriculture and oilseed industry and oil processing, food manufacturing, food service, government, food technology, and health and nutrition disciplines. Presentations included food science behind fatty acid technology, the health science of dietary fatty acids, alternatives to trans fatty acids, and the use of alternatives in food manufacturing and food service. The reduction of trans fatty acids in the food supply is a complex issue involving interdependent and interrelated stakeholders. Actions to reduce trans fatty acids need to carefully consider both intended and unintended consequences related to nutrition and public health. The unintended consequence of greatest concern is that fats and oils high in saturated fats, instead of the healthier unsaturated fats, might be used to replace fats and oils with trans fatty acids. Many different options of alternative oils and fats to replace trans fatty acids are available or in development. Decisions on the use of these alternatives need to consider availability, health effects, research and development investments, reformulated food quality and taste, supply-chain management, operational modifications, consumer acceptance, and cost. The conference demonstrated the value of collaboration between the food industry and health and nutrition professionals, and this conference model should be used to address other food development, processing, and/or technology issues.

Egert, S., et al. (2009). "Dietary alpha-Linolenic Acid, EPA, and DHA Have Differential Effects on LDL Fatty Acid Composition but Similar Effects on Serum Lipid Profiles in Normolipidemic Humans." Journal of Nutrition **139**(5): 861-868.

Our aim was to study the effects of increased dietary intake of alpha-linolenic acid (ALA), eicosapentaenoic acid (EPA), or docosahexaenoic acid (DHA) on serum lipids and LDL fatty acid compositions. To this end, a controlled parallel study was conducted in 74 healthy normolipidemic men and women aged 19-43 y. Participants were randomly assigned to 1 of 3 interventions and consumed a total intake of 4.4 g/d ALA (ALA group), 2.2 g/d EPA (EPA group), and 2.3g/d DHA (DHA group) for 6 wk. Fatty acid ethyl esters were incorporated into margarines, which replaced the participant's normal spread. The ALA, EPA, or DHA intake led to a significant enrichment of the LDL with the respective (n-3) fatty acid. In addition, LDL EPA contents in the ALA group increased by 36% (P < 0.05) with no changes in LDL DHA. The EPA intervention led to an additional enrichment with DHA (24%; P < 0.001), whereas the DHA intervention further increased the amount of EPA (249%; P < 0.001). ALA, EPA, or DHA intake did not affect fasting serum concentrations of total and LDL cholesterol, but fasting serum triacylglycerol concentrations significantly decreased in the EPA (-0.14 mmol/L) and DHA (-0.30 mmol/L) interventions and also in the ALA intervention (-0.17 mmol/L). DHA intake significantly increased serum HDL cholesterol, whereas no changes were found with ALA or EPA intake. In conclusion, the present data support the hypothesis that isolated dietary ALA, EPA, and DHA intakes lead to differential enrichment in LDL due to interconversion. Moderate amounts of ALA, EPA, and DHA are effective in improving lipid profiles of normolipidemic humans. J. Nutr. 139: 861-868, 2009.

Egert, S., et al. (2012). "Margarines Fortified with alpha-Linolenic Acid, Eicosapentaenoic Acid, or Docosahexaenoic Acid Alter the Fatty Acid Composition of Erythrocytes but Do Not Affect the Antioxidant Status of Healthy Adults." Journal of Nutrition **142**(9): 1638-1644.

We aimed to investigate the effects of increased intake of a-linolenic acid (ALA), EPA, or DHA incorporated into a food matrix on the fatty acid composition of erythrocytes and on biomarkers of oxidant/antioxidant status. To this end, a controlled dietary study was conducted in 74 healthy men and women. The participants were randomly assigned to 1 of 3 interventions in which margarines fortified with either 10 weight percent ALA, EPA, or DHA ethyl esters replaced their normal spread for 6 wk. The total intakes of ALA, EPA, and DHA were 4.4, 2.2, and 2.3 g/d, respectively. Consuming EPA increased the erythrocyte proportion of EPA (394%) and the omega-3 index (sum of EPA and DHA, 38%). Consumption of DHA increased erythrocyte DHA (91%), the omega-3 index (98%), and EPA (137%). The omega-3 index increased to a significantly greater extent in the DHA group than in the EPA group. ALA did not increase erythrocyte EPA or the omega-3 index. We found no change in plasma uric acid or antioxidant capacity in any of the groups. Plasma malondialdehyde (MDA) increased with the EPA and DHA interventions. All 3 interventions decreased erythrocyte linoleic acid hydroperoxides but did not affect their MDA concentrations. In conclusion, the intake of both isolated EPA and DHA incorporated into margarine resulted in an enhanced incorporation of EPA and DHA into erythrocytes. our findings indicate that DHA is quantitatively superior to EPA in view of the EPA+DHA tissue incorporation and also that 4 g/d ALA is not sufficient to increase the omega-3 index over a 6-wk period. J. Nutr. 142: 1638-1644, 2012.

Ellis, K. A., et al. (2006). "Comparing the fatty acid composition of organic and conventional milk." Journal of Dairy Science **89**(6): 1938-1950.

During a 12-mo longitudinal study, bulk-tank milk was collected each month from organic (n = 17) and conventional (n = 19) dairy farms in the United Kingdom. All milk samples were analyzed for fatty acid (FA) content, with the farming system type, herd production level, and nutritional factors affecting the FA composition investigated by use of mixed model analyses. Models were constructed for saturated fatty acids, the ratio of polyunsaturated fatty acids (PUFA) to monounsaturated fatty acids, total n-3 FA, total n-6 FA, conjugated linoleic acid, and vaccenic acid. The ratio of n-6: n-3 FA in both organic and conventional milk was also compared. Organic milk had a higher proportion of PUFA to monounsaturated fatty acids and of n-3 FA than conventional milk, and contained a consistently lower n-6: n-3 FA ratio (which is considered beneficial) compared with conventional milk. There was no difference between organic and conventional milk with respect to the proportion of conjugated linoleic acid or vaccenic acid. A number of factors other than farming system were identified which affected milk FA content including month of year, herd average milk yield, breed type, use of a total mixed ration, and access to fresh grazing. Thus, organic dairy farms in the United Kingdom produce milk with a higher PUFA content, particularly n-3 FA, throughout the year. However, knowledge of the effects of season, access to fresh grazing, or use of specific silage types could be used by producers to enhance the content of beneficial FA in milk.

Eloranta, A. M., et al. (2011). "Dietary factors and their associations with socioeconomic background in Finnish girls and boys 6-8 years of age: the PANIC Study." European Journal of Clinical Nutrition **65**(11): 1211-1218.

Background/Objectives: To study nutrient intake, food consumption and meal pattern, and their associations with socioeconomic background in Finnish children. Subjects/Methods: The subjects were a population sample of 424 children (211 girls, 213 boys) 6-8 years of age. Nutrient intake and meal pattern were measured by food records, and food intake and socioeconomic characteristics were assessed by questionnaires. Results: Intakes of saturated fat, sucrose and salt were higher, and intakes of vitamin D, iron and fibre and unsaturated-to-saturated fat ratio lower than recommended. Less than 5% of children consumed vegetables, fruit and berries as recommended. Children with highest parental education more likely ate fish (odds ratio (OR) 2.20, 95% confidence interval (CI) 1.06-4.54), fibre-rich bread (OR 5.06, 95% CI 1.80-14.29) and main meals (OR 2.54, 95% CI 1.34-4.83), but less likely used soft margarine (OR 0.43, 95% CI 0.20-0.94) as recommended than children with lowest parental education. Children with highest household income more likely consumed skimmed milk (OR 2.43, 95% CI 1.21-4.88) and fish (OR 2.21, 95% CI 1.12-4.36) as recommended than children with lowest household income. Only 34% of girls and 45% of boys ate all main meals daily. Snacks provided as much as 42% of total energy intake. Conclusions: Children do not meet recommendations in all important nutrients. Children from lowest socioeconomic position least likely consumed fish, skimmed milk and fibre-rich bread and ate main meals, but most likely used soft margarine as recommended. Less than half of children ate all main meals daily. European Journal of Clinical Nutrition (2011) 65, 1211-1218; doi: 10.1038/ejcn.2011.113; published online 22 June 2011

Entressangles, B. (1995). "TRANS ISOMERS OF UNSATURATED FATTY-ACIDS - METABOLIC AND NUTRITIONAL ASPECTS." Ocl-Oleagineux Corps Gras Lipides **2**(3): 162-169.

The fate of dietary geometrical and positional unsaturated fatty acid isomers was reviewed, from their ingestion to their incorporation into cell membranes. The effects of these isomers on the lipid composition, physical state and functional properties of membranes were examined. When available, the informations concerning humans were discussed with a peculiar attention. The last part of the survey is devoted to the relation between dietary isomers and risk of coronary heart disease.

Ergun, S., et al. (2005). "Influence of dietary oils on liver and blood lipid peroxidation." Saudi Medical Journal **26**(3): 442-446.

Objective: Diets high in unsaturated fatty acids have been recommended to lower the risk of cardiovascular disease. However, these lipids are more susceptible to lipid peroxidation than saturated fatty acids. The aim of the present study described herein was to investigate the effects of dietary oils (differing in their degree of saturated and unsaturated fatty acids) on liver and blood lipid peroxidation in chicks. Methods: The experiments were conducted at the laboratories of University of Dumlupinar, Kutahya, Turkey and Osmangazi University, Eskisehir, Turkey between November 2002 and December 2003. The animals were randomly divided into 5 groups of 30 and fed dietary butter, margarine, olive oil, sunflower oil or corn oil for 7 weeks. Liver malondialdehyde level, blood superoxide dismutase activity (SOD) and glutathione peroxidase activity (GPx), serum vitamin E, and total antioxidant (AOA) levels were measured to determine the effects of the dietary oils on lipid peroxidation. Results: No significant differences were observed in SOD and GPx activities, or vitamin E and AOA levels between the experimental groups. However, the results indicated that the corn oil feeding caused significant increases in liver malondialdehyde (a genotoxic by product of lipid peroxidation) level as compared with the other oils. Conclusion: The results demonstrate that corn oil feeding increases lipid peroxidation significantly and thus may raise the susceptibility of tissues to free radical oxidative damage.

Erkkila, A. T., et al. (1999). "Dietary associates of serum total, LDL, and HDL cholesterol and triglycerides in patients with coronary heart disease." Preventive Medicine **28**(6): 558-565.

Background. Diet-Lipid associations established in clinical trials have in general been weak or nonexistent in cross-sectional studies within a population. Our objective was to analyze the dietary associates of serum lipids in patients with coronary heart disease (CHD) not using lipid-lowering medication. Methods. Patients with coronary bypass grafting (n = 49), balloon angioplasty (n = 46), acute myocardial infarction (n = 79), and acute myocardial ischemia (n 79) participated in a survey (EUROASPIRE). Patients were selected from hospital records at least 6 months after hospitalization. Diet was assessed by a food record, a short questionnaire, and fatty acid composition of serum cholesteryl esters (CE). Results. Neither the intake of total fat nor that of saturated, monounsaturated, or polyunsaturated fatty acids was associated with serum lipids. Use of soft margarine on bread (though not in cooking or baking) and high intake of fiber and cereal products were associated with low total cholesterol. Linoleic acid in CE was inversely associated with total cholesterol and triglycerides, and eicosapentaenoic acid was inversely associated with triglycerides and positively associated with HDL cholesterol. Conclusions. In the present study use of soft margarine on bread (though not in cooking or baking) and high intake of fiber and cereal products were associates of lowered serum cholesterol concentrations in CHD patients. Fatty acid composition of CE reflected dietary fatty acid intake involved in cholesterol lowering better than food records. (C) 1999 American Health Foundation and Academic Press.

Eussen, S., et al. (2011). "Dose-dependent cholesterol-lowering effects of phytosterol/phytostanol-enriched margarine in statin users and statin non-users under free-living conditions." Public Health Nutrition **14**(10): 1823-1832.

Objective: To assess the effectiveness (extent to which an intervention works in daily medical practice) of the use of phytosterol/phytostanol-enriched margarines to lower total and non-HDL cholesterol levels in users and non-users of statins. Design: Retrospective cohort study. Setting: Data were obtained from questionnaires on health and food intake from a population-based longitudinal cohort linked to pharmacy-dispensing records. Subjects: The analysis included 3829 men and women (aged 31-71 years) who were examined during 1998-2002 and re-examined at 5-year follow-up during 2003-2007. Results: Recommended doses of margarines were consumed by only 9% of the subjects. Serum total cholesterol decreased by respectively -0.16 (95% CI -0.26, -0.05) mmol/l, -1.40 (95% CI -1.51, -1.30) mmol/l and -1.64 (95% CI -1.91, -1.37) mmol/l in subjects who started to use phytosterols/phytostanols only, statins only or a combination of both compounds at some point in time between examination and re-examination, compared with subjects who did not start using phytosterols/phytostanols or statins. Cholesterol-lowering effects of the phytosterols/phytostanols were similar in statin users and statin non-users and increased with increasing intake of enriched margarine (no intake, 0; low intake, -0.017 (95% CI -0.16, 0.13) mmol/l; medium intake, -0.089 (95% CI -0.22, 0.038) mmol/l; high intake, -0.32 (95% CI -0.50, -0.14) mmol/l). Conclusions: Although recommended intake levels of the enriched margarines were not reached by all persons, these data show that under customary conditions of use phytosterols/phytostanols are effective in lowering cholesterol levels in both statin users and non-users.

Eussen, S., et al. (2011). "Costs and health effects of adding functional foods containing phytosterols/-stanols to statin therapy in the prevention of cardiovascular disease." European Journal of Pharmacology **668**: S91-S100.

The present modelling study aimed to evaluate if and by how much functional foods containing phytosterols/-stanols add to the benefits of statins in the prevention of cardiovascular disease in terms of cost-effectiveness. Long-term health effects, measured as quality-adjusted life-years gained, and costs for scenarios with additional phytosterol/-stanol use were compared to scenarios without extra use. Phytosterols/-stanols were given only to persons who were eligible for use according to their 10-year absolute risk of fatal cardiovascular disease (SCORE-risk). Intake levels and discontinuation rates as observed in daily practice were included in the model. Two situations were compared: 1) A real-life situation in which persons at high SCORE-risk were identified through clinical case-finding and, 2) A theoretical maximum situation where universal screening was implemented resulting in known SCORE-risks for the whole Dutch population aged 35-75 years (8.4 million people). Sensitivity analyses were performed for variations in the cholesterol-lowering effect and intake level of phytosterols/-stanols, indirect health care costs, time horizon and discount rates. At the model's start year, a total of 1.0 (real-life situation) to 3.3 (maximum situation) million persons qualified for phytosterol/-stanol use based on their SCORE-risk (both statin users and statin non-users). Over the model's time horizon, this resulted in a gain of 2700 to 16,300 quality-adjusted life-years, and yielded cost-effectiveness ratios that ranged between (sic)92,000 and (sic)203,000 per quality-adjusted life-year. This simulation study showed that the cost-effectiveness of phytosterols/-stanols as monotherapy and as add-on to statins is above thresholds for cost-effectiveness, generally ranging between (sic)20,000 and (sic)50,000, and is thus a non-cost-effective strategy to reduce cardiovascular disease. (C) 2011 Elsevier B.V. All rights reserved.

Eussen, S., et al. (2010). "Support of drug therapy using functional foods and dietary supplements: focus on statin therapy." British Journal of Nutrition **103**(9): 1260-1277.

Functional foods and dietary supplements might have a role in supporting drug therapy. These products may (1) have an additive effect to the effect that a drug has in reducing risk factors associated with certain conditions, (2) contribute to improve risk factors associated with the condition, other than the risk factor that the drug is dealing with, or (3) reduce drug-associated side effects, for example, by restoring depleted compounds or by reducing the necessary dose of the drug. Possible advantages compared with a multidrug therapy are lower drug costs, fewer side effects and increased adherence. In the present review we have focused on the support of statin therapy using functional foods or dietary supplements containing plant sterols and/or stanols, soluble dietary fibre, n-3 PUFA or coenzyme Q(10). We conclude that there is substantial evidence that adding plant sterols and/or stanols to statin therapy further reduces total and LDL-cholesterol by roughly 6 and 10%, respectively. Adding n-3 PUFA to statin therapy leads to a significant reduction in plasma TAG of at least 15%. Data are insufficient and not conclusive to recommend the use of soluble fibre or coenzyme Q(10) in patients on statin therapy and more randomised controlled trials towards these combinations are warranted. Aside from the possible beneficial effects from functional foods or dietary supplements on drug therapy, it is important to examine possible (negative) effects from the combination in the long term, for example, in post-marketing surveillance studies. Moreover, it is important to monitor whether the functional foods and dietary supplements are taken in the recommended amounts to induce significant effects.

Feldman, E. B., et al. (1996). "Position paper on trans fatty acids. ASCN/AIN task force on trans fatty acids." American Journal of Clinical Nutrition **63**(5): 663-670.

This report addresses the current controversy about possible health hazards of dietary tuans fatty acid isomers, which are created during hydrogenation of unsaturated fats to change their textural properties and melting points. Estimates of intakes are approximations based on limited data and problematic analytic techniques. Major contributors in the diet are fried and baked foods and margarine, in which partially hydrogenated vegetable oils may replace fat sources richer in saturated fatty acids and cholesterol. Consumption of trans fatty acids in the United States has been relatively constant, and new food technologies are yielding decreases in the trans fatty acid content of commercially prepared foods. When intake of trans fatty acids (as hydrogenated fat) is compared with that of saturated fat, total and low-density-lipoprotein (LDL)-cholesterol concentrations in blood are lower, but both trans fats and saturated fats increase total and LDL concentrations when compared with cis fatty acids or native unhydrogenated fat. Epidemiologic data are conflicting with respect to cardiovascular disease outcomes. We cannot conclude that the intake of trans fatty acids is a risk factor for coronary heart disease nor can we expect that substituting trans- for cia-containing fats will reduce the risk of coronary heart disease. Few rigorous studies have dealt with biomedical effects of trans fatty acids and possible mechanisms relevant to human health and diseases. The nutrition labeling issue is unresolved. The options, recommendations, and research suggestions in this report should outline for nutrition scientists the database needed before any new dietary recommendations or changes in nutrition policy concerning trans fatty acids can be made. The debate about trans fatty acids should not detract from dietary recommendations to limit the intake of saturated fat and total fat.

Fernandez-Michel, S. G., et al. (2008). "Trans fatty acid: Intake and implications for child health." Ciencia Y Tecnologia Alimentaria **6**(1): 71-80.

Trans fatty acids (TFA) are products of partial hydrogenation industrial process. Consequently, the main source of TFA in the diet has been margarine, sweet, cookies, snacks and fast food. It has been suggested that children development may be retarded due to TFA impairment of the essential fatty acid metabolism. Some evidences also suggests a positive correlation between TFA intake and the risk of cardiovascular disease (CVD). Given the high prevalence of CVD in Mexico, it is important to promote that good nutrition begins in infancy. Due to CVD, it is believed that TFA consumption developed countries has decreased. In Mexico, there are no Current data on the amount of TFA intake in children and teenagers. But it is believed that the increase in snacks consumption is a source of TFA high levels in these groups. Hence, there is a need to Studies in Mexico.

Field, C. J., et al. (2009). "Human health benefits of vaccenic acid." Applied Physiology Nutrition and Metabolism-Physiologie Appliquee Nutrition Et Metabolisme **34**(5): 979-991.

The health risks associated with consumption of diets high in trans fats from industrially produced hydrogenated fats are well documented. However, trans fatty acids are not a homogeneous group of molecules, and less is known about the health effects of consuming diets containing vaccenic acid (VA), a positional and geometric isomer of oleic acid, the predominant trans isomer in ruminant fats. The presence of VA in industrial trans fats has raised the question of whether VA produces the same adverse health effects as industrially produced trans fats. VA is also the major trans fat in ruminant fats, and questions have arisen as to whether consuming this trans fat has the same effects on health risk. The purpose of this paper is to critically review the published studies in humans, animals, and cell lines. Epidemiological, but not rodent, studies suggest that VA intake or serum concentrations may be associated with increased cancer risk. However, epidemiological, clinical, and rodent studies to date have not demonstrated a relationship with heart or cardiovascular disease, insulin resistance, or inflammation. VA is the only known dietary precursor of c9, t11 conjugated linoleic acid (CLA), but recent data suggest that consumption of this trans fat may impart health benefits beyond those associated with CLA.

Filip, S., et al. (2010). "Trans Fatty Acids in Food and Their Influence on Human Health." Food Technology and Biotechnology **48**(2): 135-142.

Hydrogenated oils tend to have a higher trans fatty acid (TFA) content than oils that do not contain hydrogenated fats. Prospective epidemiological and case-control studies support a major role of TFAs in the risk of cardiovascular disease. In the partially hydrogenated soybean oil, which is the major source of TFAs worldwide, the main isomer is trans-10 C18:1. In the European countries with the highest TFA intake (the Netherlands and Norway), consumption of partially hydrogenated fish oils was common until the mid-1990s, after which they were omitted from the dietary fat intake. These partially hydrogenated fish oils included a variety of very long-chain TFAs. Recent findings from Asian countries (India and Iran) have indicated a very high intake of TFAs from partially hydrogenated soybean oil (4 % of energy). Thus TFAs appear to be a particular problem in developing countries, where soybean oil is used. In 2003, the United States Food and Drug Administration issued a final ruling that required food manufacturers to list the TFAs in their foods on the nutritional facts label. One way to produce 'zero' levels of TFAs is the trans-esterification reaction between vegetable oils and solid fatty acids, like C8:0, C12:0, C14:0 and C16:0.

Filip, V., et al. (2003). "Resveratrol and its antioxidant and antimicrobial effectiveness." Food Chemistry **83**(4): 585-593.

Resveratrol (3,5,4'-trihydroxystilbene) was prepared by total chemical synthesis. Water solubility, solubility of resveratrol in water/ethanol mixture (0-40% v/v) at temperatures of 0-60degreesC, antioxidation effect of resveratrol, tested in a mixture of sunflower oil-rapeseed oil, or in margarine emulsion, and antimicrobial activity of resveratrol against yeasts and moulds were tested. Water solubility of resveratrol was low and it rose as ethanol concentration and temperature increased. The solubility of resveratrol was 40 mg 1(-1) (20degreesC) when the ethanol concentration achieved 10% v/v. Resveratrol behaved as a slight antioxidant against oxidation of triacylglycerols of sunflower and rapeseed oils. Resveratrol did not achieve the effectiveness of BHT or ascorbylpalmitate. When tested in margarine emulsion w/o, resveratrol did not achieve the effectiveness of ascorbic acid. In vitro, resveratrol behaved as an antimicrobial against filamentous fungi Penicillium expansum and Aspergillus niger. (C) 2003 Elsevier Ltd. All rights reserved.

Floegel, A., et al. (2013). "Variation of serum metabolites related to habitual diet: a targeted metabolomic approach in EPIC-Potsdam." European Journal of Clinical Nutrition **67**(10): 1100-1108.

BACKGROUND/OBJECTIVE: Serum metabolites have been linked to higher risk of chronic diseases but determinants of serum metabolites are not clear. We aimed to investigate the association between habitual diet as a modifiable risk factor and relevant serum metabolites. SUBJECTS/METHODS: This cross-sectional study comprised 2380 EPIC-Potsdam participants. Intake of 45 food groups was assessed by food frequency questionnaire and concentrations of 127 serum metabolites were measured by targeted metabolomics. Reduced rank regression was used to find dietary patterns that explain the maximum variation of metabolites. RESULTS: In the multivariable-adjusted model, the proportion of explained variation by habitual diet was ranked as follows: acyl-alkyl-phosphatidylcholines (5.7%), sphingomyelins (5.1%), diacyl-phosphatidylcholines (4.4%), lyso-phosphatidylcholines (4.1%), acylcarnitines (3.5%), amino acids (2.2%) and hexose (1.6%). A pattern with high intake of butter and low intake of margarine was related to acylcarnitines, acyl-alkyl-phosphatidylcholines, lyso-phosphatidylcholines and hydroxy-sphingomyelins, particularly with saturated and monounsaturated fatty acid side chains. A pattern with high intake of red meat and fish and low intake of whole-grain bread and tea was related to hexose and phosphatidylcholines. A pattern consisting of high intake of potatoes, dairy products and cornflakes particularly explained methionine and branched chain amino acids. Dietary patterns related to type 2 diabetes-relevant metabolites included high intake of red meat and low intake of whole-grain bread, tea, coffee, cake and cookies, canned fruits and fish. CONCLUSIONS: Dietary patterns characterized by intakes of red meat, whole-grain bread, tea and coffee were linked to relevant metabolites and could be potential targets for chronic disease prevention.

Floris, R., et al. (2006). "Influence of pasture feeding and stall feeding on CLA and other fatty acids in bovine milkfat." Australian Journal of Dairy Technology **61**(1): 13-20.

The effect of various feeding regimes used in agricultural practice in The Netherlands on the composition of bovine milkfat, with an emphasis on conjugated linoleic acid (CLA), was studied. Using gas chromatography, the composition of bovine milkfat in farm sampling trials during various periods of the year was determined: pasture feeding (August 1998 and September 1999); barn feeding (April 1999); and the transition period (May 1999). In addition, the effect of the various types of silage included in winter diets on the composition of the milkfat was examined. In this latter experiment, three groups were selected from an actual situation in Dutch agricultural practice: herds fed on a diet with grass silage, herds fed on a diet with maize silage, and herds fed on a diet with both grass and maize silage. A clear seasonal effect on the CLA content of the milkfat was observed. The CLA content was highest (0.73 and 0.76 mol%) during pasture feeding and lowest (0.34 mol%) during barn feeding (winter). In the transition period, an intermediate CLA content was found (0.52 mol%). In the second study, the remarkable effect of the type of silage on the level of CLA in bovine milkfat was observed. When a mixture of grass and maize silage was fed, the amount of CLA (0.25 mol%) was lower than when either grass (0.38 mol%) or maize silage (0.35 mol%) was fed. This study indicates that it is possible to influence the level of CLA during the period of barn feeding by changing the type of silage that is fed.

Fouad, F. M., et al. (1998). "Chemical and epidemiological aspects of modified butter oil fractions." Journal of Toxicology and Environmental Health-Part B-Critical Reviews **1**(2): 149-179.

Butter lipids are an important traditional source of dietary energy intake in the form of fat. Butter lost a sizable portion of its market share due to controversies associated with its cholesterol content and high percentage of long-chain saturated fatty acids. Accordingly, the use of vegetable oils and their chemically manipulated counterparts such as those produced by partial hydrogenation or interestrification increased proportionally. However, beginning in 1940, researchers developed several procedures such as temperature-controlled crystallization, refractionation of crystallized butter oil solids, and supercritical carbon dioxide extraction to improve the acceptance of butter oil. Others proposed preparation of synthetic substitutes such as sucrose polyesters to reduce intestinal absorption of fatty acids, thus reducing caloric intake with concomitant reduction in serum cholesterol. The present review provides a summary of the efforts of several attempts to improve the acceptability of butter together with the anticipated epidemiological consequences of long-term consumption of altered butter oil to mammalian health.

Fournier, N., et al. (2012). "Deleterious impact of elaidic fatty acid on ABCA1-mediated cholesterol efflux from mouse and human macrophages." Biochimica Et Biophysica Acta-Molecular and Cell Biology of Lipids **1821**(2): 303-312.

Consumption of trans fatty acids (TFA) increase cardiovascular risk more than do saturated FA, but the mechanisms explaining their atherogenicity are still unclear. We investigated the impact of membrane incorporation of TFA on cholesterol efflux by exposing J774 mouse macrophages or human monocyte-derived macrophages (HMDM) to media enriched or not (standard medium) with industrially produced elaidic (trans-9 18:1) acid, naturally produced vaccenic (trans-11 18:1) acid (34 h, 70 mu M) or palmitic acid. In J774 macrophages, elaidic and palmitic acid, but not vaccenic acid, reduced ABCA1-mediated efflux by similar to 23% without affecting aqueous diffusion, SR-BI or ABCG1-mediated pathways, and this effect was maintained in cholesterol-loaded cells. The impact of elaidic acid on the ABCA1 pathway was weaker in cholesterol-normal HMDM, but elaidic acid induced a strong reduction of ABCA1-mediated efflux in cholesterol-loaded cells (-36%). In J774 cells, the FA supplies had no impact on cellular free cholesterol or cholesteryl ester masses, the abundance of ABCA1 mRNA or the total and plasma membrane ABCA1 protein content. Conversely, TFA or palmitic acid incorporation induced strong modifications of the membrane FA composition with a decrease in the ratio of (cis-monounsaturated FA + polyunsaturated FA):(saturated FA + TFA), with elaidic and vaccenic acids representing each 20% and 13% of the total FA composition, respectively. Moreover, we demonstrated that cellular ATP was required for the effect of elaidic acid, suggesting that it contributes to atherogenesis by impairing ABCA1-mediated cholesterol efflux in macrophages, likely by decreasing the membrane fluidity, which could thereby reduce ATPase activity and the function of the transporter. (C) 2011 Elsevier B.V. All rights reserved.

Franke, A. A., et al. (2007). "Tocopherol and tocotrienol levels of foods consumed in Hawaii." Journal of Agricultural and Food Chemistry **55**(3): 769-778.

Because of the individual biological effects and the uncertain or missing information on levels of tocopherols (T) and tocotrienols (T3) in foods frequently consumed in Hawaii, 79 food items (50 in duplicate) were analyzed for alpha-, beta-, gamma-, and delta-tocopherol (alpha T, beta T, gamma T, and delta T) and alpha-, beta-, gamma-, and delta-tocotrienol (alpha T3, beta T3, gamma T3, and delta T3) in addition to alpha-tocopheryl acetate (alpha Tac). Foods from local markets were stored according to usual household habits, freeze-dried, homogenized, and extracted three times with hexane containing butylated hydroxytoluene as a preservative and tocol as an internal standard. A normal-phase high-pressure liquid chromatography system was applied with fluorescence and photodiode array detection that resulted in baseline separation of all eight analytes and the internal standard tocol (To). The sum of all E vitamer concentrations, or total E vitamers (TEV), in all foods analyzed ranged an average from 0.6 to 828 mg/kg (T <= 542 mg/kg and T3 <= 432 mg/kg) and showed the following ranges: oils, 497-828 mg/kg (mainly alpha T and gamma T); margarines, 359-457 mg/kg (mainly gamma T); salad dressings, 20-291 mg/kg (mainly gamma T, except alpha T when soy oil was the main ingredient); cookies, 54-138 mg/kg (mainly gamma T); snacks, 101-220 mg/kg (mainly gamma T); nuts, 22-201 mg/kg (mainly alpha T); vegetables, 2-152 mg/kg (mainly alpha T); pasta, 24-90 mg/kg; cereals, 4-56 mg/kg (mainly beta T3 followed by alpha T); fish, 2-39 mg/kg (mainly alpha T); fried tofu, 64 mg/kg (mainly gamma T); breads, 20-22 mg/kg (mainly beta T3); fat-free mayonnaise, 5 mg/kg (mainly alpha T); poi (fermented taro root), 2 mg/kg (mostly alpha T); and fruits, 2 (papaya) to 13 mg/kg (canned pumpkin) with alpha T predominating. Cereals fortified with alpha Tac ranked third and eighth among all foods assayed regarding alpha T and TEV levels, respectively. As compared to the few data available in the literature, our values agreed with some (corn flakes, mango fruit, fat-free mayonnaise, dry-roasted macadamia nuts, dry-roasted peanuts, mixed nuts, spaghetti/marinara pasta sauce, oils, and red bell pepper) but differed for many other items. Our results provide new information on the E vitamer content in foods, emphasize the vast differences of bioactivities of individual E vitamers, and confirm the need for analyses of foods consumed in specific study populations.

Fransen, H. P., et al. (2007). "Customary use of plant sterol and plant stanol enriched margarine is associated with changes in serum plant sterol and stanol concentrations in humans." Journal of Nutrition **137**(5): 1301-1306.

The consumption of products enriched with plant sterol or stanol esters lowers serum total and LDL-cholesterol concentrations, thereby most likely reducing the risk of coronary heart disease. However, using plant sterol (not plant stanol) enriched products elevates serum plant sterol concentrations in humans. This may be unwanted because health effects of elevated serum plant sterol concentrations are still controversial. Within postlaunch monitoring of functional foods, we compared serum plant sterol and plant stanol concentrations among users of plant sterol (n = 67) or plant stanol (n = 13) enriched margarines with those of matched nonusers (n = 81) in the ongoing Dutch Doetinchem cohort study. Subjects (aged 29-67 y) were examined in 1994-1998 (before the introduction of enriched margarines) and re-examined in 1999-2003. Serum concentrations of plant sterols and stanols were measured in samples from nonfasting subjects by GLC-MS. Intake of plant sterols was 1.1 +/- 0.6 g/d and was associated with a decrease of serum total cholesterol concentration of 0.25 +/- 0.91 mmol/L(4%, P < 0.05), a change that differed (P < 0.05) from the nonsignificant increase in nonusers (+2%, 0.12 +/- 0.78 mmol/L, P = 0.16), Cholesterol-standardized serum sitosterol and campesterol increased in plant sterol users by 22% (P < 0.0001) and 103% (P < 0.0001), respectively. Cholesterol-standardized serum sitostanol and campestanol increased in plant stanol users by 197% (P= 0.02) and 196% (P= 0.01). To our knowledge, these data are the first to show changes in serum cholesterol, plant sterol, and plant stanol concentrations after (long-term) consumption of plant sterol and stanol enriched margarines in a free-living population in a nonexperimental setting. Whether the increased serum sterol concentrations result in adverse side effects needs to be investigated in future postlaunch monitoring studies.

Fritsche, J. and H. Steinhart (1997). "Trans fatty acid content in German margarines." Fett-Lipid **99**(6): 214-217.

Seventeen commercial samples of German margarines were analyzed by gas-liquid chromatography for the trans fatty acid (TFA) content including the following mixture of geometrical and positional isomers: 14:1 t9, 16:1 t9, 18:1 t6-t11, 18:2 c9t12, 18:2 t9c12, 18:2 t9t12 and 18:3 trans-isomers. Conventional vegetable and fat reduced margarines were found to contain 0.3-4.1% TFA, whereas diet margarines contained 0.2-0.5% TFA. Highest amounts of TFA were found in sunflower margarines (3.3-4.9% TFA). A significant decrease of the TFA amounts in German margarines since 1994 could be observed.

Fritsche, S. and H. Steinhart (1999). "Occurrence of hormonally active compounds in food: a review." European Food Research and Technology **209**(3-4): 153-179.

The present review gives an overview of the occurrence of hormones, hormone mimics, and hormone antagonists in food. The first part deals comprehensively with concentrations of the human sex steroid hormones progesterone, 17 beta-estradiol estrone, and testosterone in animal and vegetable food. The dietary in take of steroid hormones (10 mu g/day progesterone, 0.1 mu g/day estrogens, and 0.05 mu g/day testosterone) is negligible compared to the human endogenous hormone synthesis. The second part addresses the phytoestrogens (isoflavones, coumestans, other bioflavonoids, lignans, phytosterols), which occur in food in much higher amounts than steroid hormones. Therefore, they can cause hormonal effects although their estrogen equivalents (relative to 17 beta-estradiol) are estimated to be 10(-2)-10(-4). These effects can be beneficial or adverse, depending on the effectiveness and amount of the ingested hormone agonist, synergistic, and antagonistic effects with other dietary or endogenous hormones, interactions with other dietary compounds (e.g. fiber and fat intake), and the hormonal status of the individual. The review also summarizes the occurrence of steroid hormone precursors and of other growth-related hormones in food (corticosteroids, indole-3-carbinol, protein hormones). It ends with the presentation of residues and contaminants of fungal or anthropogenic origin (mycoestrogens, pesticides, plastic or food additives, industrial chemicals) which have also shown hormonal or hormone-blocking properties.

Fuentes, F., et al. (2008). "Basal plasma concentrations of plant sterols can predict LDL-C response to sitosterol in patients with familial hypercholesterolemia." European Journal of Clinical Nutrition **62**(4): 495-501.

Background: Familial hypercholesterolemia ( FH) is associated with a high risk of coronary heart disease. Pharmacological treatment and diet are both essential for the management of FH. Foods rich in plant sterols ( PS) may play an important role in the treatment of patients with these disorders. Objective: To test the effect of the intake of PS on low-density lipoprotein ( LDL) concentration, endothelial function (EF) and LDL particle size in 30 patients with FH. Design: Randomized and crossover dietary intervention study. Setting: Tertiary outpatient care. Subjects: Thirty- eight were recruited, but only 30 were subjected to four low- fat dietary intervention periods, each of 4 weeks. Methods: Each intervention had a different content of cholesterol ( <150 or 300 mg/ day) and sitosterol ( <1 or 2 g/ day). Lipid response, EF and LDL particle size were analysed after the intervention. Results: Plasma sitosterol/ cholesterol ratio was higher during both plant sterol- rich periods than during the low plant sterols periods. Basal sitosterol concentrations predicted the LDL- cholesterol response during the intake of plant sterol- enriched diets. The change in LDL- cholesterol was significantly greater in subjects in the upper and intermediate tertiles of basal plasma sitosterol concentrations ( - 21 +/- 8 mg/dl, P 0.03; - 19 +/- 7 mg/ dl, P= 0.04, respectively) than in subjects in the lower tertile ( 875 mg/ dl) when they changed from a low cholesterol diet to a low cholesterol plus plant sterol diet. Conclusion: Our study demonstrates that basal sitosterol values can predict hypolipidemic response in patients with FH.

Fukuda, S., et al. (2005). "A new strain of Butyrivibrio fibrisolvens that has high ability to isomerize linoleic acid to conjugated linoleic acid." Journal of General and Applied Microbiology **51**(2): 105-113.

A new strain of Butyrivibrio fibrisolvens (TH1) that has high potential to produce conjugated linoleic acid (CLA) was isolated. Strain TH1 had higher LA isomerase (LA-I) activity, and was much more tolerant to linoleic acid (LA) than other strains examined. However, high CLA reductase (CLA-R) activity resulted in the temporary accumulation of CLA and subsequent conversion to trans-vaccenic acid (t-VA). When LA was added to growing TH1 cultures in a solution with dimethylsulfoxide (LA/DMSO), CLA produced was greater than when LA was added in a mixture with bovine serum albumin (BSA). The number of viable cells decreased upon addition of LA/DMSO, but then increased as the CLA decreased upon its conversion to t-VA. This result suggests that B. fibrisolvens can resume growing by the removal of CLA from the cells. Most CLA was released from B. fibrisolvens cells by gentle washing with BSA, suggesting that CLA bound to the cells might be removed in the rumen and large intestine. Thus, CLA production by B. fibrisolvens in the digestive tract could be increased by a reduction in CLA-R activity without accompanying an overall decrease in the cell number of B. fibrisolvens. Fatty acids (FAs) with 18 carbon backbone inducted LA-I activity, whereas unsaturated FAs induced CLA-R activity, suggesting that FAs stimulate the synthesis of LA-I and CLA-R. Providing a diet with a low ratio of unsaturated to saturated FAs may favor CLA production.

Fukuda, S., et al. (2002). "Production of conjugated linoleic acid by intestinal bacteria in dogs and cats." Journal of Veterinary Medical Science **64**(11): 987-992.

Production of conjugated linoleic acid (CLA) by the intestinal bacteria of dogs and cats was demonstrated by incubating their feces with linoleic acid (LA). CLA accumulated once, and then decreased with time. The numbers of LA-hydrogenating bacteria in the intestines appeared to decrease greatly with the ages of dogs and cats. As a major product of LA biohydrogenation, trans-vaccenic acid (t-VA) was identified. Most CLA and t-VA were readily solubilized by shaking the incubation mixture with bovine serum albumin, which strongly supports the presumption that CLA and t-VA are mostly formed on the outer surface of cell membrane, or excreted to the outer cell surface. This result suggests that CLA and t-VA can readily be absorbed through the large intestines. Triacylglycerol and phospholipid were shown to be hydrolyzed to free fatty acids by fecal bacteria, which is critical for biohydrogenation to occur, because esterified LA is not hydrogenated. However, since the ability of intestinal bacteria to produce CLA is probably low, it is desirable to augment CLA production.

Funch, J. P., et al. (1960). "EFFECTS OF BUTTER, SOME MARGARINES AND ARACHIS OIL IN PURIFIED DIETS ON SERUM LIPIDS AND ATHEROSCLEROSIS IN RABBITS." British Journal of Nutrition **14**(3): 355-&.

Gagliardi, A. C. M., et al. (2009). "NUTRITIONAL PROFILE OF FOODS WITH ZERO TRANS FATTY ACIDS CLAIM." Revista Da Associacao Medica Brasileira **55**(1): 50-53.

OBJECTIVE. To evaluate the composition of fatty acids in some foods available in the Brazilian market in which there was a claimed reduction in the amount of trans fatty acids. Also evaluate whether these foods meet recommended amounts for saturated fat consumption, after reduction of trans fat amounts. METHODS. Industrialized food (creamy margarine A and B, plant sterol margarine, stuffed sweet biscuit, salty biscuit without stuffing, French fried potatoes and a burger lunch from a multinational chain of "fast food" all with the allegation of 0% trans fat content were purchased in commercial points and analyzed by gas chromatography. RESULTS. Despite the reduction in trans fatty acid amounts, analyzed food contained large concentrations of saturated fats mainly palmitic acid. Moreover, some of the foods studied showed a n-6/n-3 ratio outside the recommended for atherosclerosis prevention. CONCLUSION. The unrestricted consumption of such foods has strong deleterious health potential. The absence of trans fatty acid label should be viewed with caution and does not mean a release for unrestricted consumption of such foods. [Rev Assoc Med Bras 2009; 55(1): 50-3]

Gagliardi, A. C. M., et al. (2010). "Effects of margarines and butter consumption on lipid profiles, inflammation markers and lipid transfer to HDL particles in free-living subjects with the metabolic syndrome." European Journal of Clinical Nutrition **64**(10): 1141-1149.

Objective: Our purpose was to examine the effects of daily servings of butter, no-trans-fat margarine and plant sterol margarine, within recommended amounts, on plasma lipids, apolipoproteins (Apos), biomarkers of inflammation and endothelial dysfunction, and on the transfer of lipids to HDL particles in free-living subjects with the metabolic syndrome. Methods: This was a randomized, single-blind study where 53 metabolic syndrome subjects (62% women, mean age 54 years) received isocaloric servings of butter, no-trans-fat margarine or plant sterol margarine in addition to their usual diets for 5 weeks. The main outcome measures were plasma lipids, Apo, inflammatory and endothelial dysfunction markers (CRP, IL-6, CD40L or E-selectin), small dense LDL cholesterol concentrations and in vitro radioactive lipid transfer from cholesterol-rich emulsions to HDL. Difference among groups was evaluated by analysis of variance. Results: There was a significant reduction in Apo-B (-10.4 %, P = 0.043) and in the Apo-B/Apo-A-1 ratio (-11.1%, P = 0.034) with plant sterol margarine. No changes in plasma lipids were noticed with butter and no-trans-fat margarine. Transfer rates of lipids to HDL were reduced in the no-trans-fat margarine group: triglycerides -42.0%, (P<0.001 vs butter and sterol margarine) and free cholesterol -16.2% (P = 0.006 vs sterol margarine). No significant effects were noted on the concentrations of inflammatory and endothelial dysfunction markers among the groups. Conclusions: In free-living subjects with the metabolic syndrome consumption of plant sterol and no-trans-fat margarines within recommended amounts reduced, respectively, Apo-B concentrations and the ability of HDL to accept lipids. European Journal of Clinical Nutrition (2010) 64, 1141-1149; doi:10.1038/ejcn.2010.122; published online 21 July 2010

Ganguli, D., et al. (2011). "Major dietary patterns and their associations with cardiovascular risk factors among women in West Bengal, India." British Journal of Nutrition **105**(10): 1520-1529.

Few studies have examined dietary patterns in relation to cardiovascular risk factors in Asian populations, particularly in India. The present study was undertaken to explore dietary patterns in a general urban Bengalee population of women in West Bengal, India, and their association with cardiovascular risk factors. We performed a cross-sectional study of 701 women (aged 35 years and above) selected by cluster sampling from twelve different wards of the Kolkata Municipal Corporation (Kolkata, India). The following three major dietary patterns were identified: the 'vegetable, fruits and pulses' pattern (characterised by higher intakes of dark-yellow and green leafy vegetables, sweets, fruits, pulses, nuts, poultry and eggs, and lower intake of mustard oil); the 'hydrogenated and saturated fat and vegetable oil' pattern (characterised by higher intakes of butter, hydrogenated oil, ghee, vegetable oil, mustard oil, condiments, sweets, fish, high-fat dairy and refined grain); the 'red meat and high-fat dairy' pattern (characterised by higher intakes of red meat, high-fat dairy products, whole grain, high-energy drinks and condiments, and lower intakes of fish, refined grain and low-fat dairy products). The vegetable, fruits and pulses pattern was inversely associated with serum total cholesterol (TC), LDL-cholesterol and non-HDL-cholesterol (HDL-C) concentrations (P<0.05 for all). The hydrogenated and saturated fat and vegetable oil pattern was positively associated with BMI, waist circumference (WC) and HDL-C concentration (P<0.05 for all). In this Bengalee population, these three major dietary patterns were observed, and the dietary patterns were independently associated with BMI, WC and serum TC concentrations in women.

Ganguly, R. and G. N. Pierce (2012). "Trans fat involvement in cardiovascular disease." Molecular Nutrition & Food Research **56**(7): 1090-1096.

Coronary heart disease is becoming a worldwide epidemic and diet and lifestyle are well known contributing factors. Identifying the kinds of foods that may have a cardioprotective or cardiotoxic effect and understanding their molecular mechanisms of action has become of increasing importance. Through largely epidemiological evidence, trans fatty acid (TFA) intake has been associated with a variety of cardiovascular complications including atherosclerosis. Traditionally, industrial TFAs (iTFAs) have been associated with these deleterious cardiovascular effects. However, there is a current body of research that suggests that ruminant trans fats (rTFAs) may have a cardioprotective role within the heart. The molecular mechanisms whereby TFAs are delivering their effects are largely unknown. In the following review, we discuss recent in vitro, animal and epidemiological research to better understand the effect of TFAs in the diet on cardiovascular disease, particularly atherosclerosis.

Gans, K. M. and K. Lapane (1995). "TRANS FATTY-ACID AND CORONARY-DISEASE - THE DEBATE CONTINUES .3. WHAT SHOULD WE TELL CONSUMERS." American Journal of Public Health **85**(3): 411-412.

Garg, M. L., et al. (2006). "Means of delivering recommended levels of long chain n-3 polyunsaturated fatty acids in human diets." Journal of Food Science **71**(5): R66-R71.

n-3 Polyunsaturated fatty acids (n-3PUFA) of marine origin have been shown to be essential for brain development and cognitive function. In addition to their essentiality, the scientific literature is full of evidence to suggest that regular consumption and/or dietary supplementation with long chain n-3PUFA give several health benefits including: prevention of cardiovascular diseases, inflammatory diseases, dyslexia, and depression. Long chain n-3PUFA intake in the Western countries, including Australia, has been shown to be inadequate. This is largely due to the fact that the Western populations do not eat seafood on a regular basis because of its cost and availability, and many individuals do not like the flavor/taste/odor of seafood. Foods fortified with long chain n-3PUFA could play an important role in meeting the demands for optimal health. Marine n-3PUFA are not likely to compete with saturated, monounsaturated, and n-6PUFA as a major source of dietary fat; however, increasing the intake of foods containing marine n-3PUFA is an important strategy for the prevention of chronic illnesses. Recent developments in food technology allow fortification of foods, such as bread, dairy products, eggs, pasta, biscuits, margarines, and other spreads, without the undesirable fish odor/taste and with reasonable shelf life. There is a need to increase the amount of long chain n-3PUFA consumed per serve and optimize their bioavailability. This article reviews the foods fortified with marine n-3PUFA and their role in meeting daily requirements, and highlights the need for further research in this important area of functional foods.

Garland, M., et al. (1998). "The relation between dietary intake and adipose tissue composition of selected fatty acids in US women." American Journal of Clinical Nutrition **67**(1): 25-30.

We compared fatty acid amounts in adipose tissue with fatty acid intake calculated from 2 separate weeks of diet recording and two food-frequency questionnaires for 140 participants in the Nurses' Health Study. Our results showed that the amounts of polyunsaturated and trans fatty acids in adipose tissue reflect dietary intake and confirm those of previous studies. The correlation between the polyunsaturated fatty acid content of adipose tissue and polyunsaturated fatty acid intake from the average of the two food-frequency questionnaires was 0.40; this correlation for trans fatty acids was also 0.40. Linolenic acid amounts in adipose tissue were also moderately correlated with intake from the average of the food-frequency questionnaires (r = 0.34). An estimate of trans fatty acid intake from vegetable sources correlated much more strongly with adipose trans fatty acids than did an estimate of trans fatty acids from animal sources. Adipose tissue aspirates can be used to indicate intake of exogenous fatty acids.

Gates, L. J., et al. (2011). "Impact of trans-fatty acid sources on the fetal programming of atherosclerosis." Faseb Journal **25**.

Gates, L. J., et al. (2011). "Impact of Trans-Fatty Acid Sources on the Fetal Programming of Atherosclerosis." Journal of Developmental Origins of Health and Disease **2**: S49-S49.

Gatto, L. M., et al. (2001). "Trans fatty acids and cholesterol metabolism: mechanistic studies in rats and rabbits fed semipurified diets." International Journal of Food Sciences and Nutrition **52**(5): 435-441.

Studies were conducted in rabbits and rats to investigate the effects of diets rich in oleic (CIS diet), palmitic (SAT diet) and trans fatty acids (TRANS diet) on plasma lipids and lipoprotein metabolism. An important difference between these species is that rabbits possess plasma cholesteryl ester transfer protein (CETP) activity while rats are devoid of transfer activity. In the presence of dietary cholesterol (0.2% w/w) the change in plasma low density lipoprotein-cholesterol (LDL-C) concentration from baseline was significantly higher in rabbits fed the TRANS diet compared with those fed the CIS diet (P < 0.01). Despite this difference, the hepatic LDL-receptor activity was similar in all groups. Also, the fatty acid composition of hepatic phospholipids was affected by diet with lower proportion of palmitic (11%) and higher (19%) linoleic acid despite a similar content in the diet. These effects may represent the maintenance of membrane fluidity within narrow limits to ensure optimal function. The studies in rats showed that the plasma total cholesterol concentration was 20% lower (P < 0.01) in TRANS-fed rats compared with those fed the CIS diet. The results of an in vivo assay of reverse cholesterol transport (RCT) suggested that the three diets gave rise to high density lipoprotein (HDL) particles with similar capacity to accept cellular cholesterol. The differential effects of dietary trans fatty acids in these animal models provide another line of evidence that reinforces the significant role of CETP activity in determining the distribution of plasma cholesterol in response to dietary trans fatty acids.

Gatto, L. M., et al. (2002). "Trans fatty acids affect lipoprotein metabolism in rats." Journal of Nutrition **132**(6): 1242-1248.

This study was designed to investigate the effects of oleic (CIS), palmitic (SAT) and trans fatty acids (TRANS) on cholesterol metabolism. Rats fed the TRANS diet had lower plasma total cholesterol (P < 0.005) and non-HDL-cholesterol (non HDL-C) concentrations (P < 0.005) compared with their CIS-fed counterparts. Plasma HDL-C was highest in rats fed the SAT diet (P = 0.01). An in vivo assay of reverse cholesterol transport (RCT) was performed whereby radiolabeled cholesterol was delivered to the liver as acetylated LDL and the reappearance of label into plasma and HDL was determined. Plasma radioactivity in TRANS-fed rats was lower than in their SAT-fed counterparts (P = 0.01), and consistent with the cholesterol distribution in plasma, the difference was due to lower [H-3]-cholesterol in lower density lipoproteins. Despite diet-induced differences in the cholesterol and phospholipid concentrations and fatty acid composition of HDL, the amount of label in HDL did not differ among groups, suggesting that consumption of these diets resulted in HDL populations with similar capacity to participate in RCT. The present findings suggest that dietary trans fatty acids regulate the metabolism of apolipoprotein B-containing lipoproteins in rats and that the effect may be masked in species possessing high plasma cholesteryl ester transfer protein (CETP) activity. These results reinforce the important role of CETP activity in determining the distribution of plasma cholesterol in response to dietary trans fatty acids.

Gatto, L. M., et al. (2003). "Postprandial effects of dietary trans fatty acids on apolipoprotein(a) and cholesteryl ester transfer." American Journal of Clinical Nutrition **77**(5): 1119-1124.

Background: The consumption of trans fatty acids adversely affects fasting plasma lipoprotein concentrations. Objective: This study aimed to investigate whether postprandial lipoprotein metabolism is affected by the consumption of trans fatty acids. Design: In a randomized crossover study, 19 healthy men consumed fatty meals that were identical except that 10% of energy was provided as trans 18:1 acids in the trans meal and as oleic acid in the cis meal. Results: The meals induced similar responses in plasma lipids. Cholesteryl ester transfer (CET) was activated after consumption of both meals (P < 0.0001); however, it was 28% higher after the trans meal than after the cis meal (280 129 compared with 219 +/- 116 nmol cholesteryl ester/mL plasma . 6 h; time X diet interaction: P < 0.0001). Plasma apolipoprotein(a) [apo(a)] concentrations remained constant; however, triacylglycerol-rich lipoproteins formed 4 h after ingestion of the trans meal contained a higher concentration of apo(a) than did those formed after ingestion of the cis meal (48.9 +/- 6.6 compared with 39.6 +/- 5.4 U/L; P < 0.02). The change in CET and in the proportion of plasma apo(a) in the triacylglycerol-rich lipoprotein fractions correlated with indexes of alimentary lipemia. Conclusions: Consumption of meals high in trans fatty acids results in higher CET and postprandial lipoprotein concentrations enriched in apo(a) than does consumption of meals free of trans fatty acids. This study highlights the importance of double-bond configuration in determining postprandial lipoprotein composition.

Gebauer, S. K., et al. (2011). "Effects of Ruminant trans Fatty Acids on Cardiovascular Disease and Cancer: A Comprehensive Review of Epidemiological, Clinical, and Mechanistic Studies." Advances in Nutrition **2**(4): 332-354.

There are 2 predominant sources of dietary trans fatty acids (TFA) in the food supply, those formed during the industrial partial hydrogenation of vegetable oils (iTFA) and those formed by biohydrogenation in ruminants (rTFA), including vaccenic acid (VA) and the naturally occurring isomer of conjugated linoleic acid, cis-9, trans-11 CLA (c9,t11-CLA). The objective of this review is to evaluate the evidence base from epidemiological and clinical studies to determine whether intake of rTFA isomers, specifically VA and c9,t11-CLA, differentially affects risk of cardiovascular disease (CVD) and cancer compared with iTFA. In addition, animal and cell culture studies are reviewed to explore potential pro- and antiatherogenic mechanisms of VA and c9,t11-CLA. Some epidemiological studies suggest that a positive association with coronary heart disease risk exists between only iTFA isomers and not rTFA isomers. Small clinical studies have been conducted to establish cause-and-effect relationships between these different sources of TFA and biomarkers or risk factors of CVD with inconclusive results. The lack of detection of treatment effects reported in some studies may be due to insufficient statistical power. Many studies have used doses of rTFA that are not realistically attainable via diet; thus, further clinical studies are warranted. Associations between iTFA intake and cancer have been inconsistent, and associations between rTFA intake and cancer have not been well studied. Clinical studies have not been conducted investigating the cause-and-effect relationship between iTFA and rTFA intake and risk for cancers. Further research is needed to determine the health effects of VA and c9,t11-CLA in humans. Adv. Nutr. 1: 332-354, 2011.

Gebauer, S. K., et al. (2011). "Effect of trans fatty acid isomers from ruminant sources on risk factors of cardiovascular disease: Study design and rationale." Contemporary Clinical Trials **32**(4): 569-576.

Substantial evidence clearly demonstrates the deleterious effects of industrially-produced trans fatty acids (TFA); however, data are lacking from large, well controlled human feeding studies that directly compare the effects of industrially-produced and naturally-occurring TFA. The purpose of the current study is to determine whether consumption of TFA derived from different sources differentially affect risk factors of cardiovascular disease (CVD). The study was a randomized, crossover design, controlled-feeding intervention designed to compare the effects of the following diet treatments on risk factors of CVD: low TFA diet (base diet, 34% energy from fat; 0.1% energy from TFA), base diet with vaccenic acid (3.0% energy), base diet with mixed isomers of TFA from partially hydrogenated vegetable oil (3.0% energy), and base diet with cis-9, trans-11 CLA (1.0% energy). The added energy from TFA replaced energy from stearic acid. Participants were required to be between the ages of 25 and 65 years, have a body mass index between 20 and 38 kg/m(2), total cholesterol <280 mg/dl, fasting triacylglycerol <300 mg/dl, fasting glucose <126 mg/dl, and blood pressure <160/100 mm Hg (controlled with certain medications). Of the 116 participants who were randomized, a total of 95 completed the intervention. Results from this study will be important in determining whether ruminant TFA and industrially produced TFA differentially affect markers of cardiovascular risk, in the context of a highly controlled feeding study. Published by Elsevier Inc.

Gebauer, S. K., et al. (2007). "The diversity of health effects of individual trans fatty acid isomers." Lipids **42**(9): 787-799.

There are multiple adverse effects of trans fatty acids (TFA) that are produced by partial hydrogenation (i.e., manufactured TFA), on CVD, blood lipids, inflammation, oxidative stress, endothelial health, body weight, insulin sensitivity, and cancer. It is not yet clear how specific TFA isomers vary in their biological activity and mechanisms of action. There is evidence of health benefits on some of the endpoints that have been studied for some animal TFA isomers, such as conjugated linoleic acid; however, these are not a major TFA source in the diet. Future research will bring clarity to our understanding of the biological effects of the individual TFA isomers. At this point, it is not possible to plan diets that emphasize individual TFA from animal sources at levels that would be expected to have significant health effects. Due to the multiple adverse effects of manufactured TFA, numerous agencies and governing bodies recommend limiting TFA in the diet and reducing TFA in the food supply. These initiatives and regulations, along with potential TFA alternatives, are presented herein.

Geleijnse, J. M., et al. (2012). "Effects of n-3 fatty acids on cognitive decline: A randomized, double-blind, placebo-controlled trial in stable myocardial infarction patients." Alzheimers & Dementia **8**(4): 278-287.

Background: Epidemiological studies suggest a protective effect of n-3 fatty acids derived from fish (eicosapentaenoic acid [EPA] and docosahexaenoic acid [DHA]) against cognitive decline. For alpha-linolenic acid (ALA) obtained from vegetable sources, the effect on cognitive decline is unknown. We examined the effect of n-3 fatty acid supplementation on cognitive decline in coronary heart disease patients. Methods: The analysis included 2911 coronary patients (78% men) aged 60 to 80 years who participated in a double-blind placebo-controlled trial of n-3 fatty acids and cardiovascular diseases (Alpha Omega Trial). By using a 2 X 2 factorial design, patients were randomly assigned to margarines that provided 400 mg/d of EPA DHA, 2 g/d of ALA, both EPA DHA and ALA, or placebo for 40 months. Cognitive function was assessed by the Mini-Mental State Examination (MMSE) at baseline and after 40 months. The effect of n-3 fatty acids on change in MMSE score was assessed using analysis of variance. Logistic regression analysis was used to examine the effects on risk of cognitive decline, defined as a decrease of 3 or more points in MMSE score or incidence of dementia. Results: Patients in the active treatment groups had an additional intake of 384 mg of EPA DHA, 1.9 g of ALA, or both. The overall MMSE score in this cohort was 28.3 +/- 1.6 points, which decreased by 0.67 +/- 2.25 points during follow-up. Changes in MMSE score during intervention did not differ significantly between EPA DHA and placebo (-0.65 vs -0.65 points, P = .44) or between ALA and placebo (-0.60 vs -0.74 points, P = .12). The risk of cognitive decline was 1.03 (95% confidence interval: 0.84-1.26, P = .80) for EPA DHA (vs placebo) and 0.90 (0.74-1.10, P = .31) for ALA (vs placebo). Conclusion: This large intervention study showed no effect of dietary doses of n-3 fatty acids on global cognitive decline in coronary heart disease patients. (C) 2012 The Alzheimer's Association. All rights reserved.

Geleijnse, J. M., et al. (2010). "Effect of low doses of n-3 fatty acids on cardiovascular diseases in 4,837 post-myocardial infarction patients: Design and baseline characteristics of the Alpha Omega Trial." American Heart Journal **159**(4): 539-U556.

Background Weekly fish consumption has been related to a lower risk of fatal coronary heart disease (CHD) and incident stroke in populations with a low fish intake. This relation has mainly been attributed to n-3 fatty acids in fish, that is, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). It is at present unclear whether alpha-linolenic acid (ALA), a n-3 fatty acid from vegetable origin, could also be protective against cardiovascular diseases (CVDs). There is a need for food-based trials to establish the efficacy of low doses of n-3 fatty acids in CVD prevention. Objectives The aim of the study was to evaluate the effect of an additional daily intake of 400 mg of EPA + DHA and 2 g of ALA on CVD morbidity and mortality in free-living subjects with a history of myocardial infarction. Design The multicenter Alpha Omega Trial is a randomized, double-blind, placebo-controlled trial with a 2 x 2 factorial design. Between May 2002 and December 2006, we enrolled a total of 4,837 men and women aged 60 through 80 who experienced a myocardial infarction within 10 years before entering the study. Subjects were randomized to 1 of 4 margarine spreads that were enriched with EPA + DHA and/or ALA, or placebo. Compliance was monitored via tub counts and assessment of n-3 fatty acids in plasma. Subjects were observed for 40 months for the occurrence of fatal and nonfatal CVD. Results The cohort was on average 69 years old at the start of the study and comprised 22% women. Subjects had their (last) myocardial infarction approximately 4 years before enrolment. Mean body mass index was 27.7 kg/m(2), and 17% smoked. Average serum total and high-density lipoprotein cholesterol were 4.7 and 1.3 mmol/L, respectively, and 85% used statins. Mean blood pressure was 142/80 mm Hg, and most subjects were on antihypertensive medication (88%). Diabetes mellitus was reported by 17% of the subjects, and 7% reported a history of stroke. The overall mortality rate during the trial period was 23 per 1,000 person-years, with approximately 40% due to CVD. Current status Follow-up of the patients was completed in November 2009, and findings will be reported in the second part of 2010. (Am Heart J 2010; 159: 539-546. e2.)

German, J. B. and C. J. Dillard (2004). "Saturated fats: what dietary intake?" American Journal of Clinical Nutrition **80**(3): 550-559.

Public health recommendations for the US population in 1977 were to reduce fat intake to as low as 30% of calories to lower the incidence of coronary artery disease. These recommendations resulted in a compositional shift in food materials throughout the agricultural industry, and the fractional content of fats was replaced principally with carbohydrates. Subsequently, high-carbohydrate diets were recognized as contributing to the lipoprotein pattern that characterizes atherogenic dyslipidemia and hypertriacylglycerolemia. The rising incidences of metabolic syndrome and obesity are becoming commonihemes in the literature. Current recommendations are to keep saturated fatty acid, trans fatty acid, and cholesterol intakes as low as possible while consuming a nutritionally adequate diet. In the face of such recommendations, the agricultural industry is shifting food composition toward lower proportions of all saturated fatty acids. To date, no lower safe limit of specific saturated fatty acid intakes has been identified. This review summarizes research findings and observations on the disparate functions of saturated fatty acids and seeks to bring a more quantitative balance to the debate on dietary saturated fat. Whether a finite quantity of specific dietary saturated fatty acids actually benefits health is not yet known. Because agricultural practices to reduce saturated fat will require a prolonged and concerted effort, and because the world is moving toward more individualized dietary recommendations, should the steps to decrease saturated fatty acids to as low as agriculturally possible not wait until evidence clearly indicates which amounts and types of saturated fatty acids are optimal?.

Ghafoorunissa (2008). "Role of trans fatty acids in health and challenges to their reduction in Indian foods." Asia Pacific Journal of Clinical Nutrition **17**: 212-215.

Evidence indicates that dietary trans fatty acids (TFA) obtained from partially hydrogenated vegetable oils (PHVO) increase the risk of coronary heart disease (CHD). Studies have implicated TFA in increasing the risk and incidence of diabetes. Furthermore, TFA may compromise fetal and early infant growth and development. In rats, partial substitution of either linoleic acid (18:2 n-6) with saturated fatty acids (SFA, 6 en %) or SFA with TFA (3 en % from vanaspati) decreased peripheral insulin sensitivity, but these effects were greater in TFA group. Since a large proportion of Indian population is insulin resistant, the TFA content in Indian edible fats/oils and foods should be reduced. Vanaspati (PHVO) provides up to 40% TFA, is used in Indian cooking and in the preparation of commercially fried, processed, bakery, ready-to-eat and street foods. TFA in biscuits and sweets range 30-40 and 6-26% of total fatty acids respectively. There is no regulation on TFA content in vanaspati, bakery fats and shortenings. Reduction in Indian edible fats/oils and foods can be achieved by: a) specifying limits of TFA in vanaspati, bakery fats and shortenings by upgrading technology; b) advocating the substitution of natural plant oils containing lower percent of polyunsaturated fatty acids for PHVO. Indian edible oil industry needs to develop and adopt alternative technologies to produce zero TFA. Consumer education about negative health effects of TFA and providing food based guidelines to reduce TFA consumption in the entire population need to be actively pursued.

Ghahremanpour, F., et al. (2008). "Adipose tissue trans fatty acids and risk of coronary artery disease: A case-control study." Annals of Nutrition and Metabolism **52**(1): 24-28.

Background/Aims: Dietary isomeric trans fatty acids (TFAs) are suspected of increasing the risk of coronary artery disease (CAD). To assess the association between adipose tissue levels of TFA, a biomarker of intake and the risk of CAD, we conducted a population-based case-control study. Methods: We studied 105 patients aged 30-73 years with angiographically proven coronary stenosis referred to Tehran Rajaee Cardiovascular Center, and 68 healthy subjects with no history of heart disease. Adipose tissue fatty acids were determined by gas liquid chromatography technique. Results: Total TFAs in adipose tissue were higher in the cases than controls (p < 0.05). When all the subjects were classified into the three groups by tertiles of TFA levels, significant differences (p < 0.01) in LDL cholesterol were found among the three groups. After adjusting for established risk factors and other confounders, the OR of the interquintile of total TFA and trans-18: 1 was 1.41 (95% CI, 1.0-1.8) and 1.32 (95% CI, 1.0-1.8), respectively. Conclusions: These findings suggest that dietary intake of TFA is associated with increase in the risk of CAD. Further, our results show that the high percentage of TFA in adipose tissue of the Iranian population is alarming and that more health policies regarding the TFA content of hydrogenated oil used in Iran should be established. Copyright (C) 2008 S. Karger AG, Basel.

Ghavami, S., et al. (2012). "Autophagy regulates trans fatty acid-mediated apoptosis in primary cardiac myofibroblasts." Biochimica Et Biophysica Acta-Molecular Cell Research **1823**(12): 2274-2286.

Trans fats are not a homogeneous group of molecules and less is known about the cellular effects of individual members of the group. Vaccenic acid (VA) and elaidic acid (EA) are the predominant trans monoenes in ruminant fats and vegetable oil, respectively. Here, we investigated the mechanism of cell death induced by VA and EA on primary rat ventricular myofibroblasts (rVF). The MIT assay demonstrated that both VA and EA (200 mu M, 0-72 h) reduced cell viability in rVF (P<0.001). The FACS assay confirmed that both VA and EA induced apoptosis in rVF, and this was concomitant with elevation in cleaved caspase-9, -3 and -7, but not caspase-8. VA and EA decreased the expression ratio of Bcl2:Bax, induced Bax translocation to mitochondria and decrease in mitochondrial membrane potential (Delta psi). BAX and BAX/BAK silencing in mouse embryonic fibroblasts (MEF) inhibited VA and EA-induced cell death compared to the corresponding wild type cells. Transmission electron microscopy revealed that VA and EA also induced macroautophagosome formation in rVF, and immunoblot analysis confirmed the induction of several autophagy markers: LC3-beta lipidation, Atg5-12 accumulation, and increased beclin-1. Finally, deletion of autophagy genes, ATG3 and ATG5 significantly inhibited VA and EA-induced cell death (P<0.001). Our findings show for the first time that trans fat acid (TFA) induces simultaneous apoptosis and autophagy in rVF. Furthermore, TFA-induced autophagy is required for this pro-apoptotic effect. Further studies to address the effect of TFA on the heart may reveal significant translational value for prevention of TFA-linked heart disease. (C) 2012 Elsevier B.V. All rights reserved.

Gillman, M. W., et al. (1997). "Margarine intake and subsequent coronary heart disease in men." Epidemiology **8**(2): 144-149.

Margarine is a major source of trans fatty acids, the intake of which has risen since the early 20th century. Some data indicate that consumption of trans fatty acids increases the risk of coronary heart disease (CHD). In 1966-1969, 832 men from the Framingham Study, age 45-64 years and free of CHD, were administered a single 24-hour dietary recall, from which we estimated total daily margarine intake. We calculated CHD cumulative incidence rates and, using proportional hazards regression, CHD incidence rate ratios over 21 years of followup. Mean energy intake was 2,619 kcal; mean margarine intake was 1.8 (range 0-12) tsp per day. There were 267 incident cases of CHD. Age adjusted CHD cumulative incidence rose over categories of margarine intake, hut the increased risk was apparent only in the second half of the follow-up period. Adjusted for age and energy intake, the risk ratio for CHD for each increment of 1 teaspoon per day of margarine was 0.98 [95% confidence interval (CI) = 0.91-1.05] for the first 10 years of follow up and 1.10 (95% CI = 1.04-1.17) for follow-up years 11-21. Adjustment for total fat intake and for cigarette smoking, glucose intolerance, left ventricular hypertrophy, body mass index, blood pressure, physical activity, and alcohol intake did not materially change the results. Butter intake did not predict CHD incidence. These data offer modest support to the hypothesis that margarine intake increases the risk of coronary heart disease.

Gillman, M. W., et al. (1995). "MARGARINE INTAKE AND SUBSEQUENT CORONARY HEART-DISEASE." Circulation **91**(3): 925-925.

Giltay, E. J., et al. (2012). "No effects of n-3 fatty acid supplementation on serum total testosterone levels in older men: the Alpha Omega Trial." International Journal of Andrology **35**(5): 680-687.

The intake of the n-3 fatty acids alpha-linolenic acid (ALA), acid (EPA) and docosahexaenoic acid (DHA) has been related to testosterone levels in epidemiological analyses. The aim of this study was to assess whether the n-3 fatty acids affects testosterone levels in post-myocardial infarction (MI) patients, who are at risk of testosterone deficiency. In a double-blind, placebo-controlled trial of low-dose supplementation of n-3 fatty acids, we included 1850 male post-MI patients aged 6080 years who participated in the Alpha Omega Trial. Patients were randomly allocated to margarines that provided 400 mg/day of EPADHA (n = 453), 2 mg/day of ALA (n = 467), EPADHA plus ALA (n = 458), or placebo (n = 472). Serum testosterone levels were assessed at baseline and after 41 months using whole day blood samples obtained at the subjects home or at the hospital. Subjects were on average age of 68.4 (SD 5.3) years old and had baseline mean serum total testosterone of 14.8 (SD 5.6) nmol/L. The four randomized groups did not differ for baseline characteristics. ALA, EPADHA, and EPADHA plus ALA supplementation did not affect serum total testosterone compared to placebo. Moreover, n-3 fatty acid supplementation did not affect the risk of incident testosterone deficiency (n = 76 with total testosterone <8.0 nmol/L). We conclude that n-3 fatty acids supplementation did not affect serum total testosterone in men who had had a MI.

Giltay, E. J., et al. (2011). "Effects of n-3 fatty acids on depressive symptoms and dispositional optimism after myocardial infarction." American Journal of Clinical Nutrition **94**(6): 1442-1450.

Background: In patients who have experienced a myocardial infarction (MI), n-3 (omega-3) PUFA status is low, whereas the risk of depression is increased. Objective: The objective was to assess whether the plant-derived alpha-linolenic acid (ALA) and the fish fatty acids EPA and DHA would improve affective states. Design: In a secondary analysis of the randomized, double-blind, placebo-controlled Alpha Omega Trial, 4116 of 4837 (85.1%) patients (aged 60-80 y; 79.2% men) who had experienced an MI were included. Margarine spreads were used to deliver 400 mg EPA-DHA/d, 2 g ALA/d, both EPA-DHA and ALA, or a placebo for 40 mo. At 40 mo, the endpoints of depressive symptoms (15-item Geriatric Depression Scale) and dispositional optimism (a 4-item questionnaire and the Life Orientation Test-Revised) were analyzed by using a posttest-only design. Results: The 4 randomly assigned groups did not differ in baseline characteristics. ALA supplementation significantly increased plasma cholesteryl ester concentrations of ALA by 69%, and EPA-DHA supplementation increased plasma cholesteryl ester concentrations of EPA and DHA by 61% and 30%, respectively. Depressive symptoms or dispositional optimism did not differ between groups with the use of n-3 fatty acids compared with placebo at the 40-mo follow-up. The standardized mean (+/- SE) differences in depressive symptoms were as follows: for EPA-DHA plus ALA (n = 1009) compared with placebo (n = 1030), -0.025 +/- 0.044 (P = 0.57); for EPA-DHA (n = 1007) compared with placebo, -0.048 +/- 0.044 (P = 0.28); and for ALA (n = 1022) compared with placebo, -0.047 +/- 0.044 (P = 0.29). Conclusions: In patients who had experienced an MI, low-dose EPA-DHA supplementation, ALA supplementation, or a combination of both did not affect depressive symptoms and dispositional optimism. These findings are in accord with those from previous trials in individuals without psychopathology or without severe depressive symptoms. This trial was registered at clinicaltrials. gov as NCT00127452. Am J Clin Nutr 2011; 94: 1442-50.

Ginsberg, H. N. (2000). "Nonpharmacologic management of low levels of high-density lipoprotein cholesterol." American Journal of Cardiology **86**(12A): 41L-45L.

Several nonpharmacologic approaches can effectively increase low serum levels of high-density lipoprotein cholesterol (HDL-C), including weight control, specific nutritional choices, exercise, alcohol consumption, and smoking cessation. Increased visceral fat is inversely associated with HDL-C in both men and women. During weight reduction, HDL-C, HDL2-C, and apolipoprotein A-1 (apo A-1) tend to decrease, but levels increase with sustained weight loss. Overall, weight cycling is not detrimental in terms of serum lipids. Increasing monounsaturated fat intake and reducing carbohydrates increases HDL-C levels. Lowering trans-fatty acid intake also improves serum lipids. A very low-fat diet combined with stress-lowering lifestyle changes has been shown to cause regression of coronary artery disease. Moderate alcohol consumption, even in diabetic patients, and smoking cessation can increase serum HDL-C levels. (C) 2000 by Excerpta Medica, Inc.

Gladine, C., et al. (2013). "Optimized rapeseed oil enriched with healthy micronutrients: a relevant nutritional approach to prevent cardiovascular diseases. Results of the Optim'Oils randomized intervention trial." Journal of Nutritional Biochemistry **24**(3): 544-549.

Rapeseeds are naturally rich in cardioprotective micronutrients but refining leads to substantial losses or the production of undesirable compounds. The Optim'Oils European project proposed innovative refining conditions to produce an optimized rapeseed oil enriched in micronutrients and low in trans linolenic acid. We aimed to investigate cardioprotective properties of this Optimized oil. In a randomized, double-blind, controlled, cross-over study, 59 healthy normolipidaemic men consumed either Optimized or Standard rapeseed oils (20 g/d) and margarines (22 g/d) for 3 weeks. The Optimized oil reduced the trans FA concentration (p = 0.009) and increased the contents of alpha-tocopherol (p = 0.022) and coenzyme Q10 (p<0.001) in comparison with the Standard oil. Over the 3-week trial, Total-/HDL-cholesterol and LDL-/HDL-cholesterol were increased by 4% (p<0.05) with the Standard oil consumption whereas none of them rose with the Optimized rapeseed oil which increased the HDL-cholesterol and ApoA1 plasma content (+ 2%, NS and +3%, p<0.05 respectively). The effects observed on the plasma HDL-cholesterol levels (p = 0.059), the Total-/HDL-cholesterol ratio (p = 0.092), and on the ApoA1 concentrations (p = 0.060) suggest an improvement of the cholesterol profile with the Optimized rapeseed oil. Finally, the Optimized oil reduced the plasma content of LDLox (-6%, NS), this effect being significantly different from the Standard oil (p = 0.050). In conclusion, reasonable intake of an Optimized rapeseed oil resulting from innovative refining processes and enriched in cardioprotective micronutrients represent a relevant nutritional approach to prevent the risk of cardiovascular diseases by improving the cholesterol profile and reducing LDL oxidation. (C) 2013 Elsevier Inc. All rights reserved.

Gladine, C., et al. (2011). "Preservation of micronutrients during rapeseed oil refining: A tool to optimize the health value of edible vegetable oils? Rationale and design of the Optim'Oils randomized clinical trial." Contemporary Clinical Trials **32**(2): 233-239.

Numerous micronutrients naturally abundant in oilseeds prevent the risk of cardiovascular diseases by reducing cholesterolemia and oxidative stress. These micronutrients include phytosterols and various antioxidants such as polyphenols, tocopherols and coenzyme Q10/Q9 but most of them are lost during the oilseed oil refining. The main objective of the Optim'Oil project was to modify the processes of oil refining in order to reduce the lost of micronutrients. Two clinical trials (cross-over, monocentric, randomized, double-blind and controlled) were designed to investigate the effect of an optimized rapeseed oil 1) on cardiovascular biomarkers (long-term study) and 2) on oxidative stress parameters (post-prandial study). For the long-term study, 59 volunteers ingested daily 20 g of oil and 22 g of margarine (optimized or standard) for 2 periods of 3 weeks separated by a 3-week wash-out period. Blood samples were collected at the beginning and at the end of each period. For the post-prandial study, a sub-group of 16 volunteers came fasted at the laboratory and took 300 mL of a test meal containing 60% of the optimized or standard oils. Blood samples were collected before and during 6 h after the test meal intake. In comparison with the standard oil and margarine, the optimized oil and margarine exhibit as expected an increased content of phytosterol (+ 22%). polyphenols (x11), tocopherols (+ 131%) and coenzyme Q10/Q9 ( + 165%). Overall, conditions of this study were relevant to investigate the effect of the optimized rapeseed oil and margarine on the cardiovascular risk and the oxidative stress. (C) 2010 Elsevier Inc. All rights reserved.

Glew, R. H., et al. (2010). "Lipid Profiles and trans Fatty Acids in Serum Phospholipids of Semi-nomadic Fulani in Northern Nigeria." Journal of Health Population and Nutrition **28**(2): 159-166.

The Fulani are semi-nomadic pastoralists of West Africa whose diet, culture, and economy are centred on cattle. Previous studies have shown that the Fulani of northern Nigeria derive 50% of their total calories from fat and 30% of their calories from milk, cheese, yogurt, and butter oil that contain significant amounts of trans fatty acids (TFAs), primarily vaccenic acid, which raise total serum cholesterol and low-density lipoprotein-cholesterol (LDL-C), and lower high-density lipoprotein-cholesterol (HDL-C). The study was conducted to know how the consumption of relatively large amounts of dairy products by adult Fulani affected the TFA content of their serum phospholipids. Blood samples were collected from 22 male and 29 female Fulani, aged 35-60 years, who were living in rural areas of Gombe state in northeastern Nigeria. The total serum phospholipid fraction was isolated, and its fatty acid composition was determined. Surprisingly, vaccenic acid was not detected, and three other TFAs-18:1-t6, 18:1-t9, and 18:2-t9,t12-together accounted for only 0.16% of the total fatty acid. The mean serum total cholesterol, LDL-C, and triglyceride concentrations of the subjects were within the normal range for populations in developed countries; however, at 32 mg/dL, the mean serum HDL-C concentration of the Fulani males was slightly below the lower limit of the reference range. No correlations were observed between the total TFA percentage or that of the three individual TFAs and any of the parameters of the serum lipid profile. These findings indicate that, with respect to TFAs at least, the fatty acid pattern of the serum phospholipids of Fulani pastoralists does not reflect the high TFA content of their traditional diet. Despite the consumption of rumenic acid-rich dairy products, for unknown reasons, the semi-nomadic Fulani manage to maintain a low level of TFAs in their blood and a relatively healthful serum lipid profile. While the mechanism that accounts for this disconnect between the consumption of TFAs by Fulani pastoralists and the proportion of TFAs in their serum phospholipids is obscure, possibilities include discrimination against nimenic acid during the process of triglyceride synthesis and chylomicron synthesis in the intestine and the preferential oxidation of TFAs by Fulani the people compared to other ethnic groups.

Glew, R. H., et al. (2006). "Trans fatty acids and conjugated linoleic acids in the milk of urban women and nomadic Fulani of northern Nigeria." Clinica Chimica Acta **367**(1-2): 48-54.

Background: Trans fatty acids (TFAs) and conjugated linoleic acids (CLAs) are present in dairy products and human milk and can have detrimental and beneficial effects in humans. The content of TFAs and CLAs in milk is determined largely by the diet of the mother. Methods: We compared the proportions of TFAs and CLAs in the milk of rural Fulani in northern Nigeria who consume dairy products to that of women living in an urban center who consume little in the way of dairy products. Lactating Fulani women (n=41) and women residing in the city of Jos, Nigeria (n=41) were recruited into the study. We predicted that the milk of the Fulani pastoralists would contain higher amounts of TFAs and CLAs compared to their urban counterparts. Results: The mean total TFA proportions for the Fulani and urban women were 0.22% and 0.34%, respectively, and were not significantly different. The percentages of CLAs in milk fat were not different between rural and urban women (0.16% vs 0.14%). These TFA and CLA values were 4- to 10-fold lower than for milk of women elsewhere in the world. Conclusions: The percentages of TFAs and CLAs in milk were not different between rural and urban dwellers in northern Nigeria whose diets differ greatly in the amounts of dairy products they contain. However, the fact that the percentages of TFAs and CLAs in the milk of Nigerian women were much lower than the percentages reported from other parts of the world may have implications for the long-term growth and development of infants in the northern Nigeria and elsewhere in the Western Sahel. (c) 2006 Elsevier B.V. All rights reserved.

Gokce, R., et al. (2000). "Effects of dietary oils on lipoproteins, lipid peroxidation and thromboxane A(2) production in chicks." Turkish Journal of Veterinary & Animal Sciences **24**(5): 473-478.

The effects of some commonly consumed oils on plasma lipids, lipid peroxidation and thromboxane A(2) (TXA(2)) production in chicks were studied. A total of 150 1-day-old chicks were divided into 5 groups and selected as butter, margarine, sunflower oil. olive oil and corn oil groups. The oils were added to their chow as 5% (w/w) at the beginning and 7% at the end. After a period of 45 days, blood samples were obtained from the vena axillaris. Then, plasma levels of total cholesterol, HDL-C. HDL2-C, HDS-C. LDL-C, thiobarbutiric acid reactive substrates (TBARS) as malondialdehyde (MDA) and TxA(2) were measured, The results indicated that total cholesterol, HDL-C. HDL3-C and TxA(2) levels were highest in the butter group whereas HDL2-C was highest in the olive oil group. The lowest HDL2-C was in the margarine group and the second lowest level was in the butter group. TEARS levels were highest in the corn oil group, lowest in the butter group and increased in the order butter<margarine<olive oil<sunflower oil<corn oil. Our findings show that unsaturated fats added to the chow of chicks are more peroxidated in their blood than saturated ones. The effect of this peroxidation on the meat of chicks and on those who eat them is not known. On the other hand. in spite of the fact that the metabolism of lipids, lipoproteins and TxA(2) might be somewhat different from those in humans, these findings can be regarded as a guide for humans. It may be speculated that although unsaturated fats do not contain cholesterol they constitute a risk factor for many diseases including atherosclerosis, due to their low resistance to lipid peroxidation. On the other hand, although saturated fats constitute a risk factor for atherosclerosis due to their high cholesterol and saturated fatty acids contents, they are beneficial for humans due to their high resistance to lipid peroxidation. Therefore, in evaluating the consumption of fats, these 2 points must be taken into account In addition, olive oil is the most resistant oil to lipid peroxidation among unsaturated oils and the low level of HDL2-C in the margarine group is interesting with respect to atherosclerosis. Also, our unexpected finding which shows that TxA(2) production is higher in animals fed saturated fats than in those fed unsaturated ones needs to be investigated.

Golay, P. A., et al. (2009). "Streamlined Methods for the Resolution and Quantification of Fatty Acids Including Trans Fatty Acid Isomers in Food Products by Gas Chromatography." Journal of Aoac International **92**(5): 1301-1309.

To support labeling, claims, and authenticity of food products, industry needs reliable methods for the analysis of fatty acids, including trans fatty acids (TFA). In finished products, precise quantification of TFA can be problematic due to the occurrence of various positional and geometrical isomers originating from different sources, such as animal fats or processed vegetable oils and fats. The risk of underestimating TFA amounts is particularly high when inappropriate GC conditions are used. Complex sample preparation procedures involving purification of TFA isomers by silver ion chromatography have been well-documented and used for research purposes. However, in the food industry, time and cost constraints do not permit multiple analytical steps; therefore, streamlined methods are necessary. Direct methods include preparation of fatty acid methyl esters directly from food samples without prior extraction. The appropriate resolution is obtained using high-resolution GC with a highly polar 100 m capillary column, and quantification is achieved using experimentally determined response. We found that it is possible to quantify TFA in the range of 0.01 to 5.00 g/100 g of lipids in a wide range of food products. In addition, the use of direct transmethylation, response factors, and high-resolution GC allow accurate quantification of other fatty acids, including polyunsaturated and long-chain polyunsaturated fatty acids.

Gong, Y. S., et al. (2007). "Characterizing quality of rendered duck fat compared to other fats and oils." Journal of Food Quality **30**(2): 169-186.

The characteristics of rendered duck fat (RDF) were compared to commercial sources of soybean oil, lard, tallow, butter and olive oil. RDF was highly susceptible to lipid oxidation during storage compared to the other fats and oils. However 0.005% tert-butyl hydroquinone delayed the onset of lipid oxidation to an extent that was comparable to the lag phase observed in the commercial fats and oils. Positive attributes of RDF included a relatively high oleic acid content and low saturated fat content. Undesirable attributes of RDF included a lack of conjugated linoleic acid (CLA) and intermediate levels of trans fatty acids (TFA) compared to the other lipid sources. Decreasing the time and temperature of rendering decreased the TFA content in RDF. Around one-half of the TFA content in RDF was vaccenic acid which is converted to CLA after ingestion.

Gonzalez, L., et al. (2014). "Effect of supplementing different oils: Linseed, sunflower and soybean, on animal performance, carcass characteristics, meat quality and fatty acid profile of veal from "Rubia Gallega" calves." Meat Science **96**(2): 829-836.

The fatty acid (FA) composition of longisimus dorsi (LD) and subcutaneous fat (SCF) from Rubia Gallega (RG) calves was compared for three dietary oil sources (linseed, LO; sunflower, SFO or soybean, SYO). Oils were added (4.5%) to a commercial concentrate and no differences on animal performance, carcass characteristics or meat quality among diets were noted. Total n-3 polyunsaturated FA (PUFA) increased in LD and SCF when feeding LO diet (P<0.001). The trans(t) FA profiles were dominated by t11-18:1, except when feeding SFO diet, where Sigma t6- to t10-18:1 exceeded t11-18:1 leading the highest (Sigma t6-to t10-18:1)/t11-18:11 ratio in LD (P<0.05). The overall changes in n-3 PUFA and t18:1 when feeding LO and SYO could be viewed as positive for human health, but quantitatively it was apparent that most dietary PUPA were completely biohydrogenated. Inhibiting PUFA biohydrogenation will be an important next step to improve the FA composition of RG cattle. (C) 2013 Elsevier Ltd. All rights reserved.

Gopinath, B., et al. (2011). "Dietary Intake of Cholesterol Is Positively Associated and Use of Cholesterol-Lowering Medication Is Negatively Associated with Prevalent Age-Related Hearing Loss." Journal of Nutrition **141**(7): 1355-1361.

We aimed to assess associations between dietary intake of fats (saturated and monounsaturated fats and cholesterol) and certain food groups (butter, margarine, and nuts) with the prevalence, incidence, and progression of age-related hearing loss. We also aimed to investigate the link between serum lipids and cholesterol-lowering medication (statins) and hearing loss. The Blue Mountains Hearing Study is a population-based survey of age-related hearing loss. Hearing loss was measured in 2956 participants (aged >= 50 y) and was defined as the pure-tone average (PTA) of frequencies 0.5, 1.0, 2.0, and 4.0 kHz > 25 dB hearing level (PTA(0.5-4kHz)). Dietary data were collected using a semiquantitative FFQ. After multivariable adjustment, the likelihood of prevalent hearing loss increased from the lowest (reference) to the highest quartile of dietary cholesterol intake (P-trend = 0.04). Among persons self-reporting statin use (n = 274), a 48% reduced odds of prevalent hearing loss was observed after multivariable adjustment [OR = 0.52 (95% CI = 0.29-0.93)]. Participants in the second and 3rd quartiles of dietary monounsaturated fat intake compared with those in the first quartile (reference) had a significantly reduced risk of hearing loss progression 5 y later [multivariable-adjusted OR = 0.39 (95% CI = 0.21-0.71)] and [OR = 0.51 (95% CI = 0.29-0.91)], respectively. Our results suggest that a diet high in cholesterol could have adverse influences on hearing, whereas treatment with statins and consumption of monounsaturated fats may have a beneficial influence. J. Nutr. 141: 1355-1361, 2011.

Grafenauer, S. J., et al. (2013). "Baseline dietary patterns are a significant consideration in correcting dietary exposure for weight loss." European Journal of Clinical Nutrition **67**(4): 330-336.

BACKGROUND/OBJECTIVES: Dietary pattern studies are traditionally the domain of epidemiological research. From a clinical perspective, there is a need to explore the effects of changing food and dietary patterns of individuals. The aim was to identify patterns of food choice in the context of a clinical weight loss trial. Cluster analysis based on reported serves of food groups revealed dietary patterns informative for the clinical setting. SUBJECTS/METHODS: Cluster analysis was conducted using diet history data from two clinical trials at baseline, and outcomes at 3 months were reviewed based on these clusters (n = 231). The cluster solution was analysed using defined food groups in serves and with respect to clinical parameters and requirements for selected nutrients. RESULTS: Two distinct dietary patterns were identified from the reported baseline dietary intakes. Subjects in Cluster 1 reported food patterns characterised by higher intakes of low-fat dairy and unsaturated oils and margarine and were generally more closely aligned to food choices encouraged in national dietary guidelines. Subjects in Cluster 2 reported a dietary pattern characterised by non-core foods and drinks, higher-and medium-fat dairy foods, fatty meats and alcohol. At 3 months, Cluster 2 subjects reported greater reductions in energy intake (-5317 kJ; P<0.001) and greater weight loss (-5.6 kg; P<0.05) compared with Cluster 1. CONCLUSIONS: Overweight subjects with reported dietary patterns similar to dietary guidelines at baseline may have more difficulty in reducing energy intake than those with poor dietary patterns. Correcting exposure to non-core foods and drinks was key to successful weight loss. European Journal of Clinical Nutrition (2013) 67, 330-336; doi:10.1038/ejcn.2013.26; published online 13 February 2013

Griguol, V., et al. (2007). "Review of the levels of trans fatty acids reported in different food products." Grasas Y Aceites **58**(1): 87-98.

In this paper a comprehensive review of trans-fatty acid levels reported in different types of food products is offered. The lowest levels are found in some types of bread (0,1%) while the highest levels (up to 40%) are found in fried potatoes. Some foods like shortenings, cakes and pastries may have up to 30% of these fatty acids. In milk and dairy products the reported levels are between 1.50% and 5.20%, in meat and derived products between 0.20% and 21,30%; in chocolates from 0% to 15, 70%. The greatest variability is found in margarines, where a variety has been reported from "trans-free products" to products containing up to 34.30%. In relation to the trans-fatty acid profile, 18:1t is the most abundant fatty acid found in the majority of foods, followed by C18:2t, C18:3t, C18:1t y C14:1t. Due to the negative health effects of these fatty acids, there is a trend to reduce their levels in food products and to include them in the nutritional label of food packaging.

Grimm, M. O. W., et al. (2012). "Trans fatty acids enhance amyloidogenic processing of the Alzheimer amyloid precursor protein (APP)." Journal of Nutritional Biochemistry **23**(10): 1214-1223.

Hydrogenation of oils and diary products of ruminant animals leads to an increasing amount of trans fatty acids in the human diet. Trans fatty acids are incorporated in several lipids and accumulate in the membrane of cells. Here we systematically investigate whether the regulated intramembrane proteolysis of the amyloid precursor protein (APP) is affected by trans fatty acids compared to the cis conformation. Our experiments clearly show that trans fatty acids compared to cis fatty acids increase amyloidogenic and decrease nonamyloidogenic processing of APP, resulting in an increased production of amyloid beta (A beta) peptides, main components of senile plaques, which are a characteristic neuropathological hallmark for Alzheimer's disease (AD). Moreover, our results show that oligomerization and aggregation of A beta are increased by trans fatty acids. The mechanisms identified by this in vitro study suggest that the intake of trans fatty acids potentially increases the AD risk or causes an earlier onset of the disease. (C) 2012 Elsevier Inc. All rights reserved.

Gulliford, M. C. and O. C. Ukoumunne (2001). "Determinants of glycated haemoglobin in the general population: associations with diet, alcohol and cigarette smoking." European Journal of Clinical Nutrition **55**(7): 615-623.

Objective: We evaluated cigarette smoking, alcohol intake and consumption of different foods as determinants of glycated haemoglobin in a general population sample. Design: Cross-sectional survey. Setting: England. Subjects: Representative sample of 15 809 adults aged 16 y and older. Data analysed for 9772 non-diabetic, white European subjects. Main outcome measures: Glycated haemoglobin (GHb). Analyses were adjusted for age, sex, body mass index (BMI), waist-hip circumference ratio, activity level, and educational attainment. Results: After adjusting for confounding, GHb was 0.277% (95% confidence interval 0.218 to 0.336) higher in current smokers of 20 or more per day, compared with non-smokers. GHb was 0.189% (0.101 to 0.277) lower in those drinking 42 or more units of alcohol per week than in non-drinkers. GHb was not associated with frequency of consumption of pulses, fruit, vegetables and salads, cakes, bread or confectionery. GHb was higher in subjects who took sugar in tea (0.051%, 0.015 to 0.087%) or in coffee (0.069%, 0.034 to 0.105%). GHb was higher in subjects who used solid fat for cooking (0.082%, 0.022 to 0.142%), or who drank whole rather than reduced-fat milk (0.088%, 0.036 to 0.140%), or used butter or hard margarine rather than low-fat spreads (0.075%, 0.029 to 0.121%). Conclusions: In the general population, higher GHb may be associated with cigarette smoking, or frequent consumption of fat-containing foods. Consumption of alcohol may be associated with lower GHb. Sponsorship: None.

Gupta, A. and N. B. Bowden (2013). "Separation of cis-Fatty Acids from Saturated and trans-Fatty Acids by Nanoporous Polydicyclopentadiene Membranes." Acs Applied Materials & Interfaces **5**(3): 924-933.

This article describes the separation of mixtures of fatty acid salts using a new organic solvent nanofiltration membrane based on polydicyclopentadiene (PDCPD). Mixtures of free fatty acids could not be separated by the membranes because they permeated at similar rates. When triisobutylamine was added to the fatty acids, the cis-fatty acid salts (oleic, petroselinic, vaccenic, linoleic, and linolenic acid) had slower permeation though the membranes than saturated (stearic acid) and trans-fatty acid (elaidic acid) salts. The reason for the difference in permeation was due to the formation of stable salt pairs between the amine and fatty acids that increased their cross-sectional areas. The fatty acid salts derived from saturated and trans-fatty acids were smaller than the critical area cutoff for the PDCPD membranes, so they readily permeated. In contrast, the fatty acid salts derived from the cis-fatty acids had critical areas larger than critical area cutoff of the PDPCD membranes and had slowed permeation. The partitioning coefficients of fatty acids and fatty acid salts were investigated to demonstrate that they were not responsible for the difference in permeation. The use of pressure was investigated to greatly accelerate the permeation through the membranes. For a solvent mixture of 35/65 (v/v) toluene/hexanes, the permeation of solvent was approximately 39 L m(-2) h(-1). This value is similar to values reported for permeation through membranes used in industry. The separation of a mixture of fatty acids based on the composition of soybean oil was investigated using pressure. The saturated fatty acid salts were almost completely removed from the cis-fatty acid salts when iBu(3)N was used as the amine to form the salt pairs. The separation of the cis-fatty acids found in soybean oil was investigated with Pr3N as the amine. The oleic acid salt (oleic acid has one cis double bond) preferentially permeated the membrane while the linoleic (two cis double bonds) and linolenic (three cis double bonds) salts were partly retained. The separation of fatty acids using membranes may have real applications in industry to purify fatty acids on a large scale.

Gupta, A. K., et al. (2011). "Role of phytosterols in lipid-lowering: current perspectives." Qjm-an International Journal of Medicine **104**(4): 301-308.

The cholesterol-lowering effect of plant sterols was first discovered in the early 1950s. However, it is only recently that plant sterols have become clinically important, when advances in food-technology have made it possible to combine sterols with a variety of food products including margarines, yogurts, fruit juices and cereal bars. We review the clinical trial evidence of lipid-lowering efficacy of plant sterols and discuss their implications in routine clinical practice. To generate the evidence we searched the Pubmed database for English language literature, using relevant keywords and medical subject heading (MeSH) terms, and extracted the findings from recently published studies and meta-analyses on this topic. Our findings suggest that the short-term use of food supplements rich in plant sterols is a safe and effective strategy; to maximize the benefits of dietary and lifestyle therapy, either with or without statin therapy, among majority of dyslipidemic patients with need for additional lipid-lowering.

Gurdeniz, G., et al. (2013). "Effect of trans Fatty Acid Intake on LC-MS and NMR Plasma Profiles." Plos One **8**(7).

Background: The consumption of high levels of industrial trans fatty acids (TFA) has been related to cardiovascular disease, diabetes and sudden cardiac death but the causal mechanisms are not well known. In this study, NMR and LC-MS untargeted metabolomics has been used as an approach to explore the impact of TFA intake on plasma metabolites. Methodology/Principal Findings: In a double-blinded randomized controlled parallel-group study, 52 overweight postmenopausal women received either partially hydrogenated soybean oil, providing 15.7 g/day of TFA (trans18: 1) or control oil with mainly oleic acid for 16 weeks. Subsequent to the intervention period, the subjects participated in a 12-week dietary weight loss program. Before and after the TFA intervention and after the weight loss programme, volunteers participated in an oral glucose tolerance test. PLSDA revealed elevated lipid profiles with TFA intake. NMR indicated up-regulated LDL cholesterol levels and unsaturation. LC-MS profiles demonstrated elevated levels of specific polyunsaturated (PUFA) long-chain phosphatidylcholines (PCs) and a sphingomyelin (SM) which were confirmed with a lipidomics based method. Plasma levels of these markers of TFA intake declined to their low baseline levels after the weight loss program for the TFA group and did not fluctuate for the control group. The marker levels were unaffected by OGTT. Conclusions/Significance: This study demonstrates that intake of TFA affects phospholipid metabolism. The preferential integration of trans18: 1 into the sn-1 position of PCs, all containing PUFA in the sn-2 position, could be explained by a general up-regulation in the formation of long-chain PUFAs after TFA intake and/or by specific mobilisation of these fats into PCs. NMR supported these findings by revealing increased unsaturation of plasma lipids in the TFA group. These specific changes in membrane lipid species may be related to the mechanisms of TFA-induced disease but need further validation as risk markers.

Guymer, R. H. and E. W. T. Chong (2006). "Modifiable risk factors for age-related macular degeneration." Medical Journal of Australia **184**(9): 455-458.

Age-related macular degeneration (AMD) is the leading cause of irreversible blindness in Australia and other Western countries. As there is no cure for AMD, and treatments to stop its progression have met with limited success, there is an interest in identifying modifiable risk factors to prevent or slow disease progression. To date, smoking is the only proven modifiable risk factor for AMD. Other factors under study include (i) cardiovascular risk factors such as hypertension, body mass index, and atherosclerosis; and (ii) dietary risk factors including fat and antioxidant intake, but so far these studies have produced conflicting results. Dietary fat in relation to AMD has recently attracted media attention. Despite very limited work supporting an association between vegetable fat and AMD, widespread publicity advocating margarine as a cause of AMD and encouraging use of butter instead has caused confusion and anxiety among sufferers of AMD and the general public, as well as concern among health professionals. The antioxidant carotenoids-lutein and zeaxanthin-found in dark green or yellow vegetables exist in high concentrations in the macula and are hypothesised to play a protective role. Of nine controlled trials of supplementation with carotenoids and other antioxidants, three suggested that various combinations of antioxidants and carotenoids were protective. While a low-fat diet rich in dark green and yellow vegetables is advocated in general, any specific recommendations regarding certain fats or antioxidant supplementation and AMD are not based on consistent findings at this stage.

Guzman, M., et al. (1999). "Metabolism of trans fatty acids by hepatocytes." Lipids **34**(4): 381-386.

The present work was undertaken to study the metabolism of fatty acids with trans double bonds by rat hepatocytes. In liver mitochondria, elaidoyl-CoA was a poorer substrate for carnitine palmitoyltransferase I (CPT-I) than oleoyl-CoA. Likewise, incubation of hepatocytes with oleic acid produced a more pronounced stimulation of CPT-I than incubation with trans fatty acids. This was not due to a differential effect of cis and trans fatty acids on acetyl-CoA carboxylase (ACC) activity and malonyl-CoA levels. Elaidic acid was metabolized by hepatocytes at a higher rate than oleic acid. Surprisingly, compared to oleic acid, elaidic acid was a better substrate for mitochondrial and, especially, peroxisomal oxidation, but a poorer substrate for cellular and very low density lipoprotein triacylglycerol synthesis. Results thus show that trans fatty acids are preferentially oxidized by hepatic peroxisomes, and that the ACC/malonyl-CoA/CPT-I system for coordinate control of fatty acid metabolism is not responsible for the distinct hepatic utilization of cis and trans fatty acids.

Gylling, H. and T. A. Miettinen (1997). "Serum cholesterol lowering by sitostanol ester margarine alone or with simvastatin in postmenopausal women with coronary heart disease." Circulation **96**(8): 2680-2680.

Gylling, H. and T. A. Miettinen (1997). "Treatment of lipid disorders in non-insulin-dependent diabetes mellitus." Current Opinion in Lipidology **8**(6): 342-347.

The basis for treatment of lipid disorders in patients with non-insulin-dependent diabetes mellitus is weight reduction by diet and exercise, and additional control of glycaemic condition with oral antidiabetics, alone or in combination with insulin. Hypercholesterolaemic, mildly hypertriglyceridaemic non-insulin-dependent diabetes mellitus patients respond to cholesterol malabsorption caused by dietary sitostanol ester margarine, while long-term statin treatment of respective coronary patients significantly lowers the recurrence of coronary events, in addition to improving the lipid disorder. However, no information is available concerning the preventive effect of long-term improvement of lipid disorders in non-insulin-dependent diabetes mellitus patients without coronary heart disease, or in patients with the `classical' type of diabetic lipid disorder, that is, hypertriglyceridaemia with low HDL and normal - low LDL-cholesterol levels. In this group of patients, beneficial lipid effects can be obtained (although perhaps not normalization) with fibrates alone or, especially, in combination with current statins.

Gylling, H. and T. A. Miettinen (2001). "A review of clinical trials in dietary interventions to decrease the incidence of coronary artery disease." Current Controlled Trials in Cardiovascular Medicine **2**(3): 123-128.

Of the associations between dietary elements and coronary artery disease (CAD), the greatest body of evidence deals with the beneficial effect of reducing the dietary intake of saturated fatty acids and cholesterol. Furthermore, it is well established, on the basis of convincing evidence, that reduction in serum total cholesterol results in reduction in coronary morbidity and mortality, as well as in regression of other atherosclerotic manifestations. In fact, dietary intervention studies revealed that it is possible to reduce the incidence of coronary death and nonfatal myocardial infarction, as well as manifestations of atherosclerosis in cerebral and peripheral arteries, by reducing dietary intake of saturated fat and cholesterol. In two recently reported dietary interventions the incidence of coronary events, especially coronary mortality, and total mortality were reduced by increased intake of n-3 long-chain polyunsaturated fatty acids and by a modification of the diet toward a Mediterranean-type diet (rich in alpha-linolenic acid. In addition to those findings, the potential efficacy of the dietary newcomers phytostanol and phytosterol esters on reducing coronary incidence is discussed in the present review.

Gylling, H. and T. A. Miettinen (2002). "Baseline intestinal absorption and synthesis of cholesterol regulate its response to hypolipidaemic treatments in coronary patients." Atherosclerosis **160**(2): 477-481.

Baseline cholesterol metabolism was hypothesized to regulate responses of cholesterol synthesis and absorption. and serum cholesterol lowering to hypolipidaemic treatment. Thus, serum cholesterol and non-cholesterol sterols were measured before and during long-term simvastatin treatment (inhibition of cholesterol synthesis) and subsequent combination of statin with plant stanol ester margarine (inhibition of cholesterol absorption) consumption in subjects with low (n = 15) and high (n = 15) absorption of cholesterol. defined by respective love and high baseline ratios of serum cholestanol to cholesterol. Cholesterol synthesis (defined by precursors of cholesterol) was markedly reduced by the long-term statin treatment in both groups, but more extensively in the low than high absorption group (P < 0.05), yet the respective serum cholesterol reductions were similar. From among the absorption markers, sitosterol and cholestanol ratios were correspondingly increased more in the love than in the high absorption group. Plant stanol ester margarine consumption, combined with chronic statin treatment, further lowered the serum cholesterol level (P < 0.001) only in the high absorption group. The sum of cholesterol absorption markers was reduced more (P < 0.05) in the high than in the low absorption group, while the non-significant serum cholesterol reduction of the low absorption group was associated with relatively high increase of cholesterol synthesis. Thus, stanol ester margarine combined with chronic simvastatin treatment reduces cholesterol absorption and serum cholesterol more consistently in subjects with high than love baseline absorption of cholesterol. The profile of baseline cholesterol metabolism determines the changes in synthesis and absorption of cholesterol to hypolipidaemic treatments, but affects less differently serum cholesterol level. (C) 2002 Elsevier Science Ireland Ltd. All rights reserved.

Gylling, H. and T. A. Miettinen (2002). "LDL cholesterol lowering by bile acid malabsorption during inhibited synthesis and absorption of cholesterol in hypercholesterolemic coronary subjects." Nutrition Metabolism and Cardiovascular Diseases **12**(1): 19-23.

Background and Aims: Recent large-scale trials have consistently documented the fact that a 25-35% reduction in low-density lipoprotein cholesterol (LDL-C) can delay the progression of atherosclerosis, This raises the question as to how much it is possible to reduce serum cholesterol using feasible therapies. The aim of this study was to investigate the cholesterol-lowering efficacy, of a triple therapy combining bile acid malabsorption with the inhibition of cholesterol synthesis and absorption. Methods and Results: Eleven consecutive hypercholes, terolemic coronary patients from Lipid Clinics on a low-fat, low-cholesterol baseline diet added simvastatin (20 mg/day) for three months, and then dietary plant stanol ester margarine (2.25 g of stanols/day) for eight weeks; finally, cholestyramine 8 g/day was added for another eight weeks. This was a before-after trial, in which the results of each period were compared with baseline and those of the previous period. Serum lipids were quantitated using commercial kits, and serum sterols by means of gas-liquid chromatography. Simvastatin lowered LDL-C by 39% (p<0.001), and additional stanol ester margarine by a further 13% (p<0.05). The triple treatment led to 67% reduction from baseline (p<0.001), with all LDL-C values being <2.6 mmol/L, and increased high-density, lipoprotein cholesterol (HDL-C) by 15% (p<0.01). It also increased the serum lathostero/cholesterol ratio (p<0.01), thus indicating an upregulation of cholesterol synthesis, and increased the serum sitosterol ratio (p<0.01) despite the simultaneous consumption of plant stanols. Conclusions: The massive reduction in LDL and increase in HDL-C obtained using our triple therapy suggests that the combination of stanol ester with only moderate doses of statin and resin makes it possible to control LDL-C levels effectively in hypercholesterolemic subjects.

Gylling, H. and T. A. Miettinen (2005). "The effect of plant stanol- and sterol-enriched foods on lipid metabolism, serum lipids and coronary heart disease." Annals of Clinical Biochemistry **42**: 254-263.

Phytosterols are plant sterols, mainly campesterol and sitosterol, and their respective stanols (5 alpha-saturated derivatives), which chemically resemble cholesterol. They are present in a normal diet and are absorbed proportionally to cholesterol, but to a much lesser extent, such that less than 0.1% of serum sterols are plant sterols. Phytosterols inhibit intestinal cholesterol absorption, and fat-soluble plant stanol esters were introduced as a functional food for lowering serum cholesterol in the early 1990s; plant sterol esters entered the market at the end of the 1990s. Inhibition of the intestinal absorption of cholesterol stimulates cholesterol synthesis, a factor which limits serum cholesterol lowering to about 10% with phytosterols. Enrichment of the diet with plant stanol esters reduces absorption and serum concentrations of both cholesterol and plant sterols, whereas enrichment of the diet with plant sterol esters, especially in combination with statins, lowers serum cholesterol but increases serum plant sterol levels. Recent studies have suggested that high-serum plant sterol levels may be associated with increased coincidence of coronary heart disease. Estimates of coronary heart disease reduction by 20-25% with plant sterols/stanols is based mainly on short-term studies. Long-term cholesterol lowering, needed for the prevention of coronary heart disease, may be successful with plant stanol esters, which lower serum cholesterol in both genders over at least a year.

Gylling, H. and T. A. Miettinen (2010). "Plant stanol consumption for cardiovascular health: what do we know about efficacy and safety?" Clinical Lipidology **5**(6): 827-833.

Plant stanol ester enriched with different food products has proven to be effective and safe as a dietary hypocholesterolemic tool in approximately 60 published clinical studies during 15 years on the market. In addition to LDL-C lowering by 10% with 2 g of plant stanols/day, it effectively reduces serum plant sterols, and some studies suggest, also serum triglycerides. Increasing the plant stanol dose up to 9 g/day, LDL-C lowering is dose dependent and a 17% LDL-C reduction can be reached with the maximal dose, similar to that of ezetimibe. Plant stanol ester consumption reduces the plant sterol content of arterial walls, and in some, but not all studies, it improves endothelial function, a surrogate marker of preclinical atherosclerosis. However, hard end point studies both for plant stanol and plant sterol consumption are not available.

Gylling, H. and T. A. Miettinen (2013). Plant Sterols and Artery Disease.

Gylling, H., et al. (2014). "Plant sterols and plant stanols in the management of dyslipidaemia and prevention of cardiovascular disease." Atherosclerosis **232**(2): 346-360.

Objective: This EAS Consensus Panel critically appraised evidence relevant to the benefit to risk relationship of functional foods with added plant sterols and/or plant stanols, as components of a healthy lifestyle, to reduce plasma low-density lipoprotein-cholesterol (LDL-C) levels, and thereby lower cardiovascular risk. Methods and results: Plant sterols/stanols (when taken at 2 g/day) cause significant inhibition of cholesterol absorption and lower LDL-C levels by between 8 and 10%. The relative proportions of cholesterol versus sterol/stanol levels are similar in both plasma and tissue, with levels of sterols/stanols being 500-/10,000-fold lower than those of cholesterol, suggesting they are handled similarly to cholesterol in most cells. Despite possible atherogenicity of marked elevations in circulating levels of plant sterols/stanols, protective effects have been observed in some animal models of atherosclerosis. Higher plasma levels of plant sterols/stanols associated with intakes of 2 g/day in man have not been linked to adverse effects on health in long-term human studies. Importantly, at this dose, plant sterol/stanol-mediated LDL-C lowering is additive to that of statins in dyslipidaemic subjects, equivalent to doubling the dose of statin. The reported 6-9% lowering of plasma triglyceride by 2 g/day in hyper-triglyceridaemic patients warrants further evaluation. Conclusion: Based on LDL-C lowering and the absence of adverse signals, this EAS Consensus Panel concludes that functional foods with plant sterols/stanols may be considered 1) in individuals with high cholesterol levels at intermediate or low global cardiovascular risk who do not qualify for pharmacotherapy, 2) as an adjunct to pharmacologic therapy in high and very high risk patients who fail to achieve LDL-C targets on statins or are statin-intolerant, 3) and in adults and children (>6 years) with familial hypercholesterolaemia, in line with current guidance. However, it must be acknowledged that there are no randomised, controlled clinical trial data with hard end-points to establish clinical benefit from the use of plant sterols or plant stanols. (C) 2013 The Authors. Published by Elsevier Ltd. All rights reserved.

Gylling, H., et al. (1997). "Reduction of serum cholesterol in postmenopausal women with previous myocardial infarction and cholesterol malabsorption induced by dietary sitostanol ester margarine - Women and dietary sitostanol." Circulation **96**(12): 4226-4231.

Background Reduction of serum cholesterol decreases mortality in primary and especially in secondary prevention. We investigated how effectively postmenopausal women with a previous myocardial infarction reduced their serum cholesterol with dietary means by using sitostanol ester rapeseed oil margarine, alone and In combination with statins, and to what extent cholesterol metabolism was affected. Methods and Results The first study group consisted of 22 randomly chosen women with angiographically documented coronary artery disease. Baseline studies on home diet were followed by double-blind, randomized, cross-over studies on margazine without and with sitostanol (3 g/d) ester for 7 weeks in random order. A second group of 10 women on simvastatin consumed sitostanol ester margarine for 12 weeks. Sitostanol ester margarine lowered serum total cholesterol by 13% (P<.05) and LDL cholesterol by 20% (P<.01). Sitostanol ester margarine reduced total cholesterol in all patients, LDL cholesterol <2.6 mmol/L (<100 mg/dL) in 32%, and <3.4 mmol/L (<133 mg/dL) in 73% versus none and 270/c during the home diet (P<.01 for both). Combined with simvastatin, sitostanol still reduced total and LDL cholesterol by 11+/-3% and 16+/-5% (P<.01 for both). Sitostanol reduced absorption (-45%), increased fecal elimination (+45% as neutral sterols), and stimulated synthesis (+39%) of cholesterol. High cholestanol and plant sterol (high cholesterol absorption) and low baseline precursor sterol proportions (low cholesterol synthesis) predicted high decreases in serum cholesterol. Conclusions Dietary use of sitostanol ester margarine normalizes LDL cholesterol in about one third of women with previous myocardial infarction, especially in those with high baseline absorption and low synthesis of cholesterol, and in combination with statins reduces the needed drug dose.

Gylling, H., et al. (2006). "Changes in serum level and metabolism of cholesterol with plant stanol esters in postmenopausal women with and without coronary artery disease." Menopause-the Journal of the North American Menopause Society **13**(2): 286-293.

Objective: Especially in women, serum cholesterol lowering with cholesterol malabsorption using plant sterol ester margarine has revealed controversial results. Accordingly, in this retrospective study, we evaluated whether plant stanol (3 g/d) ester margarine consumption for 6 and 12 weeks lowers serum cholesterol levels in mildly hypercholesterolemic women without (n = 38) and with (n = 22) coronary heart disease. Design: The study population was selected from two of our earlier studies correspondingly matched for age, body mass index, and serum cholesterol and triglyceride levels. In addition, the long-term effect (12 months) of plant stanol ester with a dose reduction after 6 months (from 3 to 2 g stanol/d) was studied in the noncoronary group. Results: At baseline, the coronary and noncoronary groups had similar serum lathosterol (synthesis marker) and campesterol and sitosterol (absorption markers) ratios to cholesterol, but high-density lipoprotein cholesterol was lower and serum squalene and desmosterol ratios to cholesterol were significantly higher in the coronary versus noncoronary groups. Short-term plant stanol ester consumption reduced serum cholesterol by 8.7% (P < 0.001) in the coronary group from the control margarine period, and in the noncoronary group by 11% from the control group (P < 0.001). The cholesterol-lowering effect sustained unchanged in the noncoronary subjects during 1 year consumption despite reduction of the plant stanol intake from 3 g/d to 2 g/d. Conclusion: Plant stanol ester margarine consumption effectively reduced serum cholesterol in postmenopausal women with and without coronary artery disease in short-term and for at least 1 year in the noncoronary group, suggesting that stanol ester margarine might be used in the long term for cholesterol lowering in women.

Gylling, H., et al. (1995). "SITOSTANOL ESTER MARGARINE IN DIETARY-TREATMENT OF CHILDREN WITH FAMILIAL HYPERCHOLESTEROLEMIA." Journal of Lipid Research **36**(8): 1807-1812.

In familial hypercholesterolemia (FH) the lowering of serum cholesterol levels should be started in childhood in order to prevent coronary artery disease later in life. However, treatment of children is problematic. We studied the effects of sitostanol (3 g/day) ester dissolved in rapeseed oil margarine as a hypocholesterolemic agent in one homozygous and 14 heterozygous children with FH maintained on a low cholesterol diet for 6 weeks, using a double-blind crossover design. Absorption and synthesis of cholesterol were evaluated by measuring serum plant sterol and cholesterol precursor proportions to cholesterol by gas-liquid chromatography. The compliance was good, and the children could not distinguish by taste the two margarines without and with sitostanol ester. Sitostanol margarine significantly reduced serum total, intermediate density (IDL), and low density lipoprotein (LDL) cholesterol by 11, 26, and 15%, respectively, and increased HDL/LDL cholesterol ratio by 27%. The proportions of serum Delta(8)-cholestenol, lathosterol, and desmosterol were significantly increased by 36, 19, and 18%, and those of serum cholestanol, campesterol, and sitosterol were significantly decreased by 9, 42 and 29%, respectively, suggesting that cholesterol absorption was decreased and synthesis was compensatorily increased. High basal precursor sterol proportions predicted a high decrease in LDL cholesterol levels. In conclusion, partial replacement of normal dietary fat consumption by sitostanol ester margarine appears to be an effective and safe hypocholesterolemic treatment in children with FH.

Haak, L., et al. (2007). "Effect of pan-frying in different culinary fats on the fatty acid profile of pork." Food Chemistry **102**(3): 857-864.

This study was set up to determine how pan-frying either without culinary fat or with different culinary fats (polyunsaturated fatty acids (PUFA)-enriched culinary fat, olive oil and margarine) affects the fatty acid (FA) composition of pork. The meat samples (longissimus thoracis (LT)) originated from pigs fed different dietary fat sources (animal fat, soybean oil or linseed oil) and thus had different FA compositions before frying. Pan-frying resulted in considerable increases in the meat total-FA content, although this was not always significant and highly variable, despite standardisation of the frying process. The FA composition of the pan-fried meat tended to become similar to that of the culinary fat used, and the extent of changes in the content of a particular FA was relative to the FA gradient from the culinary fat to the meat. However, this was also dependent on the culinary fat used, since frying in olive oil appeared to affect the FA composition of the meat more than did frying in the other culinary fats. Differences in FA composition of meat resulting from different animal feeding treatments remained unchanged after pan-frying without fat, they became smaller after frying in margarine and PUFA-enriched culinary fat, whereas frying in olive oil largely masked the initial FA profile differences. Long chain PUFA (LCPUFA) in the meat were not significantly lost by the frying process, but their proportion was influenced by the uptake of the culinary fat. (c) 2006 Elsevier Ltd. All rights reserved.

Hadipernata, M., et al. (2013). The Utilization of Rare Sugars as a Functional Food. Ii Asia Pacific Symposium on Postharvest Research Education and Extension. H. K. Purwadaria, G. Srzednicki and S. Kanlayanarat. **1011:** 369-374.

Rare sugars are defined as monosaccharides that exist in nature but are only present in limited quantities. There are more than 50 kinds of rare sugars while naturally abundant monosaccharides such as D-glucose and D-fructose are very few in number. The rare sugars in a ring-form are called an "Izumoring". There are three different Izumorings: tetroses, pentoses, and hexoses. A scheme was drawn for the production of ketohexoses based upon the network composed of the four groups comprising all of the ketohexoses and hexitols. A symmetric Izumoring comprising of 16 aldohexoses, 8 ketohexoses, and 10 hexitols were drawn. All the compounds were connected to each other by enzyme reactions or by hydrogenation reactions. Rare sugars such as of D-Psicose showed high antioxidative activity and excellent food properties and were promising as a functional dessert for elderly people. Furthermore, rare sugars have the potential to be used in sweeteners and as food products with new functional characteristics to prevent diabetes, arteriosclerosis and obesity by suppression of lipid accumulation and hyperglycemia.

Hall, R. S., et al. (2005). "Australian sweet lupin flour addition reduces the glycaemic index of a white bread breakfast without affecting palatability in healthy human volunteers." Asia Pacific Journal of Clinical Nutrition **14**(1): 91-97.

The addition of some legume ingredients to bread has been associated with effects on glycaemic, insulinaemic and satiety responses that may be beneficial in controlling type 2 diabetes, cardiovascular disease and obesity. However, the effect of Australian sweet lupin (Lupinus angustifolius) flour (ASLF) is unknown. This investigation examined the effect of adding ASLF to standard white bread on post-meal glycaemic, insulinaemic and satiety responses and palatability in healthy subjects. Using a randomised, single-blind, cross-over design, 11 subjects consumed one breakfast of ASLF bread and two of standard white bread >= 7 days apart after fasting overnight. Each breakfast also included margarine, jam, and tea with milk and contained 50g available carbohydrate. On each test day, blood samples were taken after fasting, then several times over 2 hours post-prandially, and analysed for plasma glucose and serum insulin. Subjects rated breakfast palatability and perception of satiety. in the fasting state and over 3 hours post-prandially, after which food intake from an ad libitum buffet and for the rest of the day was recorded. Incremental areas under the curves for glucose, insulin and satiety. glycaemic index, insulinaemic index and satiety index were calculated. ASLF addition to the breakfast reduced its glycaemic index (mean +/- SEM; ASLF bread breakfast = 74.0 +/- 9.6. Standard white bread breakfast = 100, P=0.022). raised its insulinaemic index (ASLF bread breakfast = 127.7 +/- 12.0. Standard white bread breakfast = 100 P=0.046), but did not affect palatability, satiety or food intake. ASLF addition resulted in a palatable breakfast; however, the potential benefits of the lowered glycaemic index may be eclipsed by the increased insulinaemic index.

Hallikainen, M. A. and M. I. J. Uusitupa (1999). "Effects of 2 low-fat stanol ester-containing margarines on serum cholesterol concentrations as part of a low-fat diet in hypercholesterolemic subjects." American Journal of Clinical Nutrition **69**(3): 403-410.

Background: Full-fat sitostanol ester-containing margarine reduces serum total and LDL cholesterol, but the effect of plant stanol ester-containing margarine as part of a low-fat, low-cholesterol diet has not been studied. Objective: We investigated the cholesterol-lowering effects of 2 novel, low-fat stanol ester-containing margarines as part of a low-fat diet recommended for hypercholesterolemic subjects. Design: In a parallel, double-blind study, 55 hypercholesterolemic subjects were randomly assigned after a 4-wk high-fat diet (baseline) to 3 low-fat margarine groups: wood stanol ester-containing margarine (WSEM), vegetable oil stanol ester-containing margarine (VOSEM), and control margarine (no stanol esters). The groups consumed the margarines for 8 wk as part of a diet resembling that of the National Cholesterol Education Program's Step II diet. The daily mean total stanol intake was 2.31 and 2.16 g in the WSEM and VOSEM groups, respectively. Results: During the experimental period, the reduction in serum total cholesterol was 10.6% (P < 0.001) and 8.1% (P < 0.05) greater and in LDL cholesterol was 13.7% (P < 0.01) and 8.6% (P = 0.072) greater in the WSEM and VOSEM groups, respectively, than in the control group. Serum campesterol concentrations decreased 34.5% and 41.3% (P < 0.001) in the WSEM and VOSEM groups, respectively. Serum HDL cholesterol, sitostanol, campestanol, beta-carotene, and fat-soluble vitamin concentrations did not change significantly from baseline. Conclusions: We conclude that the low-fat, plant stanol ester-containing margarines are effective cholesterol-lowering products in hypercholesterolemic subjects when used as part of a low-fat, low-cholesterol diet. They offer an additional, clinically significant reduction in serum cholesterol concentrations to that obtained with a low-fat diet alone.

Halmemies-Beauchet-Filleau, A., et al. (2011). "Effect of plant oils and camelina expeller on milk fatty acid composition in lactating cows fed diets based on red clover silage." Journal of Dairy Science **94**(9): 4413-4430.

Five multiparous Finnish Ayrshire cows fed red clover silage-based diets were used in a 5 x 5 Latin square with 21-d experimental periods to evaluate the effects of various plant oils or camelina expeller on animal performance and milk fatty acid composition. Treatments consisted of 5 concentrate supplements containing no additional lipid (control), or 29 g/kg of lipid from rapeseed oil (RO), sunflower-seed oil (SFO), camelina-seed oil (CO), or camelina expeller (CE). Cows were offered red clover silage ad libitum and 12 kg/d of experimental concentrates. Treatments had no effect on silage or total dry matter intake, whole-tract digestibility coefficients, milk yield, or milk composition. Plant oils in the diet decreased short- and medium-chain saturated fatty acid (6:0-16:0) concentrations, including odd- and branched-chain fatty acids and enhanced milk fat 18:0 and 18-carbon unsaturated fatty acid content. Increases in the relative proportions of cis 18:1, trans 18:1, nonconjugated 18:2, conjugated linoleic acid (CLA), and polyunsaturated fatty acids in milk fat were dependent on the fatty acid composition of oils in the diet. Rapeseed oil in the diet was associated with the enrichment of trans 18:1 (Delta 4, 6, 7, 8, and 9), cis-9 18:1, and trans-7,cis-9 CLA, SFO resulted in the highest concentrations of trans-5, trans-10, and trans-11 18:1, Delta 9,11 CLA, Delta 10,12 CLA, and 18:2n-6, whereas CO enhanced trans-13-16 18:1, Delta 11,15 18:2, Delta 12,15 18:2, cis-9,trans-13 18:2, Delta 11,13 CLA, Delta 12,14 CLA, Delta 13,15 CLA, Delta 9,11,15 18:3, and 18:3n-3. Relative to CO, CE resulted in lower 18:0 and cis-9 18:1 concentrations and higher proportions of trans-10 18:1, trans-11 18:1, cis-9,trans-11 CLA, cis-9,trans-13 18:2, and trans-11,cis-15 18:2. Comparison of milk fat composition responses to CO and CE suggest that the biohydrogenation of unsaturated 18-carbon fatty acids to 18:0 in the rumen was less complete for camelina lipid supplied as an expeller than as free oil. In conclusion, moderate amounts of plant oils in diets based on red clover silage had no adverse effects on silage dry matter intake, nutrient digestion, or milk production, but altered milk fat composition, with changes characterized as a decrease in saturated fatty acids, an increase in trans fatty acids, and enrichment of specific unsaturated fatty acids depending on the fatty acid composition of lipid supplements.

Han, S. N., et al. (2002). "Effect of hydrogenated and saturated, relative to polyunsaturated, fat on immune and inflammatory responses of adults with moderate hypercholesterolemia." Journal of Lipid Research **43**(3): 445-452.

Consumption of diets high in hydrogenated fat/ trans fatty acids has been shown to have an adverse affect on lipoprotein profiles with respect to cardiovascular disease risk. Dietary fat and cholesterol play an important role in the regulation of immune and inflammatory responses shown to be involved in atherogenesis. We investigated the effects of diets containing hydrogenated fat on cellular immune response and production of inflammatory cytokines in human subjects with moderately elevated cholesterol levels (LDL cholesterol >130 mg/dl). In a double blind crossover study, 19 subjects consumed three diets, 30% of calories as fat, of which two thirds were provided as soybean oil, soybean oil-based stick margarine, or butter for 32 days, each in a randomized order. Production of proinflammatory mediators, prostaglandin (PG) E-2, interleukin (IL)-1beta, IL-6, and tumor necrosis factor alpha (TNF-alpha); delayed type hypersensitivity (DTH) response, in vitro lymphocyte proliferation, and production of IL-2 were determined. Production of IL-6 and TNF-alpha was significantly higher after consumption of stick margarine diet compared with soybean oil diet. IL-1beta and TNF-alpha production correlated positively with ratios of total cholesterol to HDL cholesterol (r = 0.499, P < 0.00 1 and r = 0.29 1, P = 0.04, respectively). There was no significant difference in DTH response, lymphocyte proliferation, or levels of IL-2 and PGE(2) produced among three groups. Our results indicate that consumption of a diet high in hydrogenated fat does not adversely affect cellular immunity but increases production of inflammatory cytokines that have been associated with the pathophysiology of atherosclerosis.

Harnack, L., et al. (2003). "Trends in the trans-fatty acid composition of the diet in a metropolitan area: The Minnesota Heart Survey." Journal of the American Dietetic Association **103**(9): 1160-1166.

Objective In this study, we examine trends in dietary intake of trans-fatty acids from 1980-1982 to 1995-1997 using data collected as part of the Minnesota Heart Survey (MHS). Design The MHS is an ongoing observational epidermiologic study among independent cross-sectional probability samples of adults. Twenty-four-hour dietary recalls were collected on a subset of participants. To obtain trans-fatty acid intake estimates, the dietary recall records were recalculated using the University of Minnesota Nutrition Coordinating Center Food and Nutrient Database. Subjects/setting The survey population included noninstitutionalized adults aged 25 to 74 years residing in the Minneapolis-St. Paul, MN, metropolitan area. Statistical analysis Mean intake estimates were generated for each survey, and a generalized linear mixed model was used to test the null hypothesis of no difference in the age adjusted sex-specific means between 1980-1982, 1985-1987, 1990-1992, and 1995-1997. Results Downward trends in dietary intake of transfatty acids were found between 1980-1982 and 1995-1997. For example, for men mean intake of total trans-fatty acids declined from 8.3 g per day in 1980-1982 to 6.2 g per day in 1995-1997 (P<.001). Represented as a percentage of energy, similar declines were seen with mean intake of total transfatty acids decreasing from 3.0% of total energy in 1980-1982 to 2.2% of total energy in 1995-1997 (P<.001). Applications/conclusions It seems that intake of transfatty acids is on the decline. Consideration should be given to additional changes in the food supply and consumer food choices that may result in further reduction in consumption of trans-fatty acids.

Harnack, L., et al. (1999). "Diet and physical activity patterns of Lakota Indian adults." Journal of the American Dietetic Association **99**(7): 829-835.

Objectives This study assessed specific dietary practices and overall physical activity patterns of Lakota adults residing on Indian reservations in South Dakota. Perceived barriers to changing dietary and physical activity behaviors were also examined. Design A convenience sample of Lakota adults was surveyed. Data on consumption of higher-fat foods, fruit and vegetable intake, use of sugar-sweetened beverages, physical activity patterns, and barriers to change in diet and physical activity were collected via in-person interviews. Subjects/setting A total of 219 adults from 2 adjacent reservations in South Dakota participated. Results Higher-fat foods consumed most frequently included margarine and butter (32.0% greater than or equal to 5 times per week); eggs (30.1% greater than or equal to 5 times per week); whole milk (25.7% greater than or equal to 5 times per week); potato chips, corn chips, and popcorn (15.1% greater than or equal to 5 times per week); and bacon and sausage (13.3% greater than or equal to 5 times per week). Few subjects reported consuming fruit on a daily basis. Vegetables were consumed somewhat more frequently. Most subjects reported engaging in mild or moderate physical activities 3 or more times per week, although women were found to engage in moderate and strenuous physical activities less frequently than men. Major barriers to fruit intake included expense (16.4%), quality (14.2%), and availability (13.2%). Barriers to vegetable intake mentioned most frequently included availability (11.4%), cost (10.4%), and quality (9.1%). Taste was the most frequently mentioned barrier to cutting intake of high-fat foods (27.9%). Lack of child care (15.8%), lack of time (14.7%), and safety concerns (14.6%) were the most salient barriers to regular exercise. Applications/conclusions Nutrition interventions are needed that address the major barriers to diet change reported by Lakota adults. Efforts to increase physical activity should focus on Lakota women and should address the identified barriers to regular exercise.

Harris, W. S., et al. (2012). "Changes in Erythrocyte Membrane Trans and Marine Fatty Acids between 1999 and 2006 in Older Americans." Journal of Nutrition **142**(7): 1297-1303.

Over the last several years, national programs to lower the content of industrially produced (IP) C18:1 and C18:2 trans fatty acids in foods have been implemented, but whether this has resulted in lower blood trans fatty acid levels is unknown. Likewise, an increased perception of the health benefits of fish oils rich in EPA and DHA may have resulted in an increase in consumption and blood levels of these fatty acids. To explore these issues, we analyzed the changes in RBC fatty acid composition between the 7th (1998-2001) and 8th (2005-2007) examination cycles in a random sample of the Framingham Offspring cohort. This was a retrospective cohort study of 291 participants from whom blood was drawn at both examinations and for whom complete covariate data were available. Overall, the proportion of trans fatty acids in RBC changed by -23% (95% Cl: -26 to -21%). RBC EPA+DHA proportions increased by 41% (95% Cl: 31 to 52%) in 38 individuals who were taking fish oil supplements at examination 8, but in 253 participants not taking fish oil, the proportion of RBC EPA+DHA did not change. In conclusion, in a random subsample of Framingham Offspring participants with serial observations over 6.7 y, the proportion of trans fatty acids in RBC decreased. Those of EPA+DHA increased in people taking fish oil supplements. These changes could potentially translate into a lower risk for cardiovascular disease. J. Nutr. 142: 1297-1303, 2012.

Harvey, K. A., et al. (2012). "Trans Fatty Acids: Induction of a Pro-inflammatory Phenotype in Endothelial Cells." Lipids **47**(7): 647-657.

Epidemiological data have shown an association of the intake of industrial produced trans fatty acids (TFA) and sudden cardiac death. The present study examines the impact of elaidic acid (t18:1n-9) and linoelaidic acid (t18:2n-6) on the human aortic endothelial cell functional response. Trans fatty acids predominately incorporated into the phospholipid component while only a minute fraction of the total fatty acids (FA) incorporated into triacylglycerol. Trans fatty acids incorporated into the plasma membranes at the expense of the saturated-FA, stearic, palmitic, and to a lesser extent, myristic acid. Both t18: 1n-9 and t18: 2n-6 induced a pro-inflammatory response by elevating surface expression of intercellular adhesion molecule-1 (ICAM-1). Neither oleic nor linoleic evoked a pro-inflammatory phenotype under the maximal 50 mu M treatments. Both TFA and stearic acid increased phosphorylation of the ICAM-1 transcriptional regulator, nuclear factor-kappa beta (NF-kappa beta), while oleic and linoleic acids did not appear to alter the phosphorylation status. Elaidic acid minimally affected endothelial cell growth, whereas linoelaidic acid completely inhibited growth at 100 mu M and imparted limited cytotoxicity up to 300 mu M. Stearic acid induced cytotoxicity at concentrations above 75 mu M, while oleic and linoleic acids evoked gradual dose-dependent growth inhibition with cytotoxicity occurring only at linoleic acid concentrations greater than 200 mu M. In conclusion, t18:1n-9 and t18:2n-6 fatty acids effectively incorporated into the phospholipid component of endothelial cells and subsequently induce a pro-inflammatory phenotype.

Haug, A., et al. (2007). "Bovine milk in human nutrition - a review." Lipids in Health and Disease **6**.

Milk and milk products are nutritious food items containing numerous essential nutrients, but in the western societies the consumption of milk has decreased partly due to claimed negative health effects. The content of oleic acid, conjugated linoleic acid, omega-3 fatty acids, short- and medium chain fatty acids, vitamins, minerals and bioactive compounds may promote positive health effects. Full-fat milk has been shown to increase the mean gastric emptying time compared to half-skimmed milk, thereby increasing the gastrointestinal transit time. Also the low pH in fermented milk may delay the gastric emptying. Hence, it may be suggested that ingesting full-fat milk or fermented milk might be favourable for glycaemic ( and appetite?) regulation. For some persons milk proteins, fat and milk sugar may be of health concern. The interaction between carbohydrates ( both natural milk sugar and added sugar) and protein in milk exposed to heat may give products, whose effects on health should be further studied, and the increasing use of sweetened milk products should be questioned. The concentration in milk of several nutrients can be manipulated through feeding regimes. There is no evidence that moderate intake of milk fat gives increased risk of diseases.

Haug, A., et al. (2008). "Effects of butter naturally enriched with conjugated linoleic acid and vaccenic acid on blood lipids and LDL particle size in growing pigs." Lipids in Health and Disease **7**.

Background: Cow milk is a natural source of the cis 9, trans 11 isomer of conjugated linoleic acid (c9, t11-CLA) and trans vaccenic acid (VA). These fatty acids may be considered as functional foods, and the concentration in milk can be increased by e. g. sunflower oil supplementation to the dairy cow feed. The objective of this study was to compare the effects of regular butter with a special butter naturally enriched in c9, t11-CLA and VA on plasma lipids in female growing pigs. The experimental period lasted for three weeks and the two diets provided daily either 5.0 g c9, t11-CLA plus 15.1 g VA or 1.3 g c9, t11-CLA plus 3.6 g VA. Results: The serum concentrations of c9, t11-CLA, VA and alpha-linolenic acid were increased and myristic (14: 0) and palmitic acid (16: 0) were reduced in the pigs fed the CLA+VA-rich butter-diet compared to regular butter, but no differences in plasma concentrations of triacylglycerol, cholesterol, HDL-cholesterol, LDL-cholesterol, LDL particle size distribution or total cholesterol/HDL cholesterol were observed among the two dietary treatment groups. Conclusion: Growing pigs fed diets containing butter naturally enriched in about 20 g c9, t11-CLA plus VA daily for three weeks, had increased serum concentrations of alpha-linolenic acid and decreased myristic and palmitic acid compared to pigs fed regular butter, implying a potential benefit of the CLA+ VA butter on serum fatty acid composition. Butter enriched in CLA+ VA does not appear to have significant effect on the plasma lipoprotein profile in pigs.

Hayakawa, K., et al. (2000). "The role of trans fatty acids in human nutrition." Starch-Starke **52**(6-7): 229-235.

The role of dietary fats and oils in human nutrition is currently one of the key issues related to diet and health. Nutritional fats and oils contain both saturated and unsaturated fatty acids, mostly of cis-configuration. Physiological functions of trans fatty acids in foods, especially their possible role in atherosclerosis, the level of blood cholesterol, and coronary heart disease is of concern, but still subject to controversy. Furthermore, the cancer prevention properties of conjugated linoleic acid isomers, present in small quantities in typical diets, remain to be confirmed. An overview on the occurrence and physiological considerations of trans fatty acids is given.

Hayakawa, K., et al. (2000). "The role of trans fatty acids in human nutrition." European Journal of Lipid Science and Technology **102**(6): 419-425.

The role of dietary fats and oils in human nutrition is currently one of the key issues related to diet and health. Nutritional fats and oils contain both saturated and unsaturated fatty acids, mostly of cis-configuration. Physiological functions of trans fatty acids in foods, especially their possible role in atherosclerosis, the level of blood cholesterol, and coronary heart disease is of concern, but still subject to controversy. Furthermore, the cancer prevention properties of conjugated linoleic acid isomers, present in small quantities in typical diets, remain to be confirmed. An overview on the occurrence and physiological considerations of trans fatty acids is given.

Hayes, K. C. and A. Pronczuk (2010). "Replacing Trans Fat: The Argument for Palm Oil with a Cautionary Note on Interesterification." Journal of the American College of Nutrition **29**(3): 253S-284S.

To replace dietary trans fatty acids (TFA), two practical options exist: revert to a natural saturated fat without cholesterol (most likely palm oil or its fractions) or move to a newer model of modified fat hardened by interesterification (IE). This review summarizes the relative risks for cardiovascular disease inherent in these options. Interestingly, both types of fat have been the subject of nutritional scrutiny for approximately the last 40 years, and both have positive and negative attributes. Only during that period has palm oil production developed to the point where it has become the major edible oil in world markets, making clinical studies of it an important objective. On the other hand, approximately 25 human studies have fed interesterified fat in one form or another over this period, some for weeks, some as a single meal. Two types of diet designs exist. Several fed a small amount of interesterified fat, usually incorporated within a margarine, and stayed below the radar of biological detection of any abnormal metabolism. A few fed interesterified fat that incorporated stearic acid, as interesterified 18:0 (IE-18:0), even comparing it to trans fat and saturated fat, as a major part of total daily calories to assess its metabolic impact per se. These latter 5 to 6 studies clearly reveal negative biological effects on lipoproteins, blood glucose, insulin, immune function, or liver enzymes when relatively high intake of 1E-18:0 or palmitic acid (1E-16:0) were fed in fats with sn2-saturated fatty acids. High intake of 18:0 in natural fats can depress total lipoproteins, while IE-18:0 and 1E-16:0 at high levels adversely affect lipoprotein metabolism. Still other studies have supplied interesterified fat as a single meal or fed such fat daily only in a single snack, as opposed to incorporating the fat into the entire fat pool consumed at all meals in association with most foods (which is the more physiological approach and more apt to elicit effects). Even in meal studies, 1E-18:0 typically delayed fat absorption postprandially, indicating its effect on fat metabolism originating, in part, in the intestine. Mainly 2 saturated fatty acids (18:0 or 16:0) have been interesterified to harden oils, using the 16:0 from fully hydrogenated palm oil or 18:0 from fully hydrogenated soybean oil as the source material. It is not clear that 1E-16:0 is as problematic as 1E-18:0, but 1E-16:0 has been studied less. Levels between 8% energy (%E) and 12%E from 18:0 as interestedfied fat (the typical diet provides about 2%E-4%E as 18:0 from natural fats) show the most effect. Detection of adverse effects would seem to start around 7%E-8%E as 1E-18:0, but one can assume that effects are initiated, even if undetected, at a lower intake, similar to the situation with TFA. Thus, although an intake of 1%E to 4%E from 1E-18:0 does not appear to influence lipoproteins, it is not necessarily the only system affected. The negative effects of 1E-18:0 may be alleviated or masked by dilution with other fats, especially by adding 18:2-rich polyunsaturated oils to the diet. This is similar to the trans fat story, i.e., if a limited intake of TFA is heavily diluted with other oils, the consumption of TFA fails to be detected as an adverse effect. Accordingly, more research is warranted to determine the appropriateness of interesterified fat consumption, particularly before it becomes insidiously embedded in the food supply similar to TFA and intake levels are achieved that compromise long-term health.

Hedman, M., et al. (2005). "Efficacy and safety of pravastatin in children and adolescents with heterozygous familial hypercholesterolemia: A prospective clinical follow-up study." Journal of Clinical Endocrinology & Metabolism **90**(4): 1942-1952.

Heterozygous familial hypercholesterolemia (HeFH) is associated with elevated cholesterol levels and early-onset atherosclerosis. We assessed the efficacy and safety for up to 2 yr of pravastatin treatment in 19 girls and 11 boys ( age range, 4.1 - 18.5 yr) with HeFH. Pravastatin was started at 10 mg/d, with a forced titration by 10 mg at 2, 4, 6, and 12 months until the target cholesterol level [<= 194 mg/dl (<= 5 mmol/liter)] was reached. By 2, 4, 6, 12, and 24 months of treatment, the total cholesterol levels had, respectively, decreased by 19, 20, 23, 27, and 26%, and the low-density lipoprotein cholesterol levels had decreased by 25, 27, 29, 33, and 32% compared with the dietary baseline values. Seventeen percent of patients had lipid deposits ( carotid plaque, xanthomas, or corneal arcus) at baseline, and 27% had deposits at 1 yr. The side effects were mild, and no clinically significant elevations in alanine aminotransferase, creatine kinase, or creatinine were seen. Growth and pubertal maturation remained normal in all subjects. In conclusion, pravastatin treatment was safe and well tolerated. The efficacy in children with slight or moderate hypercholesterolemia was satisfactory, but in children with severe hypercholesterolemia, it was insufficient.

Henninger, M. and F. Ulberth (1996). "Trans fatty acids in margarines and shortenings marketed in Austria." Zeitschrift Fur Lebensmittel-Untersuchung Und-Forschung **203**(3): 210-215.

Margarines and shortenings available in Austria were repeatedly sampled in 1991/1992 and the content of trans fatty acids (TFA) determined by using capillary GLC. Wide variations of the TFA contents with respect to intra- and inter-brand differences were observed. Diet margarines contained up to 1% TFA, while TFA concentrations in tub or stick margarines were much higher (15.7 +/- 5.8% and 21.3 +/- 5.3%, respectively). A sub-set of samples was also purchased in 1995 and a general reduction of the TFA content was noticed. Taking into account different market shares of certain margarine types, a weighted average of 15.7% TFA and 6.5% TFA was calculated for the 1991/1992 and the 1995 samples. Based on availability data the amount of TFA supplied with margarines was estimated to be 3.7 g per person per day, while a more accurate method of measuring dietary intakes, i.e. diet history and food frequency data, approximates the amount of TFA supplied with margarines to be 1.5 g per person per day for the 1991/1992 samples and 0.6 g for the 1995 samples.

Henninger, M. and F. Ulberth (1997). "Trans-fatty acid content of convenience food." Zeitschrift Fur Ernahrungswissenschaft **36**(2): 161-168.

Dietary intake of trans fatty acids (TFA) has recently been linked to the incidence of coronary heart disease. Partially hydrogenated oils and milk and depot fat of ruminant animals are widely regarded as the major sources of dietary TFA. Data concerning TFA contents of industrially prepared food, so-called convenience food, are, however, scarce. Therefore, the fatty acid composition of 52 canned meat products, 51 dry products (soups and sauces), 51 bakery products and snacks, and 74 ready prepared meals (canned or deep-frozen) was examined by gas/liquid chromatography. Canned meat products or prepared meals are no major sources for dietary TFA. Both product groups provided less than 1 g/100 g meat or serving. Contrary to this, dried food items may contain up to g g TFA/100 g product.

Hermansen, K., et al. (2003). "Effects of soy and other natural products on LDL : HDL ratio and other lipid parameters: A literature review." Advances in Therapy **20**(1): 50-78.

Abnormal lipid levels contribute significantly to the risk of coronary heart disease, a major cardiovascular disease and a serious health problem. Various dietary and pharmacologic treatments have been devised to reduce elevated blood cholesterol levels. Soy protein, soluble fiber, and plant sterol/ester-containing margarines are promising new food-component candidates that may help to realize this goal. Of particular interest in this context is the LDL:HDL ratio, a strong predictor of cardiac events. This report is a review of more than 50 recent trials to determine how such dietary components and garlic affect the LDL:HDL ratio and other lipid parameters. Consumption of new soy products containing high, fixed levels of isoflavones, cotyledon soy fiber, and soy phospholipids (Abacor(R) and Abalon(R)) significantly reduced the LDL:HDL ratio by up to 27%. Soluble dietary fibers such as psyllium and beta glucan from oat bran had a variable effect on LDL-cholesterol levels in the studies analyzed. Plant sterol esters, when consumed in margarines, lowered the LDL:HDL ratio by up to 22%. On average, Abacor and Abalon reduced the LDL:HDL ratio by 20%, LDL cholesterol by 15%, total cholesterol by 10%, and triglycerides by 6%, and increased HDL cholesterol by 5%. The new soy-based supplements may therefore play a valuable role in reducing cardiovascular risk.

Hernandez, E. R. S., et al. (2007). "High conjugated linoleic acid (CLA) content in milk and dairy products using a dietary supplementation of sunflower seed in cows. Thrombogenic/atherogenic risk issues." Archivos Latinoamericanos De Nutricion **57**(2): 173-178.

This study was undertaken to determine the effect of dietary supplementation of sunflower seed in cows on the chemical composition of milk and dairy products. Cream, butter and butter oil were prepared from milk produced by cows fed a control diet (control products) or diet supplemented with 11.2% sunflour seed (CLA-rich products). Milk samples collected were determined for lactose. A sample of CLArich or control product was determined for fatty acid profile as well as fat, protein and ash contents. The index of atherogenicity (IA) and the index of thrombogenicity (IT) were also calculated. Results revealed that there was no effect of the inclusion of sunflower seed in the diet on the lactose content in milk and total fat, protein and ash contents in the dairy products. Average contents of conjugated linoleic acid (CLA) and transvaccenic acid (TVA), expressed as g/100g total fatty acid were 0.54 and 1.6, respectively in the control products, and 2 and 6.4, respectively in the CLA-rich products. The content of either CLA or TVA was approximately four fold higher in the latter products. Moreover, CLA-rich products showed considerably low IA and IT, which were, respectively, 38.4 and 25.0% less than those from control products. Fatty acid profiles were unaffected during processing, which demonstrates that CLA is a stable component in the dairy products analyzed. It was concluded that dietary supplementation of sunflower seed in cows increases the CLA and TVA contents in milk, which may contribute to the reduction of the risk of cardiovascular diseases in humans.

Herrera-Meza, M. S., et al. (2013). "Dietary anhydrous milk fat naturally enriched with conjugated linoleic acid and vaccenic acid modify cardiovascular risk biomarkers in spontaneously hypertensive rats." International Journal of Food Sciences and Nutrition **64**(5): 575-586.

Saturated and trans fatty acids have been associated with the risk to develop cardiovascular diseases. However, health-promoting effects are associated with consumption of anhydrous milk fat (AMF) and ruminant trans fatty acids, such as conjugated linoleic acid (CLA) and vaccenic acid (VA) contained in the lipid fraction of milk and dairy products. The purpose of this study was to evaluate the effect of AMF naturally enriched with CLA and VA in spontaneously hypertensive rats (SHR), using sterculic oil to inhibit the conversion of VA into CLA. The administration of AMF to SHR during 7 weeks exerted beneficial effects on cardiovascular risk biomarkers (reduction of insulin, blood lipids, increase of adiponectin). When sterculic oil was included, some parameters were further ameliorated (reduction of insulin, increase of adiponectin). Sterculic oil alone reduced body weight and adiposity, and improved blood pressure, adiponectin and triglyceride levels.

Hissanaga, V. M., et al. (2012). "Trans fatty acids in Brazilian food products: a review of aspects related to health and nutrition labeling." Revista De Nutricao-Brazilian Journal of Nutrition **25**(4): 517-530.

In recent years, several studies have indicated a positive relationship between trans fatty acids and cardiovascular disease, maternal and infant diseases, inflammatory diseases and cancer. The World Health Organization manifested the need of decreasing the consumption of these fatty acids, which culminated with the recommendation of their elimination in 2004. Labeling is a measure that helps the population make food choices. This article presents a literature review on trans fatty acids, their formation, health effects and the current measures to control their intake, emphasizing food labeling. The following databases were searched: Scopus, PubMed, SciELO, Science Direct and Lilacs. In addition, national and international government sites covering the period from 1990 to 2012 were consulted. The key words used in Portuguese and English were "trans fatty acids", and/or "hydrogenated fat", conjugated with "labeling", and/or "regulation", and/or "legislation". Manufacturing, individual and public measures stemming from governmental policies and education can help to reduce the consumption of trans fatty acids. Although Brazilian law requires companies to report the amount of trans fatty acids per serving on their product labels, the way this information is presented is questionable. The effective reduction of trans fatty acids in food products can take considerable time because of the necessary cultural and technological changes. It should be noted that any initiative regarding trans fatty acids is important since it will improve the general population's health.

Ho, C. C., et al. (2007). "Beneficial effects of plant sterols/stanols-containing milk powder on lipid metabolism in hamsters." Journal of Food and Drug Analysis **15**(2): 191-201.

The effect of plant sterols/stanols-containing milk powder (phytosterol milk powder, PSMP, containing 2.78% phytosterols mixture) on lipid metabolism in hamsters was investigated. One hundred male 7-week-old Golden Syrian hamsters were given free access to regular rodent chow and water for 1 week to acclimatize. Four extremely (10%) over- and underweight hamsters were eliminated. Sixteen hamsters were killed and examined for plasma and liver lipid compositions to establish the baseline. The remaining hamster were randomly divided into 5 groups, each group of hamsters had statistically similar average body weight, but fed with different experimental diets for 4 weeks. All 5 groups of hamsters were fed with high fat, high cholesterol diet containing different ingredients. Regular rodent chow diet was supplemented with 0.5% (w/w) cholesterol and corn/coconut oil mixture (corn oil/coconut oil = 1:1) to raise the final fat content to 15% (w/w) (Group 1 - control group). Group 2 was the positive control (PC) group, which was fed with diet containing 0.72% (w/w) phytosterols (consisted of 75% P-sitosterol and 10% campesterol). Groups 3-5 were the experimental groups, of which 12.95, 25.90 or 64.75% (w/w) PSMP (1x, 2x and 5x PSMP groups) was added to the diet and the phytosterol mixture contents in these diets were 0.36, 0.72 and 1.8% (w/w), respectively. At the end of 4-week feeding period, hamsters were killed and the plasma and hepatic lipid compositions together with the fecal neutral sterol content were determined. No adverse effects of PSMP on growth and health condition in hamsters were found in this experiment. At the highest feeding dose of PSMP (64.75%, w/w), hamsters had the highest body weight gain and the lowest plasma and liver lipid contents. PSMP showed significant effects on lowering the concentrations of plasma total cholesterol and low density lipoprotein cholesterol. It could also lower the atherogenic index (LDL-C/HDL-C), hepatic lipid levels and relative liver weight while raising the fecal cholesterol and phytosterols excretion in the hyperlipidemic hamsters.

Ho, S. S. and S. Pal (2005). "Margarine phytosterols decrease the secretion of atherogenic lipoproteins from HepG2 liver and Caco2 intestinal cells." Atherosclerosis **182**(1): 29-36.

Several studies in humans have demonstrated the hypocholesterolemic effect of plant sterol consumption. It is unclear whether plant sterols regulate lipoprotein metabolism in the liver and intestines, thereby decreasing the levels of circulating atherogenic lipoproteins. We investigated the effect of the three main phytosterols: stigmasterol, campesterol, and beta-sitosterol on lipoprotein production in HepG2 human liver cells and Caco2 human intestinal cells and the mechanisms involved. Cells were incubated for 24 h with 50 mu mol/L of the different phytosterols or 10 mu mol/L of atorvastatin. Very low-density lipoprotein levels (measured by apolipoprotein (apo) B 100) in HepG2 cells and chylomicron levels (measured by apoB48) in Caco2 cells were measured using western blotting. Intracellular cholesterol levels were measured using gas chromatography. Analysis was carried out using Student's t-test and ANOVA. Secretion levels of apoB100 significantly decreased by approximately 30% after incubation with all phytosterols compared to control. In addition, cholesterol ester (CE) concentrations significantly decreased when HepG2 cells were incubated with the phytosterols compared to control cells. Secretion of apoB48 from intestinal cells significantly decreased by 15% with stigmasterol, 16% with campesterol and 19% beta-sitosterol compared to control. Collectively the data suggests that plant sterols limit lipid (CE) availability in cells. Decreases in circulating levels of LDL and chylomicron remnants seen in humans with the consumption of margarine phytosterols are possibly due to their effect on lipid production in cells and would therefore reduce the risk of developing cardiovascular disease. (c) 2005 Elsevier Ireland Ltd. All rights reserved.

Hodgson, J. M., et al. (1996). "Platelet trans fatty acids in relation to angiographically assessed coronary artery disease." Atherosclerosis **120**(1-2): 147-154.

Epidemiological and metabolic studies indicate that a higher intake of trans fatty acids (TFA) may be associated with increased risk of coronary heart disease (CHD). En a cross-sectional study of patients who underwent coronary angiography, the relationships between TFAs, measured in platelets, and the degree of coronary artery disease (CAD) were examined in 191 non-diabetic patients (134 men and 57 women). The degree of CAD was quantified by using an angiographic scoring system developed to provide an estimate of the extent of coronary atherosclerosis: an 'extent score'. The TFA composition of platelets. including palmitelaidic (16:1 omega 7t). elaidic (18:1 omega 9t), trans-10-octadecaenoic acid (18:1 omega 8t), trans vaccenic (18:1 omega 7t), trans-12-octadecaenoic acid (18:1 omega 6t) and linoelaidic (18:2 omega 6tt) acids, was measured by using gas chromatography and quantified as a percentage of total fatty acids. After adjustment for established CHD risk indicators: including age, gender, cigarette smoking, hypertension and serum total cholesterol concentration, elaidic acid (P = 0.0300) and trans-10-octadecaenoic acid (P = 0.0434) were positively associated with the extent score of CAD. The adjusted associations between other individual TFAs, including palmitelaidic acid (P = 0.1189), vaccenic acid (P = 0.7651), trans-12-octadecaenoic acid (P = 0.0582) and linoelaidic acid (P = 0.8793), and the extent score were not significant. The results of this study, therefore, provide evidence for an association between particular platelet TFAs and the degree of CAD in the patient population studied.

Hoekstra, J., et al. (2013). "Benefit-risk assessment of plant sterols in margarine: A QALIBRA case study." Food and Chemical Toxicology **54**: 35-42.

This paper presents the benefit-risk assessment of adding plant sterols to margarine as an illustration of the QALIBRA method and software. With the QALIBRA tool health effects, risks as well as benefits are expressed in a common metric (DALY) which allows quantitative balancing of benefits and risks of food intake. The QALIBRA software can handle uncertainties in a probabilistic simulation. This simple case study illustrates the data need and assumptions that go into a quantitative benefit-risk assessment. The assessment shows that the benefits of plant sterols added to margarine outweigh the risks, if any. (C) 2012 Elsevier Ltd. All rights reserved.

Hof, K., et al. (1998). "Antioxidant fortified margarine increases the antioxidant status." European Journal of Clinical Nutrition **52**(4): 292-299.

Objective: To assess the effect of supplementation with an antioxidant fortified margarine on the body's antioxidant status and on parameters of oxidative damage to lipids. Design: Single blind, placebo controlled trial, two treatment groups balanced for sex, age and Quetelet Index. Setting: Unilever Research Laboratorium, The Netherlands. Subjects: Thirty-one healthy adult volunteers accomplished the study. volunteers were recruited among inhabitants of the surrounding area of the research laboratory. Interventions: Volunteers consumed during the four weeks either 15 g/d of an antioxidant fortified margarine (providing 121 mg vitamin C, 31 mg vitamin E, 2.7 mg alpha-carotene and 5.3 mg beta-carotene) or an ordinary margarine. Fasting blood samples were taken before and at the end of the study. Results: Consumption of the antioxidant fortified margarine significantly increased the levels of the supplied antioxidants in plasma and LDL as compared to the changes found after consumption of the control margarine, with the largest increases found in LDL levels of alpha-carotene (15.5-fold increase, 95% CI: 8.4-27.8-fold) and beta-carotene (4.3-fold increase, 95% CI: 2.2-7.9-fold). this increased antioxidant status in the antioxidant fortified margarine group resulted in a significantly increased total antioxidant activity of LDL and resistance of LDL to oxidation (lag time and rate of oxidation) as compared to baseline but not in comparison to the changes found in the control group. Conclusion: Consumption of moderate doses of vitamin E, vitamin C, alpha-carotene and beta-carotene, supplied in a full-fat margarine and consumed as part of a normal diet, effectively increases the blood levels of these antioxidants.

Hoffmann, K., et al. (2004). "A dietary pattern derived to explain biomarker variation is strongly associated with the risk of coronary artery disease." American Journal of Clinical Nutrition **80**(3): 633-640.

Background: In previous studies, dietary patterns were derived in different populations without regard to a specific outcome. Objective: The objective was to apply a new statistical method to construct a specific dietary pattern that is strongly associated with the risk of coronary artery disease (CAD). Design: We applied reduced rank regression to a sample of 200 cases and 255 controls from the Coronary Risk Factors for Atherosclerosis in Women (CORA) Study. The CAD-specific dietary pattern was constructed by choosing intake data for 49 food groups as predictors and 5 established biomarkers for CAD as responses. Results: A high score for the constructed dietary pattern was characterized by high intakes of meat, margarine, poultry, and sauce and low intakes of vegetarian dishes, wine, vegetables, and whole-grain cereals. After adjustment for known CAD risk factors, the relative risks from the lowest to the highest quintiles of the pattern score were 1.0, 1.1, 3.6, 6.2, and 12.3 (95 % CI: 4.9, 30.9; P for trend < 0.0001). There was an approximate 4.5-fold difference in C-reactive protein and a 2-fold difference in C-peptide between the highest and lowest score quintiles of the study population. HDL-cholesterol concentrations ranged from 70 mg/dL in the lowest quintile to 49 mg/dL in the highest quintile of dietary pattern score. Conclusion: The new statistical method, reduced rank regression, may be a useful tool for identifying dietary patterns that simultaneously affect the concentrations of known CAD biomarkers and the risk of developing CAD.

Homma, Y., et al. (2003). "Decrease in plasma low-density lipoprotein cholesterol, apolipoprotein B, cholesteryl ester transfer protein, and oxidized low-density lipoprotein by plant stanol ester-containing spread: A randomized, placebo-controlled trial." Nutrition **19**(4): 369-374.

OBJECTIVE: The ester of plant stanols significantly reduces plasma levels of total cholesterol (TC) and low-density lipoprotein cholesterol (LDL-C) in Western people. Effects of plant stanol ester-containing spread on plasma levels of TC, LDL-C, and apolipoprotein B (apoB) were studied in a randomized, placebo-controlled trial in Japanese subjects whose diet is low in fat and cholesterol. The effects of plant stanol ester on plasma levels of arteriosclerosis-promoting factors, namely remnants of triacylglycerol. (TG)-rich lipoproteins, cholesteryl ester transfer protein (CETP), and oxidized LDL (Ox-LDL), were also studied. The assessment of safety was also made. METHODS: One hundred five healthy volunteers were assigned randomly to one of three groups: placebo spread (n = 35), 2 g/d of plant stanol (3.4 g of stanol ester; n = 34), and 3 g/d of plant stanol (5.1 g of stanol ester; n = 36). Plasma levels of lipids were measured at start of the study, at 2 and 4 wk (end of trial), and at 8 wk (+4 wk). Plasma apoproteins, cholesterol in remnant-like particles which are equivalent to remnants of TG-rich lipoproteins (RLP-C), CETP mass, and Ox-LDL were measured at the beginning and the end of the trial. Plasma levels of plant steroids and fat-soluble vitamins were also measured for the assessment of safety. RESULTS: Background and dietary composition did not differ among groups. Plasma levels of TC, LDL-C, apoB, apoE, CETP mass, and Ox-LDL were reduced significantly by 6.5%, 9.6%, 8.3%, 4.5%; 6.1%, and 20%, respectively, in the 2 g/d plant stanol group. Plasma levels of TC, LDL-C, apoB, CETP mass, and Ox-LDL were,decreased significantly by 5.5%, 7.3%, 5.6%, 3:3%, and 19%, respectively, iri the 3 g/d plant stanol group. Plasma levels of plant stanols, plant sterols, retinol, beta-carotene, and a-tocopherol did not change in any group, but levels of campestanol increased and a-tocopherol decreased slightly in the sitostanol groups. CONCLUSION: Plasma levels of TC and LDL-C were significantly reduced by the plant stanol ester-containing spread. The smaller reduction than in Western studies and the lack of dose dependency in this study might be due to the different basal diets. We concluded that plant stanol ester-containing spread is efficacious in reducing plasma LDL-C, apoB, CETP, and Ox-LDL and that 2 g/d plant stanol is adequate for Japanese people. No significant side effects were observed in any group. (C) Elsevier Science Inc. 2003.

Hou, J. C., et al. (2012). "Assessment of trans fatty acids in edible oils in China." Food Control **25**(1): 211-215.

Trans fatty acid (TFA) is commonly present in edible oils. TFA has been proven to have adverse effects on blood lipids, including increasing the LDL-cholesterol concentration and decreasing the HDL-cholesterol concentration. The aim of our study was to determine the levels of TFA in edible oil samples consumed in Harbin, China. In this study, 93 samples of soybean oil (SBO) (n = 29), rapeseed oil (RSO) (n = 23), sunflower oil (SFO) (n = 22), and corn oil (CO) (n = 19) were analyzed between October 2010 and January 2011, using a gas chromatograph (GC) with a flame ionization detector (FID). TFA (>2%) was detected in 17 (18%) samples, ranging from 0.14% to 4.76%. The overall TFA content was 1.15 +/- 0.12% for SBO, 1.37 +/- 0.23% for RSO, 1.41 +/- 0.10% for SFO, and 2.01 +/- 0.24% for CO. Trans C18:2 and C18:3 fatty acids were normally predominant in the investigated edible oils. The variance in the percentage of TFA in the edible oils probably resulted from differences in the quality, processing technique, and storage condition of the edible oils. The results indicated that, in China, TFA is widely present in edible oils at low levels. Therefore, it is important to assess the content of ITA in edible oils in China. (C) 2011 Elsevier Ltd. All rights reserved.

Huang, X. and C. Fang (2000). "Dietary trans fatty acids increase hepatic acyl-CoA: Cholesterol acyltransferase activity in hamsters." Nutrition Research **20**(4): 547-558.

The objective of this study was to examine the effect of dietary trans fatty acids (TFA) on cholesterol metabolism. Although TFA are unsaturated fatty acids, their spatial configuration and physical properties are similar to saturated fatty acids (SFA). In this study, a high TFA diet (12%) was given to hamsters for 4 weeks. Hamsters fed diets high in SFA (12%) and polyunsaturated fatty acids (PUFA) (12%) served as controls. Serum lipid profiles and the activity of a cholesterol ester synthesis enzyme, hepatic acyl-CoA: cholesterol acyltransferase (ACAT), were analyzed. Total cholesterol levels of TFA-fed and SFA-fed hamsters were 11.7% and 27.4% higher, respectively, than PUFA-fed hamster group (P<0.001). LDL-cholesterol levels of TFA-fed and SFA-fed hamsters were 41.0% and 73.9% higher, respectively, than PUFA-fed hamster group (P<0.023). The activities of ACAT were significantly greater in the SFA-fed group and TFA-fed group (812.8 and 723.48 pmol.min(-1).mg protein(-1)) compared to the PUFA-fed group (358.76 pmol.min(-1).mg protein(-1)). Findings of this study confirmed the cholesterol-raising effect of TFA, but more importantly, they indicated the possible mechanism of such an effect. Since hepatic ACAT activities were greater among the groups that received diets high in TFA and SFA, this enzyme activity may depend on fatty acid substrate spatial configuration rather than on chain saturation. It is possible that dietary TFA increases hepatic ACAT activity and, thus, raises serum cholesterol levels. (C) 2000 Elsevier Science Inc.

Huang, Z., et al. (2006). "Trans fatty acid content of selected foods in an African-American community." Journal of Food Science **71**(6): C322-C327.

Trans fatty acid content was examined in several grocery foods in an African-American community. Food samples were selected based on the frequency of use among the population group in the local community. Samples were collected 3 times with an interval of 1 wk. Total fat content was analyzed by Soxhlet method. Fatty acids profile, including trans fatty acids, was analyzed by GC-MS. In grocery foods, no trans fatty acids were detected in fish sticks, salad dressing, mayonnaise, muffin, and potato chips. Margarine contained the highest trans fatty acid of 19.13. The trans fatty acid level in crackers, cookies, butter, chicken patties, and biscuits mix ranged from 0.51% to 1.77%. In fast foods, no trans fat was detected in dressing. All the fried food and bakery food sampled in this study contain trans fat. The level varied from 2.07% to 10.30%. The principal trans fatty acid was trans 18:1. Other trans fatty acids found were trans 18:2, trans 19:1, and trans 16:1. In a total of 23 food samples, 16 of them were found to contain trans fatty acid. The results demonstrated that trans fat is commonly found in foods of the African-American community. The trans fatty acids content in tested samples varied from 0% to 19.13%.

Huang, Z. L., et al. (2006). "A simple method for the analysis of trans fatty acid with GC-MS and AT (TM)-Silar-90 capillary column." Food Chemistry **98**(4): 593-598.

The study was aimed to evaluate a simplified gas chromatography method based on the AOAC method 996.06 to analyze the trans fat content in food samples. The gas chromatograph was equipped with mass spectrometer and Alltech AT((TM))-Silar-90 capillary column. Ten kinds of the trans fatty acid standard were separated completely from the cis standard and the chemical composition of the peaks was verified by using the mass spectrum. Under the optimized conditions, the recovery rate for triheptadecanoin was 99.0%, the correlation coefficients of trans fatty acid calibration curve was 0.9998 or higher. It demonstrated that the methylation and hexane extraction procedures used in this method was effective and the result was consistent. The major fatty acids found in the shortening sample were 16:0, 18:0, trans-18:1, cis-18:1, cis-18:2, and cis-18:3. The total trans fat content in the sample was 283.6 +/- 18.2 mg/g. The current method was more convenient. It is adequate for the routine analysis of trans fat content in food products with low free fatty acid content. (c) 2005 Elsevier Ltd. All rights reserved.

Hubbard, R., et al. (2003). "Apparent skeletal muscle loss related to dietary trans fatty acids in a mixed group of omnivores and vegetarians." Nutrition Research **23**(5): 651-658.

The well-fed free-living adult subjects in this study show evidence of skeletal muscle loss, evaluated from the increased levels of plasma alanine (p < 0.0001) and decreased urinary levels of isoleucine, leucine, lysine, glycine and alanine (all p values < 0.005). Plasma fatty acid analysis showed low percentages of cis-linoleic acid associated with high percentages of both trans-linoleic acid and Mead's acid. Combining the fatty acid findings with the amino acid results in a multiple regression analysis revealed that the low levels of cis-linoleic acid are independently associated with high levels of both trans-linoleic acid (p = 0.049) and Mead's acid (p = 0.0001) and with low levels of both urinary alanine (p = 0.047) and plasma glycine (p = 0.001). These results suggest an interactive relationship between cis and trans linoleic acid that could easily disrupt prostaglandin control of absorption/utilization of the amino acids from dietary protein intake. (C) 2003 Elsevier Inc. All rights reserved.

Hulshof, K., et al. (1999). "Intake of fatty acids in western Europe with emphasis on trans fatty acids: The TRANSFAIR study." European Journal of Clinical Nutrition **53**(2): 143-157.

Objective: To assess the intake of trans fatty acids (TFA) and other fatty acids in 14 Western European countries. Design and subjects: A maximum of 100 foods per country were sampled and centrally analysed. Each country calculated the intake of individual trans and other fatty acids, clusters of fatty acids and total fat in adults and/or the total population using the best available national food consumption data set. Results: A wide variation was observed in the intake of total fat and (clusters) of fatty acids in absolute amounts. The variation in proportion of energy derived from total fat and from clusters of fatty acids was less. Only in Finland, Italy, Norway and Portugal total fat did provide on average less than 35% of energy intake. Saturated fatty acids (SFA) provided on average between 10% and 19% of total energy intake, with the lowest contribution in most Mediterranean countries. TFA intake ranged from 0.5% (Greece, Italy) to 2.1% (Iceland) of energy intake among men and from 0.8% (Greece) to 1.9% among women (Iceland) (1.2-6.7 g/d and 1.7-4.1 g/d, respectively). The TFA intake was lowest in Mediterranean countries (0.5-0.8 en%) but was also below 1% of energy in Finland and Germany. Moderate intakes were seen in Belgium, The Netherlands, Norway and UK and highest intake in Iceland. Trans isomers of C-18:1 were the most TFA in the diet. Monounsaturated fatty acids contributed 9-12% of mean daily energy intake (except for Greece, nearly 18%) and polyunsaturated fatty acids 3-7%. Conclusion: The current intake of TFA in most Western European countries does not appear to be a reason for major concern. In several countries a considerable proportion of energy was derived from SFA. It would therefore be prudent to reduce intake of all cholesterol-raising fatty acids, TFA included. Sponsorship: Commission of the European Communities (AIR 2421); National Funds; European Industries supported the chemical analyses.

Hunter, J. E. (2006). "Dietary trans fatty acids: Review of recent human studies and food industry responses." Lipids **41**(11): 967-992.

Dietary trans FA at sufficiently high levels have been found to increase low density lipoprotein (LDL)-cholesterol and decrease high density lipoprotein (HDL)-cholesterol (and thus to increase the ratio of LDL-cholesterol/HDL-cholesterol) compared with diets high in cis monounsaturated FA or PUFA. The dietary levels of trans FA at which these effects are easily measured are around 4% of energy or higher to increase LDL-cholesterol and around 5 to 6% of energy or higher to decrease HDL-cholesterol, compared with essentially trans-free control diets. Very limited data at lower levels of intake (less than 4% of energy) are available. Most health professional organizations and some governments now recommend reduced consumption of foods containing trans FA, and effective January 1, 2006, the U.S. Food and Drug Administration requires the labeling of the amounts of trans FA per serving in packaged foods. In response, the food industry is working on ways to eliminate or greatly reduce trans FA in food products. Current efforts focus on four technological options: (i) modification of the hydrogenation process, (ii) use of interesterification, (iii) use of fractions high in solids from natural oils, and (iv) use of trait-enhanced oils. Challenges to the food industry in replacing trans FA in foods are to develop formulation options that provide equivalent functionality, are economically feasible, and do not greatly increase saturated FA content.

Hur, S. J., et al. (2013). "Effects of biopolymer encapsulation on trans fatty acid digestibility in an in vitro human digestion system." Food & Function **4**(12): 1827-1834.

The purpose of this study was to examine the effects of biopolymer encapsulation on the digestion of trans fatty acids by using an in vitro human digestion model. We simulated the main components of the human digestive system using a dialysis tubing system that contained synthetic saliva, gastric juice, and digestive enzymes of the small intestine. Trans fatty acid-enriched fat was encapsulated with 1% chitosan, pectin, cellulose, and beta-glucan, and passed through the model system. Samples of trans fatty acid-enriched fat that were unencapsulated were more digestible than those that were encapsulated in biopolymers. Moreover, the levels of trans octadecenoic acids (18 : 1t) formed during the digestion of trans fatty acid-enriched fat were decreased upon biopolymer encapsulation. Fat samples enriched with trans fatty acids that were encapsulated with pectin or chitosan had lower free fatty acid contents and lipid oxidation values than unencapsulated control samples. These findings improve our understanding of the effects of biopolymer encapsulation on the digestion of total lipids and trans fatty acids within the gastrointestinal tract.

Huraux, C., et al. (1999). "Superoxide production, risk factors, and endothelium-dependent relaxations in human internal mammary arteries." Circulation **99**(1): 53-59.

Background-In a variety of disease states, endothelium-dependent vasodilation is abnormal. Reduced nitric oxide (NO) production, increased destruction of NO by superoxide, diminished cellular levels of L-arginine or tetrahydrobiopterin, and alterations in membrane signaling have been implicated, We examined these potential mechanisms in human vessels. Methods and Results-Relaxations to acetylcholine, the calcium ionophore A23187, and nitroglycerin, as well as superoxide production and NO synthase expression, were examined in vascular segments from patients with identified cardiovascular risk factors. Endothelium-dependent relaxations were also studied after incubation with L-arginine, L-sepiapterin, and liposome-entrapped superoxide dismutase (SOD) and after organoid culture with cis-vaccenic acid. Relaxations to acetylcholine and to a lesser extent the calcium ionophore A23187 were highly variable and correlated with the number of risk factors present among the subjects studied. Treatment of vessels with L-arginine, L-sepiapterin, liposome-entrapped SOD, or cis-vaccenic acid did not augment endothelium-dependent relaxations. Hypercholesterolemia was the only risk factor associated with high levels of superoxide; however, there was no correlation between superoxide production and the response to either endothelium-dependent vasodilator used. Conclusions-In human internal mammary arteries, depressed endothelium-dependent relaxations could not be attributed to increases in vascular superoxide production, deficiencies in either L-arginine or tetrahydrobiopterin, or reduced membrane fluidity. Variability in signaling mechanisms may contribute to the differences in responses to acetylcholine and the calcium ionophore A23187.

Husche, C., et al. (2011). "Validation of an isotope dilution gas chromatography-mass spectrometry method for analysis of 7-oxygenated campesterol and sitosterol in human serum." Chemistry and Physics of Lipids **164**(6): 425-431.

High dose daily intake of plant sterols decreases the uptake of cholesterol in the intestine by competitive mechanisms and thus leads to reduced serum levels of total and LDL-cholesterol. By this, the commercialization of plant sterol enriched 'functional food' products is rapidly increasing. Subjects using these kinds of diet present a duplication of their serum plant sterol levels after long-term intake. In analogy to cholesterol, plant sterols such as campesterol and sitosterol can be oxidized to oxyphytosterols and these may counteract the primary anti-atherosclerotic action of cholesterol lowering. In order to investigate the whole spectrum of the consequences following high plant sterol intake a highly sensitive and specific isotope dilution gas chromatography-mass spectrometry method for the analysis of 7-oxygenated campesterol/sitosterol in trace amounts in human serum is presented in this paper. The validation was based on limits for detection and quantification, recovery, precision and minimization of autoxidation during work-up. Our results show an overall coefficient of variation <= 10% for the precision. The lowest limits for detection and quantification for 7 alpha-hydroxy-campesterol were 7 pg/mL and 23 pg/mL, respectively. Data for overall sum recovery ranged from 92% to 115%. We practically used this method for analysis of oxyphytosterols simultaneously with plant sterol concentrations in serum from healthy volunteers. Sixteen subjects were treated with plant sterol enriched margarine (3 g/day) for 28 days. The results showed a significant increase of the oxyphytosterol 7 beta-hydroxy-sitosterol from 1.19 +/- 0.54 (before intake) to 2.24 +/- 1.24 ng/mL (mean +/- SD; +86.7%; P = 0.007) after intake of the margarine. There was a highly significant correlation between the serum levels of campesterol and the sum of 7-oxygenated campesterol (R(2) = 0.915; P < 0.001) and sitosterol and the sum of 7-oxygenated sitosterol (R(2) = 0.915; P < 0.001). We can conclude from this study that the analytic method is well suited for detection of OPS, even at trace amounts. (C) 2011 Elsevier Ireland Ltd. All rights reserved.

Huxley, R., et al. (2009). "How many Australian deaths from heart disease and stroke could be avoided by a small reduction in population cholesterol levels?" Nutrition & Dietetics **66**(3): 158-163.

Aim: To quantify the number of premature deaths from coronary heart disease and ischaemic stroke that potentially could be avoided annually among the Australian population if a sustained 10% reduction in the mean population level of low-density lipoprotein cholesterol were to be achieved. Methods: Data were obtained on the number of deaths from coronary heart disease and stroke in the Australian population, subdivided into age and sex strata, and on the mean population level of low-density lipoprotein cholesterol. Published relative risks (95% CI) from a meta-analysis of lipid-lowering therapy were used to calculate the reduction in the relative risk for coronary heart disease and stroke associated with a 5%, 10% and 15% reduction in low-density lipoprotein cholesterol. The expected number of deaths from coronary heart disease and ischaemic stroke avoidable with a 10% reduction in low-density lipoprotein cholesterol was modelled. Secondary analyses were performed assuming reductions in low-density lipoprotein cholesterol of 5% and 15%. Results: A 10% reduction in low-density lipoprotein cholesterol would prevent 2279 deaths from coronary heart disease (95% CI: 2025-2531 deaths) and 641 deaths from ischaemic stroke (95% CI: 440-881 deaths). The projected benefits are greatest among the elderly, although some benefit would be expected in all age and sex groups and among individuals with a broad range of baseline levels of low-density lipoprotein cholesterol. Conclusions: A small leftward shift in the low-density lipoprotein cholesterol distribution of the adult Australian population has the potential to save about 3000 lives from coronary heart disease and stroke annually. Achieving this goal will require the active participation of key public health, food industry and government stakeholders.

Hyun, Y. J., et al. (2005). "Plant stanol esters in low-fat yogurt reduces total and low-density lipoprotein cholesterol and low-density lipoprotein oxidation in normocholesterolemic and mildly hypercholesterolemic subjects." Nutrition Research **25**(8): 743-753.

We examined the effects of plant stanol ester contained in low-fat yogurt on serum lipids and low-density lipoprotein (LDL) oxidation in Korean young adults with normocholesterolemia and mild hypercholesterolemia. After screening tests (fasting total cholesterol, 174 to 251 mg/dL; and fasting triacylglycerols, < 266 mg/dL), 51 subjects (28.7 +/- 0.7 years, 22.6 +/- 0.4 kg/m(2)) were included in the study and randomly assigned to a group receiving yogurt with either a plant stanol ester or a placebo. Four weeks' intake of plant stanol (2 g/d) as its fatty acid ester lowered total and LDL cholesterol levels by almost 6% and 10%, respectively, without affecting high-density lipoprotein cholesterol and triacylglycerol concentrations. Plasma oxidized LDL was also reduced by 5.4% in the test group. Serum beta-carotene and retinol were unchanged in both groups; however, lipid-corrected serum alpha-tocopherol was significantly increased in the test group (P < .05) We conclude that plant stanol ester contained in low-fat yogurt may be effective in reducing total and LDL cholesterol and oxidized LDL level in a habitual diet without restriction of fat and cholesterol intake. Foods containing plant sterols or stanols might be a useful tool for normocholesterolemic and mildly hypercholesterolemic individuals to prevent more severe hypercholesterolemia and cardiovascular disease. (c) 2005 Elsevier Inc. All rights reserved.

Innis, S. M., et al. (1999). "Variability in the trans fatty acid content of foods within a food category: Implications for estimation of dietary trans fatty acid intakes." Journal of the American College of Nutrition **18**(3): 255-260.

Objective: Currently, the published information on trans fatty acid composition of foods is incomplete and of questionable accuracy. Detailed fatty acid analysis of over 200 foods was undertaken for the purpose of determining the variability in trans fatty acid content among foods within a product category, and the significance of this variability to the estimation of trans fatty acids intakes from analysis of dietary intake data. Methods: The analysis of food fatty acids used gas-liquid chromatography with 100 m capillary columns and standardized methodologies for food sampling, fat extraction, separation and quantification of trans fatty acid isomers. For the purposes of this report, trans refers to all non-naturally occurring isomers including trans, cis-trans, geometric and positional isomers. Results: The results show that the amount of trans fatty acids varies considerably among foods within a category, reflecting differences in the fats and oils used in the manufacturing or preparation process. For example, the range of trans fatty acids in 17 brands of crackers was 23 to 51% total fatty acids, representing differences of from 1 to 13 g trans fatty acids per 100 g cracker. The large errors that may arise in estimates of the trans fatty acid intake of an individual are illustrated by analyses of the potential trans fatty acid intake in a sample diet, for each food as calculated using the minimum and maximum values for trans fatty acids within a given category. The results of these analyses show estimates of trans fatty acid intake from a low of 1.4 to 25.4 g a day for the same diet. Conclusion: This study shows that the wide variability in trans fatty acid content of different foods may result in large errors in the estimation of trans fatty acid intake of individuals and, potentially, groups.

Insull, W., et al. (1994). "PLASMA-LIPID EFFECTS OF 3 COMMON VEGETABLE-OILS IN REDUCED-FAT DIETS OF FREE-LIVING ADULTS." American Journal of Clinical Nutrition **60**(2): 195-202.

We compared plasma lipid changes due to the polyunsaturated fatty acids (PUFAs) in partially hydrogenated soybean oil, corn oil, and sunflower oil fed in reduced-fat diets (22-26% of total energy). Each oil was the dominant fat in isoenergetic diets of centrally prepared foods consumed by 26 male and 35 female normolipidemic, free-living individuals. Test diets were consumed double-blind, alternating with self-selected diets for 5 wk each. The ranges of proportions of total fat were: 4.7-9.7% polyunsaturated fat, 8.9-14.2% monounsaturated fat and 5.4-7.4% saturated fat. All three diets lowered (P < 0.0001) total cholesterol(11%), LDL cholesterol (13%), and HDL cholesterol (10%), without triglyceride changes. We conclude that PUFAs at approximate to 6% of total energy result in clinically relevant plasma cholesterol-lowering and that the proportion of polyunsaturated fat must be an important consideration when planning reduced-fat, reduced-saturated-fat diets.

Iqbal, M. P. (2014). "Trans fatty acids - A risk factor for cardiovascular disease." Pakistan Journal of Medical Sciences **30**(1): 194-197.

Trans fatty acids (TFA) are produced either by hydrogenation of unsaturated oils or by biohydrogenation in the stomach of ruminant animals. Vanaspati ghee and margarine have high contents of TFA. A number of studies have shown an association of TFA consumption and increased risk of cardiovascular disease (CVD). This increased risk is because TFA increase the ratio of LDL cholesterol to HDL cholesterol. Food and Agriculture Organization of the United Nations and World Health Organization have come up with the recommendation that the contents of TFA in human dietary fat should be reduced to less than 4%. There is high prevalence of CVD in Pakistan. High consumption of vanaspati ghee which contains 14.2-34.3% of TFA could be one of the factors for this increased burden of CVD in Pakistan. Consumption of dietary fat low in TFA would be helpful in reducing the risk of CVD in South Asia. Denmark by banning the sale of food items with TFA has brought down the number of deaths due to coronary heart disease by nearly 50% over a period of 20 years. Public awareness about the adverse effects of TFA on human health would be extremely important. Media can play a very effective role in educating the masses and advocating the policy for the sale of only low TFA food items. Literature sources: Google and US National Library of Medicine, National Institute of Health were the sources of papers cited in this review article.

Iwata, N. G., et al. (2011). "Trans Fatty Acids Induce Vascular Inflammation and Reduce Vascular Nitric Oxide Production in Endothelial Cells." Plos One **6**(12).

Intake of trans fatty acids (TFA), which are consumed by eating foods made from partially hydrogenated vegetable oils, is associated with a higher risk of cardiovascular disease. This relation can be explained by many factors including TFA's negative effect on endothelial function and reduced nitric oxide (NO) bioavailability. In this study we investigated the effects of three different TFA (2 common isomers of C18 found in partially hydrogenated vegetable oil and a C18 isomer found from ruminant-derived-dairy products and meat) on endothelial NF-kappa B activation and nitric oxide (NO) production. Human endothelial cells were treated with increasing concentrations of Elaidic (trans-C18: 1 (9 trans)), Linoelaidic (trans-C18: 2 (9 trans, 12 trans)), and Transvaccenic (trans-C18: 1 (11 trans)) for 3 h. Both Elaidic and Linoelaidic acids were associated with increasing NF-kappa B activation as measured by IL-6 levels and phosphorylation of I kappa B alpha, and impairment of endothelial insulin signaling and NO production, whereas Transvaccenic acid was not associated with these responses. We also measured superoxide production, which has been hypothesized to be necessary in fatty acid-dependent activation of NF-kappa B. Both Elaidic acid and Linoelaidic acid are associated with increased superoxide production, whereas Transvaccenic acid (which did not induce inflammatory responses) did not increase superoxide production. We observed differential activation of endothelial superoxide production, NF-kappa B activation, and reduction in NO production by different C18 isomers suggesting that the location and number of trans double bonds effect endothelial NF-kappa B activation.

Jacome-Sosa, M. M., et al. (2010). "Increased hypolipidemic benefits of cis-9, trans-11 conjugated linoleic acid in combination with trans-11 vaccenic acid in a rodent model of the metabolic syndrome, the JCR:LA-cp rat." Nutrition & Metabolism **7**.

Background: Conjugated linoleic acid (cis-9, trans-11 CLA) and trans-11 vaccenic acid (VA) are found naturally in ruminant-derived foods. CLA has been shown to have numerous potential health related effects and has been extensively investigated. More recently, we have shown that VA has lipid-lowering properties associated with reduced hepatic lipidogenesis and chylomicron secretion in the JCR:LA-cp rat. The aim of this study was to evaluate potential additional hypolipidemic effects of purified forms of CLA and VA in an animal model of the metabolic syndrome (the JCR:LA-cp rat). Methods: Twenty four obese JCR:LA-cp rats were randomized and assigned to one of three nutritionally adequate iso-caloric diets containing 1% w/w cholesterol and 15% w/w fat for 16 wk: 1) control diet (CD), 2) 1.0% w/w cis-9, trans-11 CLA (CLA), 3) 1.0% w/w VA and 1% w/w cis-9, trans-11 CLA (VA+CLA). Lean rats were fed the CD to represent normolipidemic conditions. Results: Fasting plasma triglyceride (TG), total cholesterol and LDL-cholesterol concentrations were reduced in obese rats fed either the CLA diet or the VA+CLA diet as compared to the obese control group (p < 0.05, p < 0.001; p < 0.001, p < 0.01; p < 0.01, p < 0.001, respectively). The VA+CLA diet reduced plasma TG and LDL-cholesterol to the level of the normolipidemic lean rats and further decreased nonesterified fatty acids compared to the CLA diet alone. Interestingly, rats fed the VA+CLA diet had a higher food intake but lower body weight than the CLA fed group (P < 0.05). Liver weight and TG content were lower in rats fed either CLA (p < 0.05) or VA +CLA diets (p < 0.001) compared to obese control, consistent with a decreased relative protein abundance of hepatic acetyl-CoA carboxylase in both treatment groups (P < 0.01). The activity of citrate synthase was increased in liver and adipose tissue of rats fed, CLA and VA+CLA diets (p < 0.001) compared to obese control, suggesting increased mitochondrial fatty acid oxidative capacity. Conclusion: We demonstrate that the hypolipidemic effects of chronic cis-9, trans-11 CLA supplementation on circulating dyslipidemia and hepatic steatosis are enhanced by the addition of VA in the JCR:LA-cp rat.

Jahreis, G. and K. Bochmann (1998). "Comparison of dietary fats - physiological effects of fatty acids." Ernahrungs-Umschau **45**(6): 192-+.

The effects of different fatty acids in vegetable and animal fats/oils are discussed with regard to carcinogenesis, atherogenesis and body fat depots. In experiments with animal models it has been demonstrated that milk fat-based diets produce fewer tumours than polyunsaturated vegetable oil-based diets. Butter is hypercholesterolemic compared with many other fat sources such as margarines (not high-trans margarines) and vegetable oil. There is evidence that whole milk does not affect cholesterol fractions. Conjugated linoleic acids (CLA) were identified as antiatherogenic compounds in ruminant milk fat. Butter contains about 10% short- and medium-chain fatty acids, which are mainly oxidized in the liver. Long-chain fatty acids are directly stored in the fat depots. Furthermore, CLAs (not present in vegetable oils) reduce body fat deposition in animal experiments and increases fatty acid oxidation in muscle cells (higher lean body mass).

Jakic, M., et al. (2010). "Are Lipoprotein Disturbances in Chronic Hemodialyzed Patients only Renal Failure Related?" Collegium Antropologicum **34**: 181-188.

Chronically hemodialyzed (HD) patients frequently suffer from quantitative and even more often qualitative serum lipids disorders. Mostly they have increased triglycerides and VLDL-cholesterol, slightly increased or normal total and LDL-cholesterol and decreased HDL-cholesterol concentrations. The study compared lipid profile between two groups of chronic HD patients coming from regionally distinct areas, the continental and the maritime one. The aim was to examine the hypothetic influence of their different dietary habits on lipid profile. The study included 72 patients from continental region (39 men) and 50 from maritime part of the country (30 men). Patients suffering from diabetes mellitus, hypothyroidism, liver disease, alcoholics as well as sevelamer treated patients were not included. Prior to a HD session the patients were determined fasting total cholesterol, triglycerides, HDL- and LDL-cholesterol, total proteins, albumins and C-reactive protein serum concentrations. All patients were undergoing bicarbonate hemodialysis with polysulphone dialysers of low permeability. The continental group of patients were somewhat older, undergoing HD for longer period of time, of lower height, greater weight, greater body mass index, higher total (4.70 +/- 10.91: 4.42 +/- 1.02 mmol/L), and LDL-cholesterol (2.78 +/- 0.74:2.66 +/- 0.75 mmol/L) concentrations, while lower triglycerides (1.72 +/- 0.84:1.81 +/- 0.83 mmol/L) and HDL-cholesterol (1.13 +/- 0.42:1.16 +/- 0.54 mmol/L). However, all the differences were without statistical significance. Chi-square test showed that the continental group of patients consumed more often pork, bacon, smoked and cured meats, margarine, butter; walnuts, almonds, garlic, cream and full-fat cheese than fish. They prepare food more often with lard and sunflower oil. Almost every fourth continental patient received statins, while only every 25(th) in the maritime group of patients. There were not any statistically significant Chi-square values for differences in frequencies of patients with total cholesterol greater than 5.2 mmol/L, triglycerides above 1.6 mmol/L, HDL-cholesterol less than 1.1 mmol/L, LDL-cholesterol greater than 2.6 mmol/L, obesity and malnutrition between the two groups. Based on the results of this study we have concluded that diet has significant influence on lipid profile of HD patients. Even though the continental and the maritime groups of patients differed significantly in diet, they were similar in plasmatic lipoprotein concentrations. However; this similarity was ascribed only to statin treatment, which was more frequent in the continental group of patients. The influence of ESRD and HD as a method of renal replacement therapy on lipid profile was not more dominant than diet.

Jakulj, L., et al. (2006). "Plant stanols do not restore endothelial function in prepubertal children with familial hypercholesterolemia despite reduction of low-density lipoprotein cholesterol levels." Journal of Pediatrics **148**(4): 495-500.

Objective To examine the effect of plant stanols on lipids and endothelial function in pre-pubertal children with familial hypercholesterolemia (FH). Study design Children with FH (n = 42), aged 7-12 years, were enrolled in a double-blind crossover trial, in which they consumed 500 mL of it low-fat yogurt enriched with 2.0 g of plant stanols and 500 mL of a low-fat placebo yogurt for 4 week., separated by a 6-week washout period. Lipid profiles and endothelial function were assessed after both consumption periods. Endothelial function was measured as flow-mediated dilation (FMD) of the brachial artery. Results This daily intake of 2.0 g of stanols significantly decreased the levels of total cholesterol (TC) by 7.5% and low-density lipoprotein cholesterol (LDL-C) by 9.2% its compared with placebo. High-density lipoprotein cholesterol anti triglyceride levels remained unaltered. The reduction of LDL-C levels did not improve FMD, which was 10.5% +/- 5.1% after plant stanol consumption and 10.6% +/- 5.0% after placebo consumption, respectively (P = .852). Conclusion This study demonstrates that plant stanols reduce LDL-C levels in children with FH without improving endothelial function.

Jala, R. C. R., et al. (2010). "Interference effects from coexisting fatty acids on elaidic acid separation by fractionating crystallization: A model study." European Journal of Lipid Science and Technology **112**(12): 1375-1383.

A multi-stage temperature-programmed fractionating crystallization process was carried out to examine the effects of the presence of stearic acid (SA), oleic acid (OA), and linoleic acid (LA) on the separation of elaidic acid (EA). The results showed that the efficiency of fractionating crystallization of EA depended largely on the crystallization temperature, initial concentration of EA and presence of SA. The content of SA plays very important role for the fractionating performance. It was a characteristic observation that only when SA <2%, substantial crystallization of EA (>50% in stepwise crystal fractions) were obtained regardless of the initial concentration of SA. In general, SA induced crystallization of EA in earlier stage but delayed further crystallization of EA in later stage; the crystallization of EA was independent from coexisting OA and LA. After reduction of EA content in solution to certain extent (7-10%, at -20 degrees C), further reduction of EA content requires much lower crystallization temperatures (<-40 degrees C, similar to 5%) with significant loss of OA, indicating the limitation of the method. Instead, SA content could be easily reduced down to low concentration (similar to 0.5%, at -20 degrees C).

Jaudszus, A., et al. (2014). "trans Palmitoleic acid arises endogenously from dietary vaccenic acid." American Journal of Clinical Nutrition **99**(3): 431-435.

Background: trans Palmitoleic acid (t-16:ln-7, or 16:1t9 in the delta nomenclature usually applied to trans fatty acids and used herein) arouses great scientific interest because it has been suggested to serve as a biomarker for lower risks of type 2 diabetes and coronary artery disease. Objective: Although 16:1t9 has been assumed to derive from dietary sources, we examined the hypothesis that 16:1t9 might also be endogenously produced from its metabolic precursor vaccenic acid (t-18:ln-7 or 18:1t11). Design: We reevaluated fatty acid data obtained from one human intervention study and one cellular model in both of which 18:1t11 was supplemented. Both studies have already been published, but to our knowledge, 16:1t9 has not yet been considered. This reanalysis of the datasets was reasonable because a new methodology for identifying 16:1 cis and trans isomers allowed us to address the subject presented in this article. Results: Data showed that the systemic or intracellular increase in 16:1t9 was strongly correlated with the increase in 18:1t11 after the dietary intake or cellular uptake of 18:1t11. The conversion rate in humans was, on average, 17%. Conclusion: Our findings suggest that endogenous 16:1t9 is not, as has been assumed, exclusively diet derived but may also be produced by the partial beta oxidation of dietary 18:1t11.

Jaworowska, A., et al. (2013). "Nutritional challenges and health implications of takeaway and fast food." Nutrition Reviews **71**(5): 310-318.

Consumption of takeaway and fast food continues to increase in Western societies and is particularly widespread among adolescents. Since food is known to play an important role in both the development and prevention of many diseases, there is no doubt that the observed changes in dietary patterns affect the quality of the diet as well as public health. The present review examines the nutritional characteristics of takeaway and fast food items, including their energy density, total fat, and saturated and trans fatty acid content. It also reports on the association between the consumption of such foods and health outcomes. While the available evidence suggests the nutrient profiles of takeaway and fast foods may contribute to a variety of negative health outcomes, findings on the specific effects of their consumption on health are currently limited and, in recent years, changes have been taking place that are designed to improve them. Therefore, more studies should be directed at gaining a firmer understanding of the nutrition and health consequences of eating takeaway and fast foods and determining the best strategy to reduce any negative impact their consumption may have on public health.

Jenkins, A. L., et al. (2008). "Comparable Postprandial Glucose Reductions with Viscous Fiber Blend Enriched Biscuits in Healthy Subjects and Patients with Diabetes Mellitus: Acute Randomized Controlled Clinical Trial." Croatian Medical Journal **49**(6): 772-782.

Aim To compare the blood glucose-lowering effect of a highly viscous fiber blend (VFB) added to a starchy snack on postprandial glycemia between healthy participants and participants with diabetes mellitus. Methods Ten healthy participants (4 men and 6 women, aged 28 +/- 2.6 years, body mass index [BMI], 24.3 +/- 0.8 kg/m(2)) and 9 participants with diabetes mellitus type 2 (3 men and 6 women, aged 68 +/- 3.8 years, BMI 28.8 +/- 1.2 kg/m(2)) on four separate occasions took either 50 g available carbohydrates as control biscuits, biscuits with 10 g of highly viscous fiber blend, white bread with 12 g of margarine, or white bread alone. Postprandial blood glucose response, glycemic index (GI), and palatability were determined. Results Mean (95% confidence interval) GI values of the viscous fiber blend biscuits were 26 (16-36) and 37 (27-47) GI units for healthy participants and participants with diabetes mellitus, respectively. These values were significantly lower than those of white bread, white bread with 12 g of margarine, and control biscuits (P < 0.001, paired t test) both in healthy participants (GI 100, 108 [57-159], and 101 [44-158], respectively) and participants with diabetes mellitus (GI 100, 103 [79127], and 94 [78-110], respectively). Viscous fiber blend significantly reduced the glycemic index by 74% (7.4 GI units/g of fiber) in healthy participants and by 63% (6.3 GI units/g of fiber) in participants with diabetes. The GI did not differ between control meals in both healthy participants and participants with diabetes. There were no significant differences in palatability among the types of meals, although participants with diabetes found the viscous fiber blend biscuits more palatable (P = 0.002, t test). Conclusion Viscous fiber blend is a very potent and palatable soluble fiber addition to a starchy snack, which is able to reduce the glycemic response to a similar extent in both healthy participants and individuals with diabetes mellitus. Biscuits with low GI, and possibly other viscous fiber blend fortified starchy foods, may potentially be a useful replacement of high GI snack foods in the diet.

Jenkins, D. J. A., et al. (2003). "The Garden of Eden - plant based diets, the genetic drive to conserve cholesterol and its implications for heart disease in the 21st century." Comparative Biochemistry and Physiology a-Molecular & Integrative Physiology **136**(1): 141-151.

It is likely that plant food consumption throughout much of human evolution shaped the dietary requirements of contemporary humans. Diets would have been high in dietary fiber, vegetable protein, plant sterols and associated phytochemicals, and low in saturated and trans-fatty acids and other substrates for cholesterol biosynthesis. To meet the body's needs for cholesterol, we believe genetic differences and polymorphisms were conserved by evolution, which tended to raise serum cholesterol levels. As a result modern man, with a radically different diet and lifestyle, especially in middle age, is now recommended to take medications to lower cholesterol and reduce the risk of cardiovascular disease. Experimental introduction of high intakes of viscous fibers, vegetable proteins and plant sterols in the form of a possible Myocene diet of leafy vegetables, fruit and nuts, lowered serum LDL-cholesterol in healthy volunteers by over 30%, equivalent to first generation statins, the standard cholesterol-lowering medications. Furthermore, supplementation of a modern therapeutic diet in hyperlipidemic subjects with the same components taken as oat, barley and psyllium for viscous fibers, soy and almonds for vegetable proteins and plant sterol-enriched margarine produced similar reductions in LDL-cholesterol as the Myocene-like diet and reduced the majority of subjects' blood lipids concentrations into the normal range. We conclude that reintroduction of plant food components, which would have been present in large quantities in the plant based diets eaten throughout most of human evolution into modern diets can correct the lipid abnormalities associated with contemporary eating patterns and reduce the need for pharmacological interventions. (C) 2002 Elsevier Science Inc. All rights reserved.

Jensen, J., et al. (1999). "The effect of palm oil, lard, and puff-pastry margarine on postprandial lipid and hormone responses in normal-weight and obese young women." British Journal of Nutrition **82**(6): 469-479.

Only a few studies have been published on the postprandial effects of different fatty acids in obese subjects. Therefore, the present study investigated the effects of three test meals containing palm oil (PO), lard (LD), or puff-pastry margarine (PPM), all normal dietary ingredients, on postprandial lipid and hormone responses in normal-weight and obese young women. The study was performed as a randomized, crossover design. The fats differed in the content of palmitic acid, stearic acid, and traits monounsaturated fatty acids allowing a dietary comparison of different 'solid' fatty acids. The obese women had significantly higher fasting concentrations and postprandial responses of plasma total triacylglycerol (TAG), chylomicron-TAG, and insulin compared with the normal-weight women but there was no significant difference in the postprandial responses between the three test meals. The obese women had fasting concentrations of leptin four times greater than the normal-weight women. There were no postprandial changes in the concentrations of leptin. The fasting concentrations of HDL-cholesterol were significantly lower in the obese women than in the normal-weight women, whereas there was no significant difference between the two groups in the concentrations of total cholesterol or LDL-cholesterol. These results provide evidence that obese women have exaggerated lipid and hormone responses compared with normal-weight women but the different contents of saturated and trans monounsaturated fatty acids provided by PO, LD, and PPM have no effect in either group.

Jeu, L. and J. W. Cheng (2003). "Pharmacology and therapeutics of ezetimibe (SCH 58235), a cholesterol-absorption inhibitor." Clinical Therapeutics **25**(9): 2352-2387.

Background: Ezetimibe is the first of a new class of antihyperlipidemic agents, the cholesterol-absorption inhibitors. It is indicated for monotherapy or in combination with 3-hydroxy-3-methylglutaryl coenzyme A-reductase inhibitors (statins) in patients with primary hypercholesterolemia, in combination with simvastatin or atorvastatin in patients with homozygous familial hypercholesterolemia, and as monotherapy in patients with homozygous familial sitosterolemia. Objective: This article reviews available data on the clinical pharmacology, clinical efficacy, and tolerability of ezetimibe. Methods: A literature review was conducted using the search terms ezetimibe and SCH 58235 to identify articles and abstracts indexed in MEDLINE and the Iowa Drug Information Service from 1966 to February 2003. The reference lists of the identified articles were reviewed for additional publications. Results: In adults, ezetimibe 10 mg PO given once daily has been reported to reduce intestinal cholesterol absorption by 54% from baseline in association with a compensatory increase in endogenous cholesterol synthesis. Within 2 weeks of its initiation, ezetimibe monotherapy produced a 17% to 20% reduction from baseline in low-density lipoprotein cholesterol (LDL-C); in combination with statins, ezetimibe produced a reduction in LDL-C of up to 40% over the same period. Based on studies performed to date, ezetimibe appears to be well tolerated, with a safety profile similar to that of placebo. Because ezetimibe is eliminated primarily by glucuronidation and not by cytochrome P450 (CYP) oxidation, it is subject to minimal drug interactions involving the CYP enzyme system. Conclusions: Ezetimibe is an option for monotherapy in patients with mild hypercholesterolemia or in those requiring adjunctive drug therapy for reduction of LDL-C levels. It may be useful in patients at risk for adverse events (eg, liver toxicity, myopathy) from other hypocholesterolemic agents. Additive LDL-C-lowering effects of ezetimibe may allow use of lower doses of conventional agents (eg, statins, fibric acid derivatives, niacin) to achieve an equivalent effect, thereby reducing the potential for adverse events and drug interactions. However, because trials have lasted no longer than 12 weeks, the long-term effect of ezetimibe on cardiovascular morbidity and mortality remains to be determined. Copyright (C) 2003 Excerpta Medica, Inc.

Johansen, D., et al. (2006). "Food buying habits of people who buy wine or beer: cross sectional study." British Medical Journal **332**(7540): 519-521.

Objective To investigate whether people who buy wine buy healthier food items than those who buy beer. Design Cross sectional study. Setting Supermarkets in Denmark. Data Information on number, type of item, and total charge from 3.5 million transactions over a period of six months. Results Wine buyers bought more olives, fruit and vegetables, poultry, cooking oil, and low fat cheese, milk, and meat than beer buyers. Beer buyers bought more ready cooked dishes, sugar, cold cuts, chips, pork, butter or margarine, sausages, lamb, and soft drinks than wine buyers. Conclusions Wine buyers made more purchases of healthy food items than people who buy beer.

Johnson, G. H., et al. (2007). "Dietary Modeling shows that the substitution of canola oil for fats commonly used in the united states would increase compliance with dietary recommendations for fatty acids." Journal of the American Dietetic Association **107**(10): 1726-1734.

Objective To examine the effect of substituting canola oil for selected vegetable oils and canola oil-based margarine for other spreads on energy, fatty acid, and cholesterol intakes among US adults. Design Twenty-four-hour food recall data from the 19992002 National Health and Nutrition Examination Survey (NHANES) were used to calculate the effect of substituting canola oil for dietary corn, cottonseed, safflower, soybean, and vegetable oils described as "not further specified" and of canola oil-based margarine for other spreads at 25%, 50%, and 100% replacement levels. Subjects Adult participants aged >= 20 years (n=8,983) of the 1999-2002 NHANES. Statistical analysis Sample-weighted mean daily intake values and the percentage of subjects meeting dietary recommendations were estimated at the various replacement levels. Standard errors of the means and percentages were estimated by the linearization method of SUDAAN. Results Significant (P < 0.05) changes compared to estimated actual intakes included: saturated fatty acid intake decreased by 4.7% and 9.4% with 50% and 100% substitution, respectively. Complete substitution increased monounsaturated fatty acid and a-linolenic acid intakes by 27.6% and 73.0%, respectively, and decreased n-6 polyunsaturated fatty acid and linoleic acid intakes by 32.4% and 44.9%, respectively. The ratio of n-6 to n-3 fatty acids decreased from 9.8:1 to 3.1:1 with 100% replacement. Energy, total fat, and cholesterol intakes did not change. Conclusions Substitution of canola oil and canola oil-based margarine for most, other vegetable oils and spreads increases compliance with dietary recommendations for saturated fatty acid, monounsaturated fatty acid, and a-linolenic acid, but not for linoleic acid, among US adults.

Jokela, H., et al. (2005). "Sequentially combined estradiol valerate plus levonorgestrel therapy decreases 18 : 1 trans-fatty acid content of plasma lipids in healthy postmenopausal women." Gynecological Endocrinology **21**(6): 360-365.

Trans-fatty acids (TFA) have been classified as atherogenic dietary constituents but the effect of hormone replacement therapy (HRT) on their concentrations is not known. We used a washout protocol to study the effect of long-term estrogen and combined estrogen-progestin HRT on plasma elaidate (18:1t), which is the trans isomer of oleate and the major TFA in the diet. The study group comprised 15 women receiving estradiol valerate HRT and 15 women receiving combined HRT with estradiol valerate and levonorgestrel. The concentrations of elaidate in plasma phospholipids, cholesteryl esters and triglycerides were determined by gas chromatography. At baseline, the total plasma elaidate concentration was lower in the combined HRT group than in the estradiol valerate HRT group (p < 0.01). In the combined HRT group, the concentration of elaidate increased significantly after withdrawal of HRT (p < 0.001) and decreased again to the baseline level after restart of therapy (p < 0.001). These changes were due to decreases in the concentrations of phospholipids; and triglycerides; in phospholipids there was also a proportional decrease of elaidate. There were no changes in elaidate in women receiving estradiol valerate alone. Our results suggest that long-term combined HRT treatment decreases plasma TFA, which is not achieved by estrogen alone.

Jolly, S. E., et al. (2011). "Sex-specific associations of nutrition with hypertension and systolic blood pressure in Alaska Natives findings from the GOCADAN study." International Journal of Circumpolar Health **70**(3): 254-265.

Objectives. To examine sex-specific associations of nutritional factors with prevalent hypertension (HTN) and systolic blood pressure (SBP) in Alaska Natives. Diet is known to affect SBP, a major risk factor for cardiovascular disease. Study design. Cross-sectional analysis of participants without diabetes in the Genetics of Coronary Artery Disease in Alaska Natives study. Methods. Macronutrients such as fat, carbohydrate and protein and micronutrients such as sodium were investigated. HTN was defined as SBP >= 140 mmHg, diastolic blood pressure >= 90 mmHg and/or taking anti-HTN medication. Analyses were stratified by sex and covariates included age, body mass index (BMI), energy intake, smoking and physical activity. Results. Mean age was 42 years for men (n=456) and women (n=602). Men with HTN (n=106) compared to men without HEN consumed a higher proportion of calories from total (p=0.01), saturated (p<0.01) and trans fatty acid (p=0.03) fats. Women with HTN (n=99) compared to women without HTN consumed more total (p=0.03) and monounsaturated (p=0.04) fat, higher protein (p=0.02) and lower total (p<0.01) and simple (p<0.01) carbohydrates. After covariate adjustment, men not on anti-HTN medications (n=407) had significantly higher average SBP with increasing quartiles of trans fatty acid intake (p for linear trend=0.01) and sodium intake (p for linear trend=0.02). For women not on anti-HTN medications (n=528), after covariate adjustment, average SBP decreased with increasing quartiles of omega 3 fatty acid intake (p for linear trend <0.01). Conclusions. Prospective evaluation of the sex-specific associations of nutritional factors with HTN and SBP on outcomes is needed along with novel interventions to lower the risk of cardiovascular disease. (Int J Circumpolar Health 2011; 70(3):254-265)

Jones, J. L., et al. (2012). "A Mediterranean-style, low-glycemic-load diet decreases atherogenic lipoproteins and reduces lipoprotein (a) and oxidized low-density lipoprotein in women with metabolic syndrome." Metabolism-Clinical and Experimental **61**(3): 366-372.

The objective was to assess the impact of a Mediterranean-style, low-glycemic-load diet (control group, n = 41) and the same diet plus a medical food (MF) containing phytosterols, soy protein, and extracts from hops and Acacia (MF group, n = 42) on lipoprotein atherogenicity in women with metabolic syndrome. Plasma lipids, apolipoproteins (apos), lipoprotein subfractions and particle size, low-density lipoprotein (LDL) oxidation, and lipoprotein (a) were measured at baseline, week 8, and week 12 of the intervention. Three-day dietary records were collected at the same time points to assess compliance. Compared with baseline, women decreased energy intake from carbohydrate (P < .001) and fat (P < .001), whereas they increased energy intake from protein (P < .001). A significant increase in energy from monounsaturated fatty acids was also observed as well as increases in eicosapentaenoic acid and docosahexaenoic acid, whereas trans-fatty acid intake was reduced (P < .00001). The atherogenic lipoproteins, large very low-density lipoprotein (P < .0001) and small LDL (P < .0001), were reduced, whereas the ratio of large high-density lipoprotein to smaller high-density lipoprotein particles was increased (P < .0001). Apolipoprotein B was reduced for all women (P < .0001), with a greater reduction in the MF group (P < .025). Oxidized LDL (P < .05) and lipoprotein (a) (P < .001) were reduced in both groups at the end of the intervention. Consumption of a Mediterranean-style diet reduces the risk for cardiovascular disease by decreasing atherogenic lipoproteins, oxidized LDL, and apo B. Inclusion of an MF may have an additional effect in reducing apo B. (C) 2012 Elsevier Inc. All rights reserved.

Jones, P. J. H., et al. (1998). "Short-term administration of tall oil phytosterols improves plasma lipid profiles in subjects with different cholesterol levels." Metabolism-Clinical and Experimental **47**(6): 751-756.

To assess the short-term cholesterol-lowering potential of sitostanol-containing tall oil plant sterols, 22 subjects consumed fixed-food diets over two 10-day periods with or without 21.2 mg/kg body weight/d tall oil phytosterols (sitosterol 62%, sitostanol 21%, campesterol 16%, and campestanol 1%) in a randomized crossover study design. On day 10 of each diet, plasma lipoprotein cholesterol levels, plasma phytosterol concentrations, and cholesterol biosynthesis rates were determined. Total cholesterol (TC) and low-density lipoprotein (LDL) cholesterol levels were lower (P < .01) after administration of tall oil phytosterol (4.7 +/- 0.3 and 3.0 +/- 0.3 mmol/L, respectively) versus placebo (5.0 +/- 0.3 and 3.2 +/- 0.3 mmol/L, respectively). Tall oil treatment had no effect on the plasma high-density lipoprotein (HDL) cholesterol level (1.1 +/- 0.1 mmol/L) versus placebo (1.1 +/- 0.1 mmol/L). Similarly, plasma triglyceride (TG) levels did not differ between tall oil (1.3 +/- 0.2 mmol/L) and placebo (1.4 +/- 0.2 mmol/L) treatments. Plasma campesterol (15.8 +/- 3.7 mmol/mol cholesterol) and sitosterol (6.0 +/- 2.1 mmol/mol cholesterol) levels were not different after tall oil treatment versus placebo treatment (15.4 +/- 2.3 and 6.4 +/- 2.0 mmol/mol cholesterol, respectively). Plasma sitostanol levels were essentially undetectable. No difference was observed in cholesterol biosynthesis between tall oil (0.045 +/- 0.004 pools/d) and placebo (0.034 +/- 0.004 pools/d) treatments; however, the effect of treatments in subjects with different cholesterol levels varied. In subjects with lower cholesterol values, the red blood cell cholesterol fractional synthesis rate (FSR) increased from 0.0291 +/- 0.0054 pools/d after placebo to 0.0509 +/- 0.0049 pools/d (P < .05) after phytosterol treatment. In subjects with higher cholesterol values, the red blood cell cholesterol FSR did not change significantly after treatment. These results demonstrate the short-term efficacy of tall oil plant sterols as cholesterol-lowering agents. Copyright (C) 1998 by W.B. Saunders Company.

Jones, P. J. H., et al. (1997). "Dietary phytosterols as cholesterol-lowering agents in humans." Canadian Journal of Physiology and Pharmacology **75**(3): 217-227.

Phytosterols (plant sterols), abundant in fat-soluble fractions of plants, are consumed at levels of 200-400 mg/day in Western diets. Chemically resembling cholesterol, phytosterols inhibit the absorption of cholesterol. Phytosterol consumption in human subjects under a wide range of study conditions has been shown to reduce plasma total and low density lipoprotein (LDL) cholesterol levels; however, the response varies widely. Greater cholesterol-lowering efficacy occurs with consumption of the saturated phytosterol sitostanol versus sitosterol or campesterol. Most studies report no effect of phytosterol administration in high density lipoprotein (HDL) cholesterol or triglyceride levels, although certain evidence exists for an HDL cholesterol raising effect of sitostanol. Phytosterol absorption is limited, although serum phytosterol levers have proven to be important indicators of both cholesterol absorption and synthesis. Serum phytosterols correlate with HDL cholesterol level. In addition, higher phytosterol/cholesterol ratios appear in HDL versus LDL particles, suggesting the existence of an intrinsic phytosterol action, in addition to the extrinsic effect on cholesterol absorption. In conclusion, addition to diet of the phytosterol sitostanol represents an effective means of improving circulating lipid profiles to reduce risk of coronary heart disease.

Jonsson, T., et al. (2010). "A paleolithic diet is more satiating per calorie than a mediterranean-like diet in individuals with ischemic heart disease." Nutrition & Metabolism **7**.

Background: We found marked improvement of glucose tolerance and lower dietary energy intake in ischemic heart disease (IHD) patients after advice to follow a Paleolithic diet, as compared to a Mediterranean-like diet. We now report findings on subjective ratings of satiety at meals and data on the satiety hormone leptin and the soluble leptin receptor from the same study. Methods: Twenty-nine male IHD patients with impaired glucose tolerance or diabetes type 2, and waist circumference > 94 cm, were randomized to ad libitum consumption of a Paleolithic diet (n = 14) based on lean meat, fish, fruit, vegetables, root vegetables, eggs, and nuts, or a Mediterranean-like diet (n = 15) based on whole grains, low-fat dairy products, vegetables, fruit, fish, and oils and margarines during 12 weeks. In parallel with a four day weighed food record the participants recorded their subjective rating of satiety. Satiety Quotients were calculated, as the intra-meal quotient of change in satiety during meal and consumed energy or weight of food and drink for that specific meal. Leptin and leptin receptor was measured at baseline and after 6 and 12 weeks. Free leptin index was calculated as the ratio leptin/leptin receptor. Results: The Paleolithic group were as satiated as the Mediterranean group but consumed less energy per day (5.8 MJ/day vs. 7.6 MJ/day, Paleolithic vs. Mediterranean, p = 0.04). Consequently, the quotients of mean change in satiety during meal and mean consumed energy from food and drink were higher in the Paleolithic group (p = 0.03). Also, there was a strong trend for greater Satiety Quotient for energy in the Paleolithic group (p = 0.057). Leptin decreased by 31% in the Paleolithic group and by 18% in the Mediterranean group with a trend for greater relative decrease of leptin in the Paleolithic group. Relative changes in leptin and changes in weight and waist circumference correlated significantly in the Paleolithic group (p < 0.001) but not in the Mediterranean group. Changes in leptin receptor and free leptin index were not significant. Conclusions: A Paleolithic diet is more satiating per calorie than a Mediterranean-like diet.

Juan, P. (2009). "Trans fatty acids (tFA): sources and intake levels, biological effects and content in commercial Spanish food." Nutricion Hospitalaria **24**(5): 515-520.

Recent studies of dietary habits in children and adolescents performed in Spain show that a high percentage of the daily energy intake corresponds to fat (42.0-43.0%). These findings show an excessive contribution of saturated fatty acids and also a considerable supply of trans fatty acids. These compounds are formed generally during partial hydrogenation of vegetable oils, a process that converts vegetable oils into semisolid fats. Also, in some cases naturally occurring trans fatty acids in smaller amounts in meat and dairy products from ruminants (cows, sheep), these trans fatty acids are produced by the action of bacteria in the ruminant stomach by reactions of biohydrogenation. On the other hand, metabolic studies have clearly shown that traits fatty acids increase LDL cholesterol and reduce HDL cholesterol. Our results show that major sources of trans fatty acids in commercial Spanish foods are fast-food (hamburger, French fries), snacks, bakery products (cakes, donuts, biscuits), margarines and dehydrated soups.

Juarez, M., et al. (2010). "Dietary vitamin E inhibits the trans 10-18:1 shift in beef backfat." Canadian Journal of Animal Science **90**(1): 9-12.

Juarez, M., Dugan, M. E. R., Aalhus, J. L., Aldai, N., Basarab, J. A., Baron, V. S. and McAllister, T. A. 2010. Dietary vitamin E inhibits the trans 10-18:1 shift in beef backfat. Can. J. Anim. Sci. 90: 9-12. Forty feedlot steers were fed a barley-grain-based finishing diet typical for western Canada, with two levels of supplementary vitamin E (468 or 1068 IU head(-1) d(-1)) and the effect on backfat trans-18:1 isomeric profile was determined. Feeding 1068 IU vitamin E reduced the total trans-18:1 content in backfat (P <0.01), as well as the percentage of trans 10-18:1 (P <0.001), which are related to an increased risk for cardiovascular diseases. On the other hand, trans 11-18:1 (vaccenic acid) the precursor for cis 9,trans 11-18:2 (rumenic acid), which have several purported health benefits, increased (P <0.01). Vitamin E could, therefore, be used to decrease trans-18:1 in beef and improve its isomeric profile.

Juarez, M., et al. (2011). "Effects of vitamin E and flaxseed on rumen-derived fatty acid intermediates in beef intramuscular fat." Meat Science **88**(3): 434-440.

To elucidate the effects of dietary vitamin E with or without flaxseed on beef fatty acid composition, 80 feedlot steers were fed 4 diets: Control-E (451 IU dl-alpha-tocopheryl acetate/head/day), Control + E (1051 IU dl-alpha-tocopheryl acetate/head/day), Flax-E (10% ground) and Flax + E. Vitamin E had no effect on animal growth or carcass weight (p>0.05), while flaxseed-fed steers had greater average daily gain (p = 0.007), final live weight (p = 0.005) and heavier carcasses (p = 0.012). Feeding flaxseed increased the total n-3 fatty acid content of beef and this response was further accentuated by the inclusion of high levels of vitamin E in the diet. Feeding flax increased levels of some 18:3n-3 partial hydrogenation products including c15- and t13/14-18:1 and several 18:2 isomers (p<0.001) but decreased t10-18:1 (p<0.001). Vitamin E enhanced intramuscular levels of 18:3n-3 and its biohydrogenation products leading to greater accumulations of total n-3 fatty acids in lean ground beef. The consequences of increasing the concentrations of partially hydrogenated products on human health have yet to be investigated. Crown Copyright (c) 2011 Published by Elsevier Ltd. All rights reserved.

Judd, J. T., et al. (2002). "Plant sterol esters lower plasma lipids and most carotenoids in mildly hypercholesterolemic adults." Lipids **37**(1): 33-42.

The ability of plant sterol esters (PSE) in salad dressing to modify plasma lipids and carotenoids was determined in 26 men and 27 women fed controlled, weight-maintaining, isocaloric diets. Diets contained typical American foods that provided 32% of energy from fat. Dressings contained 8 g (ranch) or 4 g (Italian) of fat per serving. PSE (3.6 g/d) were provided in two servings/d of one of the dressings. Diets with ranch or Italian dressing without and with PSE were fed for 3 wk/diet and crossed over randomly within dressings. Diets were adjusted to similar fat and fatty acid concentrations. Type of salad dressing did not affect plasma lipids, lipoproteins, carotenoids, or fat-soluble vitamins (P > 0.05). Switching from a self-selected baseline diet to the control diet resulted in reduction in low density lipoprotein (LDL) cholesterol of 7.9%, a decrease in high density lipoprotein (HDL) cholesterol of 3.1 %, and a decrease in triglycerides (TG) of 9.3%. Consumption of 3.6 g of PSE resulted in further decreases in LDL cholesterol (9.7%) and TG (7.3%) but no additional change in HDL cholesterol. Total plasma carotenoids decreased 9.6% with PSE. An automated stepwise procedure was developed to produce candidate mixed models relating plasma carotenoid response to PSE. These models adjusted for preintervention plasma carotenoid levels and effects of diets on blood lipids. There were significant decreases in beta-carotene, alpha-carotene, and beta-cryptoxanthin (females only) not associated with changes in plasma lipids. Plasma carotenoids on all diets remained within normal ranges. We conclude that low-fat foods, such as salad dressings, are effective carriers for PSE.

Judd, J. T., et al. (1998). "Effects of margarine compared with those of butter on blood lipid profiles related to cardiovascular disease risk factors in normolipemic adults fed controlled diets." American Journal of Clinical Nutrition **68**(4): 768-777.

Effects of butter and 2 types of margarine on blood lipid and lipoprotein concentrations were compared in a controlled diet study with 23 men and 23 women. Table spreads, added to a common basal diet, provided 8.3% of energy as fat. Diets averaged 34.6% of energy as fat and 15.5% as protein. Each diet was fed for 5 wk in a 3 X 3 Latin-square design. One margarine (TFA-M) approximated the average trans monoene content of trans fatty acid-containing margarines in the United States (17% trans fatty acids by dry wt). The other margarine (PUFA-M) was free of ti ans unsaturated fatty acids; it contained approximately twice the polyunsaturated fatty acid content of TFA-M (49% compared with 27% polyunsaturated fatty acids). The tub-type margarines had similar physical properties at ambient temperature. Fasting blood lipids and lipoproteins were determined in 2 samples taken from the subjects during the fifth week of each dietary treatment. Compared with butter, total cholesterol was 3.5% lower (P = 0.009) after consumption of TFA-M and 5.4% lower (P < 0.001) after consumption of PUFA-M. Similarly, LDL cholesterol was 4.9% lower (P = 0.005) and 6.7% lower (Pi 0.001) after consumption of TFA-M and PUFA-M, respectively. Neither margarine differed from butter in its effect on HDL cholesterol or triacylglycerols. Thus, consumption of TFA-M or PUFA-M improved blood lipid profiles for the major lipoproteins associated with cardiovascular risk when compared with butter, with a greater improvement with PUFA-M than with TFA-M.

Kabagambe, E. K., et al. (2005). "The type of oil used for cooking is associated with the risk of nonfatal acute myocardial infarction in Costa Rica." Journal of Nutrition **135**(11): 2674-2679.

Palm oil and soybean oil are the 2 most widely used cooking oils in the world. Palm oil is consumed mainly in developing countries, where morbidity and mortality due to cardiovascular disease (CVD) are on the rise. Although claims about adverse or protective effects of these oils are commonly made, there are no epidemiologic studies assessing the association between these oils and cardiovascular disease endpoints. We examined whether consumption of palm oil relative to soybean oil and other unsaturated oils (predominantly sunflower) is associated with myocardial infarction (MI) in Costa Rica. The cases (n = 2111) were survivors of a first acute MI and were matched to randomly selected population controls (n = 2111). Dietary intake was assessed with a validated serniquantitative FFQ. Adipose tissue profiles of essential fatty acids were assessed to validate cooking oil intake and found to be consistent with self-reported major oils used for cooking. The data were analyzed using conditional logistic regression. Palm oil users were more likely to have an MI than users of soybean oil [odds ratio (OR) = 1.33; 95% CI: 1.08-1.63] or other cooking oils (OR = 1.23; CI: 0.99-1.52), but they did not differ from users of soybean oil with a high trans-fatty acid content (OR = 1.14; CI: 0.84-1.56). These data suggest that as currently used in Costa Rica, and most likely in many other developing countries, the replacement of palm oil with a polyunsaturated nonhydrogenated vegetable oil would reduce the risk of MI.

Kadegowda, A. K. G., et al. (2013). "Cis-9, trans-11 conjugated linoleic acid is endogenously synthesized from palmitelaidic (C16:1 trans-9) acid in bovine adipocytes." Journal of Animal Science **91**(4): 1614-1623.

Palmitelaidic (C16:1 trans-9) acid has been suggested to have beneficial effects on human health, including reduced adiposity. Objectives of this research were to quantify the amounts of palmitelaidic acid in beef samples and determine the effect of palmitelaidic acid supplementation on lipogenesis in bovine preadipocytes and adipocytes in vitro. For the first objective, palmitelaidic acid content of LM samples from steers finished on forage or concentrate systems was determined. Palmitelaidic acid in LM samples from forage-finished beef ranged from 10 to 17 mg/100 g of muscle corresponding to 0.52% to 0.65% of total fatty acids. Forage species grazed during finishing, and animal age at harvest also altered palmitelaidic acid concentrations and contents in the LM of forage-finished beef. Palmitelaidic acid concentration of concentrate-finished beef was lower (P < 0.05; 0.25% vs. 0.56%); however, because of increased (P < 0.05) total fatty acid content with concentrate finishing, amount of palmitelaidic acid was similar (P > 0.05) to beef from steers finished on pearl millet and greater (P < 0.05) than those finished on alfalfa. For the second objective, undifferentiated preadipocytes and differentiated adipocytes were supplemented with 0 to 300 mu M of palmitelaidic acid. Palmitelaidic acid supplementation reduced (P < 0.05) cell viability of undifferentiated preadipocytes at greater levels (150 and 300 mu M) but did not affect (P > 0.05) the viability of differentiated adipocytes. In preadipocytes, palmitelaidic acid increased (P < 0.05) palmitelaidic and trans-11 vaccenic (C18:1 trans-11) acids at high levels of supplementation (300 mu M). In adipocytes, palmitelaidic acid supplementation increased (P < 0.05) palmitelaidic acid, trans-11 vaccenic acid, and total fatty acid content. In addition, cis-9, trans-11 CLA also increased (P < 0.05) with palmitelaidic acid supplementation in adipocytes. These results indicate that palmitelaidic acid can be elongated in both preadipocytes and adipocytes and desaturated in adipocytes to generate trans-11 vaccenic acid and cis-9, trans-11 CLA, respectively. Beef products are a source of palmitelaidic acid in the human diet, which can be elongated and desaturated to produce trans-11 vaccenic acid and cis-9, trans-11 CLA.

Kalac, P. and E. Samkova (2010). "The effects of feeding various forages on fatty acid composition of bovine milk fat: A review." Czech Journal of Animal Science **55**(12): 521-537.

The nutritional image of bovine milk fat has suffered for years because of the association of saturated fatty acids and coronary heart disease. Thus the alteration of fatty acid composition has been a long-term strategy. Forages, even though containing a relatively low level of lipids, are the cheapest and often the major source of beneficial unsaturated fatty acids in ruminant diets. Recent progress in the research of factors affecting fatty acid content and composition in fresh and preserved forages and the associations between feeding such forages and milk fat profile are reviewed. Milk from cows grazed or fed fresh forage, especially from species-rich grasslands or forage legumes, has a considerably higher ratio of unsaturated to saturated fatty acids and a higher content of nutritionally beneficial trans-fatty acids (e.g. CLA, vaccenic acid) than milk from cows fed silage or hay. Grass and legume silages seem to affect the fatty acid profile more propitiously than maize silage.

Kandhro, A., et al. (2008). "GC-MS quantification of fatty acid profile including trans FA in the locally manufactured margarines of Pakistan." Food Chemistry **109**(1): 207-211.

Ten margarine brands of Pakistan were analyzed for their fatty acid composition with emphasis on trans fatty acids (TFA) using GC- MS. Saturated, cis-monounsaturated and polyunsaturated fatty acids were present at 24.2-58.1, 5.7-35.4 and 3.8-37.4% of total fatty acids, respectively. Among the saturated fatty acids, palmitic acid (16.9-33.8%) was dominant in all analyzed margarine brands and its higher amount indicates that palm oil was a major contributor in the margarine manufacturing. Among samples tested only one contained a low level of TFA (2.2%) while the rest contained very high amounts of TFA (11.5-34.8%) which clearly shows that hydrogenated oils were used in the formulation of margarines. Fatty acid profiles demonstrated that all samples belong to the hard margarine category containing high amounts of trans and saturated fatty acids which is an alarming issue for the health of consumers. (C) 2008 Elsevier Ltd. All rights reserved.

Kassis, A. N., et al. (2009). "Sugar Cane Policosanols do not Reduce LDL Oxidation in Hypercholesterolemic Individuals." Lipids **44**(5): 391-396.

Sugar cane policosanols (SCP) have been shown to exert antioxidant properties in various studies conducted in Cuba. Independent studies have since reported no significant effect of SCP consumption on oxidized LDL levels. The objective of the present study was to confirm the effects of Cuban SCP on LDL oxidation using a high-precision capture ELISA procedure in hypercholesterolemic individuals. Twenty-one otherwise healthy hypercholesterolemic men and post-menopausal women participated in a randomized double blind crossover study where they received 10 mg/day of policosanol or a placebo incorporated in margarine as an evening snack for a period of 28 days. Subjects maintained their usual dietary and exercise habits throughout the duration of the study. Blood was collected on the first as well as the last 2 days of the trial. LDL oxidation was measured from plasma using a solid phase two-site enzyme immunoassay. A lack of effect of SCP was observed on LDL cholesterol levels, as well as no difference in LDL oxidation between the SCP treatment and placebo at the end of the intervention period. Subject body weights remained stable throughout the study and showed no significant correlation with LDL oxidation levels. Absolute levels of plasma LDL cholesterol were significantly (P < 0.05) correlated with plasma concentrations of oxidized LDL. The findings of the present study suggest that SCP do not significantly affect LDL oxidation. Our results align with results of recent policosanol research questioning the efficacy of these natural extracts as cardio-protective agents.

Katan, M. B. (1995). "TRANS-FATTY-ACIDS AND CORONARY HEART-DISEASE RISK - COMMENT." American Journal of Clinical Nutrition **62**(3): 518-519.

Katan, M. B. (2000). "Trans fatty acids and plasma lipoproteins." Nutrition Reviews **58**(6): 188-191.

Perceptions of the health effects of trans fatty acids, particularly in the form of margarine, have undergone several changes during the past 10 years. What was once heralded as the healthy alternative to butter now assumes the role of co-conspirator. A new study finds that consumption of trans fatty acids, such as those found in stick margarine and shortening, have negative effects on lipoprotein profiles that are comparable to those of saturated fatty acids. In the prevention and treatment of cardiovascular diseases, therefore, it is recommended that consumers reduce intakes of both saturated and trans fatty acids.

Katan, M. B., et al. (2003). "Efficacy and safety of plant stanols and sterols in the management of blood cholesterol levels." Mayo Clinic Proceedings **78**(8): 965-978.

Foods with plant stanol or sterol esters lower serum cholesterol levels. We summarize the deliberations of 32 experts on the efficacy and safety of sterols and stanols. A meta-analysis of 41 trials showed that intake of 2 g/d of stanols or sterols reduced low-density lipoprotein (LDL) by 10%; higher intakes added little. Efficacy is similar for sterols and stanols, but the food form may substantially affect LDL reduction. Effects are additive with diet or drug interventions: eating foods low in saturated fat and cholesterol and high in stanols or sterols can reduce LDL by 20%; adding sterols or stanols to statin medication is more effective than doubling the statin dose. A meta-analysis of 10 to 15 trials per vitamin showed that plasma levels of vitamins A and D are not affected by stanols or sterols. Alpha carotene, lycopene, and vitamin E levels remained stable relative to their carrier molecule, LDL. Beta carotene levels declined, but adverse health outcomes were not expected. Sterol-enriched foods increased plasma sterol levels, and workshop participants discussed whether this would increase risk, in view of the marked increase of atherosclerosis in patients with homozygous phytosterolemia. This risk is believed to be largely hypothetical, and any increase due to the small increase in plasma plant sterols may be more than offset by the decrease in plasma LDL. There are insufficient data to suggest that plant stanols or sterols either prevent or promote colon carcinogenesis. Safety of sterols and stanols is being monitored by follow-up of samples from the general population; however, the power of such studies to pick up infrequent increases in common diseases, if any exist, is limited. A trial with clinical outcomes probably would not answer remaining questions about infrequent adverse effects. Trials with surrogate end points such as intima-media thickness might corroborate the expected efficacy in reducing atherosclerosis. However, present evidence is sufficient to promote use of sterols and stanols for lowering LDL cholesterol levels in persons at increased risk for coronary heart disease.

Katan, M. B., et al. (1995). "TRANS-FATTY-ACIDS AND THEIR EFFECTS ON LIPOPROTEINS IN HUMANS." Annual Review of Nutrition **15**: 473-493.

Trans fatty acids raise plasma low-density lipoprotein (LDL) cholesterol levels in volunteers when exchanged for cis unsaturated fatty acids in the diet. In addition, trans fatty acids may lower high-density lipoprotein (HDL) cholesterol levels and raise triglyceride and lipoprotein(a) levels in plasma. Trans and cis unsaturated fatty acids are thus not equivalent, and diets aimed at reducing the risk of coronary heart disease should be low in both trans and saturated fatty acids.

Kato, I., et al. (2010). "Dietary fatty acids, luminal modifiers, and risk of colorectal cancer." International Journal of Cancer **127**(4): 942-951.

Inconsistent observations in epidemiologic studies on the association between total fat intake and colorectal cancer may be ascribed to opposing effects of individual fatty acids and the presence of other dietary constituents that modify luminal or systemic lipid exposure. We analyzed the data from a population-based case-control study that included 1,163 cases and 1,501 controls to examine the effects of individual fatty acid groups on colorectal cancer risk as well as their interactions with calcium and fiber intake. Odds ratios (OR) and 95% confidence intervals (Cl) were estimated by unconditional logistic regression model according to quartile levels of energy-adjusted fatty acid intake. In the bivariable analyses, the risk of colorectal cancer increased with trans fatty acid (TFA) intake (OR for top vs. bottom quartile = 1.46, 95% CI 1.17-1.59, p-value for a trend <0.001), but the associations was substantially attenuated in multivariable analyses (p value for a trend = 0.176). However, a significant linear trend in the multivariable OR (p = 0.029) for TFA was present for subjects with lower calcium intake. Furthermore, multivariable ORs progressively decreased with increasing both omega-3 and omega-6 poly-unsaturated fatty acid intake (p-values for linear trend: 0.033 and 0.011, respectively) for subjects with lower dietary fiber intake. These interactions were also significant or marginally significant (p = 0.085 for TFA, 0.029 for omega-3 and 0.068 for omega-6). Our results suggest that populations with lower intake of luminal modifiers, i.e., calcium and fiber, may have differential risks of colorectal cancer associated with dietary fatty acid intake.

Kawabata, T., et al. (2010). "Intake of Trans Fatty Acid in Japanese University Students." Journal of Nutritional Science and Vitaminology **56**(3): 164-170.

Because trans fatty acids (TFAs) are a potent risk factor for coronary heart disease, it is important to know the amount of TFA consumed. We estimated TFA intakes of Japanese university students by direct measurement. Subjects included 118 students (57 males and 61 females) in two regions of Japan: Kanto (Tokyo area) and Okinawa. A dietary survey was conducted over six consecutive days using dietary records and photographic records. A single-day meal in the survey period was reproduced to measure TFA content by gas chromatography. The median values of TFA intakes (and energy percentage) estimated by the contents of reproduced meals for men were 0.43 g/d (0.22%) in Kanto and 0.30 g/d (0.14%) in Okinawa. Corresponding values for women were 0.49 g/d (0.29%) and 0.73 g/d (0.35%), respectively. Compared to the group with a low TFA intake, the subjects with a high TFA intake consumed significantly more energy from total fat and saturated fatty acids, and had a high ratio of TFA/linoleic acid. In addition, multiple regression analysis showed the intakes of MA were positively associated with those of saturated fatty acids and groups of nonessential groceries such as cookies, cakes and pastries. In conclusion, the TFA intakes of these survey subjects were relatively lower than the WHO recommended energy ratio (<1%). However, nutritional education on dietary habits seems indispensable for those subjects who are consuming high volumes of TFA.

Kawai, Y., et al. (2007). "Detection of cholesteryl ester hydroperoxide isomers using gas chromatography-mass spectrometry combined with thin-layer chromatography blotting." Analytical Biochemistry **360**(1): 130-137.

Oxidative modification of low-density lipoprotein (LDL) has been implicated in the pathogenesis of atherosclerosis. During the oxidation of LDL, cholesteryl esters, the major lipid components in LDL, are oxidized to cholesteryl ester hydroperoxides (CEOOH). The isomers of CEOOH may reflect the reactive species that initiate the peroxidation reaction. In the current study, a novel analytical method for the determination of CEOOH isomers, especially cholesteryl linoleate hydroperoxide isomers, was developed using the combination of two chromatographic techniques: (i) thin-layer chromatography blotting with diphenyl-1-pyrenylphosphine (DPPP) fluorescent detection (DPPP-TLC blotting) and (ii) gas chromatography-electron ionization-mass spectrometry (GC-EI-MS). CEOOH was applied to DPPP-TLC blotting, the obtained DPPP-derived fluorescent spots containing cholesteryl ester hydroxides were extracted and derivatized (hydrogenation, transmethylation, and trimethylsilylation), and the formed methyl ester/trimethylsilylether derivatives of hydroxyoctadecenoic acid were then analyzed by GC-EI-MS. The CEOOH isomers were determined by selected ion monitoring of isomer-specific fragment ions originated from the alpha-cleavage of the trimethylsilyloxyl group. Using these two chromatographic techniques, we were able to detect isomeric CEOOH in the oxidized human LDL. Our results indicated that GC-EI-MS analysis combined with DPPP-TLC blot is a specific method for analyzing cholesteryl ester hydroperoxide isomers in biological samples such as oxidized LDL. (c) 2006 Elsevier Inc. All rights reserved.

Kaya, A., et al. (2010). "Effects of the Trans-9 18:1 Octadecenoic Acid Isomer on Rat Liver Membrane Na+/K+ ATPase Enzyme Activity and Plasma Lipoproteins." Turkish Journal of Biochemistry-Turk Biyokimya Dergisi **35**(2): 119-125.

Purpose: The consumption of trans-fatty acids is associated with increasing coronary heart disease risk. When oils are partially hydrogenised to margarine form, trans isomers of fatty acids are formed. In this study we investigated the effects of dietary trans-9 18:1 octadecenoic acid isomer on liver cell membrane Na(+)/K(+) ATPase enzyme activity, fat composition and lipid metabolism. Method and Material: This study was conducted on two groups of rats, study and control. Study group was given 50 mg/day trans-9 18:1 octadecenoic acid isomers for ten days. Fatty acid composition of serum and liver tissue was analyzed using gas chromatography Results: Study group showed trans-9 18: 1 fatty acid presence while control group did not, thus trans-9 18: 1 octadecenoic acid isomer is not a naturally occurring compound. The meaningful increase of C18:2 6n fatty acid and meaningful decrease of C20:4 6n in study group show that trans-9 18:1 octadecenoic acid isomers affected desaturation activity and prevented C18:2 6n fatty acid from turning into C20: 4 6n. Rats fed with trans-9 18:1 octadecenoic acid showed decreased HDL and HDL2 cholesterol levels. No change was observed in HDL3, LDL, total cholesterol, triglyceride and Na(+)/K(+) ATPase activity. Our findings combined with current literature allow us to conclude; sine TFAs change serum HDL and HDL2 cholesterol levels, nutrition's containing TFA may increase the risk of heart disease.

Keita, H., et al. (2013). "The long-term ingestion of a diet high in extra virgin olive oil produces obesity and insulin resistance but protects endothelial function in rats: a preliminary study." Diabetology & Metabolic Syndrome **5**.

Background: It has been hypothesized that fatty acids derived from a diet high in saturated fat may negatively affect endothelial function more significantly than a diet high in unsaturated fat; nevertheless, the effects of the long-term ingestion of monounsaturated fatty acids on endothelial function have been poorly studied. Methods: To examine the chronic effects of monounsaturated (e.g., extra virgin olive oil (EVOO)) or saturated (e.g., margarine (M)) fatty acid-rich diets on the development of insulin resistance and endothelial dysfunction in rats, three groups of rats were fed control, high-EVOO or high-M diets for 20 weeks. Body weight, energy consumption, insulin resistance, lipid peroxidation and in vitro vascular reactivity with and without metformin were assessed during the study period. Results: Both high-fat diets produced obesity and insulin resistance. EVOO-fed rats showed smaller increases in total cholesterol and arterial lipid peroxidation when compared with M-fed rats. Vascular reactivity to phenylephrine and sodium nitroprusside was not modified, but the vasodilating effect of carbachol was especially reduced in the M-fed rats compared with the EVOO-fed or control groups. Metformin addition to the incubation media decreased the vascular response to phenylephrine; decrease that was lower in rats fed with both high fat diets, and increased the carbachol and nitroprusside effects, but the metformin-enhanced response to carbachol was lower in the M group. Conclusions: Our results suggest that feeding rats with high quantities of EVOO, despite producing obesity and insulin resistance, produces low levels of circulating cholesterol and arterial lipoperoxidation compared to M fed rats and shows a preserved endothelial response to carbachol, effect that is significantly enhanced by metformin only in rats fed with control and EVOO diets.

Kelishadi, R., et al. (2006). "Blood pressure and its influencing factors in a national representative sample of Iranian children and adolescents: the CASPIAN Study." European Journal of Cardiovascular Prevention & Rehabilitation **13**(6): 956-963.

Background This study was performed to determine the blood pressure (BP) percentile curves by height, as well as to assess the prevalence of high BP and its influencing factors among children in the first national survey in this field in Iran. Design A multicentre national cross-sectional survey. Methods This study was performed in 23 provinces among a representative sample of 21 111 students aged 6-18 years. Results Age and sex-specific percentile curves of systolic and diastolic BP were obtained by height. A comparison of the values obtained corresponding to the 90th percentiles with the Second Task Force cut-offs showed that the BP values and trends were relatively similar in both studies. The overall prevalence of systolic, diastolic as well as systolic or diastolic hypertension according to the Second Task Force study 95th percentile cut-off points were 4.2, 5.4 and 7.7%, respectively, without a significant sex difference. A history of low birthweight, overweight, taller height, the consumption of solid hydrogenated fat, as well as the frequency of fast food consumption increased the risk of both systolic and diastolic hypertension. Male sex, large waist, and low education of the mother were the risks for systolic hypertension, whereas the risk of diastolic hypertension rose with living in an urban area, attending public school, low physical activity level, having a housewife mother, and a positive family history of obesity, especially in the parents. Conclusion Considering the effect of modifiable environmental factors on the childrens' BP, encouraging breast feeding and a healthy lifestyle may have an important effect on public health.

Kelishadi, R., et al. (2008). "Factors associated with the metabolic syndrome in a national sample of youths: CASPIAN study." Nutrition Metabolism and Cardiovascular Diseases **18**(7): 461-470.

Background and aim: To date, research on the influence of environmental factors on metabolic syndrome (MS) among youths is limited. This study was conducted to investigate for the first time the association of these factors with MS in a large national, representative sample of children from a non-Western population. Methods and results: The study population comprised of 4811 students (2248 boys and 2563 girls) aged 6-18 years, living in six different provinces in Iran. MS, defined based on criteria analogous to those of the Adult Treatment Panel III, was detected in 14.1% of participants. A birth weight of > 4000 g in boys and < 2500 g in girls increased the risk of having the MS [OR, 95% CI: 1.4 (1.007, 2.05) and 1.2 (1.1, 1.4), respectively]. Poorly educated parents and a positive parental history of chronic disease were other risks factors associated with MS. Low levels of physical activity significantly increased the risk of having MS [boys: 1.3 (1.1, 1.7); girls: 1.4 (1.2, 1.6)]. The risk of MS increased in-line with the consumption of solid hydrogenated fat [boys: 1.2 (1.07, 1.3); girls, 1.3 (1.1, 1.5)] and bread made with white flour [boys: 1.6 (1.3, 2.1); girls, 1.4 (1.1, 1.7)]. In contrast, an increased frequency of consumption of fruits and vegetable, as well as dairy products decreased the risk of having MS. Conclusion: Considering the effect of modifiable lifestyle habits and birth weight on MS in youths, urgent public health approaches should be directed towards primordial and primary prevention of this rapidly growing problem. (C) 2007 Elsevier B.V. All rights reserved.

Kelishadi, R., et al. (2004). "Dietary fat intake and lipid profiles of Iranian adolescents: Isfahan healthy heart program-heart health promotion from childhood." Preventive Medicine **39**(4): 760-766.

Objectives. To assess the serum lipid profiles of Iranian adolescents and their correlation with dietary fat intake and to evaluate the knowledge, attitude, and practice (KAP) of students, parents, and school staff. Methods. The subjects of this cross-sectional study were 2000 students (1000 girls and 1000 boys), ages 11-18 years, selected by multistage random sampling, and one of their parents (2000 subjects), as well as 500 school staff in urban and rural areas of two provinces in Iran (one for further interventions and the other for reference). The data were obtained by questionnaires, anthropometric measurements, 3-day food record form, and a 20-item food frequency questionnaire (FFQ). All serum lipids were determined in the same laboratory. Results. Although the percentage of fat intake (21.2 +/- 0.4%) among the adolescents was within the recommended daily allowance (RDA less than or equal to 30%), in most cases, the percentiles of serum total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), and triglyceride (TG) were significantly higher and the percentiles of high-density lipoprotein cholesterol (HDL-C) were lower than standard values according to Lipid Research Clinics (LRC) data; for example, the mean TC values for girls in the 11- to 14- and 15- to 18-year age groups were significantly higher than LRC standard values (169 and 172 vs. 160 and 159 mg/dl, respectively, P < 0.05). This difference was also significant in boys (167 and 168 vs. 160 and 153 mg/dl, respectively) at the P < 0.05 level. A significant linear association was shown between adolescents' dyslipidemia and the frequency of intake of hydrogenated fat, fast foods, cheese puffs, and potato chips (P < 0.05). Although the protein intake was lower than the RDA (13.4 +/- 0.9% vs. 15%, P < 0.05), because of the highly prevalent consumption of fatty lamb meat, the frequency of red meat intake had a direct association with dyslipidernia (P < 0.05). Conclusion. The improper intake of high amounts of saturated fat and the observed serum lipid profile of Iranian adolescents are likely placing them at increased risk for cardiovascular disease (CVD) and necessitate developing guidelines and community-based interventions. (C) 2004 The Institute For Cancer Prevention and Elsevier Inc. All rights reserved.

Kelishadi, R., et al. (2011). "Short-Term Results of a Community-Based Program on Promoting Healthy Lifestyle for Prevention and Control of Chronic Diseases in a Developing Country Setting: Isfahan Healthy Heart Program." Asia-Pacific Journal of Public Health **23**(4): 518-533.

The objective of the study is to investigate the effect of a comprehensive community trial on behavioral modification after 2 years of intervention. The interventions of this 6-year, comprehensive community-based study target the whole population, of nearly 2 I 80 000, living in 2 cities in Iran and are compared with another Iranian city considered as reference. Educational, environmental, and legislative interventions are being conducted at the population level. From the baseline to the second year of evaluation of this study, the consumption of hydrogenated fat decreased significantly in the intervention community, but it remained nearly constant in the reference area. Meanwhile, the consumption of liquid oil increased in the intervention community, whereas it decreased in the reference area. The prevalence of current smoking and attempt to smoke decreased, respectively, in men and youths living in the intervention area but increased or remained constant in the reference area; however, no favorable change was seen for smoking among women. Leisure time physical activity increased in women and declined in men of both communities; the slopes of these changes were greater in the intervention area. Although the consumption of salty/fat snacks slightly decreased in the school students of the intervention area, it had a sharp increase in the reference area. This program succeeded in improving some aspects of lifestyle in its different target groups. The authors suggest that the synergy of activities intensified the dose of interventions and led to this improvement.

Kelly, E. R., et al. (2011). "Effects of long term plant sterol and -stanol consumption on the retinal vasculature: A randomized controlled trial in statin users." Atherosclerosis **214**(1): 225-230.

As sitosterolemic patients have an increased cardiovascular risk, there is concern that reducing serum LDL-cholesterol concentrations by plant sterols enriched functional foods might adversely affect vascular function. Whether increased concentrations of plant sterols truly affect vascular function and whether these effects are exclusive to the larger vessels remains unknown. We compared the effects of long-term plant sterol and -stanol consumption on changes in retinal vessels diameter which reflex alterations in the microcirculation. Three randomized groups were studied at baseline and after 85-weeks. Group one (N = 11) consumed plant sterol enriched margarine (2.5 g/day), the second (N=8) plant stanol enriched margarine (2.5 g/day), and the control group (N = 11) non-enriched margarine (2.5 g/day). Serum cholesterol-standardized campesterol and sitosterol concentrations increased by 354.84 +/- 168.22.102 mu mol/mmol and 84.36 +/- 48.26.102 mu mol/mmol (p < 0.001), respectively in the sterol group, while decreasing non-significantly in the plant stanol group. Serum LDL-cholesterol concentrations decreased significantly in both the plant sterol (-0.33 +/- 0.33 mmol/L, p = 0.016) and -stanol groups (-0.38 +/- 0.34 mmol/L, p = 0.018) compared to the increase in the controls (0.29 +/- 0.34 mmol/L). The mean change in venular diameters for the plant sterol group (2.3 +/- 3.1 mu m), plant stanol groups (-0.8 +/- 3.4 mu m) and control group (-0.8 +/- 5.1 mu m) did not reach significance but the change in cholesterol-standardized campesterol concentrations correlated positively with the change in venular diameter independent of changes in serum LDL-cholesterol concentrations (r = 0.39, N = 30, p = 0.033). Increased serum campesterol concentration correlated positively with increased retinal venular diameter, independent from changes in serum LDL-cholesterol concentrations. This may constitute an explanation for the suggested effects of plant sterols on vascular function. However, this novel finding needs confirmation and further study. (C) 2010 Elsevier Ireland Ltd. All rights reserved.

Ketomaki, A., et al. (2004). "Effects of plant stanol and sterol esters on serum phytosterols in a family with familial hypercholesterolemia including a homozygous subject." Journal of Laboratory and Clinical Medicine **143**(4): 255-262.

We studied the concentrations and ratios to cholesterol of noncholesterol sterols reflecting absorption (eg, campesterol) or synthesis (eg, lathosterol) of cholesterol off and on plant sterol and stanol ester spreads in serum and in different lipoproteins of a family with familial hypercholesterolemia, including heterozygous parents receiving no treatment and their homozygous offspring undergoing long-term treatment with statins and apheresis. Serum cholesterol levels were similar in the homozygous and heterozygous individuals, but the concentrations of sterols reflecting cholesterol absorption were as much as 10 times greater in the homozygous child than in the heterozygous parents, whereas the respective markers of cholesterol synthesis only tended to be higher. About 70% of squalene in the homozygous individual (60% in the heterozygous family members) and 85% to 90% of noncholesterol sterols (60%-80% in the heterozygous subjects) were transported by low-density lipoprotein. The ratios of absorption sterols to cholesterol were higher in high-density lipoprotein (HDL) than in very low-density lipoprotein (VLDL), whereas those of synthesis markers and plant stanols were highest in VLDL. The ratios of absorption sterols in serum were mostly lower than those in HDL but higher than in VLDL, whereas the ratios of synthesis sterols in serum were lower than they were in VLDL. Both spreads reduced serum total cholesterol by about 14% in the heterozygous family members and 9% in the homozygous individual. The sterol ester spread increased serum plant sterol concentrations (eg, campesterol in the homozygous family member increased from 5 to 9 mg/dL) and the ratios to cholesterol, but the stanol ester spread decreased them. Plant sterol esters seemed to similarly decrease serum cholesterol in this family with familial hypercholesterolemia, but the clinical role of increased plant sterol concentrations, almost doubled in the LDL of homozygous individuals, is not known.

Ketomaki, A., et al. (2004). "Removal of intravenous Intralipid in patients with familial hypercholesterolemia during inhibition of cholesterol absorption and synthesis." Clinica Chimica Acta **344**(1-2): 83-93.

Background: While plant stanols are known to upregulate low density lipoprotein (LDL) receptors, we studied the effects of plant stanol (STA) and sterol (STE) ester spreads on triglyceride-rich lipoprotein (TRL) removal in statin-treated patients with familial hypercholesterolemia (FH) using intravenous Intralipid(R)-squalene fat tolerance test. Methods: Five patients consumed STA and STE in a randomized, crossover study for 4 weeks. TRL removal was studied at baseline and at the end of both periods. Serum, chylomicron (CM), and very low density lipoprotein lipids, squalene, and plant sterols were measured. Results: LDL cholesterol was decreased by both spreads (15-16%, p<0.05). Plant sterol concentrations were doubled in serum and CM by STE vs. STA. After the injection of Intralipid(R), CM squalene and sitosterol, but not triglycerides (TG), reached higher peak levels (and area under the incremental curve (AUIC) of squalene) by both spreads than at baseline. Despite different plant sterol concentrations by STE vs. STA, the incremental curves for plant sterols were similar by the spreads. Conclusions: Despite the retarded removal of TRL lipids by STA and STE in the statin-treated subjects with FH, improvement of the fasting lipid profile was suggested important in consideration of combination of cholesterol absorption inhibitor with statins even in FH. (C) 2004 Elsevier B.V. All rights reserved.

Khachik, F. (2011). "Industrially viable processes for synthesis of biologically active hydroxycarotenoids commonly found in fruits and vegetables." Journal of Food Composition and Analysis **24**(6): 826-829.

Human plasma and tissues contain in excess of 12 dietary carotenoids and several metabolites that originate from consumption of fruits and vegetables. The major hydroxycarotenoids absorbed by humans are: (3R,3'R,6'R)-lutein (1), (3R,3'R)-zeaxanthin (2), (3R,6'R)-alpha-cryptoxanthin (3), and (3R)-beta-cryptoxanthin (4) and their E/Z-stereoisomers. In addition, several hydroxycarotenoids that result from metabolic transformation of 1 have also been identified in human plasma and ocular tissues. Epidemiological and experimental evidence to date suggest hydroxycarotenoids may protect against chronic diseases such as cancer, cardiovascular disease and age-related macular degeneration (AMD). Therefore, supplementation with these carotenoids in individuals with a low dietary intake of fruits and vegetables is essential. However, with the exception of 1 and 2, industrial production of 3 and 4 have not yet materialized. A relatively straightforward semisynthetic process has been developed that transform 1 into a mixture of 3 (12%) and 4 (80%). Hydroxycarotenoid 3 can also be directly prepared from allylic deoxygenation of 1 in a single step in an excellent yield. These two processes provide an easy access to optically active 3 and 4 that are normally prepared by numerous synthetic steps. (C) 2011 Elsevier Inc. All rights reserved.

Khatoon, S. and S. R. Y. Reddy (2005). "Plastic fats with zero trans fatty acids by interesterification of mango, mahua and palm oils." European Journal of Lipid Science and Technology **107**(11): 786-791.

Speciality plastic fats with no trans fatty acids suitable for use in bakery and as vanaspati are prepared by interesterification of blends of palm hard fraction (PSt) with mahua and mango fats at various proportions. It was found that the interesterified samples did not show significant differences in solid fat content (SFC) after 0.5 or 1 h reaction time. The blends containing PSt/mahua (1:1) showed three distinct endotherms, indicating a heterogeneity of triacylglycerols (TG), the proportions of which altered after interesterification. The SFC also showed improved plasticity after interesterification. Similar results were observed with other blends of PSt/mahua (1:2). These changes in melting behavior are due to alterations in TG composition, as the trisaturated-type TG were reduced and the low-melting TG increased after interesterification. The blends containing PSt/mango (1:1) showed improvement in plasticity after interesterification, whereas those containing PSt/mango (2:1) were hard and showed high solid contents at higher temperature and hence may not be suitable for bakery or as vanaspati. The blends with palm and mahua oils were softer and may be suitable for margarine-type products. The results showed that the blends of PSt/ mahua (1:1, 1:2) and PSt/mango (1:1) after interesterification for 1 h at 80 degrees C showed an SFC similar to those of commercial hydrogenated bakery shortenings and vanaspati. Hence, they could be used in these applications in place of hydrogenated fats as they are free from trans acids, which are reported to be risk factors involved in coronary heart disease. For softer consistency like margarine applications, the blends containing palm oil and mahua oil are suitable.

Khosla, P. and K. C. Hayes (1996). "Dietary trans-monounsaturated fatty acids negatively impact plasma lipids in humans: Critical review of the evidence." Journal of the American College of Nutrition **15**(4): 325-339.

Trans fatty acids (t-FA) are geometrical isomers of unsaturated fatty acids that assume a saturated fatty acid-like configuration. Human diets contain t-FA derived from animal sources (e.g., dairy products and ruminant meats), but most are supplied by products containing industrially hydrogenated vegetable oils ( e.g., margarines, shortenings and baked goods). Typical intake of t-FA in American diets has been estimated to be between 8-15 g/day, although wide variation exists between individuals. Human clinical studies since 1990 have revealed that relative to cis-monounsaturated fatty acids (i.e., oleic acid), t-FA increase total cholesterol (TC) and low density lipoprotein cholesterol (LDL-C), and tend to decrease high density lipoprotein cholesterol (HDL-C) concentrations. Additionally, t-FA tend to increase the atherogenic lipoprotein (a). Thus, t-FA induce an adverse plasma lipid profile (increased ratios of TC/LDL-C and LDL-C/HDL-C), which represents increased risk for coronary heart disease. The effects of t-FA on LDL-C and HDL-C appear to be directly related to intake and clinically measurable above 3%en as t-FA. The cholesterol-raising ability of t-FA is analogous to that of the 12-16 carbon saturated fatty acids, possibly reflecting increased LDL production or delayed LDL clearance. By contrast, t-FA are unlike the saturated fatty acids in their depression of HDL-C. Preliminary evidence suggests that at least part of their impact on lipoproteins reflects increased serum cholesteryl ester transfer protein activity, i.e., increased transfer of cholesteryl esters from HDL to LDL. Since the adverse effects of t-FA on human plasma lipids may be confined to specific isomers, future studies delineating their effects are warranted.

Kim, B. H., et al. (2008). "trans-free margarines prepared with canola oil/palm stearin/palm kernel oil-based structured lipids." Journal of Agricultural and Food Chemistry **56**(17): 8195-8205.

Structured lipids (SLs) for formulating trans-free margarines were synthesized by lipase-catalyzed interesterification of the blends of canola oil (CO), palm stearin (PS), and palm kernel oil (PKO) in weight ratios (CO/PS/PKO) of 40:60:0, 40:50:10, 40:40:20, 40:30:30, 50:30:20, and 60:25:15. The atherogenicity was determined using fatty acid profiles. We also determined the physical properties (melting/crystallization profiles, solid fat content, polymorphism, and microstructure) of SLs and the textural properties of margarines made with the SLs. The SLs from the 50:30:20 and 60:25:15 blends had atherogenic indices similar to or lower than those of the commercial trans (CTMF) and similar to the trans-free margarine fats (CTFMF). SLs from the blends with PKO contained a wide range of fatty acids (C6-C20) and had more beta' than beta polymorphs. Margarines made with SLs from 50:30:20 and 60:25:15 blends possessed similar hardness, adhesiveness, or cohesiveness to margarines made with CTMF and CTFMF, respectively. Therefore, CO/PS/PKO-based SLs were suitable for formulating trans-free margarines with low atherogenicity and desirable textural properties.

King, I. B., et al. (2005). "Serum trans-fatty acids are associated with risk of prostate cancer in beta-carotene and retinol efficacy trial." Cancer Epidemiology Biomarkers & Prevention **14**(4): 988-992.

Biomarkers of trans-fatty acid consumption have been associated with increased risks of breast and colon cancer, although no studies have examined their associations with prostate cancer risk. Using data from the beta-Carotene and Retinol Efficacy Trial, this nested case-control study examined the relationships between serum phospholipid trans-fatty acids and prostate cancer incidence in 272 case and 426 control men. Trans-fatty acids were measured using organic extraction followed by separations with TLC and gas chromatography. Adjusted odds ratios for risk of prostate cancer with increasing levels of trans-fatty acids were calculated using logistic regression. There were consistent trends for increasing prostate cancer risk with higher levels of C18 but not C16 trans-fatty acids, although only trends for AM 18:1 trans-vaccenic and Delta 9c,12t 18:2 fatty acids reached statistical significance. Odds ratios (95% confidence interval) contrasting low versus high quartiles for these fatty acids were 1.69 (1.03-2.77) and 1.79 (1.02-3.15), respectively. There were no consistent differences in associations between low-grade and high-grade cancer among the subset of 209 cases with information on tumor grade. Additional studies are needed to confirm these findings and better control for factors, such as use of prostate-specific antigen screening, which may confound this association.

Kinney, A. J. (1996). "Development of genetically engineered soybean oils for food applications." Journal of Food Lipids **3**(4): 273-292.

The major use of the ten billion pounds or so of soybean oil produced in the US is for food products such as cooking oils, shortenings and margarines. Refined, bleached and deodorized (RED) soybean oil used for cooking is usually hydrogenated to increase storage life and stability during frying. RED soybean oil is also extensively hydrogenated to increase melting point for functionality in shortenings and margarines. Hydrogenation results in oils rich in trans fatty acids, the consumption of which may be associated with coronary heart disease. RED oils used for salad oils are not hydrogenated but are rich in palmitic acid, the consumption of which has also been associated with coronary heart disease. Therefore, it is nutritionally desirable to produce trans-free soybean oils rich in monounsaturated fatty acids with reduced palmitic acid for cooking and soybean oils with no saturated fatty acids for salad oils. It is also desirable to produce trans-free oils rich in stearic and oleic acids for shortenings and margarines. Cloned genes may be introduced into soybeans to create transgenic lines with improved oil traits. The design of transgene constructs has been assisted by the use of soybean somatic embryos in suspension culture as a model system for soybean seed transformation. This system has allowed the selection of the right genes and promoters to achieve the desired phenotypes in transgenic soybeans. Current soybeans in development include lines producing oil with reduced palmitic acid, lines with over 80% oleic acid and lines with up to 30% stearic acid. Commercialization of high oleic acid transgenic soybeans has demonstrated that it is possible to drastically alter the fatty acid composition of a soybean seed without affecting the yield or environmental sensitivity of the soybean plant.

Kinney, A. J. (1998). "Plants as industrial chemical factories - new oils from genetically engineered soybeans." Fett-Lipid **100**(4-5): 173-176.

The major uses of soybean oils world-wide are for food products such as frying oils, shortenings and margarine. Refined soybean oil is usually chemically hydrogenated to increase storage life, stability during frying, and to increase its melting point for use in solid fat applications. Hydrogenation results in the formation of monounsaturated trans fatty acids, the consumption of which has been associated with an increased risk of coronary heart disease in humans. It is nutritionally desirable, therefore, to produce trans-free soybean oils rich in monounsaturated fatty acids for cooking and trans-free oils rich in stearic and oleic acids for shortenings and margarine. Cloned genes may be introduced into soybeans to create transgenic lines with improved oil traits. The design of transgene constructs has been assisted by the use of soybean somatic embryos in suspension culture as a model system for soybean seed transformation. This system has allowed the selection of the right genes and promoters to achieve the desired phenotypes in transgenic soybeans. By manipulating the expression of fatty acid desaturase genes we have produced lines with 85% oleic acid in their seed oil and lines with up to 30% stearic acid. Commercialization of high-oleic acid transgenic soybeans has demonstrated that it is possible to drastically alter the fatty acid composition of a soybean seed without affecting the yield or environmental sensitivity of the soybean plant. We have demonstrated that high-oleic soybean oil is also useful for non-food applications such as biodegradable lubricants. We have now cloned a number of fatty acid desaturase-related genes from species which produce unusual and industrially useful fatty acids. By expressing these genes it will be possible to produce new fatty acids in soybean seeds, which could potentially replace petrochemicals as raw material for many industrial processes.

Kliem, K. E. (2009). "Improving the nutritional quality of milk Optimising milk fatty acid profile by manipulating the dairy cow diet." Agro Food Industry Hi-Tech **20**(5): 8-11.

Epidemiological evidence suggests high milk consumption protects against certain chronic diseases, and yet the high saturated fatty acid (SFA) concentration of milk fat has lead to research into reducing SFA and trans- fatty acid content, and enhancing conjugated linoleic acid (CLA) content. The most successful method of reducing SFA content is by feeding dairy cows supplemental oilseeds, although amount, type and form of oilseed influence the degree of effect. Also, the high unsaturated fatty acid content of oilseeds leads to increases in milk fat trans- fatty acids unless the oilseed is protected from rumen metabolism. Milk fat CLA concentrations can be increased by feeding fish oils, however this can also lead to increases in trans- fatty acids. Trans- fatty acids are thought to have negative effects on human health, although the consumption and isomeric profile of ruminant-derived trans- fatty acids are different to consumption and profile of those derived from industrial hydrogenation. Future research should be directed towards sustainable methods of supplementing dairy cow diets with plant ads in a way that produces the most beneficial milk fatty acid profile.

Kliem, K. E., et al. (2009). "Effect of replacing calcium salts of palm oil distillate with extruded linseeds on milk fatty acid composition in Jersey and Holstein cows." Animal **3**(12): 1754-1762.

Clinical and biomedical studies have provided evidence for the critical role of n-3 fatty acids on the reduction of chronic disease risk in humans, including cardiovascular disease. In the current experiment, the potential to enhance milk n-3 content in two breeds with inherent genetic differences in mammary lipogenesis and de novo fatty acid synthesis was examined using extruded linseeds. Six lactating cows (three Holstein and three Jersey) were used in a two-treatment switchback design with 3 x 21-day experimental periods to evaluate the effect of iso-energetic replacement of calcium salts of palm oil distillate (CPO) in the diet (34 g/kg dry matter (DM)) with 100 g/kg DM extruded linseeds (LIN). For both breeds, replacing CPO with LIN had no effect (P > 0.05) on DM intake or milk yield, but reduced (P < 0.05) milk fat and protein yield (on average, from 760 to 706 and 573 to 552 g/day, respectively). Relative to CPO, the LIN treatment reduced (P < 0.01) total saturated fatty acid content and enhanced (P < 0.001) 18:3n-3 in milk, whereas breed by diet interactions were significant for milk fat 16:0, total trans fatty acid and conjugated linoleic acid concentrations. Increases in 18:3n-3 intake derived from LIN in the diet were transferred into milk with a mean marginal transfer efficiency of 1.8%. Proportionate changes in milk fatty acid composition were greater in the Jersey, highlighting the importance of diet-genotype interactions on mammary lipogenesis. More extensive studies are required to determine the role of genotype on milk fat composition responses to oilseeds in the diet.

Kliem, K. E., et al. (2013). "Incremental effect of a calcium salt of cis-monounsaturated fatty acids supplement on milk fatty acid composition in cows fed maize silage-based diets." Journal of Dairy Science **96**(5): 3211-3221.

In most Western countries, saturated fatty acid (SFA) intake exceeds recommended levels, which is considered a risk factor for cardiovascular disease (CVD). As milk and dairy products are major contributors to SFA intake in many countries, recent research has focused on sustainable methods of producing milk with a lower saturated fat concentration by altering dairy cow diets. Human intervention studies have shown that CVD risk can be reduced by consuming dairy products with reduced SFA and increased cis-monounsaturated fatty acid (MUFA) concentrations. This milk fatty acid profile can be achieved by supplementing dairy cow diets with cis-MUFA-rich unsaturated oils. However, rumen exposure of unsaturated oils also leads to enhanced milk trans fatty acid (TFA) concentrations. Because of concerns about the effects of TFA consumption on CVD, feeding strategies that increase MUFA concentrations in milk without concomitant increases in TFA concentration are preferred by milk processors. In an attempt to limit TFA production and increase the replacement of SFA by cis-MUFA, a preparation of rumen-protected unsaturated oils was developed using saponification with calcium salts. Four multiparous Holstein-Friesian cows in mid-late lactation were used in a 4 x 4 Latin square design with 21-d periods to investigate the effect of incremental dietary inclusion of a calcium salt of cis-MUFA product (Ca-MUFA; 20, 40, and 60 g/kg of dry matter of a maize silage-based diet), on milk production, composition, and fatty acid concentration. Increasing Ca-MUFA inclusion reduced dry matter intake linearly, but no change was observed in estimated ME intake. No change in milk yield was noted, but milk fat and protein concentrations were linearly reduced. Supplementation with Ca-MUFA resulted in a linear reduction in total SPA (from 71 to 52 g/100 g of fatty acids for control and 60 g/kg of dry matter diets, respectively). In addition, concentrations of both cis- and trans-MUFA were increased with Ca-MUFA inclusion, and increases in other biohydrogenation intermediates in milk fat were also observed. The Ca-MUFA supplement was very effective at reducing milk SPA concentration and increasing cis-MUFA concentrations without incurring any negative effects on milk and milk component yields. However, reduced milk fat and protein concentrations, together with increases in milk TFA concentrations, suggest partial dissociation of the calcium salts in the rumen.

Kliem, K. E., et al. (2011). "Effect of replacing calcium salts of palm oil distillate with incremental amounts of conventional or high oleic acid milled rapeseed on milk fatty acid composition in cows fed maize silage-based diets." Animal **5**(8): 1311-1321.

Based on potential benefits to human health, there is increasing interest in altering the composition of ruminant-derived foods. Including rapeseeds in the dairy cow diet is an effective strategy for replacing medium-chain saturated fatty acids (SFA) with cis-monounsaturated fatty acids (MUFA) in bovine milk, but there is limited information on the optimum level of supplementation. Decreases in SFA due to plant oils are also accompanied by increases in milk trans fatty acid (FA) content and it is possible that high oleic acid rapeseeds may result in a higher enrichment of cis-9 18:1 and lower increases in trans FAs in milk compared with conventional varieties. Seven multiparous lactating Holstein-Friesian cows were allocated to one of seven treatments in an incomplete Latin square design with five 28-day experimental periods, to evaluate the effect of replacing calcium salts of palm oil distillate (CPO; 41 g/kg diet dry matter, DM) with 128, 168 or 207 g/kg diet DM of conventional (COR) or a high oleic acid (HOR) rapeseed fed as a supplement milled with wheat. Rapeseed variety and inclusion level had no effect (P > 0.05) on DM intake, milk yield and composition. Both rapeseed varieties decreased linearly (P < 0.001) milk fat SFA content, which was partially compensated for by a linear increase (P < 0.001) in cis-9 18:1 concentration. Reductions in milk SFA were also associated with increases (P < 0.05) in trans 18:1 and total trans FA content, with no difference (P > 0.05) between rapeseed varieties. Replacing CPO in the diet with milled rapeseeds had no effect (P > 0.05) on total milk conjugated linoleic acid (CLA) concentration. Relative to a COR, inclusion of a high oleic acid variant in the diet increased (P = 0.01) the ratio of trans-MUFA :trans-polyunsaturated fatty acids in milk that may have implications with respect to cardiovascular disease risk in humans. In conclusion, data indicated that replacing CPO with milled rapeseeds at levels up to 1150 g oil/day could be used as a nutritional strategy to lower milk SFA content without inducing adverse effects on DM intake and milk production. HOR reduced milk fat SFA content to a greater extent than a conventional variety, but did not minimise associated increases in trans FA concentrations. However, the high oleic acid variant did alter the relative abundance of specific trans 18:1, CLA and trans 18:2 isomers compared with conventional rapeseeds.

Kliem, K. E., et al. (2013). "Seasonal variation in the fatty acid composition of milk available at retail in the United Kingdom and implications for dietary intake." Food Chemistry **141**(1): 274-281.

Milk and dairy products are major sources of fat in the human diet, but there are few detailed reports on the fatty acid composition of retail milk, trans fatty acids in particular, and how these change throughout the year. Semi-skimmed milk was collected monthly for one year from five supermarkets and analysed for fatty acid composition. Relative to winter, milk sold in the summer contained lower total saturated fatty acid (SFA; 67 vs 72 g/100 g fatty acids) and higher cis-monounsaturated fatty acid (MUFA; 23 vs 21 g/100 g fatty acids) and total trans fatty acid (6.5 vs 4.5 g/100 g fatty acids) concentrations. Concentrations of most trans-18:1 and -18:2 isomers also exhibited seasonal variation. Results were applied to national dietary intakes, and indicated that monthly variation in the fatty acid composition of milk available at retail has limited influence on total dietary fatty acid consumption by UK adults. (C) 2013 Elsevier Ltd. All rights reserved.

Kochan, Z., et al. (2010). "Dietary trans-fatty acids and metabolic syndrome." Postepy Higieny I Medycyny Doswiadczalnej **64**: 650-658.

Trans-fatty acids (TFAs), products of partial hydrogenation of vegetable oils, have become more prevalent in our diet since the 1960s, when they replaced animal fats. TFAs also occur naturally in meat and dairy products from ruminants. There is growing evidence that dietary trans-fatty acids may increase the risk of metabolic syndrome. Several studies have demonstrated adverse effects of TFAs on plasma lipids and lipoproteins. In dietary trials, trans-fatty acids have been shown to raise the total cholesterol/HDL cholesterol ratio and Lp(a) levels in blood. Moreover, a high intake of TFAs has been associated with an increased risk of coronary heart disease. Prospective cohort studies have shown that dietary trans-fatty acids promote abdominal obesity and weight gain. In addition, it appears that TFA consumption may be associated with the development of insulin resistance and type 2 diabetes. The documented adverse health effects of TFAs emphasise the importance of efforts to reduce the content of partially hydrogenated vegetable oils in foods.

Koga, T., et al. (1997). "Linoleic and alpha-linolenic acids differently modify the effects of elaidic acid on polyunsaturated fatty acid metabolism and some immune indices in rats." British Journal of Nutrition **77**(4): 645-656.

To explore whether the metabolic responses to trans, compared with cis, fatty acids depend on the source of dietary polyunsaturated fatty acids (PUFA), male Sprague-Dawley rats, 5 weeks old, were fed on diets containing 30 g oleic (cis) or elaidic (trans) acids/kg in combination with either 70 g perilla oil (alpha-linolenic acid) or safflowerseed oil (linoleic acid)/kg for 3 weeks in separate experiments, The dietary fats were adjusted to have the same level of total PUFA, The dietary manipulation did not influence the growth indices, but spleen weight was greater when the dietary PUFA source was perilla oil, The incorporation of trans fatty acid into liver phosphatidylcholine, phosphatidylethanolamine, phosphatidylinositol and phosphatidylserine and adipose tissue lipids, particularly phospholipids, was significantly higher when rats were fed on safflowerseed oil compared with perilla oil, However, only limited differences were observed in the effects of cis and trans fatty acids on the proportions of PUFA in liver phospholipids. Splenic production of prostaglandin E-2 was reduced by trans fatty acid when safflowerseed oil was the PUFA source, but no trans effect was observed on leukotriene C-4 production, Dietary PUFA significantly influenced the concentration of plasma immunoglobulins (Ig) but the effect of geometry was only seen in IgG which was increased by trans acid, Dietary trans fatty acid increased the CD4(+):CD8(+) T-lymphocyte ratio in the spleen, reflecting a decreasing trend of the proportion of CD8(+), when combined with perilla oil, These observations indicate that the type of PUFA simultaneously ingested specifically influences the effect that trans acid exerts on PUFA metabolism, eicosanoid production and some immune indices.

Kolanowski, W. and G. Laufenberg (2006). "Enrichment of food products with polyunsaturated fatty acids by fish oil addition." European Food Research and Technology **222**(3-4): 472-477.

Fish oil remains the main dietary source of long chain polyunsaturated fatty acids omega-3, which desirably impact on human health. Increase of omega-3 fatty acids intake is currently recommended. Results of many studies showed that consumption of food products enriched with fish oil offers the potential health benefits, especially in protection against cardiovascular diseases (CVD), cancer and improvement of brain development and function. Health influence, methods, advantages and disadvantages of food enrichment with fish oil as well as characteristics of market of such products were presented.

Koletzko, B. (1991). "INTAKE, METABOLISM AND BIOLOGICAL EFFECTS OF TRANS-ISOMERIC FATTY-ACIDS WITH INFANTS." Nahrung-Food **35**(3): 229-283.

Consumption of trans-fatty acids increased markedly during this century due to the widespread use of partially hydrogenated fats. A sensitive analytical method was developed which enables the precise determination of 7 trans-isomers in small sample volumes. With this method we documented the materno-fetal transfer of trans-fatty acids across the human placenta. The content in human milk depends on maternal diet and is lower in Germany than in the Sudan. The distribution in fore- and hind-milk, in milk fat fractions and within the triglyceride molecule was determined. The content of trans-fatty acids is lower in commercial and home-made infant formulae than in human milk, although there is a certain batch to batch variation in formulae. Infants absorb dietary trans-isomers and incorporate them into endogenous lipids, subcutaneous tissue and cell membranes. Trans-fatty acids in plasma lipids are significantly higher in infants fed human milk than in those fed formulae. African children have a lower exposure than Germans. The relative contribution of trans-octadecenoic acid is lower in plasma sterolesters than in triglycerides and phospholipids, pointing to a negative selectivity of plasmatic cholesterol esterification with this fatty acid. Thus, a high supply of trans-octadecenoic acid might have negative effects on the cholesterol levels. In premature infants we found an inverse correlation between trans-fatty acid exposure and birthweight, thus interference with intrauterine growth appears possible. A possible causative factor could be impaired biosynthesis of long-chain polyunsaturated fatty acids by trans-isomers, for which we found strong indications. The results of our investigations the question whether the consumption of trans-fatty acids in pregnant and lactating women and in infants is nutritionally safe.

Koletzko, B. and T. Decsi (1997). "Metabolic aspects of trans fatty acids." Clinical Nutrition **16**(5): 229-237.

The consumption of trans isomers of unsaturated fatty acids has been associated with untoward metabolic effects. Several clinical investigations demonstrated that trans fatty acids increase plasma LDL-cholesterol and lipoprotein (a) and reduce HDL-cholesterol concentrations. These alterations of plasma lipid profiles indicate an atherogenic effect of trans fatty acids. Both in preterm infants and in healthy children aged 1-15 years, we found blood plasma arachidonic acid (C20:4 omega-6) levels and the product/substrate ratios of arachidonic acid synthesis (C20:4 omega-6/C18:2 omega-6) inversely correlated to the level of the principal trans fatty acid, trans octadecaenoic acid (C18:1 omega-9/7, trans), which is compatible with a dose-dependent inhibition of arachidonic acid synthesis by trans fatty acids. Moreover, in premature infants trans fatty acids in blood plasma correlated inversely with birth weight in an observational study, indicating that trans fatty acids may impair early human growth. It appears desirable to limit the dietary intake of trans fatty acids. The major dietary sources of trans fatty acids are partially hydrogenated vegetable and fish oils, Refinement of the industrial technology of partial hydrogenation and appropriate food labelling may lead to a considerably decrease of human exposure to trans fatty acids.

Kopec, A., et al. (2011). "PROFILE AND HEALTH-RELATED PROPERTIES OF PLANT STEROLS." Zywnosc-Nauka Technologia Jakosc **18**(3): 5-14.

Sterols are basic components of cell membranes in animal and plant organisms. So far, almost 40 types of plant sterols have been identified, and, among them, the most known and the most commonly occurring are: beta-sitosterol, kampesterol, and stigmasterol. Stanols constitute their saturated type obtained during the hydrogenation of sterols. Phytosterols are natural plant components of, for example: soybeans, plant oils, rice, and pine wood. Small amounts of phytosterols are also in nuts, vegetables, and fruits. An adequate measured quantity of plant sterols is able to essentially reduce the cholesterol level in blood. The mechanism of their activity consists in decreasing the intestinal absorption of cholesterol by replacing it in micelles. Extensive clinical research projects showed that a dose of 2 - 3 g sterols per day caused the level of total cholesterol to be reduced by about 10 % and the LDL fraction to be decreased by ca. 15 %. The intake of those compounds reduces the risk of heart attack and prevents atherosclerosis and coronary heart disease. Therefore, plant sterols are more and more often added to food products, among other things to margarines, oils, yogurts, ripening cheeses, bakery products, muesli, juices and fruit beverages.

Koppe, S. W. P., et al. (2009). "Trans fat feeding results in higher serum alanine aminotransferase and increased insulin resistance compared with a standard murine high-fat diet." American Journal of Physiology-Gastrointestinal and Liver Physiology **297**(2): G378-G384.

Koppe SW, Elias M, Moseley RH, Green RM. Trans fat feeding results in higher serum alanine aminotransferase and increased insulin resistance compared with a standard murine high-fat diet. Am J Physiol Gastrointest Liver Physiol 297: G378-G384, 2009. First published June 18, 2009; doi: 10.1152/ajpgi.90543.2008.-Diets high in trans fats are associated with an increased risk of cardiovascular disease and components of the metabolic syndrome. The influence of these toxic fatty acids on the development of nonalcoholic fatty liver disease has not been significantly examined. Therefore, we sought to compare the effect of a murine diet high in trans fat to a standard high-fat diet that is devoid of trans fats but high in saturated fats. Male AKR/J mice were fed a calorically identical trans fat diet or standard high-fat diet for 10 days, 4 wk, and 8 wk. Serum alanine aminotransferase (ALT), lipid, insulin, and leptin levels were determined and the quantitative insulin-sensitivity check index (QUICKI) was calculated as a measure of insulin resistance. Additionally, hepatic triglyceride content and gene expression of several proinflammatory genes were assessed. By 8 wk, trans fat-fed mice exhibited higher ALT values than standard high-fat-fed mice (126 +/- 16 vs. 71 +/- 7 U/l, P < 0.02) despite similar hepatic triglyceride content at each time point. Trans fat-fed mice also had increased insulin resistance compared with high-fat-fed mice at 4 and 8 wk with significantly higher insulin levels and lower QUICKI values. Additionally, hepatic interleukin-1 beta (IL1 beta) gene expression was 3.6-fold higher at 4 wk (P < 0.05) and 5-fold higher at 8 wk (P < 0.05) in trans fat-fed mice compared with standard high-fat-fed mice. Trans fat feeding results in higher ALT values, increased insulin resistance, and elevated IL-1 beta levels compared with standard high-fat feeding.

Korver, O. and M. B. Katan (2006). "The elimination of trans fats from spreads: How science helped to turn an industry around." Nutrition Reviews **64**(6): 275-279.

Mensink and Katan showed in 1990 that trans fiats reduce high- and increase low-density lipoprotein cholesterol. Unilever aided this study because the company considered knowledge on trans fats incomplete in spite of their long history of safe use. The decision in 1994 to remove trans fats from Unilever's retail spreads was triggered by media events, but it was built on a solid understanding of the nutritional and technological aspects of trans fats. Over the next 14 years, manufacturers worldwide followed suit. This experience illustrates that food companies need to know about the health effects of their products and how to apply that knowledge.

Kostogrys, R. B., et al. (2012). "Effects of margarine supplemented with T10C12 and C9T11 CLA on atherosclerosis and steatosis in apoE/LDLR -/- mice." Journal of Nutrition Health & Aging **16**(5): 482-490.

The objective of this study was to evaluate functional effects of margarine supplemented with individual CLA isomers trans-10, cis-12 and cis-9, trans-11 in apoE/LDLR -/- mice. In LONG experiment (LONG), two-month old mice with no atherosclerosis were assigned to experimental groups and fed for the next 4 months. In SHORT experiment (SHORT), four-month old mice, with pre-established atherosclerosis, were assigned to experimental groups and fed for the next 2 months. The experimental diets were: ALN-93G (margarine), AIN-93G + 0.5% trans-10, cis-12 CLA (tl0cl2), and AIN-93G + 0.5% cis-9, trans-11 CLA (c9tll). In both experiments (LONG and SHORT), liver weight was significantly (P < 0.05) increased in mice fed t110c12 CLA. Hepatic steatosis was found in animals fed t110c12 diet and no signs of the steatosis was observed in mice fed c9tll CLA. Dietary treatments with t110c12 CLA significantly increased total plasma cholesterol and plasma triacylglycerols. There were no isomer-specific effects of CLA isomers on area of atherosclerotic plaque in aortic root. In conclusion, t110c12 CLA significantly increased liver weight in mice in LONG and SHORT experiments. Our results do not support the notion that CLA isomer supplementation to the margarine possess anti-atheroclerotic effect. Therefore, no isomer-specific effects of CLA on development of atherosclerosis were observed.

Kostogrys, R. B., et al. (2012). "Low carbohydrate, high protein diet promotes atherosclerosis in apolipoprotein E/low-density lipoprotein receptor double knockout mice (apoE/LDLR-/-)." Atherosclerosis **223**(2): 327-331.

Although in apoE/LDLR-/- mice atherosclerotic plaques develop spontaneously, various atherogenic diets (e. g. Western diet) are frequently used to accelerate the disease in this model. The objective of this study was to compare the effects on atherosclerosis of Western diet and other types of high-fat, high cholesterol, hypertriglyceridemic diets with the effects of the low carbohydrate, high protein (LCHP) diet. 16-18 week old mice with pre-established atherosclerosis were assigned to experimental groups and fed for the next 10 weeks with control diet, margarine diet (margarine 7%), hypertrigliceridemic diet (fructose 62%), high-fat diet (Western diet), high cholesterol diet (egg yolk diet) or with LCHP diet. No differences in body weight were observed among experimental groups. Plasma cholesterol concentration was significantly increased in egg yolk diet- and LCHP diet-fed apoE/LDLR-/- mice as compared to other types of diets. Plasma concentration of triacylglycerols was significantly elevated in egg yolk diet- and LCHP diet-fed apoE/LDLR-/- mice. The area of atherosclerotic plaques in the aortic root was substantially increased in LCHP diet-fed mice as compared to other types of diets. Furthermore, in brachiocephalic arteries of LCHP diet-fed mice there was evidence of plaque rupture. In conclusion, the LCHP diet promoted atherosclerosis in apoE/LDLR-/- mice more intensively than classical Western diet and favored the development of unstable lesions. (C) 2012 Elsevier Ireland Ltd. All rights reserved.

Kraft, J., et al. (2011). "Differential Effects of the trans-18:1 Isomer Profile of Partially Hydrogenated Vegetable Oils on Cholesterol and Lipoprotein Metabolism in Male F1B Hamsters." Journal of Nutrition **141**(10): 1819-1826.

Trans-fatty acid consumption from partially hydrogenated vegetable oil (PHVO) has been positively associated with multiple cardiovascular disease risk factors and events. This study was designed to examine the effects of trans-fatty acid isomer profile of PHVO on plasma lipids and lipoproteins and hepatic expression of key genes involved in cholesterol and fatty acid metabolism. Thirty-three male FIB strain Syrian Golden Hamsters were allocated to 1 of 3 hypercholesterolemic diets containing (5% by weight): 1) tristearin (control fat (CON)1; 2) partially hydrogenated high-oleic acid sunflower oil (PH-SUN); or 3) partially hydrogenated high-linoleic acid safflower oil (PH-SAF). PH-SUN contained more trans-4 to trans-10 18:1 compared with PH-SAF, which contained more trans-11 to trans-16 18:1. The addition of both PHVO to the diet increased plasma total cholesterol concentrations relative to CON, but only PH-SUN increased the plasma ratio of non-HDL:HDL cholesterol compared with CON. PH-SUN increased VLDL (total, large, and medium) and IDL particle concentrations while decreasing total, medium, and small HDL particle concentrations relative to CON. Both PHVO diets increased the hepatic cholesterol ester concentration, whereas the hepatic TG concentration was lower in PH-SUN compared with PH-SAF and CON. Levels of hepatic LDL receptor, HMG-CoA reductase, and sterol response element binding protein 1 mRNA were specifically reduced in the PH-SUN group compared to the CON group. Expression of SREBP1c was upregulated in both PHVO groups compared to CON, whereas only the PH-SAF group had higher levels of the lipogenic enzymes acetyl-CoA carboxylase, fatty acid synthase, and stearoyl-CoA desaturase-1 compared to CON. These results indicate that differences in the trans-fatty acid profile of PHVO can differentially affect lipid and lipoprotein metabolism. J. Nutr. 141: 1819-1826, 2011.

Kratz, M., et al. (2007). "Similar serum plant sterol responses of human subjects heterozygous for a mutation causing sitosterolemia and controls to diets enriched in plant sterols or stanols." European Journal of Clinical Nutrition **61**(7): 896-905.

Objective: We investigated the serum phytosterol responses of heterozygous relatives of sitosterolemia patients to diets enriched in phytosterols or stanols. Design: Randomized double-blind crossover design. Setting: Muenster, Germany. Subjects: Eight heterozygous and 13 control subjects were recruited. One heterozygote and three controls dropped out. Interventions: Seven heterozygotes and 10 controls received daily portions of margarine containing 2 g of plant sterols, 2 g of stanols or a control margarine for 6 weeks each in a randomized order. These phases were intercepted by wash-out periods of 6 weeks each. Results: Compared to the control period, serum phytosterol concentrations increased overall by more than 20% when subjects consumed the plant sterol margarine (F((1,15)) = 8.719, P = 0.01), with no significant difference between heterozygotes (mean +14.5 (s.d. 17.2) mu mol/ l, +23.0%) and controls (+4.9 (9.9) mu mol/l, 20.5%; F((1,15)) = 2.168, P = 0.162), but decreased when subjects consumed the stanol-enriched margarine (F((1,15)) = 12.124, P = 0.003), again to a similar extent in heterozygotes (-34.2 (41.2) mu mol/l, -54.2%) and controls (-12.2 (9.2) mu mol/l, -50.6%; F((1,15)) 2.729, P = 0.119). The lowest total serum concentrations of cholesterol and phytosterols were seen after the diet enriched in stanols. Serum stanol concentrations increased on this diet, but on a very low level and never exceeded 0.05% of serum cholesterol levels in any subject. Conclusions: Serum phytosterol concentrations increased only moderately in heterozygotes consuming a diet enriched in phytosterols, indicating that they retained considerable capacity to excrete phytosterols even at higher intakes. Sponsorship: Supported by a grant of the Stifterverband fur die Deutsche Wissenschaft (project number TS022/12372/2002) to MK.

Krauss, R. M., et al. (2000). "AHA dietary guidelines - Revision 2000: A statement for healthcare professionals from the nutrition committee of the American Heart Association." Circulation **102**(18): 2284-2299.

Krauss, R. M., et al. (2000). "AHA dietary guidelines - Revision 2000: A statement for healthcare professionals from the Nutrition Committee of the American Heart Association." Stroke **31**(11): 2751-2766.

Krauss, R. M., et al. (2001). "Revision 2000: A statement for healthcare professionals from the nutrition committee of the American Heart Association." Journal of Nutrition **131**(1): 132-146.

Kravic, S. Z., et al. (2011). "Fatty acid composition including trans-isomers of Serbian biscuits." Hemijska Industrija **65**(2): 139-146.

An experimental study was carried out with the aim of evaluating the quality of the lipid fraction of Serbian biscuits. Total fat contents of the biscuit samples ranged between 10.2 and 24.5%. The saturated, cis-monounsaturated and cis-polyunsaturated fatty acid contents were within the ranges of 18.5-85.6%, 10.6-49.9% and 2.7-13.3% of total fatty acids, respectively. The content of trans-fatty acids (TFA) ranged from 0.0 to 42.5% and the mean was 10.2%. In a total of 34 investigated samples, 10 of them were found to be trans-free, 8 contained low level of TFA (under 2%), 4 samples contained between 2 and 10% of TFA, while 12 samples contained very high amounts of TFA (12.0-42.5%). The results obtained showed a considerable variability in fatty acid composition of biscuits which indicated that different types of fats and oils were used for production of biscuits in Serbia.

Kreuzer, J. (2011). "Phytosterols and phytostanols: is it time to rethink that supplemented margarine?" Cardiovascular Research **90**(3): 397-398.

Krieglstein, J., et al. (2010). "Damage of Guinea Pig Heart and Arteries by a Trioleate-Enriched Diet and of Cultured Cardiomyocytes by Oleic Acid." Plos One **5**(3): A61-A70.

Background: Mono-unsaturated fatty acids (MUFAs) like oleic acid have been shown to cause apoptosis of cultured endothelial cells by activating protein phosphatase type 2C alpha and beta (PP2C). The question arises whether damage of endothelial or other cells could be observed in intact animals fed with a trioleate-enriched diet. Methodology/Principal Findings: Dunkin-Hartley guinea pigs were fed with a trioleate-enriched diet for 5 months. Advanced atherosclerotic changes of the aorta and the coronary arteries could not be seen but the arteries appeared in a pre-atherosclerotic stage of vascular remodelling. However, the weight and size of the hearts were lower than in controls and the number of apoptotic myocytes increased in the hearts of trioleate-fed animals. To confirm the idea that oleic acid may have caused this apoptosis by activation of PP2C, cultured cardiomyocytes from guinea pigs and mice were treated with various lipids. It was demonstrable that oleic acid dose-dependently caused apoptosis of cardiomyocytes from both species, yet, similar to previous experiments with cultured neurons and endothelial cells, stearic acid, elaidic acid and oleic acid methylester did not. The apoptotic effect caused by oleic acid was diminished when PP2C alpha and beta were downregulated by siRNA showing that PP2C was causally involved in apoptosis caused by oleic acid. Conclusions/Significance: The glycerol trioleate diet given to guinea pigs for 5 months did not cause marked atherosclerosis but clearly damaged the hearts by activating PP2C alpha and beta. The diet used with 24% (wt/wt) glycerol trioleate is not comparable to human diets. The detrimental role of MUFAs for guinea pig heart tissue in vivo is shown for the first time. Whether it is true for humans remains to be shown.

Kris-Etherton, P. M., et al. (2002). "Bioactive compounds in foods: Their role in the prevention of cardiovascular disease and cancer." American Journal of Medicine **113**: 71-88.

"Bioactive compounds" are extranutritional constituents; that typically occur in small quantities in foods. They are being intensively studied to evaluate their effects on health. The impetus sparking this scientific inquiry was the result of many epidemiologic studies that have shown protective effects of plant-based diets on cardiovascular disease (CVD) and cancer. Many bioactive compounds have been discovered. These compounds vary widely in chemical structure and function and are grouped accordingly. Phenolic compounds, including their subcategory, flavonoids, are present in all plants and have been studied extensively in cereals, legumes, nuts, olive oil, vegetables, fruits, tea, and red wine. Many phenolic compounds have antioxidant properties, and some studies have demonstrated favorable effects on thrombosis and tumorogenesis and promotion. Although some epidemiologic studies have reported protective associations between flavonoids or other phenolics and CVD and cancer, other studies have not found these associations. Various phytoestrogens are present in soy, but also in flaxseed oil, whole grains, fruits, and vegetables. They have antioxidant properties, and some studies demonstrated favorable effects on other CVD risk factors, and in animal and cell culture models of cancer. However, because phytoestrogens act both as partial estrogen agonists and antagonists, their effects on cancer are likely complex. Hydroxytyrosol, one of many phenolics in olives and olive oil, is a potent antioxidant. Resveratrol, found in nuts and red wine, has antioxidant, antithrombotic, and anti-inflammatory properties, and inhibits carcinogenesis. Lycopene, a potent antioxidant carotenoid in tomatoes and other fruits, is thought to. protect against prostate and other cancers, and inhibits tumor cell growth in animals. Organosulfur compounds in garlic and onions, isothiocyanates in cruciferous vegetables, and monoterpenes in citrus fruits, cherries, and herbs have anticarcinogenic actions in experimental models, as well as cardioprotective effects. In summary, numerous bioactive compounds appear to have beneficial health effects. Much scientific research needs to be conducted before we can begin to make science-based dietary recommendations. Despite this, there is sufficient evidence to recommend consuming food sources rich in bioactive compounds. From a practical perspective, this translates to,recommending a diet rich in a variety of fruits, vegetables, whole grains, legumes, oils, and nuts. (C) 2002 by Excerpta Medica, Inc.

Krisetherton, P. M. (1995). "TRANS-FATTY-ACIDS AND CORONARY HEART-DISEASE RISK." American Journal of Clinical Nutrition **62**(3): S651-S708.

This review critically evaluates the scientific data on trans fatty acids and coronary heart disease (CHD) risk. Trans fatty acids are present in a variety of foods but they contribute only 4-12% of total dietary fat intake (2-4% of total energy intake) in the United States. The physical properties of trans fatty acids are intermediate between cis and saturated fatty acids, but a trans double bond is chemically less reactive than a cis double bond. Biochemical data indicate that trans fatty acids are subject to the same metabolic control mechanisms that regulate the metabolism of saturated and cis-isomeric fatty acids. Equivocal results have been reported in observational studies of trans fatty acid intake and CHD because of numerous methodologic limitations, including the difficulties inherent in quantifying trans fatty acid intake. Studies in hamsters indicate that trans fatty acids have a neutral effect on low-density-lipoprotein (LDL)-receptor activity, LDL-cholesterol production rate, and plasma LDL-cholesterol concentration. Other animal studies show no differences in atherosclerosis incidence or severity between diets containing hydrogenated and native vegetable oils. In clinical studies partially hydrogenated oils lower total and LDL-cholesterol concentrations when substituted for animal or vegetable fats rich in saturates but raise total and LDL-cholesterol concentrations when substituted for the unhydrogenated native oil. The effects of trans fatty acids on high-density lipoprotein cholesterol and lipoprotein(a) concentrations are unclear because of limited and conflicting clinical data. Data supporting a relation between trans fatty acid intake and CHD risk are equivocal compared with extensive data from studies in animals and humans linking saturated fat intake to CHD. Additional research is needed to resolve questions about the independent effects of trans fatty acids on plasma lipoproteins and their mechanisms of action.

Kritchevsky, D. (1982). "TRANS FATTY-ACID EFFECTS IN EXPERIMENTAL ATHEROSCLEROSIS." Federation Proceedings **41**(11): 2813-2817.

Kritchevsky, D. (1996). "The effects of dietary trans fatty acids." Chemistry & Industry(15): 565-567.

Kritchevsky, D. (1997). "Trans fatty acids and cardiovascular risk." Prostaglandins Leukotrienes and Essential Fatty Acids **57**(4-5): 399-402.

The major source of trans unsaturated fatty acid bearing fats (trans fats) is the partially hydrogenated fats present in margarines, salad and cooking oils. When ingested, trans fats are deposited in tissues but disappear when the nutritional stimulus is removed. They have no adverse effects on growth or reproduction in rats. Trans fats are hypercholesterolemic for rabbits and monkeys but no more atherogenic than their cis counterparts. In man, trans fats elevate cholesterol but the extent of elevation may depend on the level of dietary linoleic acid. In some, but not all, studies they elevate Lp(a); the difference may reflect the presence of specific trans isomers - an area that merits further studies. Tissue of subjects with coronary disease contain no more trans fatty acids than those of controls. Reviews of the literature by expert committees in the US and UK conclude that at current levels of intake dietary trans fats pose no health problems. However, more research is needed especially with regard to pregnancy, lactation, and neonatal health. Current concerns should not deflect our attention from the larger aspects of fat and health.

Kritchevsky, D. and S. C. Chen (2005). "Phytosterols - health benefits and potential concerns: a review." Nutrition Research **25**(5): 413-428.

Phytosterols have been used as blood cholesterol-lowering agents for the last half century. They have been shown to be effective and safe. Originally presented as a pharmaceutical formulation, phytosterols are now being added to an increasing variety of foodstuffs. On occasion, questions have arisen concerning their safety, but at the present time and at the current level of usage, no adverse effects have been observed. (c) 2005 Elsevier Inc. All rights reserved.

Kritchevsky, D., et al. (1980). "INFLUENCE OF DIETARY TRANS FATTY-ACID ON ATHEROSCLEROSIS IN RABBITS." Journal of the American Oil Chemists Society **57**(2): A131-A131.

Krogager, T. P., et al. (2012). "Identification of a potential biomarker panel for the intake of the common dietary trans fat elaidic acid (trans Delta 9-C18:1)." Journal of Proteomics **75**(9): 2685-2696.

Trans fatty acid intake has been correlated to an unfavorable plasma lipoprotein profile and an increased cardiovascular disease risk. The present study aimed to identify a plasma protein biomarker panel related to human intake of elaidic acid. The human liver cell line HepG2-SF was used as a model system, and the cells were maintained for seven days in serum-free medium containing 100 mu M elaidic acid (trans Delta 9-C18:1), oleic acid (cis Delta 9-C18:1) or stearic acid (C18:0). The secretomes were analyzed by stable isotope labeling of amino acids in cell culture (SILAC), difference in gel electrophoresis (DIGE) and gene expression microarray analysis. Twelve proteins were found to be differentially regulated based on SILAC data (>1.3 fold change, P-value <0.05), 13 proteins were found to be differentially regulated based on DIGE analysis (>1.3 fold change, P-value <0.05), and 17 mRNA transcripts encoding extracellular proteins were determined to be affected (>1.3 fold change, P-value <0.01) following the addition of elaidic acid compared to oleic acid or stearic acid. The results revealed that 37 proteins were regulated specifically in response to elaidic acid exposure, and nine of these proteins were confirmed to be regulated in this manner by using selected reaction monitoring mass spectrometry. (C) 2012 Elsevier B.V. All rights reserved.

Kromhout, D., et al. (2011). "n-3 Fatty Acids, Ventricular Arrhythmia-Related Events, and Fatal Myocardial Infarction in Postmyocardial Infarction Patients With Diabetes." Diabetes Care **34**(12): 2515-2520.

OBJECTIVE-We carried out a secondary analysis in high-risk patients with a previous myocardial infarction (MI) and diabetes in the Alpha Omega Trial. We tested the hypothesis that in these patients an increased intake of the n-3 fatty acids eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA), and alpha-linolenic acid (ALA) will reduce the incidence of ventricular arrhythmias and fatal MI. RESEARCH DESIGN AND METHODS-A subgroup of 1,014 post-MI patients with diabetes aged 60-80 years was randomly allocated to receive one of four trial margarines, three with an additional amount of n-3 fatty acids and one placebo for 40 months. The end points were ventricular arrhythmia related events and fatal MI. The data were analyzed according to the intention-to-treat principle, using multivariable Cox proportional hazards models. RESULTS-The patients consumed on average 18.6 g of margarine per day, which resulted in an additional intake of 223 mg EPA plus 149 mg DHA and/or 1.9 g ALA in the active treatment groups. During follow-up, 29 patients developed a ventricular arrhythmia related events and 27 had a fatal MI. Compared with placebo patients, the EPA-DHA plus ALA group experienced less ventricular arrhythmia related events (hazard ratio 0.16; 95% Cl 0.04-0.69). These n-3 fatty acids also reduced the combined end-point ventricular arrhythmia related events and fatal MI (0.28; 0.11-0.71). CONCLUSIONS-Our results suggest that low-dose supplementation of n-3 fatty acids exerts a protective effect against ventricular arrhythmia related events in post-MI patients with diabetes.

Kromhout, D., et al. (2010). "n-3 Fatty Acids and Cardiovascular Events after Myocardial Infarction." New England Journal of Medicine **363**(21): 2015-2026.

BACKGROUND Results from prospective cohort studies and randomized, controlled trials have provided evidence of a protective effect of n-3 fatty acids against cardiovascular diseases. We examined the effect of the marine n-3 fatty acids eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) and of the plant-derived alpha-linolenic acid (ALA) on the rate of cardiovascular events among patients who have had a myocardial infarction. METHODS In a multicenter, double-blind, placebo-controlled trial, we randomly assigned 4837 patients, 60 through 80 years of age (78% men), who had had a myocardial infarction and were receiving state-of-the-art antihypertensive, antithrombotic, and lipid-modifying therapy to receive for 40 months one of four trial margarines: a margarine supplemented with a combination of EPA and DHA (with a targeted additional daily intake of 400 mg of EPA-DHA), a margarine supplemented with ALA (with a targeted additional daily intake of 2 g of ALA), a margarine supplemented with EPA-DHA and ALA, or a placebo margarine. The primary end point was the rate of major cardiovascular events, which comprised fatal and nonfatal cardiovascular events and cardiac interventions. Data were analyzed according to the intention-to-treat principle, with the use of Cox proportional-hazards models. RESULTS The patients consumed, on average, 18.8 g of margarine per day, which resulted in additional intakes of 226 mg of EPA combined with 150 mg of DHA, 1.9 g of ALA, or both, in the active-treatment groups. During the follow-up period, a major cardiovascular event occurred in 671 patients (13.9%). Neither EPA-DHA nor ALA reduced this primary end point (hazard ratio with EPA-DHA, 1.01; 95% confidence interval [CI], 0.87 to 1.17; P = 0.93; hazard ratio with ALA, 0.91; 95% CI, 0.78 to 1.05; P = 0.20). In the prespecified subgroup of women, ALA, as compared with placebo and EPA-DHA alone, was associated with a reduction in the rate of major cardiovascular events that approached significance (hazard ratio, 0.73; 95% CI, 0.51 to 1.03; P = 0.07). The rate of adverse events did not differ significantly among the study groups. CONCLUSIONS Low-dose supplementation with EPA-DHA or ALA did not significantly reduce the rate of major cardiovascular events among patients who had had a myocardial infarction and who were receiving state-of-the-art antihypertensive, antithrombotic, and lipid-modifying therapy.

Kromhout, D., et al. (1995). "DIETARY SATURATED AND TRANS-FATTY-ACIDS AND CHOLESTEROL AND 25-YEAR MORTALITY FROM CORONARY-HEART-DISEASE - THE 7 COUNTRIES STUDY." Preventive Medicine **24**(3): 308-315.

Background. In the Seven Countries Study associations between intake of individual fatty acids and dietary cholesterol were studied in relation to serum cholesterol and 25-year mortality from coronary heart disease. All analyses concern only intercohort comparisons. Methods. In the baseline surveys carried out between 1958 and 1964, risk factors for coronary heart disease were measured among 12,763 middle-aged men constituting 16 cohorts in seven countries. In 1987 and 1988 equivalent food composites representing the average food intake of each cohort at baseline were collected locally and analyzed in a central laboratory. The vital status of all participants was verified at regular intervals during 25 years of follow-up. Results. Of the individual saturated fatty acids, the average population intake of lauric and myristic acid was most strongly related to the average serum cholesterol level (r > 0.8, P < 0.001). Strong positive associations were observed between 25-year death rates from coronary heart disease and average intake of the four major saturated fatty acids, lauric, myristic, palmitic, and stearic acid (r > 0.8, P < 0.001); the trans fatty acid elaidic acid (r = 0.78, P < 0.001); and dietary cholesterol (r = 0.55, P < 0.05). Conclusions. Interpreted in the light of experimental and clinical studies, the results of these cross-cultural analyses suggest that dietary saturated and trans fatty acids and dietary cholesterol are important determinants of differences in population rates of coronary heart disease death. (C) 1995 Academic Press, Inc.

Kuhnt, K., et al. (2007). "Dietary supplementation with trans-11-and trans-12-18 : 1 increases cis-9, trans-11-conjugated linoleic acid in human immune cells, but without effects on biomarkers of immune function and inflammation." British Journal of Nutrition **97**(6): 1196-1205.

Trans-fatty acid intake is associated with an increased risk of CHD and diabetes. The effects of single trans-fatty acid isomers are largely unexplored. The present study examined the effects of a 6-week supplementation with two trans-18:1 isomers (trans- I I and trans- 12) in human subjects on immune cells, several inflammatory and immunological biomarkers (for example, IL, TNF alpha, C-reactive protein, adiponectin, intercellular adhesion molecule-1, prostacyclin, phagocytic process). Following a 2-week adaptation period without supplements, the test group (n 12) received vaccenic acid (trans-11-18:1) and trans-12-18:1 in equal amounts (6-0 g/d) for 6 weeks. The control group (n 12) consumed an oil without trans-fatty acids and conjugated linoleic acids (CLA). Samples were collected at the end of both periods. Trans-11-and trans-12-18: I were significantly increased in cellular lipids. The endogenous synthesis of cis-9, trans-11-CLA from trans-11-18:1 was demonstrated via increased CLA in cellular lipids of the test group. Generally, trans-isomer supplementation did not affect either inflammatory biomarkers (for example, IL-6, IL-8, TNF alpha) or immune function (for example, phagocytosis) during the present study. The dietary supplementation of trans-11- and trans-12-18:1 (6g/d) and their accumulation in leucocytes had no effects on biomarkers of inflammation and immune function. However, because of the limited data on the safety of trans-fatty acid intake and effects of individual trans isomers on human health (for example, trans-9-18 : 1, trans- 10-18:1) at present, it is prudent to reduce trans-fat intake in general.

Kuhnt, K., et al. (2006). "Dietary supplementation with 11trans- and 12trans-18 : 1 and oxidative stress in humans." American Journal of Clinical Nutrition **84**(5): 981-988.

Background: High consumption of trans fat has been associated with high oxidative stress in humans, which could increase the risk of the development or acceleration of several diseases, such as atherosclerosis, cancer, and type 2 diabetes. Objective: Several urinary and blood biomarkers of oxidative stress [8-iso-prostaglandin-F2(alpha) (PGF(2 alpha)), 15-keto-dihydro-PGF(2 alpha), and 7,8-dihydro-8-oxo-2'-deoxy-guanosine in urine and alpha-, beta, gamma-, delta-tocopherol, and retinol in plasma] were monitored to evaluate the oxidative stress induced by dietary supplementation of 11trans- and 12trans-18:1 isomers in humans during a 6-wk intervention. Design: After a 14-d adaptation period free of trans fatty acid supplementation (baseline), the test group (n = 12) received 3.0 g 11trans-18:1/d and 3.0 g 12trans-18:1/d (Sigma 6.0 g/d), and the control group (n = 12) consumed a control oil free of trans fatty acids and conjugated linoleic acids for 6 wk. Results: The postintervention concentration of urinary 8-iso-PGF(2 alpha) (free radical-induced lipid peroxidation) in the test group was significantly higher than baseline and significantly higher than that observed in the control group. The concentrations of 15-ketodihydro-PGF(2 alpha) (cyclooxygenase-mediated inflammatory response indicator) and 7,8-dihydro-8-oxo-2'-deoxy-guanosine (oxidative DNA damage) were not affected by the 11trans- and 12trans-18:1 supplementation. Conclusions: Although an increase in urinary 8-iso-PGF(2 alpha) was observed and the effects of prolonged high (ie, > 5.0 g/d) consumption of trans fat could be relevant to the development of disease, the mean intakes of 11trans- and 12trans-18:1 in Europeans are estimated to be significantly below the amounts administered in this study (ie, 6.0 g/d); such low intakes could minimize the possible risk of detrimental effects on human health.

Kuksis, A. (2001). "Plasma non-cholesterol sterols." Journal of Chromatography A **935**(1-2): 203-236.

Increased levels of plasma sterols other than cholesterol can serve as markers for abnormalities in lipid metabolism associated with clinical disease. Premature atherosclerosis and xanthomatosis occur in two rare lipid storage diseases, Cerebrotendinous xanthomatosis (CTX) and sitosterolemia. In CTX, cholestanol is present in all tissues. In sitosterolemia, dietary campesterol and sitosterol accumulate in plasma and red blood cells. Plasma accumulation of oxo-sterols is associated with inhibition of bile acid synthesis and other abnormalities in plasma lipid metabolism. Inhibition of cholesterol biosynthesis is associated with plasma appearance of precursor sterols. The increases in non-cholesterol sterols, while highly significant, represent only minor changes in plasma sterols, which require capillary gas-liquid chromatography and MS for effective detection, identification and quantification. (C) 2001 Elsevier Science B.V. All rights reserved.

Kummerow, F. A. (2009). "The negative effects of hydrogenated trans fats and what to do about them." Atherosclerosis **205**(2): 458-465.

Partially hydrogenated vegetable oils have been in the American diet since 1900. More than 50 years ago they were found to contain trans fatty acids that were different from natural fatty acids in plant oils and in animal fat. There was growing evidence that the consumption of trans fats have negative health effects, including increasing plasma lipid levels. In 2003, the Food and Drug Administration (FDA) ruled that the amount of trans fat in a food item must be stated on the label after January 1, 2006; food items could be labeled 0% trans if they contain less than 0.5 g/serving. Since the initial ruling, it is now known that the fatty acids in partially hydrogenated vegetable oil are 14 cis and trans isomers of octadecenoic and octadecadienoic acids that are formed during hydrogenation. They cause inflammation and calcification of arterial cells: known risk factors for coronary heart disease (CHD). They inhibit cyclooxygenase, an enzyme required for the conversion of arachidonic acid to prostacyclin, necessary for the regulation of blood flow. There have been several reformulations of hydrogenated fat containing varying amounts of trans fatty acids and linoleic acid, an essential fatty acid that is converted to arachidonic acid. Epidemiological data suggest that when trans fat percentages go up and linoleic acid percentages go down, death rates rise; when trans goes down, death rates go down. In spite of the harmful effects of trans fats, the FDA allows it in the food supply as long as the amount in a food item is declared on the label. Trans fat should be banned from the food supply. (C) 2009 Elsevier Ireland Ltd. All rights reserved.

Kummerow, F. A., et al. (1993). "PLASMA-LIPID PHYSICAL-PROPERTIES IN SWINE FED MARGARINE OR BUTTER IN RELATION TO DIETARY MAGNESIUM INTAKE." Journal of the American College of Nutrition **12**(2): 125-132.

Plasma lipids obtained from swine which had been fed butter or margarine at two dietary magnesium (Mg) levels indicated that the level of dietary Mg was more significant to plasma total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C) and high-density lipoprotein cholesterol (HDL-C) levels than was the presence of butter or margarine. At 270 mg Mg/kg, which is considered adequate for swine, there was a significant difference in the plasma TC between swine fed margarine and those fed butterfat (105 and 126 mg %, respectively). Plasma LDL-C was higher in swine fed butter than in those fed margarine (88 and 71 mg %, respectively). In swine fed an additional 247 mg Mg/kg, however, there was no significant difference in plasma TC between those fed margarine or butter. Although at 247 mg Mg/kg plasma LDL-C was higher in swine fed margarine and HDL-C was higher in those fed butter, there were no significant differences in the order parameters of LDL and HDL. Studies in which the influences of dietary fats on plasma cholesterol were first noted were carried out on liquid diets deficient in Mg. Mg, a cofactor in the enzymes involved in desaturation of saturated fatty acids, is also necessary in desaturation of linoleic to arachidonic acid.

Kummerow, F. A., et al. (2004). "Trans fatty acids in hydrogenated fat inhibited the synthesis of the polyunsaturated fatty acids in the phospholipid of arterial cells." Life Sciences **74**(22): 2707-2723.

Our hypothesis that the trans fatty acids in hydrogenated fat inhibited the synthesis of polyunsaturated fatty acids in the phospholipid of arterial cells was tested with five groups each with six pregnant porcine fed from d 35 of gestation and during lactation. The basal diet contained 2% corn oil (control). The other four diets included the control + 10% butter or 10% hydrogenated fat plus two levels of Mg. Plasma, milk and aortic phospholipid fatty acids, phospholipid composition and calcium content of the aorta from the piglets were determined. At 48 + 2 d of age, the aorta phospholipid of piglets from porcine fed hydrogenated fat contained a significantly higher concentration of linoleic acid, less arachidonic acid, and less long chain polyunsaturated fatty acid (PUFA) than did piglets from porcine fed either butterfat or the control diet. Mg had no effect. These changes in composition in piglets from porcine fed hydrogenated fat indicate that trans fat inhibits the metabolic conversion of linoleic acid to arachidonic acid and to other n-6 PUFA. The aortic calcium content data showed a significant interaction of calcium concentration with age. We concluded: 1) that dietary trans fat perturbed essential fatty acid (EFA) metabolism which led to changes in the phospholipid fatty acid composition in the aorta, the target tissue of atherogenesis, 2) this inhibition of EFA to PUFA by the isomeric fatty acids in hydrogenated fat is a risk factor in the development of coronary heart disease. (C) 2004 Elsevier Inc. All rights reserved.

Kurbanli, K. and I. Mehmetoglu (2009). "Investigation of Lipid Peroxidation and Antioxidant Capacity of Rats Fed with Various Oils." Asian Journal of Chemistry **21**(3): 1910-1916.

In this study, the effects of the oils such as butter, olive oil, sunflower oil and margarine on the serum lipid peroxidation. oxidized low density lipoprotein (LDL) and serum total antioxidant activity were investigated. Except control group, rats of all groups have been nourished by a special fodder embracing 15% oil addition for a period of two months and were measured malondialdehyde (MDA), ox-LDL and antioxidant activity levels of samples. No significant difference was found in serum MDA and ox-LDL levels of the groups subjected to oil. However, when the serum total antioxidant activity levels were compared, it was noted that the measurements of olive oil group (1.08 +/- 0.23 nmol/mL) were statistically higher (p < 0.05) than those of sunflower oil group (0,83 +/- 0.12 nmol/mL). In addition to this. serum total antioxidant activity values of butter group (1.17 +/- 0.14 nmol/mL) were statistically higher (p < 0.001) than those of sunflower group (0.93 +/- 0.12 nmol/mL). It was found that MDA results decreased as; butter > margarine > olive oil > sunflower oil > control group and the antioxidant activity results decreased as: butter > control > olive oil > margarine > sunflower oil group. Butter gives the highest oxidized LDL and total antioxidant activity results and margarine gives the lowest oxidized low density. Sunflower oil gives the lowest total antioxidant activity results.

Kyro, C., et al. (2011). "Intake of whole grains in Scandinavia is associated with healthy lifestyle, socio-economic and dietary factors." Public Health Nutrition **14**(10): 1787-1795.

Objective: To identify the dietary, lifestyle and socio-economic factors associated with the intake of whole grains (WG) in Norway, Sweden and Denmark. Design: A cross-sectional study. Setting: Subsample of the Scandinavian cohort 'HELGA' consisting of three prospective cohorts: The Norwegian Women and Cancer Study; The Northern Sweden Health and Disease Study; and the Danish Diet, Cancer and Health Study. Subjects: A total of 8702 men and women aged 30-65 years. Dietary data are from one 24 h dietary recall and data on socio-economic status and lifestyle factors including anthropometric values are from the baseline collection of data. Results: Vegetables, fruits, dairy products, fish and shellfish, coffee, tea and margarine were directly associated with the intake of WG, whereas red meat, white bread, alcohol and cakes and biscuits were inversely associated. Smoking and BMI were consistently inversely associated with the intake of WG. Furthermore, length of education was directly associated with the intake of WG among women. Conclusions: The intake of WG was found to be directly associated with healthy diet, lifestyle and socio-economic factors and inversely associated with less healthy factors, suggesting that these factors are important for consideration as potential confounders when studying WG intake and disease associations.

Laatikainen, T., et al. (2002). "Changes in cardiovascular risk factors and health behaviours from 1992 to 1997 in the Republic of Karelia, Russia." European Journal of Public Health **12**(1): 37-43.

Background: In Russia rapid changes have taken place both in total and chronic disease mortality during recent years. Little reliable information is available on the trends in conventional risk factors in Russia. Methods: Chronic disease risk factors and health behaviours were studied in the Republic of Karelia, Russia in 1992 and 1997, in population surveys connected with the National FINRISK Study in Finland. Independent random population samples (n=1000) of people aged between 25 and 64 years were drawn in both survey years. Surveys included a self-administered questionnaire, physical measurements and laboratory analyses. Results: The levels of systolic blood pressure, total serum cholesterol, and high-density lipoprotein cholesterol decreased among both genders from 1992 to 1997, but the difference between the survey years was statistically significant only among women. Both self-reported alcohol consumption and serum gamma-glutamyl transferase levels increased significantly in both men and women. There was a significant shift in the type of fat used on bread and in cooking, from butter use to use of margarine and vegetable oil, among both genders. Conclusions: As a whole the risk factor levels in the Republic of Karelia are high. However, some slight improvement in risk profile was seen. Positive changes in dietary habits, such as change in the quality of fat and associated reduction in serum cholesterol levels may have contributed to the decline in cardiovascular disease mortality seen in Russia since 1995. However, since smoking and elevated blood pressure levels as well as alcohol consumption are still highly prevalent, there is a great need for effective interventions.

Labonte, M. E., et al. (2011). "Comparison of the impact of trans fatty acids from ruminant and industrial sources on surrogate markers of cholesterol homeostasis in healthy men." Molecular Nutrition & Food Research **55**: S241-S247.

Scope: Mechanisms by which trans fatty acids (TFA) from industrial (iTFA) and ruminant (rTFA) sources alter cholesterol homeostasis are virtually unknown. We compared the impact of dietary iTFA and rTFA on surrogate markers of cholesterol absorption (beta-sitosterol and campesterol) and synthesis (lathosterol) in healthy men. Methods and results: In a randomized, controlled double-blind crossover study, 38 healthy men consumed three experimental isoenergetic diets for 4wk each. The three diets were (i) high in iTFA (10.2 g/2500 kcal), (ii) high in rTFA (10.2 g/2500 kcal) and (iii) control diet low in TFA from any source (2.2 g/2500 kcal). The sum of plasma beta-sitosterol and campesterol concentrations was significantly reduced after the iTFA diet compared with the control diet (-12%, p=0.050). The reduction in combined b-sitosterol and campesterol levels was larger in magnitude after the rTFA diet (-29% versus the control diet and -20% versus the iTFA diet, p<0.0001). The TFA-rich diets had no impact on plasma lathosterol concentrations. Conclusions: Very high intakes of rTFA and iTFA decrease cholesterol absorption but have no impact on cholesterol synthesis. Consumption of rTFA reduces cholesterol absorption to a greater extent than iTFA, but this difference does not ultimately affect plasma cholesterol concentrations.

Lacroix, E., et al. (2012). "Randomized controlled study of the effect of a butter naturally enriched in trans fatty acids on blood lipids in healthy women." American Journal of Clinical Nutrition **95**(2): 318-325.

Background: Whereas the negative effect of consuming trans fatty acids found in partially hydrogenated vegetable oils on cardiovascular disease (CVD) risk is well established, the effect of trans fatty acids from ruminant sources (rTFAs) on CVD risk factors has not yet been established, particularly among women. Objective: We investigated the effects of a butter naturally enriched in rTFAs, of which vaccenic acid is the predominant isomer, on plasma lipid concentrations among healthy women. Design: In a double-blind, randomized, crossover controlled study, 61 healthy women aged 19-70 y were fed 2 isoenergetic diets lasting 4 wk each. The 2 diets were defined as moderately high in rTFAs (3.7 g/d, 1.5% of daily energy) and control (0.9 g/d, 0.3% of daily energy). Results: No significant effect of the rTFA diet was found on total plasma cholesterol, LDL cholesterol, apolipoprotein B, apolipoprotein A-I, and triglyceride concentrations compared with the control diet. There was a small yet statistically significant reduction in plasma HDL-cholesterol concentrations with the rTFA diet (-2.8%; P = 0.004), which was significant (P for the BMI x treatment interaction = 0.006) among women with a BMI (in kg/m(2)) >= 25 (-5.2%; P = 0.004; n = 18) but not among women with a BMI <25 (-1.2%; P = 0.13; n = 43). Conclusions: These results suggest that an increase in dietary rTFAs equivalent to similar to 1% of daily energy has no significant effect on LDL but may be associated with a reduction in plasma HDL-cholesterol concentrations, particularly in overweight women. This trial is registered at clinicaltrials.gov as NCT00930137. Am J Clin Nutr 2012;95:318-25.

Laforest, L., et al. (2007). "Use of margarine enriched in phytosterols by patients at high cardiovascular risk and treated by hypolipidemic drugs." Nutrition Metabolism and Cardiovascular Diseases **17**(9): 657-665.

Background and aims: The use of phytosterol-enriched margarines (PEM) in patients at cardiovascular risk has not been thoroughly explored. We determined the proportion of users of PEM in a population at high cardiovascular risk, and their characteristics. In addition, the correlates of using at least 25 g/d of PEM were identified. Methods and results: Patients with at Least two cardiovascular risk factors in addition to dyslipidemia (primary prevention) or with past cardiovascular disease (secondary prevention) were recruited by general practitioners (GPs). Baseline characteristics were collected from a computerized GP database linked to a survey. GPs recorded patterns of PEM use. First, users were compared with non-users. Then, analyses were conducted to identify characteristics of patients using PEM at a recommended dose (>= 25 g/d). Among 1631 patients with documented consumption, a minority used PEM (15.2%), and only 36.4% of consumers used it at recommended level. Overall, PEM users did not differ from non-users as to general characteristics, nor as to the level of cardiovascular risk in primary prevention. However, PEM users reported significantly more cardiovascular events among their parents (OR = 1.4; 95% CI = [1.0-1.9]). Consumers who used at least 25 g/d of PEM were more likely to be men (OR = 3.1; 95% CI = [1.6-5.8]), to be aged 60-74 (OR=3.0; 95% CI = [1.4-6.4]), or 75 or older (OR=4.0; 95% Cl = [1.5-10.6]). Again, no difference was observed regarding the level of cardiovascular risk. Conclusions: The level of use of PEM was low in this population of high cardiovascular risk patients. In addition, only a third of users consumed margarine at the recommended level. Our data suggest that pattern of use of PEM is not related to the level of cardiovascular risk. (c) 2006 Elsevier B.V. All rights reserved.

Lagstrom, H., et al. (1999). "Nutrient intakes and cholesterol values of the parents in a prospective randomized child-targeted coronary heart disease risk factor intervention trial - the STRIP project." European Journal of Clinical Nutrition **53**(8): 654-661.

Objective: To analyze food consumption, nutrient intakes and serum cholesterol concentrations of the parents in a child-targeted CHD intervention trial, during which the age of children increased from 7 months to 5 y. Design and subjects: The children were randomized to an intervention group (n = 540) or a control group (n = 522) at six months of age. The intervention families were counseled at 3-6 month intervals to reduce their child's intake of saturated far and cholesterol. Dietary issues were discussed with the control families only briefly. The parents' food consumption was analyzed by 24 h dietary recall at the child's age of 7 and 13 months and at 2, 3, 4, and 5 y. Nutrient intakes were calculated using the Micro-Nutrica program(R) Results: The mothers and fathers of the intervention children used less butter, more margarine and more skim milk than those of the control children (P < 0.001 for all measurements). After the onset of counseling, the intervention mothers consumed continuously less fat (1.4 E% less at the child's age of 5 y), less saturated fat (1.5 E% less at the child's age of 5 y) and more polyunsaturated fat (0.5 E% more at the child's age of 5 y) than the control mothers (P = 0.008, P < 0.001 and P < 0.001 for trend, respectively). After the child's age of 13 months the intervention fathers also had a continuously lower fat intake (2.4 E% less at the child's age of 5 y) and consumed less saturated fat(1.5 E% less at the child's age of 5 y) than the control fathers (P < 0.001 for trend for both measurements). The serum cholesterol concentration of the intervention mothers was consistently lower than that of the control mothers during the intervention (at child's age of 5 y 4.86 and 5.09 mmol/L, respectively; P for trend = 0.03), while the values of the intervention and control fathers showed no differences. Conclusions: Continuous dietary intervention begun in infancy and focused on modification of the childs diet according to the current principles of preventive cardiology, was accompanied by a moderate decrease in the intake of total and saturated fat in the parents, but serum cholesterol concentration diminished consistently only in the mothers of the intervention children.

Laitinen, J., et al. (1996). "Diet and cardiovascular risk factors among Lapp and Finnish reindeer herders." Nutrition Research **16**(7): 1083-1093.

The aim was to evaluate and compare diet and dietary habits and levels of cardiovascular risk factors in Lapp and Finnish reindeer herders. Dietary data were obtained by postal inquiry and by 24-hour recall. Body weight, height and blood pressure were measured and blood tests taken during a visit to the local health centre. Subjects were 668 male reindeer herders in Finnish Lapland, 56 of whom were Lapps, 497 Finnish and 115 whose ethnic group remained unknown. The mean age of the subjects was 43 years. A high daily intake of total fat (42 %E), saturated fatty acids (24 %E) and dietary cholesterol (601 mg) and a low intake of carbohydrates and fibre were observed relative to dietary recommendations. One third of the herders were overweight (BMI over 27 kg/m(2)). Serum total cholesterol and systolic and diastolic blood pressure were elevated in the majority of the subjects, and 37 % of them were current smokers. The Lapps consumed more reindeer meat (194 g/day vs. 65 g/day, p<0.001), more margarine (14 g vs. 7 g, p<0.05) and less milk products (618 g vs. 929 g, p<0.001) than the Finns. Due to different food patterns, intakes of total fat, saturated fatty acids, calcium and riboflavin were lower in the Lapps but intakes of protein, potassium and iron were higher. The Lapps were 3 cm shorter than the Finns, but body weight and BMI were similar. Serum lipids and diastolic blood pressure were similar in both groups, but systolic blood pressure was lower in the Lapps (134 mmHg vs. 139 mmHg, p<0.05). It is concluded that the diet of reindeer herders is high in fat, especially saturated fatty acids, and thus atherogenic. Although the Lapps consumed considerably more reindeer meal and margarine and less milk products than the Finns, only slight differences were found the lipid pattern.

Laitinen, K. and H. Gylling (2012). "Dose-dependent LDL-cholesterol lowering effect by plant stanol ester consumption: clinical evidence." Lipids in Health and Disease **11**.

Elevated serum lipids are linked to cardiovascular diseases calling for effective therapeutic means to reduce particularly LDL-cholesterol (LDL-C) levels. Plant stanols reduce levels of LDL-C by partly blocking cholesterol absorption. Accordingly the consumption of foods with added plant stanols, typically esterified with vegetable oil fatty acids in commercial food products, are recommended for lowering serum cholesterol levels. A daily intake of 1.5 to 2.4 g of plant stanols has been scientifically evaluated to lower LDL-C by 7 to 10% in different populations, ages and with different diseases. Based on earlier studies, a general understanding is that no further reduction may be achieved in intakes in excess of approximately 2.5 g/day. Recent studies however suggest that plant stanols show a continuous dose-response effect in serum LDL-C lowering. This review discusses the evidence for a dose-effect relationship between plant stanol ester consumption and reduction of LDL-C concentrations with daily intakes of plant stanols of 4 g/day or more. We identified five such studies and the overall data demonstrate a linear dose-effect relationship with the most pertinent LDL-Cholesterol lowering outcome, 18%, achieved by a daily intake of 9 to 10 g of plant stanols. Along with reduction in LDL-C, the studies demonstrated a decrease in cholesterol absorption markers, the serum plant sterol to cholesterol ratios, by increasing the dose of plant stanol intake. None of the studies with daily intakes up to 10 g of plant stanols reported adverse clinical or biochemical effects from plant stanols. In a like manner, the magnitude of decrease in serum antioxidant vitamins was not related to the dose of plant stanols consumed and the differences between plant stanol ester consumers and controls were minor and insignificant or nonexisting. Consumption of plant stanols in high doses is feasible as a range of food products are commercially available for consumption including spreads and yoghurt type drinks. In conclusion, a dose-effect relationship of plant stanols in higher doses than currently recommended has been demonstrated by recent clinical studies and a meta-analysis. Further studies are called for to provide confirmatory evidence amenable for new health claim applications and dietary recommendations.

Laitinen, S., et al. (1995). "DIET OF FINNISH CHILDREN IN RELATION TO THE FAMILY SOCIOECONOMIC-STATUS." Scandinavian Journal of Social Medicine **23**(2): 88-94.

The differences between higher and lower socio-economic groups in food consumption, energy intake and nutrient density of the diet of Finnish 9- to 15-year-old children were examined in a study performed within the project entitled Cardiovascular Risk in Young Finns. Data on food consumption were collected using the 48-hour recall method. Family's socio-economic status was defined according to the father's educational level, his occupation, and family income. Children of families with higher socio-economic status used more fruit, low-fat milk, soft vegetable margarine and less high-fat milk, butter, rye products and coffee than did the children of families with lower socioeconomic status. Consequently, the main differences appeared in the fat, vitamin D, vitamin C and fatty acid content of the diet. Differences in energy intake and in mineral density of the diet were minor. If these childhood dietary differences remain in adulthood, it is possible that the present disparity between socio-economic groups in mortality from coronary heart disease will not disappear.

Larque, E., et al. (2003). "Fatty acid composition and nutritional relevance of most widely consumed margarines in Spain." Grasas Y Aceites **54**(1): 65-70.

This study examines the fatty acid composition of margarines of major consumption in Spain in 2000. All the margarines contained at least 20% of linoleic acid, the average content of this fatty acid being 38%. Saturated fatty acids (lauric and miristic acids) did not exceed 4% of the total fatty acid content. Most of the margarines analyzed contained less than 5% trans C 18: 1, although this content varied greatly among margarines (coefficient of variation: 112%) being median value 2.5%; polyunsaturated trans C18:2 and trans C18:3 did not represent more than 1%. Nutritionally important ratios like saturated/unsaturated fatty acids, thrombogenicity and atherogenicity indexes were lower than 0.5. The findings suggest that Spanish margarines have moved to becoming products with a potentially healthier distribution of fatty acids. Even so, the great variability shown in fatty acid composition of margarines and poor labeling, highlight the importance of greater consumer information to avoid upsetting the traditional Mediterranean diet of Spain.

Lau, V. W. Y., et al. (2005). "Plant sterols are efficacious in lowering plasma LDL and non-HDL cholesterol in hypercholesterolemic type 2 diabetic and nondiabetic persons." American Journal of Clinical Nutrition **81**(6): 1351-1358.

Background: Because of hyperglycemia and hyperinsulinemia, diabetic persons have higher cholesterol synthesis and lower cholesterol absorption rates than do nondiabetic persons. Differences in plant sterol efficacy between diabetic and nondiabetic persons have not been examined. Objective: The objective was to compare the degree of response of plasma lipid concentrations and glycemic control to plant sterol consumption in a controlled diet between hypercholesterolemic type 2 diabetic and nondiabetic subjects. Design: Fifteen nondiabetic subjects and 14 diabetic subjects participated in a double-blinded, randomized, crossover, placebo-controlled feeding trial. The diet included 1.8 g/d of either plant sterols or cornstarch placebo over 21 d, separated by a 28-d washout period. Results: Plant sterol consumption significantly reduced (P < 0.05) LDL-cholesterol concentrations from baseline in both nondiabetic and diabetic subjects by 15.1% and 26.8%, respectively. The diabetic subjects had significantly (P < 0.05) lower absolute concentrations of total cholesterol after treatment than did the nondiabetic subjects; however, there was no significant difference in the percentage change from the beginning to the end of the trial. There was also a significant decrease (P < 0.05) in absolute non-HDL-cholesterol concentrations after treatment in both groups. Conclusions: The results showed that plant sterols are efficacious in lowering LDL cholesterol and non-HDL cholesterol in both diabetic and nondiabetic persons. Plant sterol consumption may exist as a dietary management strategy for hypercholesterolemia in persons with type 2 diabetes.

Laufs, U. and S. H. Schirmer (2012). "Margarines supplemented with low dose n-3 fatty acids are not effective in secondary prevention." European Heart Journal **33**(13): 1555-1557.

Law, M. (2000). "Plant sterol and stanol margarines and health." British Medical Journal **320**(7238): 861-864.

Law, M. R. (1999). "Lowering heart disease risk with cholesterol reduction: evidence from observational studies and clinical trials." European Heart Journal Supplements **1**(S): S3-S8.

In considering any food or drug that lowers serum lipid levels, the question arises as to the expected reduction in heart disease mortality given the reduction in serum total or low-density lipoprotein (LDL) cholesterol. Such quantitative assessment of the relationship between heart disease and its risk factors is best done by analysing observational and trial data in tandem, since the two are complementary in strengths and weaknesses. Estimates based on trials alone are imprecise and short term. Observational data from cohort studies show that, in absolute units, the effect of a given cholesterol difference on heart disease risk is similar whether based on LDL or total serum cholesterol levels. The relationship between heart mortality ton a logarithmic scale) and serum cholesterol tin absolute units) fits a linear model extremely well, indicating that a constant absolute decrease in cholesterol from any point on the distribution in Western countries is associated with a constant proportionate decrease in heart disease mortality. The strength of the relationship varies with age, being proportionately stronger in younger age groups. In the age group 55-64 years, trial data show little reduction in heart disease risk in the first 2 years, but a reduction from the third year onwards that is remarkably close to the cohort study estimate of 27% for a 0.6 mmol.1(-1) cholesterol reduction. This result is important, showing that risk is reversed relatively quickly (after 2 years), and reinforcing the cohort study estimate of the size of the long-term effect. Therefore, a population dietary intervention that lowered serum cholesterol by 0.6 mmol. 1(-1) (10%) would reduce heart disease mortality after 2 years by about a quarter. Margarines containing plant sterol/stanol esters have been shown to reduce cholesterol by about this much. Such an effect is particularly important in Britain, where the population average serum cholesterol level has not changed significantly over many years. Although it might be considered preferable to direct dietary intervention to those with the highest cholesterol levels in a community, the large number of persons with cholesterol levels close to the average gives rise to many more heart disease deaths than the smaller number with relatively high levels, and reinforces the importance of a population-wide intervention.

Lea, L. J. and P. A. Hepburn (2006). "Safety evaluation of phytosterol-esters. Part 9: Results of a European post-launch monitoring programme." Food and Chemical Toxicology **44**(8): 1213-1222.

Phytosterol-esters were developed by Unilever as a cholesterol lowering novel food ingredient for use initially in vegetable oil spreads. In addition to an extensive package of safety studies and clinical studies a programme of post-launch monitoring (PLM) was developed. PLM was used to address the following questions: (a) Is the product use as predicted/recommended? (b) Are the known effects as predicted? (c) Does the product cause unexpected health effects? The overall conclusions from the PLM programme were: the product is being bought by the target population but intakes are less than the original assumptions made in the risk assessment; long-term use of phytosterol-ester enriched spreads results in a reduction in the serum levels of the most lipophilic carotenoids but at current levels of intake this is unlikely to result in reductions in carotenoids that are of biological significance; evaluation of health related consumer complaints have not indicated any unexpected health effects associated with the use of the product in the marketplace. As part of the European approval under Regulation (EC) No. 258/97 on Novel Foods and Food Ingredients the results of the PLM programme had to be submitted to the European Commission (EC) and reviewed by the Scientific Committee on Food (SCF). They concluded that the study provided valuable information, which complemented the pre-market safety evaluation studies, and that the EC mandatory requirement had been met. (c) 2006 Elsevier Ltd. All rights reserved.

Lecerf, J. M. (2007). "Phytosterols and cardiovascular risk." Nutrition Clinique Et Metabolisme **21**(1): 17-27.

Phytosterols are natural plant compounds. Phytostanols are derived from phytosterols hydrogenation. Both they inhibit intestinal dietary cholesterol absorption by competition, and they decrease LDL cholesterol by 8-15%, in a dose-dependant manner. They impair carotenoids bioavailability. A very small and variable part of phytosterols and phytostanols is absorbed. No epidemiological data is available for assessing the beneficial of plant sterols intake and cardiovascular risk. In the other hand there are many studies which have shown paradoxically a positive relationship between serum phytosterols concentrations and increase of the coronary heart disease risk. Other studies have established a link between the phytosterols absorption and their plasma and arterial plaque levels. Phytosterols and cholesterol hyperabsorbers subjects would be particularly involved in this unfavourable issue. Phytostanols could have a different effect from that point of view. In animal studies, data are less inconsistent with, in most of the studies, a lesser progression of atheroma lesions, perhaps due to an antiinflammatory effect of phytosterols in atheroma plaque. The place of phytosterols and phytostanols in the therapeutic step for cardiovascular prevention is actually not defined. Many queries are still open. Complementary studies are needed for improving the clinical indications and the efficiency of these compounds. (c) 2007 Elsevier Masson SAS. Tous droits reserves.

Lecerf, J. M., et al. (2009). "Small, qualitative changes in fatty acid intake decrease plasma low-density lipoprotein-cholesterol levels in mildly hypercholesterolemic outpatients on their usual high-fat diets." International Journal of Food Sciences and Nutrition **60**: 151-163.

Objective The diet is the first step in managing hypercholesterolemia. The objective of the present study is to assess whether moderate changes in dietary fatty acids improve plasma lipid parameters in mildly hypercholesterolemic outpatients. Methods Using a randomized double-blind study, 121 outpatients within two groups received an isocaloric amount of unsaturated margarine or butter. Clinical and anthropometric measurements and a 3-day food record were made. Chi-square and Fisher's tests were used to compare qualitative variables and the general linear procedure was used to compare the groups. Additional analyses were performed after adjustment. Results There was a significant difference (P < 0.03) in low-density lipoprotein-cholesterol levels between the groups. Total cholesterol, low-density lipoprotein-cholesterol, non-high-density lipoprotein-cholesterol and apolipoprotein B values decreased in the unsaturated group in comparison with the saturated group. Low-density lipoprotein-cholesterol changes were correlated with the variation in polyunsaturated fatty acid intake and with plasma phospholipid linoleic acid levels. Conclusion A small change in saturated by polyunsaturated fatty acid intake may improve plasma lipid parameters in mildly hypercholesterolemic subjects.

Ledoux, M. and L. Laloux (2006). "Conjugated linoleic acids: occurrence in food and physiological properties." Sciences Des Aliments **26**(4): 291-314.

Conjugated linoleic acids (CLA) refer to a group of linoleic acid (18:2 9c, 12c) isomers in which the double bonds are conjugated. Produced during the rumination, CLA are naturally found in dairy products that the main CLA is the rumenic acid 18:2 9c, 11t (> 85% total CLA). CLA are also produced during catalytic hydrogenation and during heating process, but in that cases, CLA contents are low and isomer distribution drastically different. During chemical synthesis, the 18:2 10t, 12c isomer is one of the main CLA isomers while it is almost absent from milk fat. CLA intake depends on food consumption, especially on dairy product intake. The average intake in French population is about 0.18-0.21 g CLA/d. CLA are incorporated in body fat and metabolized, differently according to the isomers. During experimental studies on animals, CLA shown physiological properties potentially interesting on fat mass/lean mass repartition, on cancer development, on immune response, on some components of the metabolic syndrome, and on some markers of atherosclerosis risks. On the opposite, 18:2 10t, 12c isomer is responsible of hepatic steatosis. Recently, studies were done to transpose these findings on human. When some would envisage to increase CLA intakes via ruminant feeding or using food complements, it seems interesting to review knowledge on CLA.

Ledoux, M., et al. (2000). "Trans fatty acid isomers: origin and occurrence in food." Sciences Des Aliments **20**(4-5): 393-411.

Experimental and epidemiological studies have recently pointed out the influence of trans fatty acids on plasmatic cholesterol levels. These studies have tried to demonstrate the incidence of the occurrence of such isomers in food on coronary heart diseases. Conjugated Linoleic Acid (CLA) would exhibit a protective effect against chemio-inducted cancers. The main food sources of trans fatty acids are milk fat products, partially hydrogenated oils and heated oils. In this review, the geometrical and positional isomer contents and distribution in milk fat products are compared to the trans fatty acid contents in margarines and partially hydrogenated vegetable fat, and in cooking oils. Trans fatty acids in milk fat products have their origin in the hydrogenation of polyunsaturated fatty acids by rumen micro-organisms. The effect of the diet of mammals on the trans fatty acid production in milk is preponderant. The bio-hydrogenation results mainly in 18:1 trans isomers, especially the Ii-trans vaccenic acid, and produces also noticeable amounts of 9-cis, 11-trans 18:2 rumenic acid, a conjugated linoleic acid (CLA) having anti-carcinogenic properties. Trans isomers in margarine are mainly 18:1 acids as well, but the positional isomer distribution is Gaussian, centred around 9-trans 18:1 elaidic acid. Fatty acid isomerisation during heating treatments affects linoleic (18:2) and alpha -linolenic (18:3) acids, two essential fatty acids. All these topics are discussed in this review.

Lee, E., et al. (2008). "n-3 Polyunsaturated fatty acids and trans fatty acids in patients with the metabolic syndrome: a case-control study in Korea." British Journal of Nutrition **100**(3): 609-614.

n-3 and Trans fatty acids are considered to be the important modifiable factors of the metabolic syndrome. The purpose of this study was to test the hypothesis that lower Omega-3 fatty acids and/or higher trans fatty acids of erythrocytes (RBC) are associated with the risk of the metabolic syndrome. Forty-four patients with the metabolic syndrome, defined by three or more risk factors of the modified Adult Treatment Panel III criteria, and eighty-eight age- and sex-matched controls with less than three risk factors were recruited for the study. The mean age was 54.5 (SEM 0.8) years and 45 % of Subjects were female. Trans fatty acids of RBC were higher in patients than controls (0.82 (SEM 0.04) v. 0.73 (SEM 0.03) %; P=0.043) while their Omega-3 indexes, the sum of EPA and DHA in RBC, did not significantly differ (11.78 (SEM 0.04) v. 12.39 (SEM 0.02) %). Multivariable-adjusted regression analysis showed positive association between trans fatty acid and risk of the metabolic syndrome (OR 7.13: 95 % CI 1.53, 33.27: P=0.013). Fasting serum insulin (7.9 (SEM 0.7) v. 4.9 (SEM 0.3) mu U/ml; P < 0.001) and high sensitivity C-reactive protein (18 (SEM 3) v. 11 (SEM 17) mg/ l; P=0.042) were also higher in patients than controls. There were significant positive relationships between trans fatty acids and waist circumference. and between trans fatty acids and BMI. The results suggested that RBC trans fatty acids might be a predictor of increased risk for the metabolic syndrome, but n-3 fatty acids were not in this Population.

Lee, J. H., et al. (2010). "Trans Fatty Acids Content and Fatty Acid Profiles in the Selected Food Products from Korea between 2005 and 2008." Journal of Food Science **75**(7): C647-C652.

Since a high intake of trans fatty acids (TFA) has been associated with the increased risk of developing cardiovascular disease, food regulation worldwide has been amended with respect to nutrition labeling and health claims on TFA. In the present study, the TFA levels of Korean food products were investigated to assess the regulation effect of TFA labeling. Same Korean food products within 7 different categories were purchased in years 2005 and 2008, and the contents of TFA and lipid and fatty acid composition were investigated. Lipid and TFA contents decreased in all food products manufactured in 2008. TFA levels were 0.01 to 6.88 g/100 g food in 2005, but the levels remarkably decreased to nondetectable level or up to 0.5 g TFA/100 g food in 2008. The foods from 2005 contained a various level of TFA ranging 0.6% to 44.6% of total fatty acids; however, the TFA level significantly decreased in most foods up to 3.8% from year 2008. For TFAs, trans C18:1 levels were greater than trans isomers of C18:2, and the levels in 2005 were significantly reduced in 2008 (P < 0.05). TFA levels at the sn-2 position were up to 48.3% of total fatty acids in 2005, but the level considerably decreased up to 5.4% in 2008. The considerably decreased content of TFA in 2008 suggested that food manufacturers recognized the adverse effect of TFA on human health and followed the compulsory trans fat labeling rule by Korean Food and Drug Administration (KFDA), which started December 2007.

Lee, J. H., et al. (2008). "Preparation of interesterified plastic fats from fats and oils free of Trans fatty acid." Journal of Agricultural and Food Chemistry **56**(11): 4039-4046.

Interesterified plastic fats were produced with trans-free substrates of fully hydrogenated soybean oil, extra virgin olive oil, and. palm stearin in a weight ratio of 10:20:70, 10:40:50, and 10:50:40, respectively, by lipase catalysis. The major fatty acids of the products were palmitic (32.2-47.4%), stearic (12.0-12.4%), and oleic acid (33.6-49.5%). After storage at 5 degrees C (refrigerator temperature) or 24 degrees C (room temperature) for 16 h, the physical properties were evaluated for solid fat content, texture, melting, and crystallization behavior, viscoelastic properties, crystal polymorphism, and crystal microstructure. The interesterified fats contained desirable crystal polymorphs (beta' form) as determined by X-ray diffraction spectroscopy. They exhibited a wide plastic range of solid fat content of 52-58% at 10 degrees C and 15% at 40 degrees C. The physical properties were influenced by the ratio of palm stearin and olive oil, Harder and more brittle texture, crystallization and melting at higher temperature, higher solid fat contents, and more elastic (G') or viscous (G') characteristics were observed in the produced fats containing a higher content of palm stearin and lower content of olive oil. The produced fats stored at 5 degrees C consisted mostly of beta' form crystal together with a small content of beta form, while those at 24 degrees C had only beta' form. The produced fat with a higher amount of palm stearin appeared to have more beta' form crystal and small size crystal clusters. Thus, the physical properties of the produced plastic fats may be desirable for use in a bakery product.

Lee, Y. M., et al. (2003). "A phytosterol-enriched spread improves the lipid profile of subjects with type 2 diabetes mellitus - A randomized controlled trial under free-living conditions." European Journal of Nutrition **42**(2): 111-117.

Background Phytosterol-enriched margarines are known to significantly lower total and LDL cholesterol, but little is known about the effect of such margarines in subjects with type 2 diabetes. Aim of the study Investigation of the effect of a phytosterol-enriched spread in subjects with type 2 diabetes mellitus on serum lipids, Hb(A1c), and blood glucose under free-living conditions. Methods Randomized, placebo-controlled, double-blind clinical trial in two parallel groups over 12 weeks; 85 type 2 diabetic patients with serum LDL cholesterol levels greater than or equal to 3.60 mmol/l and without hypolipidemic medication were included in the study. Participants consumed 2 x 10 g of spread with or without 8 % phytosterol-esters daily. Fasting blood samples were analyzed at 0, 4, 8, and 12 weeks. Results After 4 weeks, total and LDL cholesterol were significantly reduced in the phytosterol group by 5.2 % and 6.8 %, respectively, compared to baseline (p < 0.05). After 8 and 12 weeks, these reductions became smaller and were not significant any more compared to baseline or between the groups, but a repeated measurement analysis demonstrated a significant difference for both variables between the two groups (each p < 0.05). HDL cholesterol was significantly increased in the phytosterol group compared to the placebo group after 8 and 12 weeks, but there was no overall difference in the repeated measurement analysis between the two groups. In the phytosterol group, there was a small reduction in Hb(A1c) compared to the control group which was only significant after 4 weeks. Conclusions This clinical study shows that a phytosterol-enriched spread is effective in lowering total and LDL cholesterol in subjects with type 2 diabetes but also illustrates the difficult maintenance under free-living conditions over time. Although this effect is modest, it may contribute to decreasing the elevated risk of cardiovascular disease in type 2 diabetes.

Lefevre, M., et al. (2012). "Predicted Changes in Fatty Acid Intakes, Plasma Lipids, and Cardiovascular Disease Risk Following Replacement of trans Fatty Acid-Containing Soybean Oil with Application-Appropriate Alternatives." Lipids **47**(10): 951-962.

The varied functional requirements satisfied by trans fatty acid (TFA)-containing oils constrains the selection of alternative fats and oils for use as potential replacements in specific food applications. We aimed to model the effects of replacing TFA-containing partially hydrogenated soybean oil (PHSBO) with application-appropriate alternatives on population fatty acid intakes, plasma lipids, and cardiovascular disease (CVD) risk. Using the National Health and Nutrition Examination Survey 24-hour dietary recalls for 1999-2002, we selected 25 food categories, accounting for 86 % of soybean oil (SBO) and 79 % of TFA intake for replacement modeling. Before modeling, those in the middle quintile had a mean PHSBO TFA intake of 1.2 % of energy. PHSBO replacement in applications requiring thermal stability by either low-linolenic acid SBO or mid-oleic, low-linolenic acid SBO decreased TFA intake by 0.3 % of energy and predicted CVD risk by 0.7-0.8 %. PHSBO replacement in applications requiring functional properties with palm-based oils reduced TFA intake by 0.8 % of energy, increased palmitic acid intake by 1.0 % of energy, and reduced predicted CVD risk by 0.4 %, whereas replacement with fully hydrogenated interesterified SBO reduced TFA intake by 0.7 % of energy, increased stearic acid intake by 1.0 % of energy, and decreased predicted CVD risk by 1.2 %. PHSBO replacement in both thermal and functional applications reduced TFA intake by 1.0 % of energy and predicted CVD risk by 1.5 %. Based solely on changes in plasma lipids and lipoproteins, all PHSBO replacement models reduced estimated CVD risk, albeit less than previously reported using simpler replacement models.

Lemaitre, R. N., et al. (2006). "Plasma phospholipid trans fatty acids, fatal ischemic heart disease, and sudden cardiac death in older adults - The cardiovascular health study." Circulation **114**(3): 209-215.

Background - Intake of trans fatty acids is associated with increased risk of coronary heart disease. Whether different classes of trans fatty acids show similar associations is unclear. We previously reported an association of sudden cardiac death with red cell membrane trans-18:2 but not trans-18:1 fatty acids. To extend these findings, we investigated the associations of plasma phospholipid trans fatty acids with fatal ischemic heart disease (IHD) and sudden cardiac death. Methods and Results - We conducted a case-control study nested in the Cardiovascular Health Study. We identified 214 cases of fatal IHD ( fatal myocardial infarction and coronary heart disease death) between 1992 and 1998. We randomly selected 214 controls, matched to cases on demographics, prevalent cardiovascular disease, and timing of blood draw. Plasma phospholipid fatty acids were assessed in blood samples collected earlier. Higher levels of plasma phospholipid trans-18:2 fatty acids were associated with higher risk of fatal IHD (odds ratio [OR] for interquintile range 1.68, 95% confidence interval [CI] 1.21 to 2.33) after adjustment for risk factors and trans-18:1 levels. Trans-18:1 levels above the 20th percentile were associated with lower risk (OR 0.34, 95% CI 0.18 to 0.63). In analyses limited to cases of sudden cardiac death (n=95), higher levels of trans-18:2 fatty acids were associated with higher risk (OR 2.34, 95% CI 1.27 to 4.31) and higher trans-18:1 with lower risk (OR 0.18, 95% CI 0.06 to 0.54). Conclusions - Higher levels of trans-18:2 and lower levels of trans-18:1 fatty acids are associated with higher risks of fatal IHD and sudden cardiac death. If confirmed, these findings suggest that current efforts at decreasing trans fatty acid intake in foods should take into consideration the trans-18:2 content.

Lemaitre, R. N., et al. (1998). "Assessment of trans-fatty acid intake with a food frequency questionnaire and validation with adipose tissue levels of trans-fatty acids." American Journal of Epidemiology **148**(11): 1085-1093.

Past studies of the association of trans-fatty acid intake with coronary heart disease have been hindered by the lack of a database on the trans-fatty acid content of various foods. The authors used new data from the US Department of Agriculture to estimate trans-fatty acid intake using a self-administered food frequency questionnaire (FFQ), and they assessed the validity of the FFQ by comparing the dietary estimates with trans-fatty acid concentrations in adipose tissue. The 1996 study included 27 women and 24 men aged 51-78 years. The mean consumption of total trans-fatty acids estimated from the FFQ was 2.24 g per day and 5% of total dietary fat. The mean concentration of total trans-fatty acids in buttock adipose tissue was 4.7% of total fatty acids. Pearson correlations between total dietary intake of trans-fatty acids and total trans-fatty acid levels in adipose tissue were 0.67 (95% confidence interval (CI) 0.36-0.84) among men and 0.58 (95% CI 0.26-0.79) among women. After adjustment for energy intake, age, and body mass index, the correlation coefficients were 0.76 (95% Cl 0.51-0.89) among men and 0.52 (95% CI 0.17-0.75) among women. The FFQ validated in this study is an important new tool for assessing usual intake of trans-fatty acids.

Lemaitre, R. N., et al. (2002). "Cell membrane trans-fatty acids and the risk of primary cardiac arrest." Circulation **105**(6): 697-701.

Background-The relation of trans-fatty acid intake to life-threatening arrhythmias and primary cardiac arrest is unknown. Methods and Results-We investigated the association of trans-fatty acid intake, assessed through a biomarker, with the risk of primary cardiac arrest in a population-based case-control study. Cases, aged 25 to 74 years, were out-of-hospital cardiac arrest patients attended by paramedics in Seattle, Washington from 1988 to 1999 (n=179). Controls, matched to cases by age and sex, were randomly identified from the community (n=285). Participants were free of previous clinically diagnosed heart disease. Blood was obtained at the time of cardiac arrest (cases) or at the time of an interview (controls) to assess trans-fatty acid intake. Higher total trans-fatty acids in red blood cell membranes was associated with a modest increase in the risk of primary cardiac arrest after adjustment for medical and lifestyle risk factors (odds ratio for interquintile range, 1.5; 95% CI, 1.0 to 2.1). However, trans isomers of oleic acid were not associated with risk (odds ratio for interquintile range, 0.8; 95% CI, 0.5 to 1.2), whereas higher levels of trans isomers of linoleic acid were associated with 3-fold increase in risk (odds ratio for interquintile range, 3.1; 95% CI, 1.7 to 5.4). Conclusions-These findings suggest that dietary intake of total trans-fatty acids is associated with modest increase and trans isomers of linoleic acid with a larger increase in the risk of primary cardiac arrest. These associations need to be confirmed in future studies that distinguish between trans isomers of linoleic acid and trans isomers of oleic acid.

Lemaitre, R. N., et al. (2010). "Endogenous red blood cell membrane fatty acids and sudden cardiac arrest." Metabolism-Clinical and Experimental **59**(7): 1029-1034.

Little is known of the associations of endogenous fatty acids with sudden cardiac arrest (SCA). We investigated the associations of SCA with red blood cell membrane fatty acids that are end products of de novo fatty acid synthesis: myristic acid (14:0), palmitic acid (16:0), palmitoleic acid (16:1 n7), vaccenic acid (18:1 n7), stearic acid (18:0), oleic acid (18:1 n9), and a related fatty acid, cis-7 hexadecenoic acid (16:1 n9). We used data from a population-based case-control study where cases, aged 25 to 74 years, were out-of-hospital SCA patients attended by paramedics in Seattle, WA (n = 265). Controls, matched to cases by age, sex, and calendar year, were randomly identified from the community (n = 415). All participants were free of prior clinically diagnosed heart disease. We observed associations of higher red blood cell membrane levels of 16:0, 16:1n-7, 18:1n-7, and 16:1n-9 with higher risk of SCA. In analyses adjusted for traditional SCA risk factors and trans- and n-3 fatty acids, a 1-SD-higher level of 16:0 was associated with 38% higher risk of SCA (odds ratio, 1.38; 95% confidence interval, 1.12-1.70) and a 1-SD-higher level of 16:1n-9 with 88% higher risk (odds ratio, 1.88; 95% confidence interval, 1.27-2.78). Several fatty acids that are end products of fatty acid synthesis are associated with SCA risk. Further work is needed to investigate if conditions that favor de novo fatty acid synthesis, such as high-carbohydrate/low-fat diets, might also increase the risk of SCA. (C) 2010 Elsevier Inc. All rights reserved.

Lemcke-Norojarvi, M., et al. (2001). "Corn and sesame oils increase serum gamma-tocopherol concentrations in healthy Swedish women." Journal of Nutrition **131**(4): 1195-1201.

We studied the effects of dietary intervention with three vegetable oils (Linola, corn or sesame oil, all good sources of gamma -tocopherol) on absolute and relative concentrations of alpha- and gamma -tocopherol in human serum. The oils contained only small amounts of linolenic acid but varying amounts of oleic and linoleic acids, and they had different concentrations of a-tocopherol. Forty healthy female students (mean age 26 y) were randomly assigned to one of three groups and consumed a diet that contained one of the three oils for 4 wk. Refined oils were distributed as ingredients in specially prepared buns, in margarine or as dressing. Serum tocopherols, serum lipoproteins and plasma malondialdehyde concentrations were measured. The gamma -tocopherol concentrations normalized to serum lipids increased significantly in the corn and sesame oil groups (P < 0.01), and the <alpha>-/gamma -tocopherol ratios decreased significantly from baseline concentrations in all groups (P < 0.05). The <alpha>-tocopherol concentrations did not change during the diet period in any of the three groups. Serum cholesterol, serum apolipoprotein B and plasma malondialdehyde concentrations decreased significantly only in the Linola oil group (P < 0.05). These data show that a moderately modified natural diet that contains both <alpha>- and gamma -tocopherol increases the serum gamma -tocopherol concentration in healthy women without affecting the serum alpha -tocopherol concentration.

Lenz, T. L. (2005). "Therapeutic lifestyle changes and pharmaceutical care in the treatment of Dyslipidemias in adults." Journal of the American Pharmacists Association **45**(4): 492-501.

Objective: To review each therapeutic lifestyle change (TLC) component listed in the National Cholesterol Education Program (NCEP) Adult Treatment Panel III (ATP III) cholesterol guidelines and discuss how the guidelines can be used by pharmacists in the treatment of patients with dyslipidemias. Data Sources: Published guidelines and abstracts identified through PubMed ( May 1987-March 2004), Medline ( January 1966-March 2004), using the search terms cholesterol, hypercholesterolemia, dyslipidemia, hyperlipidemia, diet, saturated fats, unsaturated fats, trans-fatty acids, overweight, obese, exercise, physical activity, program adherence, and guidelines; as well as the NCEP ATP III guidelines, the 2004 ATP III update, National Heart, Lung, and Blood Institute Obesity Guidelines, and Dietary Guidelines for Americans 2005. Study Selection: Performed manually by author. Data Extraction: Performed manually by author. Data Synthesis: TLC components are recommended in the NCEP ATP III guidelines for treatment of patients with dyslipidemias independent of medication use. Dietary modifications are the primary focus of TLC therapy. Saturated fat intake should be limited to less than 7% of total caloric intake and trans-fatty acid intake should be low for patients with dyslipidemias. Persons who are overweight or obese with dyslipidemias should reduce body weight through a combination of physical activity, total calorie reduction, and behavior therapy modifications. Conclusion: Pharmacists, given the proper training, can be effective at offering preventive pharmaceutical care for decreasing high blood cholesterol and the risk for coronary heart disease through patient counseling on TLC components as well as drug therapy in patients with dyslipidemias.

Lercker, G. and G. M. Caramia (2010). "CHEMICAL COMPOSITION AND HEALTHY ASPECTS OF VIRGIN OLIVE OILS." Rivista Italiana Delle Sostanze Grasse **87**(3): 147-169.

Many diseases are caused by the uncontrollable receipt of food, especially food containing in excess saturated fatty acids (animal fats). Mediterranean countries, where olive oil consumption is high, suffer less arteriosclerosis and cardiovascular problems from any other country in the world where the consumption of animal fat is high. Olive oil is known for its high levels of monounsaturated fatty acids and is also a good source of phytochemicals including polyphenolic compounds, squalene, alpha-tocopherol, carotenoid. Accumulating evidence suggests that olive oil, an integral ingredient of the Mediterranean diet, may have health benefits that include reduction of risk factor of coronary heart disease, prevention of several varieties of cancers, and modification of immune and inflammatory responses. olive oil appears to be an example of a "nutraceutic" or "functional" food since infant age, one of the best medicaments for delaying aging, with varied components that may contribute to its overall therapeutic characteristics. Man has always acknowledged the importance of nutrition in establishing and maintaining an optimum state of Health. Confirmation of this was given by Hippocrates (460-377 a.c) who stated that "good health implies an awarness (not only of man's constitution but also) of the power of various foodstuffs either in the natural state or prepared (according to the ability) and Leonardo da Vinci (1452-1519) maintained that "A man's life depends on what he eats". There are well-grounded reasons for believing that the olive oil is the best nutritional gift we can offer to ourselves and helps us keep good in health making our life pleasant.

Lessa, N. M. V., et al. (2010). "Deposition of trans Fatty Acid from Industrial Sources and Its Effect on Different Growth Phases in Rats." Annals of Nutrition and Metabolism **57**(1): 23-34.

Although the effects of trans fatty acids (TFA) from industrially produced sources (IP-TFA), such as partially hydrogenated vegetable oil, are reported, their implications on metabolism and growth are still not fully disclosed. In this study, female Wistar rats were assigned to control diet (AIN-93G) or Trans diet groups (5% IP-TFA) after gestation. The male offspring were classified and grouped as infant, weanling, and young adult (YA) rats (n = 10), and received the same control or Trans diets throughout their life span. Samples of abdominal adipose tissue, liver and plasma were collected to determine fatty acid profile and fasting glycemia. Morphometric analysis of the liver and hepatosomatic index determination were conducted. Deposition of TFA was observed in the liver, adipose tissue and plasma of IP-TFA-fed rats. Fasting glycemia concentration was higher in Trans YA rats than in the control YA group (p = 0.004). A higher accumulation of fat was observed in the liver of the Trans group than in the control group during the three phases. Hepatosomatic index was higher in the YA Trans group than in the YA control group (p < 0.05). Dietary TFA was deposited in the tissues and plasma and raised fasting glucose in growing rats. Copyright (C) 2010 S. Karger AG, Basel

Leviton, A. (1995). "TRANS FATTY-ACID AND CORONARY-DISEASE - THE DEBATE CONTINUES .1. THE USE OF POPULATION ATTRIBUTABLE RISK." American Journal of Public Health **85**(3): 410-410.

Lewis, D. S. and O. Matvienko (2004). Healthy food versus phytosterol-fortified foods for primary prevention of coronary artery disease.

High concentrations of plasma total cholesterol (TC) and low-density lipoprotein cholesterol (LDL-C) accelerate atherogenesis in the teenage years, and 22-year-old men with high cholesterol levels are 5.6 times more likely to develop coronary artery disease (CAD), 6.0 times more likely to have a heart attack, and 9.6 times more likely to die during the next 40 years than those with lower cholesterol levels. Although the National Cholesterol Education Program Adult Treatment Panel recommends measuring blood cholesterol levels in all adults beginning at 20 years of age, the approach to be used to lower the cholesterol levels is still not clear. There is controversy about using hypocholesterolemic drugs as a means of primary prevention of atherosclerosis in young adults, and the American Heart Association (AHA) therapeutic lifestyle changes (TLC) diets have limited effectiveness in many individuals with hypercholesterolemia. Phytosterols are in the forefront of nutraceutical research on the development of food products. Experimental data clearly demonstrate that phytosterols in vegetarian-based diets and in fortified foods with phytosterols are highly effective at lowering plasma cholesterol in diverse populations including children, young adults and older adults. The use of phytochemicals such as phytosterols to alter the food supply appears to be one of the most promising avenues to significantly prevent and mitigate the prevalence and incidence of CAD in young adults.

Li, D., et al. (1999). "Effect of dietary alpha-linolenic acid on thrombotic risk factors in vegetarian men." American Journal of Clinical Nutrition **69**(5): 872-882.

Background: Vegetarians have lower platelet and plasma concentrations of n-3 polyunsaturated fatty acids (PUFAs) than do omnivores, We recently showed that male vegetarians have higher platelet aggregability than do omnivores. Objective: We investigated whether male vegetarians (n = 17) who consumed an increased amount of dietary alpha-linolenic acid (ALA) showed any changes in their tissue profile of PUFAs, plasma thromboxane concentrations, platelet aggregability, or hemostatic factors. Design: During the study, all subjects maintained their habitual vegetarian diets except that a proportion of dietary fat was replaced with vegetable oils and margarines that were provided. Initially, all subjects consumed a low-ALA diet (containing safflower oil and safflower oil-based margarine) for 14 d; they then consumed either a moderate-ALA diet (containing canola oil and canola oil-based margarine) or a high-ALA diet (containing linseed oil and linseed oil-based margarine) for 28 d. Blood samples were collected at day 0 (baseline), day 14, and day 42. Results: Eicosapentaenoic acid, docosapentaenoic acid, total n-3 PUFAs, and the ratio of n-3 to n-6 PUFAs were significantly increased (P < 0.05), whereas the ratio of arachidonic acid to eicosapentaenoic acid was decreased (P < 0.05), in platelet phospholipids, plasma phospholipids, and triacylglycerols after either the moderate-ALA or high-ALA diet compared with the low-ALA diet. No significant differences were observed in thrombotic risk factors. Conclusion: ALA from vegetable oils (canola and linseed) has a beneficial effect on n-3 PUFA concentrations of platelet phospholipids and plasma lipids in vegetarian males.

Li, N. Y., et al. (2007). "Plant sterol-enriched milk tea decreases blood cholesterol concentrations in Chinese adults: a randomised controlled trial." British Journal of Nutrition **98**(5): 978-983.

The cholesterol-lowering effects of plant sterols in a format suitable for use in China have not previously been investigated. We conducted the study to quantify in adult Chinese the effects on blood lipid concentrations of a plant sterol-enriched milk tea powder. The study was a double-blind, randomised trial in which 309 participants were randomised to receive daily 2.3 or 1.5 g plant sterol supplementation or placebo for 5 weeks. The milk tea was consumed with the two fattiest meals of the day with half the assigned daily dose taken on each occasion. Fasting venous blood samples were collected before commencement and upon completion of randomised treatment. The mean age of study participants was 44 years, 62 % were female and 62 % had a history of hypercholesterolaemia. Baseline mean total cholesterol was 5.5 mmol/l and LDL-cholesterol was 3.2 mmol/l. Compared with placebo, the 2.3 g/d plant sterol dose reduced total cholesterol by 0.25 (95 % Cl 0.07, 0.43) mmol/l (P=0.01) and the 1.5 g/d dose by 0.23 (95 % Cl 0.06, 0.41) mmol/l (P=0.01). For LDL-cholesterol the corresponding reductions were 0.17 (95 % Cl 0.00, 0.35) mmolA (P= 0.06) and 0.15 (95 % Cl - 0.02, 0.32) mmol/l (P= 0.08). For neither outcome was there evidence of differences between the effects of the two doses (both P values >0.4). In conclusion, the consumption of plant sterol-enriched milk tea decreased cholesterol concentrations although to a lesser extent than was anticipated. The reason for reduced efficacy is unclear but may be attributable to the novel food format used or the Chinese population studied.

Li, X. B., et al. (2014). "Syntheses of tanshinone anhydrides and their suppression on oxidized LDL uptake in macrophages and foam cell formation." Pharmazie **69**(3): 163-167.

We synthesized eight tanshinone anhydrides and the alcoholytic derivatives through a mild oxygen-insertion under Pd/C catalytic hydrogenation conditions. The suppressive effects of the anhydrides on the oxidized low-density lipoprotein (oxLDL) uptake and the oxLDL-induced macrophage-derived foam cell formation were studied. Our results revealed that both anhydrides la and 2a could significantly suppress the oxLDL uptake in macrophages and the foam cell formation at micromolar level, which might be partially attributed to their inhibition of oxLDL-induced LOX-1 expression in macrophages.

Li, X. P., et al. (2013). "Linolelaidic Acid Induces a Stronger Proliferative Effect on Human Umbilical Vein Smooth Muscle Cells Compared to Elaidic Acid." Lipids **48**(4): 395-403.

Trans fatty acids (TFA) have been considered as an independent risk factor of coronary heart disease, sudden death and insulin-resistance, and different TFA isomers may have different effects on the progression of cardiovascular diseases such as atherosclerosis. The aim of the study was to investigate the effects of two major TFA, elaidic acid and linolelaidic acid which have the same number of carbons but a different number and configuration of trans bonds, on the proliferation of human umbilical vein smooth muscle cells (HUVSMC). Methyl thiazolyl tetrazolium and flow cytometry assays showed that the cell proliferation rose to 115.37 +/- A 0.39 and 117.5 +/- A 0.57 % and the cell number in the S phase of the cell cycle reached 27.7 +/- A 0.7 and 25.8 +/- A 2.8 % when treated with 50 mu M elaidic acid and 20 mu M linolelaidic acid, respectively. Quantitative real-time reverse transcriptase-polymerase chain reaction and Western blotting analyses showed that the two TFA increased the mRNA and protein expression levels of PCNA, CDK2 and Cyclin E in HUVSMC. Moreover, gas chromatography analysis showed that the total PUFA level of HUVSMC was lower after treatment with the two TFA, especially n-3 PUFA. These results suggested that linolelaidic acid exhibited a stronger proliferative effect on HUVSMC than elaidic acid, and regulation of CDK2 and Cyclin E may be important for the effect of the TFA on atherosclerosis.

Li, Y. B., et al. (2009). "Progress in the Synthesis and Application of Nipecotic Acid and Its Derivatives." Chinese Journal of Organic Chemistry **29**(7): 1068-1081.

Nipecotic acid and its derivatives, which have high bioactivity, are significant pharmaceutical intermediates. In this review, the synthetic methods of nipecotic acid and its derivatives are summarized. The application of nipecotic acid and its derivatives to synthesizing drugs for gamma-aminobutyric acid (GABA) uptake inhibition, cancer chemotherapy, growth hormone secretion, anti-inflammation, cardiovascular disease, Alzheimer's disease, nootropics, anti-flu virus and bone disease is presented as well.

Liang, Y., et al. (2014). "A review of the research progress on the bioactive ingredients and physiological activities of rice bran oil." European Food Research and Technology **238**(2): 169-176.

Rice bran oil is not only a nutritious vegetable oil, but also a specialty oil with unique properties and many health benefits. Good stability, appealing flavor and long fry-life enable rice bran oil be used for frying and also to make margarine and shortening and advanced nutritional oils. More importantly, rice bran oil has been reported to have a high potential for making pharmaceuticals and cosmeceuticals. Rice bran oil has surprisingly high levels of nutraceutical components, such as oryzanol, fat-soluble vitamins, sitosterol, other plant sterols and other nutrients. Thus, rice bran oil has been a study focus in relation to its function and application in many countries in the world, as well as a family's daily health edible oil. This paper summarizes the research progress on the bioactive ingredients and the physiological activities of rice bran oil.

Lichtenstein, A. H. (1997). "Trans fatty acids, plasma lipid levels, and risk of developing cardiovascular disease - A statement for healthcare professionals from the American Heart Association." Circulation **95**(11): 2588-2590.

Lichtenstein, A. H. (1998). "Trans fatty acids and blood lipid levels, Lp(a), parameters of cholesterol metabolism, and hemostatic factors." Journal of Nutritional Biochemistry **9**(5): 244-248.

Diets high in trans fatty acids and/or hydrogenated fat have been reported to increase total and low density lipoprotein (LDL) cholesterol levels, and in some cases decrease high density lipoprotein (HDL) cholesterol levels. More recent evidence supports these observations. The lack of consistency among the data regarding HDL cholesterol levels may be related to differences in the actual level of trans fatty acids consumed or the relative decrease in saturated fat accompanying the dietary modification. The decrease in HDL cholesterol levels, when present, has been related to increased cholesterol ester transferase protein (CETP) activity. Trans fatty acids have been reported to either increase or have no significant effect on lipoprotein (a) [Lp(a)] levels, whereas saturated fat has been reported to decrease Lp(a) levels. Available data on the effect of trans fatty acid intake on cholesterol metabolism other than CETP activity are too limited to draw firm conclusions at this time. The effect of trans fatty acids on the susceptibility of LDL to oxidation or on a variety of hemostatic factors suggest no adverse effects. On this basis of the data available it appears prudent to recommend restricting both saturated and trans fatty acid intake to reduce the risk of developing cardiovascular disease. Caution needs to be exerted when communicating this message so as to avoid putting undue emphasis on trans fatty acids at the expense of saturated fatty acids. Instead patients should be encouraged to reduce intakes of both. (C) Elsevier Science Inc. 1998.

Lichtenstein, A. H. (2000). "Trans fatty acids and cardiovascular disease risk." Current Opinion in Lipidology **11**(1): 37-42.

Recent studies continue to confirm previous observations that trans fatty acids elevate low density lipoprotein cholesterol levels, and at relatively high intakes decrease high density lipoprotein cholesterol levels. Considerable interest is focused on the potential benefits of trans-free margarines. Both adipose and plasma trans fatty acid levels reflect dietary intake. Current estimates of trans fatty acid intake in developed countries range from 0.5 to 2.6% of energy, contributed to primarily by differences in food availability and preference, and partly by the methodological differences used to calculate the data. Curr Opin Lipidol 11:37-42. (C) 2000 Lippincott Williams & Wilkins.

Lichtenstein, A. H., et al. (1993). "HYDROGENATION IMPAIRS THE HYPOLIPIDEMIC EFFECT OF CORN-OIL IN HUMANS - HYDROGENATION, TRANS-FATTY-ACIDS, AND PLASMA-LIPIDS." Arteriosclerosis and Thrombosis **13**(2): 154-161.

The effects on plasma lipoproteins and apolipoproteins of replacing corn oil with corn-oil margarine in stick form as two thirds of the fat in the National Cholesterol Education Program (NCEP) Step 2 diet were assessed in 14 middle-aged and elderly women and men (age range, 44-78 years) with moderate hypercholesterolemia (low density lipoprotein cholesterol [LDL-C] range, 133-219 mg/dl [3.45-5.67 mmol/l] at screening). During each 32-day study phase, subjects received all their food and drink from a metabolic kitchen. Subjects were first studied while being fed a diet approximating the composition of the current US diet (baseline), which contained 35% of calories as fat (13% saturated fatty acids [SFAs], 12% monounsaturated fatty acids [MUFAs; 0.8% 18:1n-9 trans], and 8% polyunsaturated fatty acids [PUFAs]) and 128 mg cholesterol/1,000 kcal. This baseline phase was followed by a corn oil-enriched diet containing 30% fat (6% SFA, 11% MUFA [0.4% 18:1n-9 trans], and 10% PUFA) and 83 mg cholesterol/1,000 kcal, and then a corn-oil margarine-enriched diet containing 30% fat (8% SFA, 12% MUFA [4.2% 18:1n-9 trans], and 8% PUFA) and 77 mg cholesterol/1,000 kcal. All diets were isocaloric. Mean fasting LDL-C and apolipoprotein (apo) B levels were 153 mg/dl (3.96 mmol/l) and 101 mg/dl on the baseline diet, 17% and 20% lower (both p<0.001) on the corn oil-enriched diet, and 10% and 10% lower (both p<0.01) on the margarine-enriched diet. Mean fasting high density lipoprotein cholesterol (HDL-C) and apoA-I levels were 48 mg/dl (1.24 mmol/l) and 134 mg/dl on the baseline diet, 9% and 0.4% lower on the corn oil-enriched diet (p<0.01 for HDL-C), and 10% and 3% lower on the margarine-enriched diet (p<0.01 for HDL-C). No significant effects of diet on triglyceride, apoA-I, or lipoprotein(a) concentrations were noted. Replacing corn oil with a typical corn-oil margarine in stick form, as is currently available, resulted in a 10-fold increase in dietary trans fatty acid intake as well as 21% and 14% increases in SFA and MUFA intake, respectively, and a 12% decrease in PUFA intake. These changes resulted in higher plasma concentrations of total cholesterol (p=0.039), LDL-C (p=0.058), and LDL apoB (p=0.068) and a less favorable total cholesterol to HDL-C ratio (p=0.037). Both experimental diets resulted in significant reductions in plasma cholesterol relative to the baseline diet; however, the differences resulting from the substitution of the corn-oil margarine for corn oil were associated with a less favorable lipid profile with regard to coronary heart disease risk. We therefore recommend that hydrogenation be minimized during the processing of foods for use in cholesterol-lowering diets.

Lichtenstein, A. H., et al. (1999). "Effects of different forms of dietary hydrogenated fats on serum lipoprotein cholesterol levels." New England Journal of Medicine **340**(25): 1933-1940.

Background Metabolic studies suggest that fatty acids containing at least one double bond in the trans configuration, which are found in hydrogenated fat, have a detrimental effect on serum lipoprotein cholesterol levels as compared with unsaturated fatty acids containing double bonds only in the cis configuration. We compared the effects of diets with a broad range of trans fatty acids on serum lipoprotein cholesterol levels. Methods Eighteen women and 18 men consumed each of six diets in random order for 35-day periods. The foods were identical in each diet, and each diet provided 30 percent of calories as fat, with two thirds of the fat contributed as soybean oil (<0.5 g of trans fatty acid per 100 g of fat), semiliquid margarine (<0.5 g per 100 g), soft margarine (7.4 g per 100 g), shortening (9.9 g per 100 g), or stick margarine (20.1 g per 100 g). The effects of those diets on serum lipoprotein cholesterol, triglyceride, and apolipoprotein levels were compared with those of a diet enriched with butter, which has a high content of saturated fat. Results The mean (+/-SD) serum low-density lipoprotein (LDL) cholesterol level was 177+/-32 mg per deciliter (4.58+/-0.85 mmol per liter) and the mean high-density lipoprotein (HDL) cholesterol level was 45+/-10 mg per deciliter (1.2+/-0.26 mmol per liter) after subjects consumed the butter-enriched diet. The LDL cholesterol level was reduced on average by 12 percent, 11 percent, 9 percent, 7 percent, and 5 percent, respectively, after subjects consumed the diets enriched with soybean oil, semiliquid margarine, soft margarine, shortening, and stick margarine; the HDL cholesterol level was reduced by 3 percent, 4 percent, 4 percent, 4 percent, and 6 percent, respectively. Ratios of total cholesterol to HDL cholesterol were lowest after the consumption of the soybean-oil diet and semiliquid-margarine diet and highest after the stick-margarine diet. Conclusions Our findings indicate that the consumption of products that are low in trans fatty acids and saturated fat has beneficial effects on serum lipoprotein cholesterol levels. (N Engl J Med 1999;340: 1933-40.) (C) 1999, Massachusetts Medical Society.

Lichtenstein, A. H., et al. (2001). "Stanol/sterol ester-containing foods and blood cholesterol levels - A Statement for Healthcare Professionals from the Nutrition Committee of the Council on Nutrition, Physical Activity, and Metabolism of the American Heart Association." Circulation **103**(8): 1177-1179.

Considerable attention in the recent past. has focused on the potential benefits or adverse effects of butter versus different types of margarines, usually with respect to their relative content of polyunsaturated, saturated, and trans fatty acids, and the impact of these on low-density lipoprotein (LDL) cholesterol levels. Recently, a new class of margarines and other fat-derived products (eg, salad dressings, mayonnaise) containing plant-derived sterols that are intended for use to lower blood cholesterol levels have been introduced into the food supply. These products are being marketed as adjuncts to low-saturated-fat and low-cholesterol diets to maximize reductions in LDL cholesterol levels achievable by dietary means.

Lichtenstein, A. H., et al. (2003). "Influence of hydrogenated fat and butter on CVD risk factors: remnant-like particles, glucose and insulin, blood pressure and C-reactive protein." Atherosclerosis **171**(1): 97-107.

Dietary trans fatty acids/partially-hydrogenated fat has been associated with increased risk of developing cardiovascular disease (CVD), possibly greater than predicted from changes in lipoprotein levels. To explore this issue further potential risk factors were assessed in subjects provided with each of six diets in randomized order containing as the major source of fat: soybean oil, semi-liquid margarine, soft margarine, shortening, traditional stick margarine or butter. Plasma fatty acid profiles reflected diet, with triglyceride and phospholipid subfractions affected to a greater extent than cholesteryl ester. Non-fasting LDL-cholesterol levels were 144 27, 141 27, 146 26, 148 30, 151 29 and 165 +/- 31 mg/dl (P < 0.001) and total cholesterol/HDL-cholesterol ratios were 5.50 +/- 1.25, 5.54 +/- 1.50, 5.69 +/- 1.29, 5.82 +/- 1.40, 6.11 +/- 1.30 and 5.94 +/- 1.43 (P = 0.011), respectively, whereas other lipoprotein levels were not significantly different. Remnant-like particles levels were unaffected by dietary fat, either in the fasting or non-fasting state. Differences in fasting insulin and glucose levels were small and would not be predicted to have a large impact on glucose homeostasis. There was no significant effect of dietary fat type on C-reactive protein levels or blood pressure. These data suggest that, as previously demonstrated, the major CVD risk factor adversely affected by dietary trans fatty acids/partially-hydrogenated fat is LDL-cholesterol levels and total cholesterol/HDL-cholesterol ratios. (C) 2003 Elsevier Ireland Ltd. All rights reserved.

Lichtenstein, A. H., et al. (2006). "Novel soybean oils with different fatty acid profiles alter cardiovascular disease risk factors in moderately hyperlipidemic subjects." American Journal of Clinical Nutrition **84**(3): 497-504.

Background: A variety of soybean oils were developed with improved oxidative stability and functional characteristics for use as alternatives to partially hydrogenated fat. Objective: The objective was to assess the effect of selectively bred and genetically modified soybean oils with altered fatty acid profiles, relative to common soybean and partially hydrogenated soybean oils, on cardiovascular disease risk factors. Design: Thirty subjects (16 women and 14 men) aged > 50 y with LDL-cholesterol concentrations > 130 mg/dL at screening consumed 5 experimental diets in random order for 35 d each. Diets contained the same foods and provided 30% of energy as fat, of which two-thirds was either soybean oil (SO), low-saturated fatty acid soybean oil (LoSFA-SO), high-oleic acid soybean oil (HiOleic-SO), low-a-linolenic acid soybean oil (LoALA-SO), or partially hydrogenated soybean oil (Hydrog-SO). Results: Plasma phospholipid patterns reflected the predominant fat in the diet. LDL-cholesterol concentrations were 3.66 +/- 0.67(b) 3.53 +/- 0.77(b), 3.70 +/- 0.66(b), 3.71 +/- 0.64(a,b), and 3.92 +/- 0.70(a) mol/L HDL-cholesterol concentrations were 1.32 +/- 0.32(a,b), 1.32 +/- 0.35(b), 1.36 +/- 0.33(a), 1.32 +/- 0.33(b), and 1.32 +/- 0.32(a,b) mol/L for the SO, LoSFA-SO, HiOleic-SO, LoALA-SO, and Hydrog-SO diets, respectively (values with different superscript letters are significantly different, P < 0.05). No significant effects were observed on VLDL-cholesterol, triacylglycerol, lipoprotein(a), and C-reactive protein concentrations or on ratios of LDL cholesterol to apolipoprotein B (apo 13) and HDL cholesterol to apo A-I. Total cholesterol:HDL cholesterol was lower after subjects consumed the unhydrogenated soybean oils than after they consumed the Hydrog-SO diet. Conclusions: All varieties of soybean oils resulted in more favorable lipoprotein profiles than did the partially hydrogenated form. These soybean oils may provide a viable option for reformulation of products to reduce the content of trans fatty acids.

Limburg, P. J., et al. (2008). "Prospective evaluation of trans-fatty acid intake and colorectal cancer risk in the Iowa Women's Health Study." International Journal of Cancer **123**(11): 2717-2719.

Concerns regarding the safety of dietary trans-fatty acids (tFAs) have generated recent public interest. scientific discussion and legislative action. Although most widely recognized its it risk factor for cardiovascular disease, associations between tFA intake and incident cancer have also been proposed. With respect to colorectal cancer (CRC), existing observational data remain limited and inconclusive. Therefore. we conducted a prospective evaluation of tFA intake and CRC risk. overall and by anatomic subsite, among participants in the Iowa Women's Health Study (IWHS). it population-based cohort of older women (ages 55-69 years it it enrollment). Exposure data were collected at baseline using it semiquantitative food-frequency questionnaire. Incident CRC cases were identified through annual linkage to the Iowa Cancer Registry. CRC risks were estimate(] using Cox proportional hazards regression models. In total. 35,216 women met our inclusion criteria and 1,229 CRC cases (631 proximal. 571 distal, 27 site not specified) were observed through 18 years of follow-up. Adjusting for age and total energy consumption. tFA intake in the 4th versus 1st quartile was not significantly associated with overall CRC risk [relative risk (RR) = 1.12; 95% confidence interval (CI) = 0.96-1.32]. Similarly, risk estimates based on proximal (RR = 1.09; 95% CI = 0.81-1.37) and distal (RR = 1.18; 95% CI = 0.93-1.49) CRC subsites did not differ from unity. Multivariable adjustment yielded slightly attenuated risk estimates. but the observed associations were not meaningfully altered. Given these findings, tFA intake does not appear to be a major CRC risk factor, at least among older women. (C) 2008 Wiley-Liss, Inc.

Lindeberg, S., et al. (2007). "A Palaeolithic diet improves glucose tolerance more than a Mediterranean-like diet in individuals with ischaemic heart disease." Diabetologia **50**(9): 1795-1807.

Aims/hypothesis Most studies of diet in glucose intolerance and type 2 diabetes have focused on intakes of fat, carbohydrate, fibre, fruits and vegetables. Instead, we aimed to compare diets that were available during human evolution with more recently introduced ones. Methods Twenty-nine patients with ischaemic heart disease plus either glucose intolerance or type 2 diabetes were randomised to receive (1) a Palaeolithic ('CyOld Stone Age') diet (n=14), based on lean meat, fish, fruits, vegetables, root vegetables, eggs and nuts; or (2) a Consensus (Mediterranean-like) diet (n=15), based on whole grains, low-fat dairy products, vegetables, fruits, fish, oils and margarines. Primary outcome variables were changes in weight, waist circumference and plasma glucose AUC (AUC Glucose(0-120)) and plasma insulin AUC (AUC Insulin(0-120)) in OGTTs. Results Over 12 weeks, there was a 26% decrease of AUC Glucose(0-120) (p=0.0001) in the Palaeolithic group and a 7% decrease (p=0.08) in the Consensus group. The larger (p=0.001) improvement in the Palaeolithic group was independent (p=0.0008) of change in waist circumference (-5.6 cm in the Palaeolithic group, -2.9 cm in the Consensus group; p=0.03). In the study population as a whole, there was no relationship between change in AUC Glucose(0-120) and changes in weight (r=-0.06, p=0.9) or waist circumference (r=0.01, p=1.0). There was a tendency for a larger decrease of AUC Insulin(0-120) in the Palaeolithic group, but because of the strong association between change in AUC Insulin(0-120) and change in waist circumference (r=0.64, p=0.0003), this did not remain after multivariate analysis. Conclusions/interpretationA Palaeolithic diet may improve glucose tolerance independently of decreased waist circumference.

List, G. R. and J. W. King (2006). "Hydrogenation of lipids for use in food." Modifying Lipids for Use in Food: 173-200.

Lister, T. (2003). "Does trans fatty acid consumption contribute to adult cardiovascular disease?" Canadian Journal of Dietetic Practice and Research **64**(3): A4-A4.

Liu, Q., et al. (2002). "High-oleic and high-stearic cottonseed oils: Nutritionally improved cooking oils developed using gene silencing." Journal of the American College of Nutrition **21**(3): 205S-211S.

Gene technology and plant breeding are combining to provide powerful means for modifying the composition of oilseeds to improve their nutritional value and provide the functional properties required for various food oil applications. Major alterations in the proportions of individual fatty acids have been achieved in a range of oilseeds using conventional selection, induced mutation and, more recently, post-transcriptional gene silencing (PTGS). In particular, a number of high-oleic oils have been developed in order to provide high-stability cooking oils. These oils provide the opportunity to replace the current widespread use of saturated fats and hydrogenated oils that contribute significantly to increased risk of cardiovascular disease due to the effect of saturated and trans-fatty acids on elevating LDL cholesterol in the bloodstream. Similarly, oils with increased stearic acid content are being developed to enable the production of solid fats without the need for hydrogenation. We have recently applied hpRNA-mediated PTGS in cotton to down-regulate key fatty acid desaturase genes and develop nutritionally-improved high-oleic (HO) and high-stearic (HS) cottonseed oils (CSOs). Silencing of the ghFAD2-1 Delta12-desaturase gene raised oleic acid content from 13% to 78% and silencing of the ghSAD-1 Delta9-desaturase gene substantially increased stearic acid from the normal level of 2% to as high as 40%. Additionally, palmitic acid was significantly lowered from 26% to 15% in both HO and HS lines. Intercrossing the HS and HO lines resulted in a wide range of unique intermediate combinations of palmitic, stearic. oleic and linoleic contents. The oxidative stability, flavor characteristics and physical properties of these novel CSOs are currently being evaluated by food technologists.

Liu, X. R., et al. (2013). "Erythrocyte membrane trans-fatty acid index is positively associated with a 10-year CHD risk probability." British Journal of Nutrition **109**(9): 1695-1703.

Industry-generated trans-fatty acids (TFA) are detrimental to risk of CHD, but ruminant-originated TFA have been reported as neutral or equivocal. Therefore, the total TFA amount should not be the only factor considered when measuring the effects of TFA. In the present study, we addressed whether a version of the TFA index that unifies the effects of different TFA isomers into one equation could be used to reflect CHD risk probability (RP). The present cross-sectional study involved 2713 individuals divided into four groups that represented different pathological severities and potential risks of CHD: acute coronary syndrome (ACS, n 581); chronic coronary artery disease (CCAD, n 631); high-risk population (HRP, n 659); healthy volunteers (HV, n 842). A 10-year CHD RP was calculated. Meanwhile, the equation of the TFA index was derived using five TFA isomers (trans-16 : 1n-7, trans-16 : 1n-9, trans-18 : 1n-7, trans-18 : 1n-9 and trans-18 : 2n-6n-9), which were detected in the whole blood, serum and erythrocyte membranes of each subject. The TFA index and the 10-year CHD RP were compared by linear models. It was shown that only in the erythrocyte membrane, the TFA isomers were significantly different between the groups. In the ACS group, industry-generated TFA (trans-16 : 1n-9, trans-18 : 1n-9 and trans-18 : 2n-6n-9) were the highest, whereas ruminant-originated TFA (trans-16 : 1n-7 and trans-18 : 1n-7), which manifested an inverse relationship with CHD, were the lowest, and vice versa in the HV group. The TFA index decreased progressively from 7.12 to 5.06, 3.11 and 1.92 in the ACS, CCAD, HRP and HV groups, respectively. The erythrocyte membrane TFA index was positively associated with the 10-year CHD RP (R-2 0.9981) and manifested a strong linear correlation, which might reflect the true pathological severity of CHD.

Livingstone, K. M., et al. (2014). "Comparative effect of dairy fatty acids on cell adhesion molecules, nitric oxide and relative gene expression in healthy and diabetic human aortic endothelial cells." Atherosclerosis **234**(1): 65-72.

Objective: Dairy intake, despite its high saturated fatty acid (SFA) content, is associated with a lower risk of cardiovascular disease and diabetes. This in vitro study determined the effect of individual fatty acids (FA) found in dairy, and FA mixtures representative of a high SFA and a low SFA dairy lipid on markers of endothelial function in healthy and type II diabetic aortic endothelial cells. Methods: Cells were incubated for 24 h with FA mixtures (400 mu M) and individual FA: oleic acid (OA; 150 mu M); palmitic acid (PA; 150 mu M); stearic acid (SA: 40 mu M); trans-palmitelaidic acid (trans-PA; 20 mu M); trans-vaccenic acid (trans-VA; 20 mu M); alpha-linolenic acid (ALA; 20 mu M) and linoleic acid (LA; 20 mu M). Cellular adhesion molecules (sICAM-1, sVCAM-1 and sE-selectin) and nitric oxide (NO) were measured using ELISA and a chemiluminescent-based assay, respectively. Relative gene expression of these markers, including the insulin receptor, was performed using real-time PCR as well as FA compositions of cell pellets by gas chromatography. Results: FA mixtures affected sE-selectin concentrations (P = 0.008), with concentrations lower following the high SFA compared to the low SFA mixture (P = 0.004), while NO concentrations were higher in diabetic compared to healthy cells (P = 0.029). Individual FA affected NO (P = 0.007) and sE-selectin (P = 0.040) concentrations with an increase following PA incubation relative to all other FA treatments (P < 0.05). PA increased sE-selectin compared with other FA treatments (P < 0.05). sE-selectin concentrations were also higher in healthy compared to diabetic cells (P = 0.023). Expression of ICAM-1 and insulin receptor was up-regulated in healthy compared to diabetic cells (P = 0.014 and P = 0.006 respectively). Conclusions: Healthy and type II diabetic cells respond differently to incubation with FA treatments. Overall, physiological concentrations of dairy FA, but not dairy FA mixtures, substantially affected markers of endothelial function. (C) 2014 Elsevier Ireland Ltd. All rights reserved.

Lock, A. L., et al. (2003). Dairy products and milk fatty acids as functional food components.

Lock, A. L., et al. (2005). "Effect of vaccenic acid/conjugated linoleic acid-enriched buffer on plasma lipoproteins in the cholesterol-fed hamster." Journal of Dairy Science **88**: 290-290.

Lock, A. L., et al. (2005). "Butter naturally enriched in conjugated linoleic acid and vaccenic acid alters tissue fatty acids and improves the plasma lipoprotein profile in cholesterol-fed hamsters." Journal of Nutrition **135**(8): 1934-1939.

Butter, which is naturally enriched in cis-9, trans-11 conjugated linoleic acid (rumenic acid; RA) and vaccenic acid (VA), has been shown to be an effective anticarcinogen in studies with animal models; however, there has been no examination of the effects of a naturally derived source of VA and RA on atherosclerosis-related biomarkers. The current study was designed to determine the effect of a diet containing VA/RA-enriched butter on plasma lipoproteins and tissue fatty acid profiles in cholesterol-fed hamsters. Male Golden Syrian hamsters were fed diets containing 0.2% cholesterol and 20% added fat as: 1) Control, 20% standard butter (CT); 2) 5% standard butter + 15% VA/RA-enriched butter (EB); 3) 15% standard butter + 5% partially-hydrogenated vegetable oil (VO). After 4 wk, plasma lipoproteins were isolated, cholesterol quantified, and tissue fatty acid profiles determined. Tissue concentrations of:VA and RA were increased by consumption of the EB diet compared with both the CT and VO diets, whereas the VO diet increased their concentration compared with the CT diet only. Total and LDL cholesterol concentrations were significantly reduced in hamsters fed EB and VO compared with CT, whereas VLDL cholesterol concentrations were reduced in hamsters fed EB compared with those fed CT and VO. HDL cholesterol concentrations did not differ among treatments. The ratio of potentially atherogenic lipoproteins [VLDL + intermediate density lipoproteins (IDL) + LDL] to antiatherogenic HDL was significantly lower in hamsters fed VA/RA-enriched butter (0.60) than in those fed either control diet (1.70) or the diet containing partially hydrogenated vegetable oil (1.04). Thus, increasing the VA/RA concentration of butter results in a plasma lipoprotein cholesterol profile that is associated with a reduced risk of atherosclerosis.

Lock, A. L., et al. (2005). "Effect of vaccenic acid/conjugated linoleic acid-enriched butter on plasma lipoproteins in the cholesterol-fed hamster." Journal of Animal Science **83**: 290-290.

Lock, A. L., et al. (2005). "The biology of trans fatty acids: implications for human health and the dairy industry." Australian Journal of Dairy Technology **60**(2): 134-142.

This review discusses the biology of trans fatty acids and how this relates to human health and the dairy industry. In recent times, the medical focus has been on the association between the intake of trans fatty acids and the risk of atherosclerosis, with current public health policy strongly recommending a reduction in the intake of trans fatty acids. This review considers recent legislation related to trans fatty acids and examines available data highlighting potential differences in the biological effects of trans fatty acids from ruminant fats vs. industrially produced partially hydrogenated vegetable oils; these two dietary sources differ in both their amount and type of trans fatty acids. The two key trans fatty acids in ruminant fats, vaccenic and rumenic acids, have been shown to posses anti-carcinogenic and anti-atherogenic properties, and this review will discuss these findings in relation to health maintenance and disease prevention, especially those studies which have used naturally enriched dairy products to supply these bioactive fatty acids.

Lockheart, M. S. K., et al. (2007). "Dietary patterns, food groups and myocardial infarction: a case - control study." British Journal of Nutrition **98**(2): 380-387.

Certain dietary patterns may be related to the risk of CVD. We hypothesised that a plant-centred dietary pattern would be associated with a reduced risk of first myocardial infarction (MI). A case-control study of Norwegian men and postmenopausal women (age 45-75 years) was performed. A FFQ was administered, generally within 3 d after incident MI (n 106 cases). Controls (n 105) were frequency matched on sex, age and geographic location. On the FFQ, 190 items were categorised into thirty-five food groups and an a priori healthy diet pattern score was created. We estimated OR using logistic regression with adjustment for energy intake, family history of heart disease, marital status, current smoking, education and age. Among food groups, the risk of MI was significantly higher per SD of butter and margarine (OR 1.66 (95 % CI 1.12, 2.46)), and lower per So Of tomatoes (OR 0.53 (95 % CI 0.35, 0.79)), high-fat fish (OR 0.57 (95 % CI 0.38, 0.86)), wine (OR 0.58 (95 % Cl 0.41, 0.83)), salad (OR 0.59 (95 % Cl 0.40, 0.87)), wholegrain breakfast cereals (OR 0.64 (95 % CI 0.45, 0.90)), cruciferous vegetables (OR 0.66 (95 % Cl 0.47, 0.93)) and non-hydrogenated vegetable oil (OR 0.68 (95 % Cl 0.49, 0.95)). An abundance of cases were found to have a low a priori healthy diet pattern score. A dietary pattern emphasising nutrient-rich plant foods and high-fat fish and low in trans fatty acids was associated with decreased risk of MI among Norwegians.

Lohner, S., et al. (2014). "Inverse association between 18-carbon trans fatty acids and intelligence quotients in smoking schizophrenia patients." Psychiatry Research **215**(1): 9-13.

This study aimed to investigate polyunsaturated (PUFA) and trans isomeric fatty acid status in schizophrenia patients Fatty acid composition of plasma phospholipids (PL) and triacylglycerols (TG) was analyzed by gas chromatography in 29 schizophrenia patients and 15 healthy controls. We found no difference in PL n-3 fatty acid status between the two groups, while the values of 22:5n-6 were significantly higher in patients with schizophrenia than in controls. In TG, values of docosatrienoic acid (20:3n-3) and docosapentaenoic acid (20:5n-3) were significantly higher in schizophrenia patients than in controls. We found no difference in the trans fatty acid status between patients and controls. In smoking schizophrenia patients significant negative correlations were detected between Wechsler adult full-scale intelligence quotients and values of total trans fatty acids in PL lipids, whereas no such correlation was seen either in non-smoking schizophrenia patients, or in healthy controls. While data obtained in the present study fail to furnish evidence for n-3 PUFA supplementation to the diet of patients with schizophrenia, they indicate that in smoking schizophrenia patients high dietary exposure to trans fatty acids is associated with lower intelligence quotients. (C) 2013 Elsevier Ireland Ltd. All rights reserved.

Longnecker, M. P. (1993). "DO TRANS-FATTY-ACIDS IN MARGARINE AND OTHER FOODS INCREASE THE RISK OF CORONARY HEART-DISEASE." Epidemiology **4**(6): 492-495.

Lopez-Garcia, E., et al. (2005). "Consumption of Trans fatty acids is related to plasma biomarkers of inflammation and endothelial dysfunction." Journal of Nutrition **135**(3): 562-566.

Trans fatty acid intake has been associated with a higher risk of cardiovascular disease. The relation is explained only partially by the adverse effect of these fatty acids on the lipid profile. We examined whether trans fatty acid intake could also affect biomarkers of inflammation and endothelial dysfunction including C-reactive protein (CRIP), interleukin-6 (IL-6), soluble tumor necrosis factor receptor 2 (sTNFR-2), E-selectin, and soluble cell adhesion molecules (sICAM-1 and sVCAM-1). We conducted a cross-sectional study of 730 women from the Nurses' Health Study I cohort, aged 43-69 y, free of cardiovascular disease, cancer, and diabetes at time of blood draw (1989-1990). Dietary intake was assessed by a validated FFQ in 1986 and 1990. CRP levels were 73% higher among those in the highest quintile of trans fat intake, compared with the lowest quintile. IL-6 levels were 17% higher, sTNFR-2 5%, E-selectin 20%, sICAM-1 10%, and sVCAM-1 levels 10% higher. Trans fatty acid intake was positively related to plasma concentration of CRP (P = 0.009), sTNFR-2 (P = 0.002), E-selectin (P = 0.003), slCAM-1 (P = 0.007), and sVCAM-1 (P = 0.001) in linear regression models after controlling for age, BMI, physical activity, smoking status, alcohol consumption, intake of monounsaturated, polyunsaturated, and saturated fatty acids, and postmenopausal hormone therapy. In conclusion, this study suggests that higher intake of trans fatty acids could adversely affect endothelial function, which might partially explain why the positive relation between trans fat and cardiovascular risk is greater than one would predict based solely on its adverse effects on lipids.

Lottenberg, A. M., et al. (2003). "The human cholesteryl ester transfer protein I405V polymorphism is associated with plasma cholesterol concentration and its reduction by dietary phytosterol esters." Journal of Nutrition **133**(6): 1800-1805.

We examined the relationships of 1405V cholesteryl ester transfer protein (CETP), Taq1B CETP and apolipoprotein (apo)E polymorphisms with the pattern of response to dietary plant sterol ester (PSE) by plasma lipids and CETP concentrations as well as lecithin-cholesterol acyltransferase (LCAT) activity. Subjects with moderate primary hypercholesterolemia (20-60 y old; 50 women; 10 men) consumed margarine (20 g/d) without (placebo) or with PSE (2.8 g/d = 1.68 g/d phytosterols) for 4 wk each period, in a crossover, double-blind study. Plasma CETP concentration was measured by ELISA; endogenous LCAT activity was expressed as the percentage of esterification (30 min incubation) of the subjects' C-14-unesterified cholesterol HDL. PSE reduced concentrations of plasma total cholesterol (TC) (10%) and LDL cholesterol (LDL-C) (12%). In relation to the 1405V CETP polymorphism, the percentage reductions in TC with consumption of PSE for the II, IV and VV phenotypes were 7.2, 4.2 and not significant, respectively, whereas LDL-C significant reductions occurred only for II (9.5%). However, the CETP concentration diminished only in the II phenotype. J. Nutr. 133: 1800-1805, 2003.

Lovejoy, J. C., et al. (2001). "Relationship of dietary fat and serum cholesterol ester and phospholipid fatty acids to markers of insulin resistance in men and women with a range of glucose tolerance." Metabolism-Clinical and Experimental **50**(1): 86-92.

High-fat diets are associated with insulin resistance, however, this effect may vary depending on the type of fat consumed. The purpose of this study was to determine the relationship between intakes of specific dietary fatty acids (assessed by 3-day diet records and fatty acid composition of serum cholesterol esters [CEs] and phospholipids [PLs]) and glucose and insulin concentrations during an oral glucose tolerance test (OGTT). Nineteen men and 19 women completed the study. Nine subjects had type 2 diabetes or impaired glucose tolerance. Pasting insulin correlated with reported intakes of total fat (r = .50, P < .01), monounsaturated fat (r = .44, P < .01), and saturated fat (r = .49, P < .01), but not with trans fatty acid intake (r = .11, not significant [NS]). Pasting glucose also correlated with total (r = .49, P < .05) and monounsaturated fat intakes (r = .37, P < .05). In multivariate analysis, both total and saturated fat intake were strong single predictors of fasting insulin (R-2 <similar to> .25), and a model combining dietary and anthropometric measures accounted for 47% of the variance in fasting insulin. Significant relationships were observed between fasting insulin and the serum CE enrichments of myristic (C14:0), palmitoleic (C16:1), and dihomo-gamma -linolenic (C20:3n-6) acids. In multivariate analysis, a model containing CE 14:0 and percent body fat explained 45% of the variance in fasting insulin, and C14:0 and age explained 30% of the variance in fasting glucose. PL C20:3n-6 explained 30% of the variance in fasting insulin, and a model including PL C18:1n-11 cis, C20:3n-6, age and body fat had an R2 of .58. In conclusion, self-reported intake of saturated and monounsaturated fats, but not trans fatty acids, are associated with markers of insulin resistance. Furthermore, enhancement of dihomo-gamma -linolenic and myristic acids in serum CE and PI presumably markers for dietary intake, predicted insulin resistance. Copyright (C) 2001 by W.B. Saunders Company.

Lovejoy, J. C., et al. (2002). "Effects of diets enriched in saturated (palmitic), monounsaturated (oleic), or trans (elaidic) fatty acids on insulin sensitivity and substrate oxidation ion healthy adults." Diabetes Care **25**(8): 1283-1288.

OBJECTIVE- Diets high in total and saturated fat are associated with insulin resistance. T is study examined the effects of feeding monounsaturated, saturated, and trans fatty acids on insulin action in healthy adults. RESEARCH DESIGN AND METHODS- A randomized, double-blind, crossover study was conducted comparing three controlled 4-week diets (57% carbohydrate, 28% fat, and 15% protein) enriched with different fatty acids in 25 healthy men and women. The monounsaturated fat diet (M) had 9% of energy as C18:1cis (oleic acid). The saturated fat diet (S) had 9% of energy as palmitic acid, and the trans fatty acid diet (T) had 9% as C18:1trans. Body weight was kept constant throughout the study. After each diet period, insulin pulsatile secretion, insulin sensitivity index (S,) by the minimal model method, serum lipids, and fat oxidation by indirect calorimetry were measured. RESULTS- Mean S, for the M, S, and T diets was 3.44 +/- 0.26, 3.20 +/- 0.26, and 3.40 +/- 0.26 X 10(-4) min(-1) . muU(-1) . ml(-1), respectively (NS). S-1 decreased by 24% on the S versus M diet in overweight subjects but was unchanged in lean subjects (NS). Insulin secretion was unaffected by diet, whereas total and HDL cholesterol increased significantly on the S diet. Subjects oxidized the least fat on the M diet (26.0 +/- 1.5 g/day) and the most fat on the T diet (31.4 +/- 1.5 g/day) (P = 0.02). CONCLUSIONS- Dietary fatty acid composition significantly influenced fat oxidation but did not impact insulin sensitivity or secretion in lean individuals. Overweight individuals were more susceptible to developing insulin resistance on high-saturated fat diets.

Lukic, T., et al. (2003). "Disodium ascorbyl phytostanyl phosphate reduces plasma cholesterol concentrations and atherosclerotic lesion formation in apolipoprotein E-deficient mice." Metabolism-Clinical and Experimental **52**(4): 425-431.

Disodium ascorbyl phytostanyl phosphate (FM-VP4) consists of ascorbic acid covalently bound to phytostanols by a phosphodiester linkage and is derived as the disodium salt. The purpose of this study was to evaluate the lipid-lowering and antiatherosclerotic properties of FM-VP4 following administration to apolipoprotein E (ApoE)-deficient mice. Four-week-old male C57BL/6J mice with a homozygous deletion of the ApoE gene (apolipoprotein E knock-out) were administered 0 (control), 0.1%, 0.5%, 1.0%, and 2.0% (wt/vol) FM-VP4 in their drinking water or 2.0% FM-VP4 (wt/wt) in their diet for 12 consecutive weeks. All animals received a standard mouse chow diet consisting of 9.0% (wt/wt) fat and 0.2% (wt/wt) cholesterol. Plasma cholesterol and triglyceride levels were determined at baseline and at 4-week intervals (4, 8, and 12 weeks) throughout the term of the study. At the end of the study, mice were killed using CO2 gas, and blood was taken from the heart. The heart and aorta were removed and sections of the aortic roots were stained with oil red 0 (ORO) and Movat's stain. The lesions found in this area were measured using a computer-assisted image analysis. Consumption of FM-VP4 by either food or drinking water routes was associated with an approximately 75% reduction in total plasma cholesterol levels and a 75% decrease in aortic atherosclerotic lesion area in ApoE-deficient mice over 12 weeks compared to controls. A trend in decreasing plasma triglyceride levels was also observed. Taken together these data suggest that FM-VP4 has both lipid-lowering and antiatherosclerotic properties following 12-week administration to ApoE-deficient mice. Copyright 2003 Elsevier, Inc. All rights reserved.

Lupi, F. R., et al. (2011). "A rheological analysis of structured water-in-olive oil emulsions." Journal of Food Engineering **107**(3-4): 296-303.

Structured emulsions are widely used in the food industry. In the case of water-in-oil emulsions, an oil phase structuration is achieved by the creation of a saturated fat crystalline network inside which water droplets are entrapped. Traditional technology based on the hydrogenation of vegetable oils, leads to the formation of saturated trans-fatty acids, considered unhealthy owing to their potential contribution to cardio-vascular diseases. As a consequence, nowadays the use of hydrogenated fatty acids has been reduced and the consumption of healthy oils has increased. However oils need to be properly structured to be used as solid fat replacers. The present work deals with the theological study of W/O emulsions, structured through the oil phase crystallisation by organogelator agents (mono- and di-glycerides of fatty acids). The oil phase was prepared by blending a high-oleic-acid-containing oil (olive oil) with a natural saturated fatty acids source (cocoa butter). A highly structured network is obtained by rapidly cooling the molten oil phase at low shear rates. The emulsions prepared were compared with commercial margarines and they showed theological properties suitable to a potential application as "solid fats". (C) 2011 Elsevier Ltd. All rights reserved.

Machado, R. M., et al. (2010). "Intake of trans Fatty Acids Causes Nonalcoholic Steatohepatitis and Reduces Adipose Tissue Fat Content." Journal of Nutrition **140**(6): 1127-1132.

We investigated the effects of dietary trans fatty acids, PUFA, and SEA on body and liver fat content, liver histology, and mRNA of enzymes involved in fatty acid metabolism. LDL receptor knockout weaning male mice were fed for 16 wk with diets containing 40% energy as either trans fatty acids (TRANS), PUFA, or SEA. Afterwards, subcutaneous and epididymal fat were weighed and histological markers of nonalcoholic fatty liver disease (NAFLD) were assessed according to the Histological Scoring System for NAFLD. PPAR alpha, PPAR gamma, microsomal triglyceride transfer protein (MTP), carnitine palmitoyl transferase 1 (CPT-1), and sterol regulatory element binding protein-1c (SREBP-1c) mRNA were measured by quantitative RT-PCR. Food intake was similar in the 3 groups, although mice fed the TRANS diet gained less weight than those receiving the PUFA diet. Compared with the PUFA- and SEA-fed mice, TRANS-fed mice had greater plasma total cholesterol (TC) and triglyceride (TG) concentrations, less epididymal and subcutaneous fat, larger livers with nonalcoholic steatohepatitis (NASH)-like lesions, and greater liver TC and TG concentrations. Macrosteatosis in TRANS-fed mice was associated with a higher homeostasis model assessment of insulin resistance (HOMA(IR)) index and upregulated mRNA related to hepatic fatty acid synthesis (SREBP-1 c and PPAR gamma) and to downregulated MTP mRNA. Diet consumption did not alter hepatic mRNA related to fatty acid oxidation (PPAR alpha and CPT-1). In conclusion, compared with PUFA- and SFA-fed mice, TRANS-fed mice had less adiposity, impaired glucose tolerance characterized by greater HOMA(IR) index, and NASH-like lesions due to greater hepatic lipogenesis. These results demonstrate the role of trans fatty acid intake on the development of key features of metabolic syndrome. J. Nutr. 140: 1127-1132, 2010.

Madsen, M. B., et al. (2007). "The effect of a combination of plant sterol-enriched foods in mildly hypercholesterolemic subjects." Clinical Nutrition **26**(6): 792-798.

Background & aims: The purpose of this study was to evaluate the effect of low-fat products enriched with plant sterols in addition to a National Cholesterol Education Program step 1 diet on serum lipids and lipoproteins. Methods: This study was a double-blind, randomised, placebo-controlled cross-over design with a run-in period and 2 intervention periods, each lasting 4 weeks. A total of 46 mildly hypercholesterolemic subjects (age 50.6+/-9.8) completed the trial. The study products consisted of 20g low-fat margarine (35% fat) and 250 ml low-fat milk (0.7% fat), in total delivering 2.3 g plant sterols/d. Results: Serum total, and tow-density lipoprotein cholesterol. were significantly reduced by 5.5% (p<0.001, 95% CI: 2.5; 8.3) and 7.7% (p = 0.001, 95% CI: 3.4; 11.9), respectively, by plant sterol-enriched products compared to placebo. Serum apolipoprotein B was significantly reduced by 4.6% (p<0.05, 95% CI: 1.7; 7.5), and apolipoprotein B/apolipoprotein A-I by 3.4% (p<0.05, 95% CI: 0.1; 6.6) after plant sterol intake compared to the placebo supplement. Conclusions: A combination of tow-fat margarine and milk enriched with plant sterols significantly reduced low-density lipoprotein cholesterol, apolipoprotein B and the ratio of apolipoprotein B to apolipoprotein A-I in mildly hypercholesterolemic subjects, but had no effect on C-reactive protein and lipoprotein (a) concentrations. Sponsorship: Unilever Denmark A/S. (C) 2007 Elsevier Ltd and European Society for Clinical Nutrition and Metabolism. All rights reserved.

Maki, K. C., et al. (2001). "Lipid responses to plant-sterol-enriched reduced-fat spreads incorporated into a National Cholesterol Education Program Step I diet." American Journal of Clinical Nutrition **74**(1): 33-43.

Background: Plant sterol esters reduce cholesterol absorption and lower circulating blood cholesterol concentrations when incorporated into the habitual diet. Objective: This randomized, double-blind, 3-group parallel, controlled study evaluated the influence of esterified plant sterols on serum lipid concentrations in adults with mild-to-moderate primary hypercholesterolemia. Design: Subjects incorporated a conventional 50%-fat spread into a National Cholesterol Education Program Step I diet for a 4-wk lead-in period, followed by a 5-wk intervention period of the diet plus either a control reduced-fat spread (40% fat; n = 92) or a reduced-fat spread enriched with plant sterol esters to achieve intakes of 1.1 g/d (n = 92; low-sterol group) or 2.2 g/d (n = 40; high-sterol group). Results: Subjects in the low- and high-sterol groups who consumed greater than or equal to 80% of the scheduled servings (per-protocol analyses) had total cholesterol values that were 5.2% and 6.6% lower, LDL-cholesterol values that were 7.6% and 8.1% lower, apolipoprotein B values that were 6.2% and 8.4% lower, and ratios of total to HDL cholesterol that were 5.9% and 8.1% lower, respectively, than values for the control group (P < 0.001 for all). Additionally, triacylglycerol concentrations decreased by 10.4% in the high-sterol group. Serum concentrations of fat-soluble vitamins and carotenoids were generally within reference ranges at baseline and postintervention. Serum plant sterol concentrations increased from baseline (0.48% of total sterol by wt) to 0.64% and 0.71% by wt for the low- and high-sterol groups, respectively (P < 0.05 compared with control). Conclusion: A reduced-fat spread containing plant sterol esters incorporated into a low-fat diet is a beneficial adjunct in the dietary management of hypercholeslerolemia.

Malinowski, J. M. and M. M. Gehret (2010). "Phytosterols for dyslipidemia." American Journal of Health-System Pharmacy **67**(14): 1165-1173.

Purpose. The efficacy and safety of phytosterols for the management of dyslipidemia are reviewed. Summary. Phytosterols have been evaluated in over 40 clinical trials. The incorporation of 2 g of phytosterols daily into margarine, mayonnaise, orange juice, olive oil, low-fat milk, yogurt, and tablets is associated with significant reductions in low-density-lipoprotein (LDL) cholesterol from baseline over 1-12 months in adults with normal or high cholesterol, in children, and in patients with type 2 diabetes mellitus. Phytosterol dosages of 1.6-3 g daily have been shown to reduce LDL cholesterol by 4.1-15% versus placebo within the first month of therapy. One meta-analysis found mean reductions of 10-11%, but results vary. Several placebo-controlled trials found that the addition of phytosterols to statin therapy was associated with reductions of 7-20% in LDL cholesterol for up to 1.5 years. Overall, phytosterols are useful for reducing LDL cholesterol in patients who cannot reach their treatment goal by diet alone or who are taking maximum tolerated doses of statins. These products offer an alternative to statins in patients who cannot take statins or whose statin dosage is restricted because of potential drug interactions or concomitant diseases. Commonly reported adverse effects are primarily gastrointestinal in nature. Conclusion. Phytosterol therapy produces an average 10-11% reduction in LDL cholesterol concentration, but it is unknown whether this effect persists beyond two years. Phytosterol products are well tolerated and have few drug interactions, but their long-term safety has not been established. Current evidence is sufficient to recommend phytosterols for lowering LDL cholesterol in adults.

Mannisto, S., et al. (2005). "Dietary patterns and breast cancer risk: results from three cohort studies in the DIETSCAN project." Cancer Causes & Control **16**(6): 725-733.

Objective: Only a few consistent findings on individual foods or nutrients that influence breast cancer risk have emerged thus far. Since people do not consume individual foods but certain combinations of them, the analysis of dietary patterns may offer an additional aspect for assessing associations between diet and diseases such as breast cancer. It is also important to examine whether the relationships between dietary patterns and breast cancer risk are consistent across populations. Methods: We examined the risk of breast cancer with two dietary patterns, identified as "Vegetables" (VEG) and "Pork, Processed Meat, Potatoes" (PPP), common to all cohorts of the DIETSCAN project. During 7 to 13 years of follow-up, three of the cohorts - the Netherlands Cohort Study on diet and cancer (NLCS), the Swedish Mammography Cohort (SMC), and the Ormoni e Dieta nella Eziologia dei Tumori (Italy-ORDET) - provided data on 3271 breast cancer cases with complete information on their baseline diet measured by a validated food frequency questionnaire. Results: After adjustment for potential confounders, VEG was not associated with the risk of breast cancer across all cohorts. PPP was also not associated with the risk of breast cancer in SMC and ORDET, but a high PPP score tended to be inversely associated with breast cancer in the NLCS study (RR = 0.69; 95% CI, 0.52-0.92, highest versus lowest quartile). PPP differed in one aspect between the cohorts: butter loaded positively on the pattern in all cohorts except NLCS, in which butter loaded negatively and appeared to be substituted by low-fat margarine loading positively. Conclusion: In general, the dietary patterns showed consistent results across the three cohorts except for the possible protective effect of PPP in the NLCS cohort, which could be explained by a difference in that pattern for NLCS. The results supported the suggestion derived from traditional epidemiology that relatively recent diet may not have an important role in the etiology of breast cancer.

Mantzioris, E., et al. (2000). "Biochemical effects of a diet containing foods enriched with n-3 fatty acids." American Journal of Clinical Nutrition **72**(1): 42-48.

Background: Results of many studies indicate that consumption of n-3 fatty acids can benefit persons with cardiovascular disease and rheumatoid arthritis. However, encapsulated fish oil is unlikely to be suited to lifetime daily use and recommendations to increase fish intake have not been effective. Objective: The objective was to examine the effectiveness of a diet that incorporates foods rich in n-3 fatty acids in elevating tissue concentrations of eicosapentaenoic acid and in suppressing the production of inflammatory mediators. Design: Healthy male volunteers were provided with foods that were enriched in alpha-linolenic acid (cooking oil, margarine, salad dressing, and mayonnaise) and eicosapentaenoic and docosahexaenoic acids (sausages and savory dip) and with foods naturally rich in n-3 fatty acids, such as flaxseed meal and fish. Subjects incorporated these products into their food at home for 4 wk. Fatty acid intakes, cellular and plasma fatty acid concentrations. and monocyte-derived eicosanoid and cytokine production were measured. Results: Analyses of dietary records indicated that intake of eicosapentaenoic acid plus docosahexaenoic acid averaged 1.8 g/d and intake of alpha-linolenic acid averaged 9.0 g/d, These intakes led to an average 3-fold increase in eicosapentaenoic acid in plasma, platelet, and mononuclear cell phospholipids. Thromboxane B-2, prostaglandin E-2, and interleukin 1 beta synthesis decreased by 36%, 26%, and 20% (P < 0.05), respectively. Conclusions: Foods that are strategically or naturally enriched in n-3 fatty acids can be used to achieve desired biochemical effects without the ingestion of supplements or a change in dietary habits. A wide range of n-3-enriched foods could be developed to support large-scale programs on the basis of the therapeutic and disease-preventive effects of n-3 fatty acids.

Marhol, P., et al. (2007). "Higher content of C18 : 1 trans fatty acids in early human milk fat of Roma breast-feeding women." Annals of Nutrition and Metabolism **51**(5): 461-467.

Aim: The purpose of our study was to determine the content of trans fatty acids in early human breast milk as an indicator of dietary exposure in a sample of Roma breast-feeding women and in a sample of women from the general Czech population. Methods: We collected samples of early human milk from 43 Prague women from the general population and 21 Roma women. After lipid extraction, the fatty acids were converted into methyl esters (FAMEs). Finally, gas chromatography with flame ionization detector (GC-FID) analysis on a CP-Sil 88 column was used to determine C18:1 trans monoenic fatty acid levels and total trans isomers fatty acid levels in human milk. Results: A significantly higher content of C18:1 trans fatty acid isomers was detected in human milk fat from Roma mothers than in women of the general population (2.73 vs. 2.09%, p < 0.05). Both groups monitored did not differ in the representation of total fatty acid trans isomers. Differences in the frequency of consumption of certain TFA sources (butter, fried crisps) were established. Conclusions: The study proved a higher fatty acid trans isomers content in Roma breast-feeding mothers in the Czech Republic, and this is probably related to their bad eating habits. Copyright c 2007 S. Karger AG, Basel.

Marks, D., et al. (2003). "A review on the diagnosis, natural history, and treatment of familial hypercholesterolaemia." Atherosclerosis **168**(1): 1-14.

Background: Familial hypercholesterolaemia (FH) affects approximately 1 in 500 people (10 million world-wide) and the elevated serum cholesterol concentrations lead to a more than 50% risk of fatal or non-fatal coronary heart disease by age 50 years in men and at least 30% in women aged 60 years. Based on a systematic literature search, we review the natural history of FH, describe the diagnostic criteria, and consider the effectiveness of treatment. Methods: A comprehensive review was conducted of the literature on the diagnosis of FH, the morbidity and mortality related to treated and untreated FH, and the evidence on the effectiveness of treatment of FH in adults and children. Treatment options have changed since statin treatment became available, and we have not considered pre-statin therapy studies of treatment effectiveness. Findings and discussion: A clinical diagnosis of FH is widely used, but a definitive diagnosis can be made by genetic screening, although mutations are currently only detected in 30-50% of patients with a clinical diagnosis. Under-diagnosis of FH has been reported world-wide ranging from less than 1% to 44%. The relative risk of death of FH patients not treated with statins is between three and fourfold but treatment is effective, and delays or prevents the onset of coronary heart disease. Early detection and treatment is important. Aggressive LDL therapy is more effective in the regression of the carotid intima media thickness than conventional LDL therapy. Diagnosis at birth is problematic, and should be delayed until at least 2 years of age. Statins are not generally recommended for the treatment of children up to adolescence. Resins may be used but poor adherence is a problem. Technical advances in mutation detection, and the identification of other genes that cause FH, are likely to have important implications for the cost effectiveness of genetic diagnosis of FH. (C) 2002 Elsevier Science Ireland Ltd. All rights reserved.

Martikainen, J. A., et al. (2007). "Plant stanol esters are potentially cost-effective in the prevention of coronary heart disease in men: Bayesian modelling approach." European Journal of Cardiovascular Prevention & Rehabilitation **14**(2): 265-272.

Background Plant stanol esters in spreads have demonstrated efficacy in reducing serum cholesterol. The cost-effectiveness of plant stanol esters in the prevention of coronary heart disease, however, has remained unevaluated. Design A Bayesian modelling approach was applied to synthesize clinical evidence and evaluate the cost-effectiveness (EURO/quality-adjusted life years) of plant stanol esters in spread in the prevention of coronary heart disease based on published FINRISK and 4S risk functions. Results The regular use of plant stanol esters reduced total serum cholesterol by - 0.362 mmol/l [95% credibility interval (Crl) -0.31 to -0.41]. The corresponding placebo-adjusted reduction attributable to stanol esters when combined with statin was - 0.385 mmol/l (95% Crl - 0.18 to - 0.61). The cost-effectiveness estimations were assessed for men and women separately at four different initial ages at which the regular use of stanol esters was assumed to be started. The base case cost per quality-adjusted life years gained by using stanol esters regularly ranged from EURO 7436 to EURO 20 999 in men and from EURO 34 327 to EURO 12 151 in women based on the initial starting age. According to uncertainty analysis, there is over a 90% probability that the use of plant stanol esters is cost-effective for men inclusively and for 60-year-old and older women assuming that decision-makers' maximum willingness to pay per quality-adjusted life year is EURO 50 000. Conclusions A recommendation that plant stanol ester-containing spreads be used as a part of daily diet replacing regular spread could be viewed as potentially cost-effective public health policy in the prevention of CHD in all adult men and in older age-groups of women with total serum cholesterol levels of 5 mmol/l or greater.

Martin, C. A., et al. (2005). "Trans fatty acid content of Brazilian biscuits." Food Chemistry **93**(3): 445-448.

The fatty acid composition and trans fatty acid (TFA) contents of samples of five brands Brazilian cream cracker biscuits were determined by gas-liquid chromatography, using a polar 100 in capillary column CP Sil-88 and flame ionization detection. The identification of fatty acids done by equivalent chain length for trans fatty acids. Total TFA ranged from 12.2% to 31.2% of total fatty acid and the mean was 20.1%. Trans 18:1 isomers were the major group of TFA present in all the analyzed brands, representing 83.2% of total trans isomers. The mono-trans 18:2 isomer content ranged from 1.6% to 4.2% of total fatty acids, this being the most prevalent group of trans polyunsaturated acid. The di-trans 18:2 isomer (9t, 12t) was found at very low levels (0.10-0.15% of total fatty acids). Trans 18:3 isomer content ranged from 0. 11% to 0.75% of total fatty acids representing 24.4-75.0% of total a-linolenic acid. The results indicate that Brazilian cream cracker biscuits contain considerable proportions of trans fatty acids, both monounsaturated and polyunsaturated. (c) 2004 Elsevier Ltd. All rights reserved.

Martin, J. C. and K. Valeille (2002). "Conjugated linoleic acids: all the same or to everyone its own function?" Reproduction Nutrition Development **42**(6): 525-536.

Conjugated linoleic acid (CLA) is a generic term referring to a mixture of geometrical and positional isomers of linoleic acid in which up to 16 members have been identified. Many potentially beneficial health effects have been ascribed to these fatty acids when consumed as a mixture, and where generally 2 isomers dominate, e. g. the 9c,11t-isomer, the so-called rumenic acid, and the 10t,12c-isomer: anti-carcinogenic, immune modulator, anti-atherosclerotic, and anti-obesity among the most spectacular. The question arises as to whether the pleiotropic biological activity is supported by one or several of the isomers. Recent studies using pure individual isomers have started to elucidate this issue, but many others are required to ascribe a respective role to each CLA isomer (the main ones as well as the minor ones), such as those occurring in some complex mixtures already commercially available, or even in foodstuff. The aim of the present study was to focus on the CLA-isomer specific effects depicted in the literature up to now.

Matthan, N. R., et al. (2000). "Deuterium uptake and plasma cholesterol precursor levels correspond as methods for measurement of endogenous cholesterol synthesis in hypercholesterolemic women." Lipids **35**(9): 1037-1044.

To assess the validity of two techniques used to measure human cholesterol synthesis, the rate of uptake of deuterium (D) into plasma free cholesterol (FC), and plasma cholesterol precursor (squalene, lanosterol, desmosterol and lathosterol) levels were compared in 14 women [65-71 yr with low density lipoprotein-cholesterol (LDL-C) greater than or equal to 3.36 mmol.L-1]. Subjects consumed each of six diets for 5-wk periods according to a randomized crossover design. The experimental diets included a baseline diet (39% energy as fat, 164 mg chol.4.2 MJ(-1)) and five reduced-fat diets (30% of energy as fat), where two-thirds of the fat was either soybean oil; squeeze, tub or stick margarines; or butter. Fractional and absolute synthesis rates (FSR and ASR) of FC were determined using the deuterium incorporation (DI) method, while cholesterol precursor levels were measured using gas-liquid chromatography. Data were pooled across diets for each variable and correlation coefficients were calculated to determine if associations were present. There was good agreement among levels of the various cholesterol precursors. In addition, FSR in pools/d (p.d(-1)) and ASR in grams/d (g.d(-1)) were strongly associated with lathosterol (r = 0.72 and 0.71, P = 0.0001), desmosterol (r = 0.75 and 0.75, P = 0.0001), lanosterol (r = 0.67 and 0.67), and squalene (r = 0.69 and 0.68) when levels of the precursors were expressed as mu mol.mmol(-1) C. Significant but lower correlations were observed between the D uptake and plasma cholesterol precursor levels when the latter were expressed in absolute amounts (mu mol.L-1). The wide range of fatty acid profiles of the experimental diets did not influence the degree of association between methods. In conclusion, the DI method and levels of some cholesterol precursors correspond as methods for short-term measurement of cholesterol synthesis.

Matthys, C., et al. (2006). "Sources of saturated fatty acids in Belgian adolescents' diet: implications for the development of food-based dietary guidelines." British Journal of Nutrition **95**(3): 546-554.

The objectives of the present study are to describe the dietary sources of total fat and of saturated fatty acids (SFA) and to formulate food-based dietary guidelines for SFA in Belgian adolescents. A random sample of 13-18-year-old adolescents was drawn from secondary schools in the region of Ghent. A 7 d estimated food record method was used to quantify nutrient and food intake. The average daily SFA intake is 4% above the recommended 10% of the total energy contribution. The most important contributors of SFA on food group level were 'fats, oils and savoury sauces', 'meat and meat products', 'sugar, confectionery, sweet fillings and sauces', 'cheese', 'milk and milk products' and 'bread, rusk and breakfast rolls'. On food subgroup level 'fresh meat', 'high-fat margarine' and 'high-fat cheese' had the highest contribution to SFA intake in all adolescents. Adolescents with a low SFA intake (lowest tertile) were compared with adolescents with a high intake (highest tertile). In the lowest tertile the intake of total fat and MUFA was significantly lower than in the highest tertile, while the intake of total carbohydrates, mono- and disaccharides and complex carbohydrates was significantly higher. Overall, the high-fat cheese intake is significantly lower in the lowest tertile, while the fruit intake is higher. The present analysis shows that the nutritional profile of Belgian adolescents could be potentially improved by decreasing the portion sizes of fresh meat (in boys), high-fat margarine, high-fat cheese and reducing intake of commercially prepared baked goods and processed foods, including fast foods.

Matvienko, O. A., et al. (2002). "A single daily dose of soybean phytosterols in ground beef decreases serum total cholesterol and LDL cholesterol in young, mildly hypercholesterolemic men." American Journal of Clinical Nutrition **76**(1): 57-64.

Background: Consumption of phytosterol-supplemented margarine lowers total plasma cholesterol (TC) and LDL-cholesterol concentrations in older middle-aged hypercholesterolemic individuals. The effects of incorporating phytosterols into lower-fat foods on the plasma lipids of young men at increased risk of developing cardiovascular disease have not been studied. Objective: We tested the hypothesis that a single daily dose of soybean phytosterols added to ground beef will lower plasma TC and LDL-cholesterol concentrations in mildly hypercholesterolemic young men. Design: In a triple-blind, 4-wk study, 34 male college students with elevated plasma TC (5.85 +/- 0.70 mmol/L), LDL cholesterol (4.02 +/- 0.60 mmol/L), and TC:HDL cholesterol (5.5 +/- 1.2) were randomly assigned to the control (ground beef alone) or treatment (ground beef with 2.7 g of phytosterols) group. The phytosterol mixture was two-thirds esterified and one-third nonesterified and consisted of beta-sitosterol (48%), campesterol (27%), and stigmasterol (21%). Results: Consumption of phytosterol-supplemented ground beef lowered plasma TC and LDL-cholesterol concentrations and TC:HDL cholesterol from baseline by 9.3%, 14.6%, and 9.1%, respectively (P < 0.001). The LDL particle size did not change, suggesting that the decrease was primarily of particle number. The decreases were similar in subjects with (n = 8) and without (n = 9) a family history of premature cardiovascular disease. No significant changes were found in the control group. Conclusion: Phytosterol-supplemented ground beef effectively lowers plasma TC and LDL cholesterol and has the potential to become a functional food to help reduce the risk of cardiovascular disease.

Mauger, J. F., et al. (2003). "Effect of different forms of dietary hydrogenated fats on LDL particle size." American Journal of Clinical Nutrition **78**(3): 370-375.

Background: Dietary trans fatty acids (FAs), which are formed during the process of hydrogenating vegetable oil, are known to increase plasma LDL-cholesterol concentrations. However, their effect on LDL particle size has yet to be investigated. Objective: We investigated the effect of trans FA consumption on the electrophoretic characteristics of LDL particles. Design: Eighteen women and 18 men each consumed 5 experimental diets in random order for 35-d periods. Fat represented 30% of total energy intake in each diet, with two-thirds of the fat in the form of semiliquid margarine (0.6 g trans FAs/100 g fat), soft margarine (9.4 g trans FAs/100 g fat), shortening (13.6 g trans FAs/100 g fat), stick margarine (26.1 g trans FAs/100 g fat), or butter, which was low in trans FAs (16 g trans FAs/100 g fat) but rich in saturated fat. LDL particle size and distribution were characterized by nondenaturing, 2-16% polyacrylamide gradient gel electrophoresis. Results: Relative to the LDL particle size observed after consumption of the butter-enriched diet, LDL particle size decreased significantly and in a dose-dependent fashion with increasing amounts of dietary trans FAs (P < 0.001). Cholesterol concentrations in large (> 260 Angstrom) and medium-sized (255-260 Angstrom) LDL particles also increased proportionately to the amount of trans FAs in the diet. Conclusion: Consumption of dietary trans FAs is associated with a deleterious increase in small, dense LDL, which further reinforces the importance of promoting diets low in trans FAs to favorably affect the lipoprotein profile.

Mayneris-Perxachs, J., et al. (2010). "Diet and plasma evaluation of the main isomers of conjugated linoleic acid and trans-fatty acids in a population sample from Mediterranean north-east Spain." Food Chemistry **123**(2): 296-305.

The aim of the present study was to describe the dietary pattern of a representative sample of 516 adult participants (203 men and 313 women) from Catalonia, a Spanish Mediterranean region, to assess their current dietary and plasma levels of trans C18:1, the major trans-fatty acid (TFA), and cis-9, trans-11 CLA, and trans-10, cis-12 CLA, the two major conjugated linoleic acid (CLA) isomers, and to evaluate their correlation with several cardiovascular disease risk factors. The population was a random sample derived from the Catalan Nutrition Survey. Plasma levels of the CLA isomers were determined in a subsample of 100 volunteers. The Catalan diet seemed to maintain some traits of the 'traditional' Mediterranean diet, although other components were lost. The dietary intakes of saturated fatty acids (SFA), TFA, cis-9, trans-11 CIA, and trans-10, cis-12 CIA were 12.3%, 0.84% (2.0 g/d), 0.030% (71.5 mg/d), and 0.0015% (3.4 mg/d) of the energy intake, respectively. Trans C18:1 accounted for 0.19% of the total plasma fatty acids, while the sum of cis-9, trans-11 and trans-10, cis-12 CIA isomers represented about 0.09% of the plasma fatty acids. Trans C18:1 isomers correlated significantly with the intake of French fries and pastries, while cis-9, trans-11 CIA significantly correlated with the intake of dairy products and ruminant meat. None of the cardiovascular disease risk factors were found to be associated with the plasma levels of TFA or CIA. The results of this study suggest that monounsaturated fatty acids (MUFA) are the main dietary fat source in the Catalan population, due to their regular olive oil consumption. Moreover, plasma levels of the main TFA and CIA suggest that the Catalan diet is not at present strongly influenced by the occidental dietary patterns. However, a reduction of the intake of SFA in the Catalan population should be recommended. (C) 2010 Elsevier Ltd. All rights reserved.

McCarthy, J., et al. (2008). "Determination of trans fatty acid levels by FTIR in processed foods in Australia." Asia Pacific Journal of Clinical Nutrition **17**(3): 391-396.

Health authorities around the world advise 'limiting consumption of trans fatty acids', however in Australia the trans fatty acid (TFA) content is not required to be listed in the nutrition information panel unless a declaration or nutrient claim is made about fatty acids or cholesterol. Since there is limited knowledge about trans fatty acid levels in processed foods available in Australia, this study aimed to determine the levels of TFA in selected food items known to be sources of TFA from previously published studies. Food items (n=92) that contain vegetable oil and a total fat content greater than 5% were included. This criterion was used in conjunction with a review of similar studies where food items were found to contain high levels of trans fatty acids. Lipids were extracted using solvents. Gravimetric methods were used to determine total fat content and trans fatty acid levels were quantified by Attenuated Total Reflectance Fourier Transform Infrared spectroscopy. High levels of trans fatty acids were found in certain items in the Australian food supply, with a high degree of variability. Of the samples analysed, 13 contained greater than I g of trans fatty acids per serving size, the highest value was 8.1 g/serving. Apart from when the nutrition information panel states that the content is less than a designated low level, food labels sold in Australia do not indicate trans fatty acid levels. We suggested that health authorities seek ways to assist consumers to limit their intakes of trans fatty acids.

McCloy, U., et al. (2004). "A comparison of the metabolism of eighteen-carbon C-13-unsaturated fatty acids in healthy women." Journal of Lipid Research **45**(3): 474-485.

Altered use of different dietary fatty acids may contribute to several chronic diseases, including obesity, noninsulin-dependent diabetes mellitus, and cardiovascular disease. However, few comparative data are available to support this link, so the goal of the present study was to compare the metabolism of [C-13]oleate, [C-13]alpha-linolenate, [C-13]elaidate, and [C-13]linoleate through oxidation and incorporation into plasma lipid fractions and adipose tissue. Each tracer was given as a single oral bolus to six healthy women. Samples were collected over 8 days, and C-13 was analyzed using isotope ratio mass spectrometry. At 9 It post-dose, cumulative oxidation was similar for [C-13]elaidate, [C-13]oleate, and [C-13]a-linolenate (19 +/- 1%, 20 +/- 4%, and 19 +/- 3% dose, respectively). Significantly lower oxidation of [C-13]linoleate (12 +/- 4% dose; P < 0.05) was accompanied by its higher incorporation into plasma phospholipids and cholesteryl esters. Abdominal adipose tissue was enriched with [C-13]alpha-linolenate, [C-13]elaidate, or [C-13]linoleate within 6 h. The percentage linoleate in plasma phospholipids correlated positively with [C-13]linoleate and [C-13]elaidate oxidation, indicating a potential role of background diet. Conversion of [C-13]linoleate and [C-13]alpha-linolenate to longer chain polyunsaturates was a quantitatively minor route of utilization.-McCloy, U., M. A. Ryan, P. B. Pencharz, R. J. Ross, and S. C. Cunnane. A comparison of the metabolism of eighteen-carbon C-13-unsaturated fatty acids in healthy women.

McKimmie, R. L., et al. (2013). "Acyl chain length, saturation, and hydrophobicity modulate the efficiency of dietary fatty acid absorption in adult humans." American Journal of Physiology-Gastrointestinal and Liver Physiology **305**(9): G620-G627.

Intestinal fat absorption is known to be, overall, a highly efficient process, but much less is known about the efficiency with which individual dietary fatty acids (FA) are absorbed by the adult small intestine. We therefore measured the absorption efficiency of the major dietary FA using sucrose polybehenate (SPB) as a nonabsorbable marker and analyzed how it is modulated by acyl chain physicochemical properties and polymorphisms of proteins involved in chylomicron assembly. Dietary FA absorption efficiency was measured in 44 healthy subjects fed a standard diet containing 35% fat and 5% SPB. FA and behenic acid (BA) were measured in homogenized diets and stool samples by gas chromatography-mass spectroscopy, and coefficients of absorption for each FA were calculated as 1 - [(FA/BA)(feces)/(FA/BA)(diet)]. Absorption coefficients for saturated FA decreased with increasing chain length and hydrophobicity (mean +/- SE) and ranged from 0.95 +/- 0.02 for myristate (14:0), 0.80 +/- 0.03 for stearate (18: 0), to 0.26 +/- 0.02 for arachidate (20:0). Absorption coefficients for unsaturated FA increased with increasing desaturation from 0.79 +/- 0.03 for elaidic acid (18: 1t), 0.96 +/- 0.01 for linoleate (18:2), to near complete absorption for eicosapentaenoic (20:5) and docosahexaenoic (22:6) acids. Of several common genetic polymorphisms in key proteins involved in the chylomicron assembly pathway, only the intestinal fatty acidbinding protein-2 A54T allele (rs1799883) had any impact on FA absorption. We conclude that acyl chain length, saturation, and hydrophobicity are the major determinants of the efficiency with which dietary FA are absorbed by the adult small intestine.

McNamara, R. K., et al. (2007). "Abnormalities in the fatty acid composition of the postmortem orbitofrontal cortex of schizophrenic patients: Gender differences and partial normalization with antipsychotic medications." Schizophrenia Research **91**(1-3): 37-50.

Previous studies have observed significant abnormalities in the fatty acid composition of peripheral tissues from drug-naive first episode schizophrenic (SZ) patients relative to normal controls, including deficits in omega-3 and omega-6 polyunsaturated fatty acids, which are partially normalized following chronic antipsychotic treatment. We hypothesized that postmortem cortical tissue from patients with SZ would also exhibit deficits in cortical docosahexaenoic acid (DHA, 22:6n-3) and arachidonic acid (AA; 20:4n-6) relative to normal controls, and that these deficits would be greater in drug-free SZ patients. We determined the total fatty acid composition of postmortem orbitofrontal cortex (OFC) (Brodmann area 10) from drug-free and antipsychotic-treated SZ patients (n=21) and agematched normal controls (n=26) by gas chromatography. After correction for multiple comparisons, significantly lower DHA (-20%) concentrations, and significantly greater vaccenic acid (VA) (+12.5) concentrations, were found in the OFC of SZ patients relative to normal controls. Relative to age-matched same-gender controls, OFC DHA deficits, and elevated AA:DHA, oleic acid:DHA and docosapentaenoic acid (22:5n-6):DHA ratios, were found in male but not female SZ patients. SZ patients that died of cardiovascular-related disease exhibited lower DHA (-31%) and AA (-19%) concentrations, and greater OA (+20%) and VA (+17%) concentrations, relative to normal controls that also died of cardiovascular-related disease. OFC DHA and AA deficits, and elevations in oleic acid and vaccenic acid, were numerically greater in drug-free SZ patients and were partially normalized in SZ patients treated with antipsychotic medications (atypical > typical). Fatty acid abnormalities could not be wholly attributed to lifestyle or postmortem tissue variables. These findings add to a growing body of evidence implicating omega-3 fatty acid deficiency as well as the OFC in the pathoaetiology of SZ, and suggest that abnormalities in OFC fatty acid composition may be gender-specific and partially normalized by antipsychotic medications. (c) 2006 Elsevier B.V. All rights reserved.

Meijer, G. W., et al. (2001). "Effect of dietary elaidic versus vaccenic acid on blood and liver lipids in the hamster." Atherosclerosis **157**(1): 31-40.

Male hamsters (30 per group) were fed five different semi-purified diets ad libitum. The diets, containing 30% of energy (en%) as fat, differed in their dietary fat composition (specified fatty acids exchanged at 10 en%) and were fed for 4 weeks. The five fatty acids compared in mixed triglycerides were elaidic acid (C18:1 9t), vaccenic acid (C18:1 lit), their tis-counterpart oleic acid (C18:1 9t), medium-chain fatty acids (MCFA: C8:0 and C10:0), and palmitic acid (C16:0). Compared with oleic acid, dietary MCFA and palmitic acid tended to increase blood cholesterol levels in the hamsters. The effect of elaidic and vaccenic acid on blood cholesterol did not differ from that of oleic acid. When elaidic acid and vaccenic acids were compared directly, the ratio of LDL/HDL-cholesterol in plasma was significantly higher in hamsters fed vaccenic acid than in those fed elaidic acid, and elaidic acid was incorporated at low levels, but more efficiently than vaccenic acid at the sn-2 position of platelet phospholipids. Biological consequences of this low incorporation are considered unlikely as levels of arachidonic acid (C20:4 n-6) and docosohexaenoic acid (C22:6 n-3) in the platelet phospholipids of all dietary groups did not differ. With respect to the effect on the LDL/HDL-cholesterol ratio, elaidic acid may be preferable to vaccenic acid. We conclude that this animal study does not provide evidence for the suggestion, based on epidemiological observations, that elaidic acid would be more detrimental to cardiovascular risk than vaccenic acid. (C) 2001 Elsevier Science Ireland Ltd. All rights reserved.

Meijer, G. W. and J. A. Weststrate (1997). "Interesterification of fats in margarine: Effect on blood lipids, blood enzymes, and hemostasis parameters." European Journal of Clinical Nutrition **51**(8): 527-534.

Objectives: In 60 healthy humans, a blend of commonly used edible vegetable fats was compared with the same fat blend after random chemical interesterification, for their effects in terms of nutritional safety on blood lipids, blood enzymes and hemostasis parameters. Design: Both fat blends were supplied double-blind at two energy levels (4 and 8% of energy) in margarine according to a parallel design. At either energy level, the two fat blends were consumed according to a cross-over design for two periods of three weeks, without an intermediate wash-out period. Results: The 30 parameters studied revealed no statistically significant differences between the two fat blends, except for slightly (similar to 10%) lower D-dimers concentrations after consumption of the interesterified fat blend. Conclusions: Increased levels of the fibrin-degradation products D-dimers are positively associated with risk for coronary heart disease. Thus, it was concluded that the inclusion of a chemically interesterified vegetable fat blend in the diet of healthy people does not influence fasting blood lipids, blood enzymes and/or hemostasis parameters in an adverse way, when compared with a non-interesterified fat blend with the same fatty acid composition.

Menaa, F., et al. (2013). "Trans-fatty acids, dangerous bonds for health? A background review paper of their use, consumption, health implications and regulation in France." European Journal of Nutrition **52**(4): 1289-1302.

Trans-fatty acids (TFAs) can be produced either from bio-hydrogenation in the rumen of ruminants or by industrial hydrogenation. While most of TFAs' effects from ruminants are poorly established, there is increasing evidence that high content of industrial TFAs may cause deleterious effects on human health and life span. Indeed, several epidemiological and experimental studies strongly suggest that high content of most TFA isomers could represent a higher risk of developing cardiovascular diseases by a mechanism that lowers the "good HDL cholesterol" and raises the "bad LDL cholesterol." With respect to the general precautionary principle and considering the existence of an international policy consensus regarding the need for public health action, some industrialized countries, such as France, are still not sufficiently involved in preventive strategies that aim to efficiently reduce TFAs content and TFAs consumption and produce alternative healthier fat sources. In this manuscript, we provide an overview about TFAs origins, their use and consumption among French population. We also discuss their potential human health implications as well as the preventive and regulatory measures undertaken in France.

Menaa, F., et al. (2013). "Technological Approaches to Minimize Industrial Trans Fatty Acids in Foods." Journal of Food Science **78**(3): R377-R386.

Trans fatty acids (TFAs) mainly arise from 2 major sources: natural ruminal hydrogenation and industrial partial catalytic hydrogenation. Increasing evidence suggests that most TFAs and their isomers cause harmful health effects (that is, increased risk of cardiovascular diseases). Nevertheless, in spite of the existence of an international policy consensus regarding the need for public health action, several countries (for example, France) do not adopt sufficient voluntary approaches (for example, governmental regulations and systematic consumer rejections) nor sufficient industrial strategies (for example, development of healthier manufacturing practices and innovative processes such as fat interesterifications) to eliminate deleterious TFAs from processed foods while ensuring the overall quality of the final product (for example, nutritional value and stability). In this manuscript, we first review the physical-chemical properties of TFAs, their occurrence in processed foods, their main effects on health, and the routine analytical methods to characterize TFAs, before emphasizing on the major industrial methods (that is, fat food reformulation, fat interesterification, genetically modified FAs composition) that can be used worldwide to reduce TFAs in foods.

Mendis, S., et al. (2008). "Fatty acid profile of Canadian dairy products with special attention to the trans-octadecenoic acid and conjugated linoleic acid isomers." Journal of Aoac International **91**(4): 811-819.

Current scientific evidence indicates that consumption of industrial trans fatty acids (TFA) produced via partial hydrogenation of vegetable oils increases the risk of coronary heart disease. However, some studies have suggested that ruminant TFA, especially vaccenic acid (VA or 11t-18:1) and rumenic acid (RA or 9c,11t-1 8:2), which is a conjugated linoleic acid (CLA) isomer, may have potential beneficial health effects for humans. To date, no concerted effort has been made to provide detailed isomer composition of ruminant TFA and CLA of Canadian dairy products, information that is required to properly assess their nutritional impacts. To this end, we analyzed the fatty acid profile of popular brands of commercial cheese (n = 17), butter (n = 12), milk (n = 8), and cream (n = 4) sold in retail stores in Ottawa, Canada, in 2006-2007 by silver nitrate thin-layer chromatography and gas liquid chromatography. The average total TFA content of cheese, butter, milk, and cream samples were 5.6, 5.8, 5.8, and 5.5% of total fatty acids, respectively. VA was the major trans-octadecenoic acid (18:1) isomer in all the Canadian dairy samples with average levels of (as % total trans-18:1) 33.9% in cheese, 35.6% in butter, 31.0% milk, and 30.1% in cream. The different dairy products contained very similar levels of CLA, which ranged from 0.5 to 0.9% of total fat. RA was the major CLA isomer of all the dairy products, accounting for 82.4-83.2% of total CLA. There were no significant differences (P > 0.05) in the fatty acid profile between the 4 different dairy groups, which suggests lack of processing effects on the fatty acid profile of dairy fat.

Menotti, A., et al. (1999). "Food intake patterns and 25-year mortality from coronary heart disease: Cross-cultural correlations in the Seven Countries Study." European Journal of Epidemiology **15**(6): 507-515.

In the Seven Countries Study, associations between the intake of food-groups and 25-year mortality from coronary heart disease (CHD, defined as sudden coronary death or fatal myocardial infarction) were investigated. Baseline surveys were carried out between 1958 and 1964. A number of individual characteristics were measured in 12,763 middle-aged men belonging to 16 cohorts in seven countries (USA, Finland, The Netherlands, Italy, former Yugoslavia, Greece and Japan). Dietary information was collected in sub-samples using the weighed record method. Vital status of all participants was verified at regular intervals during 25 years of follow-up and the underlying cause of death was adjudicated. Eighteen different food-groups and combinations were considered for comparison among cohorts. Large differences in food-group consumption were seen, with high consumption of dairy products in Northern Europe, meat in the USA, vegetables, legumes, fish, and wine in Southern Europe, and cereals, soy products, and fish in Japan. Population death rates from CHD showed large differences, ranging from 268 per 1000 in East Finland to 25 per 1000 in Crete, Greece. Animal food-groups were directly correlated, and vegetable food-groups (except potatoes) as well as fish and alcohol were inversely correlated with CHD mortality. Univariate analysis showed significant positive correlation coefficients for butter (R = 0.887), meat (R = 0.645), pastries (R = 0.752), and milk (R = 0.600) consumption, and significant negative correlation coefficients for legumes (R = -0.822), oils (R = -0.571), and alcohol (R = -0.609) consumption. Combined vegetable foods (excluding alcohol) were inversely correlated (R = -0.519), whereas combined animal foods (excluding fish) were directly correlated (R = 0.798) with CHD death rates. Multivariate stepwise analysis selected butter, lard+margarine and meat as significant predictors and produced an R(2) of 0.922. These findings were confirmed by factor analysis. These cross-cultural analyses are consistent with the hypothesis that dietary patterns are important determinants of differences in population CHD death rates, and confirm the opposite effects on apparent risk of animal and vegetable foods.

Mensink, R. P. (2009). Cardiovascular Effects of Trans Fatty Acids.

Key Points Trans fatty acids are found in hydrogenated fats and in fats from ruminants. The intake of trans fatty acids in the United States is in decline and is around 2% of energy. Tissue levels of trans fatty acids reflect dietary intakes. Trans fatty acids have an adverse effect on the serum lipoprotein profile. Epidemiological studies show a positive relationship between the intake of trans fatty acids from partially hydrogenated fats and cardiovascular risk. Keep the intake of trans fatty acids below 1% of energy.

Mensink, R. P., et al. (1992). "EFFECT OF DIETARY CIS AND TRANS-FATTY-ACIDS ON SERUM LIPOPROTEIN A LEVELS IN HUMANS." Journal of Lipid Research **33**(10): 1493-1501.

Serum lipoprotein[a] (Lp[a]) is a strong risk factor for coronary heart disease. We therefore examined the effect of dietary fatty acid composition on serum Lp[a] levels in three strictly controlled experiments with healthy normocholesterolemic men and women. In Expt. I, 58 subjects consumed a control diet high in saturated fatty acids for 17 days. For the next 36 days, 6.5% of total energy intake from saturated fatty acids was replaced by monounsaturates plus polyunsaturates (monounsaturated fatty acid diet; n = 29) or by polyunsaturates alone (polyunsaturated fatty acid diet; n = 29). Both diets caused a slight, nonsignificant, increase in median Lp[a] levels, with no difference between diets. In Expt. II, 10% of energy from the cholesterol-raising saturated fatty acids (lauric, myristic, and palmitic acid) was replaced by oleic acid or by trans-monounsaturated fatty acids. Each of the 59 participants received each diet for 3 weeks in random order. The median level of Lp[a] was 26 mg/l on the saturated fatty acid diet; it increased to 32 mg/l (P < 0.020) on the oleic acid diet and to 45 mg/l (P < 0.001) on the trans-fatty acid diet. The difference in Lp[a] between the trans-fatty acid and the oleic acid diets was also highly significant (P < 0.001). Expt. III involved 56 subjects; all received 8% of energy from stearic acid, from linoleic acid, or from trans-monounsaturates, for 3 weeks each. All other nutrients were equal. Median Lp[a] levels were 69 mg/l on both the stearate diet and linoleate diet, and rose to 85 mg/l (P < 0.01) on the trans diet. Changes in Lp[a] were positively related to initial levels. Samples from Expt. I had been stored for +3 months, those from Expt. II for 31 months, and samples from Expt. III for 14 months at -40-degrees-C or lower. Comparison of 19 paired samples suggested that storage may have caused an overall decrease of 5-12% in Lp[a] levels, with no effect on the order of ranking of Lp[a] within studies. These short-term experiments suggest that diets high in trans-monounsaturated fatty acids may increase serum levels of Lp[a].

Mensink, R. P., et al. (1996). Dietary trans fatty acids and serum lipoproteins.

Trans fatty acids are produced during industrial hydrogenation of vegetable and marine oils. Hydrogenation is used to change the characteristics of oils so that they can be incorporated into food items, such as margarines, shortenings, salad oils, and high-fat baked goods. Hydrogenated oils, however, are not the only source of trans fatty acids in the human diet. Fat from ruminants also contains small amounts of trans fatty acids due to ''natural'' biohydrogenation by bacteria in the rumen. Most trans fatty acids have 18 carbon atoms and one double bond (trans-C18:1). Information on the average intake of trans fatty acids as well as on the variation in intake between individuals is scarce because of missing and unreliable figures for trans-C18:1 in most food composition tables. The health aspects of trans-C18:1 have been evaluated and the general conclusion was that intakes of trans-C18:1 had no adverse effects on health. Five years ago, however, interest in trans-C18:1 revived because it was reported that trans-C18:l. raised low-density Lipoproteins and Lp(a) and lowered high-density lipoproteins as compared with oleic acid (cis-C18:1). The results from all of the recent studies combined suggest that effects of trans-C18:1 on low-density lipoproteins and high-density lipoproteins-which may be mediated by cholesterol ester transfer protein-are dose-dependent with no threshold effect. This suggests that the intake of trans-C18:1, like that of the cholesterol-raising saturated fatty acids, should be as low as possible to minimize coronary heart disease risk.

Metcalf, P. A., et al. (1999). "Modifiable risk factor levels of coronary heart disease survivors in a middle-aged workforce." Nutrition Metabolism and Cardiovascular Diseases **9**(3): 125-132.

Background and Aim: Coronary heart disease (CHD) is common in New Zealand. Risk factors for CHD are modifiable or non-modifiable. Modifiable risk factor levels of CHD survivors were compared with those without such a history (non-CHD). Methods and Results: Participants were from a cross-sectional survey of 5,656 workers aged greater than or equal to 40. CHD survivors were 73 general practitioner (GP)-confirmed participants with a history of hospitalisation for CHD. There were no significant differences in mean blood pressure levels between CHD survivors and non-CHD workers rafter adjusting for age, gender and ethnicity, bur current rise of antihypertensive medications was higher in CHD survivors (34.2%) than non-CHD workers (8.1%): p<0.001. CHD survivors had higher, similarly adjusted, mean serum total cholesterol, triglyceride and lower HDL-cholesterol levels and their reported carbohydrate, fibre, polyunsaturated fat intakes and ratio of polyunsaturated to saturated fat intakes were higher ann total fat, saturated fat and monounrsaturated fat intakes were lower. CHD survivors ate fewer servings of red meats per month and more servings of fruit, and cereal, and number of cups of milk. Salt added to meals was lower and margarine rise higher in CHD survivors. There were no significant differences in the proportions of those who exercised regularly, or were current cigarette smokers. However, more CHD survivors (57.5%) than non-CHD workers (33.1%) were ex-smokers p<0.001, who had stopped smoking at a higher mean (se) age (41.1 (1.36) vs 37.6 (0.20) years respectively; p=0.012). Conclusions: A large proportion of CND survivors were dyslipidaemic, despite consuming a lower fat, higher fibre and carbohydrate diet More than 50% of CHD survivors were ex-cigarette smokers, who had given up smoking at a later age than non-CHD workers. These high-risk CHD survivors would benefit from more aggressive measures aimed at correcting their dyslipidaemias. (C) 1999, Medikal Press.

Metcalf, P. A., et al. (1998). "Comparison of diets of NIDDM and non-diabetic African Americans and whites: The atherosclerosis risk in communities study." Nutrition Research **18**(3): 447-456.

compare dietary intakes of participants with non-insulin-dependent diabetes (NIDDM) with nondiabetic participants, to determine whether those with previously diagnosed NIDDM were complying with the 1986 American Diabetes Association (ADA) guidelines and to examine associations between diet and new cases of NIDDM. Cross-sectional data were obtained by trained interviewers from participants aged 45-64 years, chosen by random probability sampling of four U.S. communities. Dietary intakes were assessed by food frequency questionnaire in 475 African Americans and 674 whites with NIDDM and 3,255 African American and 10,439 white non-diabetic participants. Participants with diagnosed NIDDM consumed less calories, carbohydrates, sucrose, alcohol, candy, added sugar and soft drinks, but more fiber, protein, cholesterol, low calorie drinks, fruits, vegetables, cheese, poultry, red meat, and eggs compared to the ethnic-specific non-diabetic group. African Americans diagnosed with NIDDM consumed more total and monounsaturated fats (both as %) and cereal, and less fried foods and carbohydrate compared with non-diabetic African Americans; and whites with diagnosed NIDDM consumed more milk, yogurt or ice cream; margarine; fish; bread and peanut butter and less sugared foods compared with non-nutrient intakes of participants with new NIDDM were not different from non-diabetic individuals 1986 ADA guidelines. Participants with diagnosed NIDDM were eating a low calorie, high protein, high cholesterol, and low carbohydrate diet. Dietary intakes of new cases; of NIDDM were not implicated in its etiology. (C) 1998 Elsevier Science Inc.

Metcalf, R. G., et al. (2003). "A practical approach to increasing intakes of n-3 polyunsaturated fatty acids: use of novel foods enriched with n-3 fats." European Journal of Clinical Nutrition **57**(12): 1605-1612.

Objectives: To assess the effects of providing a wide range of foodstuffs containing n-3 polyunsaturated fatty acids (PUFA), occurring naturally or from fortification, on intake and blood and tissue proportions of n-3 PUFA. Design: Before/after dietary intervention study. Setting: Adelaide, Australia. Subjects: 16 healthy males recruited from the community. Interventions: Subjects were provided with a range of foodstuffs naturally containing n-3 PUFA (fresh fish, canned fish, flaxseed meal, canola oil) and items fortified with fish oil (margarine spread, milk, sausages, luncheon meat, french onion dip). Food choices were left to the discretion of each subject. Intake was estimated by diet diary. Blood was collected at-2, 0, 2, and 4 weeks for fatty acid analysis. Main outcome measures: Dietary intakes; plasma, platelet, and mononuclear cell phospholipid fatty acids. Results: Consumption of n-3 PUFA increased significantly: alpha-linolenic acid (ALA) from 1.4 to 4.1 g/day (P<0.001), eicosapentaenoic acid (EPA) from 0.03 to 0.51 g/day (P<0.001), and docosahexaenoic acid (DHA) from 0.09 to 1.01 g/day (P<0.001). Linoleic acid ( LA) intake decreased from 13.1 to 9.2 g/day (P<0.001). The proportions of EPA and DHA increased significantly in all phospholipid pools examined; plasma EPA from 1.13% of total fatty acids to 3.38% (P<0.001) and DHA from 3.76 to 7.23% (P<0.001); mononuclear cell EPA from 0.40 to 1.25% (P<0.001) and DHA from 2.33 to 4.08% (P<0.001); platelet EPA from 0.41 to 1.2% (P<0.001) and DHA from 1.64 to 3.07% (P<0.001). Conclusion: Incorporating fish oil into a range of novel commercial foods provides the opportunity for wider public consumption of n-3 PUFA with their associated health benefits. Sponsorship: Dawes Scholarship, Royal Adelaide Hospital.

Meyer, B. J., et al. (1999). "Polyunsaturated fatty acid content of foods: differentiating between long and short chain omega-3 fatty acids." Food Australia **51**(3): 81-95.

Recognising that the health benefits of n-3 polyunsaturated fatty acids (PUFA) are attributable to the long chain (LC) PUFA eicosapentanoic acid (20:5n-3) docosapentanoic acid (22:5n-3) and docosahexanoic acid (22:6n-3), we have sought to define tbe health potential of foods containing the short chain precursor n-3 PUFA, alpha-linolenic acid (18:3n-3), By assuming that a limited proportion of their 18:3n-3 content (say 15%) will be converted to 20:5n-3, 22:5n-3 or 22:6n-3, we derived an LC n-3 PUFA equivalent value for such foods. Using data from Australian Food Composition Tables, recent publications and personal communications from food companies and relevant researchers, the total fat content, total n-6 fatty acids, 18:3n-3, 20:5n-3 22:5n-3 22:6n-3, total n-3 fatty acids, and estimated LC n-3 PUFA equivalent value are presented for: nuts and seeds; butters, margarines, dairy blends and spreads; fats and oils; salad dressings; milk and dairy products; cheeses; eggs; meats; fresh dish and canned fish. Fish is the richest source of LC n-3 PUFA but other foods have the potential to make important contributions to the requirement for LC n-3 PUFA, While the hypothesised conversion rate from 18:3n-3 to LC n-3 PUFA is only a crude estimate and probably an overestimate, we believe it is more meaningful to make this adjustment when formulating dietary recommendations than not to differentiate between foods rich in either 18:3n-3 or 20:5n-3/22:6n-3 and erroneously assume that they offer the same health benefits. In this sense, the LC n-3 PUFA equivalent is a better indicator of the potential health benefit of the n-3 fatty acid contents of foods.

Micallef, M. A. and M. L. Garg (2009). "Beyond blood lipids: phytosterols, statins and omega-3 polyunsaturated fatty acid therapy for hyperlipidemia." Journal of Nutritional Biochemistry **20**(12): 927-939.

Phytosterols and omega-3 fatty acids are natural compounds with potential cardiovascular benefits. Phytosterols inhibit cholesterol absorption, thereby reducing total- and LDL cholesterol. A number of clinical trials have established that the consumption of 1.5-2.0 g/day of phytosterols can result in a 10-15% reduction in LDL cholesterol in as short as a 3-week period in hyperlipidemic populations. Added benefits of phytosterol consumption have been demonstrated in people who are already on lipid-lowering medications (statin drugs). On the other hand, omega-3 fatty acid supplementation has been associated with significant hypotriglyceridemic effects with concurrent modifications of other risk factors associated with cardiovascular disease, including platelet function and pro-inflammatory mediators. Recent studies have provided evidence that the combination of phytosterols and omega-3 fatty acids may reduce cardiovascular risk in a complementary and synergistic way. This article reviews the health benefits of phytosterols and omega-3 fatty acids, alone or in combination with statins, for the treatment/management of hyperlipidemia, with particular emphasis on the mechanisms involved. (C) 2009 Elsevier Inc. All rights reserved.

Micha, R., et al. (2010). "Food sources of individual plasma phospholipid trans fatty acid isomers: the Cardiovascular Health Study." American Journal of Clinical Nutrition **91**(4): 883-893.

Background: The overall consumption of trans fatty acids (TFAs) increases the risk of coronary artery disease. However, multiple TFA isomers exist, each with potentially different health effects. Different food sources of these specific TFA isomers are not well established. Objective: Our objective was to determine the major independent food sources of specific TFA isomers. Design: We investigated relations of major potential food sources of TFAs, as assessed by serial food-frequency questionnaires, with 10 plasma phospholipid TFA isomers [5 trans (t-) 18:1, 3 t-18:2, and 2 t-16:1] in 3330 older adults in the Cardiovascular Health Study, a community-based multicenter cohort. Stepwise regression was used to identify independent major food sources of individual plasma phospholipid TFA isomers, which were adjusted for demographic, lifestyle, and dietary factors. Results: All 5 t-18:1 isomers were similarly associated with foods commonly made with partially hydrogenated vegetable oils (PHVOs), including biscuits (0.51 higher SD of total 18:1 fatty acid concentrations per serving/d, P < 0.01), chips and/or popcorn (0.33 higher SD per serving/d, P = 0.02), margarine (0.32 higher SD per serving/d, P < 0.001), fried foods (0.32 higher SD per serving/d, P = 0.04), and bakery foods (0.23 higher SD per serving/d, P = 0.02). Each of the t-18:2 isomers were associated only with bakery foods (0.50 higher SD of total 18:2 fatty acid concentrations per serving/d, P < 0.001). Ruminant foods were major correlates of t-16:1n-7, including red meats (0.72 higher SD per serving/d, P < 0.001), butter (0.43 higher SD per serving/d, P < 0.001), and higher-fat dairy (0.37 higher SD per serving/d, P < 0.001). In contrast, t-16:1n-9 were derived mainly from margarine (0.31 higher SD per serving/d, P < 0.001). Conclusions: t-18:1 Isomers are similarly derived from multiple PHVO-containing foods. In contrast, t-18:2 and t-16:1n-9 isomers are derived from more-specific types of PHVO-containing foods. Ruminant foods are major sources of t-16:1n-7. Different TFA isomers and dietary sources should be considered when investigating health effects and interventions to lower TFAs. Am J Clin Nutr 2010; 91:883-93.

Micha, R. and D. Mozaffarian (2008). "Trans fatty acids: Effects on cardiometabolic health and implications for policy." Prostaglandins Leukotrienes and Essential Fatty Acids **79**(3-5): 147-152.

In both developed and developing countries, trans fatty acids (TFA) are largely consumed from partially hydrogenated vegetable oils. This article focuses on TFA as a modifiable dietary risk factor for cardiovascular disease, reviewing the evidence for lipid and non-lipid effects; the relations of trans fat intake with clinical endpoints; and current policy and legislative issues. In both observational cohort studies and randomized clinical trials, TFA adversely affect lipid profiles (including raising LDL and triglyceride levels, and reducing HDL levels), systemic inflammation, and endothelial function. More limited but growing evidence suggests that TFA also exacerbate visceral adiposity and insulin resistance. These potent effects of TFA on a multitude of cardiovascular risk factors are consistent with the strong associations seen in prospective cohort studies between TFA consumption and risk of myocardial infarction and coronary heart disease (CHD) death. The documented harmful effects of TFA along with the feasibility of substituting partially hydrogenated vegetable oils with healthy alternatives indicate little reason for continued presence of industrially produced TFA in food preparation and manufacturing or in home cooking fats/oils. A comprehensive strategy to eliminate the use of industrial TFA in both developed and developing countries, including education, food labeling, and policy and legislative initiatives, would likely prevent tens of thousands of CHD events worldwide each year. (c) 2008 Elsevier Ltd. All rights reserved.

Micha, R. and D. Mozaffarian (2009). "Trans fatty acids: effects on metabolic syndrome, heart disease and diabetes." Nature Reviews Endocrinology **5**(6): 335-344.

The major dietary sources of trans fatty acids (TFAs) in most countries are partially hydrogenated vegetable oils. TFA consumption is a modifiable dietary risk factor for metabolic syndrome, diabetes mellitus, and coronary heart disease. Here, we review the available data on various effects of TFAs, including metabolic and signaling pathways that mediate these effects, affected tissues, and relationships with clinical end points. TFA consumption causes metabolic dysfunction: it adversely affects circulating lipid levels, triggers systemic inflammation, induces endothelial dysfunction, and, according to some studies, increases visceral adiposity, body weight, and insulin resistance. Dietary TFAs influence the function of multiple cell types, including hepatocytes, adipocytes, macrophages and endothelial cells. Among dietary fats and nutrients, TFAs seem to have a unique cardiometabolic imprint that is linked to insulin-resistance and metabolic-syndrome pathways. Consistent with these adverse physiological effects, consumption of even small amounts of TFAs (2% of total energy intake) is consistently associated with a markedly increased incidence of coronary heart disease. relationships between TFA consumption and diabetes mellitus have been less consistent, possibly owing to differences in study designs. Nevertheless, the documented adverse effects of TFAs underscore their potential to cause harm and the importance of policy measures to minimize consumption of industrially produced TFAs.

Miettinen, T. A. (2001). "Cholesterol absorption inhibition: A strategy for cholesterol-lowering therapy." International Journal of Clinical Practice **55**(10): 710-716.

A clear relationship has been documented between plasma levels of low-density lipoprotein cholesterol (LDL-C) and the risk of coronary heart disease. LDL-C is believed to be key in the pathogenesis of coronary atherosclerosis, although increasing evidence suggests that low levels of high-density lipoprotein cholesterol and elevated triglyceride levels are contributory factors. Chylomicron remnants formed via the exogenous (dietary and biliary) pathway of cholesterol metabolism may also have atherogenic potential. Dietary modification, especially with plant stanol (sterol) ester margarine, which inhibits cholesterol absorption and improves the fatty acid pattern, lowers LDL-C sufficiently in many hypercholesterolaemic patients, and is also a useful adjunct to pharmacological therapy Cholesterol absorption inhibitors typically lower LDL-C by 10-20%. Ezetimibe, the first selective cholesterol absorption inhibitor, has been shown to lower LDL-C by approximately 18% following a once-daily 10 mg dose, either as monotherapy or as combination therapy Combination therapy with selective cholesterol absorption inhibitors such as ezetimibe along with statins or fibrates may allow more patients with hypercholesterolaemia to achieve target LDL-C levels compared with treatment with monotherapy. Ezetimibe may be useful in the management of patients who respond poorly to or are unable to tolerate statins, or in patients with hereditary or drug-induced phytosterolaemia.

Miettinen, T. A. and H. Gylling (1999). "Regulation of cholesterol metabolism by dietary plant sterols." Current Opinion in Lipidology **10**(1): 9-14.

Renewal has occurred in the use of plant sterols for the treatment of hypercholesterolemias. A novel development was to convert plant sterols to corresponding stanols and esterify them to fat soluble form. In contrast to the crystalline plant sterols or stanols, plant stanol esters can be easily consumed during normal food intake in soluble form in different fat-containing food constituents when they have a potent cholesterol-lowering effect, shown in normo- and hypercholesterolemic men and women without or with coronary heart disease, children and diabetes. Cholesterol lowering is approximately 10% for total and 15% for LDL cholesterol, with the respective values for stanol ester margarine (2-3 g/day stanols) being 15% and 20%. Stanol esters reduce cholesterol absorption efficiency by up to 65%, increase cholesterol elimination in feces as cholesterol itself, usually not as bile acids, and stimulate cholesterol synthesis. Serum beta-carotene level is lowered, but no fat malabsorption or lowering of serum fat soluble vitamins have been observed. In contrast to plant sterols, stanols and their esters are minimally absorbed and they reduce serum plant sterol concentrations, also preventing statin-induced increase of plant sterols. Stanol ester margarine has been included in dietary treatment of hypercholesterolemia followed by the addition of drug treatment in resistant cases. Curr Opin Lipidol 10:9-14. (C) 1999 Lippincott Williams & Wilkins.

Miettinen, T. A. and H. Gylling (2003). "Non-nutritive bioactive constituents of plants: Phytosterols." International Journal for Vitamin and Nutrition Research **73**(2): 127-134.

Normal human diet contains small amounts of phytosterols, mainly sitosterol and campesterol. Intestinal absorption of these plant sterols is low, about one tenth of that of cholesterol, such that their serum concentrations are also low, about 0.1 to 1% of the cholesterol levels. Like cholesterol they are transported by lipoproteins, mainly by LDL and secreted unchanged in bile. Addition of plant sterols, or especially of their delta-5 saturated derivatives plant stanols into diet as fat-soluble esters inhibit cholesterol absorption and lower serum cholesterol similarly in short-term studies. Long-term consumption of plant stanol esters lowers serum cholesterol to the extent expected to reduce clinical manifestation of coronary heart disease by over 20% without detectable side effecs, cholesterol lowering being especially effective in combination with cholesterol synthesis inhibitors statins.

Miettinen, T. A. and H. Gylling (2004). "Plant stanol and sterol esters in prevention of cardiovascular diseases." Annals of Medicine **36**(2): 126-134.

Statin trials have indicated that effective reduction of serum cholesterol should last up to one year before reduced risk of cardiovascular diseases can be detected. This observation can be applied most probably also to the use of plant stanol/sterol ester spreads for the treatment of hypercholesterolemia. However, despite the fact that the two spreads lower serum cholesterol similarly in short term studies, a comparison of one year results reveals an inconsistent effect of plant sterol spread as compared with that of plant stanol spread on cholesterol concentration in both men and women. This favors the use of plant stanol ester spread for long-term lowering of serum cholesterol. Doses of about 2 g/day of plant stanols as fatty acid ester spread enhances fecal elimination of cholesterol, but not of bile acids, through inhibition of cholesterol absorption by about 40%. This lowers serum total and low density lipoprotein (LDL) cholesterol despite enhanced compensatory increase in cholesterol synthesis by about 10% and 15% as compared with control spread, respectively, and by up to 20% as compared with the baseline diet. About one-third of mildly hypercholesterolemic subjects reach an accepted cholesterol level. A small dose of statin should be added to treatment in individuals resistant to monotherapy with plant stanol ester spread. A life-long consumption of plant stanol ester spread has been predicted to lower coronary events by about 20%.

Miettinen, T. A. and H. Gylling (2005). "Effect of statins on noncholesterol sterol levels: Implications for use of plant stanols and sterols." American Journal of Cardiology **96**(1): 40D-46D.

Normal serum contains small amounts of noncholesterol sterols, including those reflecting cholesterol absorption and those that are markers of cholesterol synthesis. Absorption marker sterols include serum plant sterols, whereas cholesterol precursor sterols correlate with whole-body synthesis of cholesterol. Thus, serum noncholesterol sterols, and especially their ratios to cholesterol, can be used to evaluate the major features of cholesterol metabolism (ie, synthesis and absorption). Statin treatment reduces serum cholesterol precursors but increases serum plant sterols severalfold, especially in subjects with high-absorption marker sterol levels indicative of efficient cholesterol and sterol absorption in general. Statin therapy is most effective in subjects with high serum cholesterol precursor levels. In subjects with high-absorption sterol markers, dietary cholesterol absorption inhibition (eg, with plant stanol and sterol ester margarine) needs to be combined with a statin to achieve effective serum cholesterol reduction. However, whereas dietary plant stanol esters reduce statin-induced elevations of serum plant sterol levels, serum plant sterol levels remain elevated during dietary plant sterol ester consumption. The clinical implication of high serum plant sterol levels is under active investigation. (c) 2005 Elsevier Inc. All rights reserved.

Miettinen, T. A. and H. Gylling (2006). "Plant stanol and sterol esters in prevention of cardiovascular diseases: a review." International Journal of Clinical Pharmacology and Therapeutics **44**(6): 247-250.

Plant sterol and stanol esters have been introduced as an additional dietary means to lower serum total and LDL cholesterol concentration. In short-term studies they lower LDL cholesterol by 10%, and according to a meta-analysis by Malcolm Law the incidence of coronary heart disease is considered to be reduced by over 20% in long-term use of these products. Plant stanol and sterol esters are not identical sterols; they have different metabolic effects and their long-term efficacy seems to be different. The present review deals with the differences of the sterols and discusses what is known of their role in preventing the cardiovascular diseases.

Miettinen, T. A. and H. Gylling (2009). "The Effects of Statins and Sitosterols: Benefit or Not?" Current Atherosclerosis Reports **11**(1): 23-27.

Statins reduce plasma plant sterol concentrations and, less consistently, their ratios to cholesterol in short-term studies. They most likely accomplish this by decreasing their transport protein levels. In long-term treatment with large doses of effective statins, serum plant sterol concentrations and frequently their ratios to cholesterol are consistently increased, especially with high, as opposed to low, baseline ratios. Enhanced intestinal absorption, decreased biliary secretion, and reversed cholesterol and plant sterol transport could explain these findings. However, statin treatment increases plant sterol ratios in serum and also in arterial plaques of endarterectomized patients. No trials of functional foods with plant sterols or stanols are available for coronary heart disease, even though their combination with statins effectively reduces low-density lipoprotein cholesterol. Plant sterols increase and plant stanols decrease serum plant sterols. Longterm statin treatment lowers coronary heart disease events only in patients with low baseline plant sterols who have high cholesterol synthesis. No convincing evidence is available that statin-induced phytosterolemia worsens atherosclerosis.

Miettinen, T. A., et al. (2000). "Noncholesterol sterols and cholesterol lowering by long-term simvastatin treatment in coronary patients - Relation to basal serum cholestanol." Arteriosclerosis Thrombosis and Vascular Biology **20**(5): 1340-1346.

Coronary patients with low baseline ratios of serum cholestanol and plant sterols to cholesterol (indicating low cholesterol absorption) but not those with high ratios (high absorption) experienced reduced recurrences of coronary events during simvastatin treatment in the Scandinavian Simvastatin Survival Study. Thus, in the present study, serum cholesterol, its precursor sterols (reflecting cholesterol synthesis), plant sterols (campesterol and sitosterol), and cholestanol were measured before and during a 5-year period of placebo treatment (n=433) and simvastatin treatment (n=434) in patients from a subgroup of the Scandinavian Simvastatin Survival Study to determine whether changes in cholesterol synthesis and serum levels were related to cholesterol absorption. Serum cholesterol level was unchanged, the ratios of cholesterol precursor sterols to cholesterol were decreased, and the ratios of plant sterols to cholesterol were increased in relation to increasing baseline ratios of cholestanol qual-tiles. The latter predicted 5-year ratios and simvastatin-induced reductions of the precursor sterols, with the lowering of the ratios (cholesterol synthesis reduction) being almost twice higher in the lowest versus the highest quartile. The ratios of plant sterols, especially campesterol, to cholesterol were markedly increased during simvastatin treatment, mostly in subjects with the highest baseline cholestanol quartiles. Simvastatin reduced serum cholesterol mon (P=0.003) in the lowest versus the highest cholestanol quartile during the 5-year treatment period. The results show for the first time that baseline cholesterol metabolism, measured by serum noncholesterol sterols, predicts the effectiveness of simvastatin in reducing cholesterol synthesis and serum levels of cholesterol. The drug suppresses the synthesis of cholesterol markedly more effectively in subjects with high than with low baseline synthesis but reduces respective serum cholesterol levels less markedly than synthesis. Subjects with high cholesterol absorption and low synthesis may need a combination therapy to lower more effectively their serum cholesterol levels and prevent an increase in the levels of plant sterols.

Miller, S., et al. (2008). "Impact of increasing adiposity in hyperlipidemic children." Clinical Pediatrics **47**(7): 679-684.

Despite lifestyle management, children with high-risk hyperlipidemias may become overweight, and this may further adversely impact their lipid profile. Regression analysis was used to determine changes over time in adiposity and their association with lipid profiles and other risk factors for hyperlipidemic children followed in a lipid disorder clinic. 184 patients were included. Median age at presentation was 7 years (2-17 years), and median duration of follow-up was 9 years (5-20 years). Mean initial total cholesterol was 6.9 +/- 1.6 mmol/L, low-density lipoproteins were 5.2 +/- 1.7 mmol/L, high-density lipoproteins were 1.2 +/- 0.4 mmol/L, triglycerides were 1.1 +/- 0.8 mmol/L, and body mass index z score was +0.4 +/- 1.0. A significant increase in body mass index z score (+0.032/year, P < .001) was observed. There was an associated significant increase in total cholesterol and triglyceride levels and decrease in high-density lipoprotein levels over time. Worsening adiposity is prevalent in hyperlipidemic children and adversely affects their lipid profiles and cardiovascular risk.

Minville-Walz, M., et al. (2012). "Distinct regulation of stearoyl-CoA desaturase 1 gene expression by cis and trans C18:1 fatty acids in human aortic smooth muscle cells." Genes and Nutrition **7**(2): 209-216.

Consumption of trans fatty acids is positively correlated with cardiovascular diseases and with atherogenic risk factors. Trans fatty acids might play their atherogenic effects through lipid metabolism alteration of vascular cells. Accumulation of lipids in vascular smooth muscle cells is a feature of atherosclerosis and a consequence of lipid metabolism alteration. Stearoyl-CoA desaturase 1 (scd1) catalyses the production of monounsaturated fatty acids (e.g. oleic acid) and its expression is associated with lipogenesis induction and with atherosclerosis development. We were interested in analysing the regulation of delta-9 desaturation rate and scd1 expression in human aortic smooth muscle cells (HASMC) exposed to cis and trans C18:1 fatty acid isomers (cis-9 oleic acid, trans-11 vaccenic acid or trans-9 elaidic acid) for 48 h at 100 mu M. Treatment of HASMC with these C18:1 fatty acid isomers led to differential effects on delta-9 desaturation; oleic acid repressed the desaturation rate more potently than trans-11 vaccenic acid, whereas trans-9 elaidic acid increased the delta-9 desaturation rate. We then correlated the delta-9 desaturation rate with the expression of scd1 protein and mRNA. We showed that C18:1 fatty acids controlled the expression of scd1 at the transcriptional level in HASMC, leading to an increase in scd1 mRNA content by trans-9 elaidic acid treatment, whereas a decrease in scd1 mRNA content was observed with cis-9 oleic acid and trans-11 vaccenic acid treatments. Altogether, this work highlights a differential capability of C18:1 fatty acid isomers to control scd1 gene expression, which presumes of different consequent effects on cell functions.

Misra, A., et al. (2009). "South Asian diets and insulin resistance." British Journal of Nutrition **101**(4): 465-473.

A role of dietary nutrients in relation to insulin resistance has been suggested but conclusive evidence in human beings is lacking. Asian Indians and South Asians are prone to develop insulin resistance and the metabolic syndrome. In the present paper, data pertaining to nutrient intake, insulin resistance and cardiovascular risk factors in Asian Indians and South Asians have been reviewed. In these populations, several dietary imbalances have been reported: low intake of MUFA, n-3 PUFA and fibre, and high intake of fats, saturated fats, carbohydrates and trans-fatty acids (mostly related to the widespread use of Vanaspati, a hydrogenated oil). Some data suggest that these nutrient imbalances are associated with insulin resistance, dyslipidaemia and subclinical inflammation in South Asians. Specifically, in children and young individuals, a high intake of n-6 PUFA is correlated with fasting hyperinsulinaemia, and in adults, high-carbohydrate meat consumption was reported to cause hyperinsulinaemia, postprandial hyperglycaemia and hypertriacylglycerolaemia. Dietary supplementation with n-3 PUFA leads to an improved lipid profile but not insulin sensitivity. Inadequate maternal nutrition in pregnancy, low birth weight and childhood 'catch-up' obesity may be important for the development of the metabolic syndrome and diabetes. Even in rural populations, who usually consume traditional frugal diets, there is an increasing prevalence of cardiovascular risk factors and the metabolic syndrome due to changes in diets and lifestyle. Nationwide community intervention programmes aimed at creating awareness about the consequences of unhealthy food choices and replacing them by healthy food choices are urgently needed in urban and rural populations in India, other countries in South Asia and in migrant South Asians.

Mitmesser, S. H. and T. P. Carr (2005). "Trans fatty acids alter the lipid composition and size of apoB-100-containing lipoproteins secreted by HepG2 cells." Journal of Nutritional Biochemistry **16**(3): 178-183.

This study was conducted to determine the secretion rate and composition of lipoproteins secreted by HepG2 cells as influenced by the type of fatty acid present in the incubation medium. Cells were preincubated for 24 h with palmitic, oleic, elaidic, linoleic or conjugated linoleic acid (CLA), and the lipoproteins secreted during a subsequent incubation period of 24 h were collected for analysis. The secretion rate of apolipoprotein B-100 (apoB) was significantly greater in HepG2 cells preincubated with elaidic acid compared with those preincubated with palmitic or oleic acid; apoB secretion was greater in cells preincubated with CLA compared with those preincubated with linoleic acid. The lipid composition of secreted lipoproteins was also influenced by fatty acid treatment, resulting in significantly smaller lipoprotein particles secreted by cells preincubated with elaidic acid and CLA compared with those secreted by cells treated with oleic acid and linoleic acid, respectively. Our results are relevant to human metabolism for the following reasons: (1) the size of plasma low-density lipoproteins (LDLs) is determined, at least in part, by the composition of apoB-containing lipoproteins secreted by the liver; (2) small plasma LDL particles are associated with an increased risk of coronary heart disease; and (3) specific dietary fatty acids can affect the composition and size of plasma LDLs, thereby imparting a relative atherogenicity to plasma LDLs independent of LDL cholesterol concentration. The present study therefore suggests that elaidic acid and CLA promote the hepatic secretion of small apoB-containing lipoproteins, which could lead to an increased production of small plasma LDL particles. (c) 2005 Elsevier Inc. All rights reserved.

Moghadasian, M. H. (2000). "Pharmacological properties of plant sterols - In vivo and in vitro observations." Life Sciences **67**(6): 605-615.

Plant sterols have been investigated as one of the safe potential alternative methods in lowering plasma cholesterol levels. Several human studies have shown that plant sterols/stanols significantly reduce plasma total and LDL cholesterol. In this article, pharmacological characteristics of plant sterols/stanols have been summarized and discussed. In particular, experimental data that demonstrate the effects of dietary phytosterols on lipid metabolism and development of atherosclerotic lesions have been critically reviewed. Despite their similar chemical structures, phytosterols and cholesterol differ markedly from each other in regard to their pharmacological characteristics including intestinal absorption and metabolic fate. Compared to cholesterol, plant sterols have poor intestinal absorption. The most and best studied effects of plant sterols are their inhibition of intestinal cholesterol absorption. Other biological activities of phytosterols such as effects on lecithin:cholesterol acyltransferase activity, bile acid synthesis, oxidation and uptake of lipoproteins, hepatic and lipoprotein lipase activities and coagulation system have been linked to their anti-atherogenic properties, Moreover, evidence for beneficial effects of plant sterols on disorders such as cutaneous xanthomatosis, colon cancer and prostate hyperplasia has been discussed. Finally, the potential adverse effects of plant sterols as well as pathophysiology of hereditary sitosterolemia are also reviewed. In conclusion, more pharmacokinetic data are needed to better understand metabolic fate of plant sterols/stanols and their fatty acid esters as well as their interactions with other nutraceutical/pharmaceutical agents. (C) 2000 Elsevier Science Inc. All rights reserved.

Moghadasian, M. H. and J. J. Frohlich (1999). "Effects of dietary phytosterols on cholesterol metabolism and atherosclerosis: Clinical and experimental evidence." American Journal of Medicine **107**(6): 588-594.

Although plant sterols (phytosterols) and cholesterol have similar chemical structures, they differ markedly in their synthesis, intestinal absorption, and metabolic fate. Phytosterols inhibit intestinal cholesterol absorption, thereby lowering plasma total and low-density lipoprotein (LDL) cholesterol levels. In 16 recently published human studies that used phytosterols to reduce plasma cholesterol levels in a total of 590 subjects, phytosterol therapy was accompanied by an average 10% reduction in total cholesterol and 13% reduction in LDL cholesterol levels. Phycosterols may also affect other aspects of cholesterol metabolism that contribute to their antiatherogenic properties, and may interfere with steroid hormone synthesis. The clinical and biochemical features of hereditary sitosterolemia, as well as its treatment, are reviewed, and the effects of cholestyramine treatment in 12 sitosterolemic subjects are summarized. Finally, new ideas for future research into the role of phytosterols in health and disease are discussed. Am J Med. 1999;107:588-594. (C) 1999 by Excerpta Medica, Inc.

Moghimi, S. M., et al. (2004). "Causative factors behind poloxamer 188 (pluronic F68, Flocor (TM))-induced complement activation in human sera. A protective role against poloxamer-mediated complement activation by elevated serum lipoprotein levels." Biochimica Et Biophysica Acta-Molecular Basis of Disease **1689**(2): 103-113.

Poloxamer 188 is a complex polydisperse mixture of non-ionic macromolecules. Adverse non-IgE-mediated hypersensitivity reactions occur in some individuals following intravenous injection of poloxamer 188-based pharmaceuticals, presumably via complement activation. Here we have delineated potential causal chemical and biological interactive factors behind poloxamer 188-induced complement activation in human serum specimens. We identified the molecular constituents inherent in poloxamer 188 preparations and studied their effect on generation of the two complement split products, SC5b-9 and Bb. Poloxamer 188 activated complement at sub-micellar concentrations and the results indicated the potential involvement of all three known complement activation pathways. The poloxamer-induced rise of SC5b-9 in human sera was abolished in the presence of a recombinant truncated soluble form of complement receptor type 1, thus confirming the role of C3/C5 convertases in the activation process. Poloxamer 188-mediated complement activation is an intrinsic property of these macromolecules and was independent of the degree of sample polydispersity, as opposed to other non-polymeric constituents. Poloxamer 188 preparations also contained unsaturated chains of diblock copolymers capable of generating SC5b-9 in human sera; this effect was terminated following the removal of double bonds by catalytic hydrogenation. By quasi-elastic light scattering, we established interaction between poloxamer and lipoproteins; interestingly, poloxamer-induced rise in SC5b-9 was significantly suppressed when serum HDL and LDL cholesterol levels were increased above normal to mimic two relevant clinical situations. This observation was consistent with previously reported data from patients with abnormal or elevated lipid profiles where no or poor complement activation by poloxamer 188 occurred. Our findings could provide the basis of novel approaches to the prevention of poloxamer-mediated complement activation. (C) 2004 Elsevier B.V. All rights reserved.

Mohankumar, S. K., et al. (2013). "Dietary supplementation of trans-11-vaccenic acid reduces adipocyte size but neither aggravates nor attenuates obesity-mediated metabolic abnormalities in fa/fa Zucker rats." British Journal of Nutrition **109**(9): 1628-1636.

Conjugated linoleic acid (CLA) present in dairy and ruminant fat has beneficial effects on metabolic syndrome characteristics in humans and some rodent models. Production practices to increase the milk content of CLA are also substantially elevating trans-11-vaccenic acid (VA). Questions are being raised whether VA has the same beneficial actions as CLA or has adverse biological effects similar to industrially produced trans-fatty acids. The present study examined the effects of dietary supplementation of either 0 or 1.5% (w/w) VA for 8 weeks on lipidaemia, glycaemia, blood pressure, hepatic steatosis, adipocyte size and molecular markers of inflammation and insulin signalling in fa/fa Zucker rats. Dietary supplementation of VA did not alter feed intake, weight gain, blood pressure or organ: body weight (BW) ratios, except the epididymal fat:BW ratio which was lower in the VA group compared with the control group. The total liver lipid concentration as an indicator of hepatic steatosis was not different between the groups. Likewise, there were no changes in fasting lipidaemia, glycaemia or oral glucose tolerance. Although there were no physiological differences observed between the groups, animals supplemented with VA had smaller adipocytes (approximately 7% smaller than the controls). The VA group also had higher adipophilin and IL-10 protein levels in epididymal adipose tissue (1.7-and 1.4-fold higher than the controls, respectively); however, there were no changes observed in critical nodes of insulin signalling. The present study provides evidence that supplementation with VA, a naturally produced trans-fat, has some positive effects on adipose tissue and did not exacerbate obesity-mediated metabolic abnormalities.

Molin, M., et al. (2013). "Effect of Different Degrees of Hydrogenated Fish Oil on Intestinal Carcinogenesis in Min/+ mice." Anticancer Research **33**(2): 477-483.

Intake of trans fatty acids from hydrogenated fish oils has been related to increased risk of coronary heart diseases. The possible effect on colorectal carcinogenesis is unclear. Materials and Methods: Multiple intestinal neoplasia (Min/+) mice were fed one of four experimental diets: either raw fish oil (FO), low (LHFO)-, high (HHFO)- or fully-hydrogenated fish oil (FFHO), from 0 to 9 weeks of age. The number and size of intestinal tumors were recorded. Results: There was no difference between the intervention groups in the numbers of developed intestinal tumors. The tumor size was statistically significantly lower in HHFO vs. the FO-group in male Min/+ mice. The HHFO and FHFO groups had lower weight gain than did the FO group (p=0.008 and p=0.04, respectively), but gender differences, due to effect of dietary intervention on weight gain, were found in Min/+ mice. Conclusion: When compared with raw fish oil, different degrees of hydrogenation of the fish oil had no effect on intestinal carcinogenesis in Min/+ mice.

Molkentin, J. and D. Precht (1995). "Determination of trans-octadecenoic acids in German margarines, shortenings, cooking and dietary fats by Ag-TLC/GC." Zeitschrift Fur Ernahrungswissenschaft **34**(4): 314-317.

According to numerous, even recent studies, trans fatty acids (TFA) are related to coronary heart disease. Thus, for the evaluation of the daily TFA-intake precise data on the content of TFA in currently available edible fats are of great interest. The present study gives a comprehensive overview on total trans-octadecenoic acid contents in 93 brands of German margarines, shortenings, cooking and dietary fats purchased in 1994, that were obtained by a two-dimensional chromatography method (Ag-TLC/GC). Conventional margarines were found to contain 0.17 - 25.90 wt% (n = 46) and shortenings/cooking fats 0.04-32.51 wt% (n = 16) TFA related to total fatty acids. Mean values were 9.32 resp. 9.79 %, whereas dietary and reformatory fats exhibited a mean of 0.65 % (n = 31) TFA. Among conventional margarines the highest TFA contents were detected in products (n = 11) derived exclusively from sunflower oil (mean value = 20.71 %). Seasonal changes in single brands were relatively small.

Molkentin, J. and D. Precht (1996). "Isomeric distribution and rapid determination of trans-octadecenoic acids in German brands of partially hydrogenated edible fats." Nahrung-Food **40**(6): 297-304.

The determination of trans fatty acids (TFA), in particular trans-octadecenoic acids, in edible fats is of current interest, since just in the last years a variety of negative physiological effects has been related to TFA. A main source of C18:1 trans fatty acids are partially hydrogenated fats. Besides the total content of trans-octadecenoic acids, their isomeric distribution seems to be even more important, as fats of different origin, e.g, partially hydrogenated fats and ruminant fats, possibly show different physiological properties. In this study, 46 margarines and 16 shortenings and cooking fats, purchased in August of 1994, were analyzed for trans-octadecenoic acid isomers by a two-step method (Ag-TLC/HRGC). The mean relative isomeric distributions (g/100 g TFA) of both groups determined with a 100 m-column were comparable, with Delta 9 and Delta 10 being the main isomers. By repeated analysis of 15 brands between August of 1994 and January of 1996, the mean total C18:1 TFA content was found to have decreased in these margarines (n=8) from 9.58% to 4.62% but not in shortenings/cooking fats (n=7; 11.62% to 11.92%). The relative isomeric distribution was not affected in both groups. To avoid the problem of overlaps between cis- and trans-C18:1 isomers with GC analysis, formulae for the rapid determination of total C18:1 TFA contents in margarines and shortenings/cooking fats from direct GC data were statistically derived. Thus, applying these formulae and considering the mean relative distributions, absolute contents of ail individual isomers of trans-octadecenoic acids can rapidly be deter mined from direct GC.

Molkentin, J. and D. Precht (1997). "Occurrence of trans-C16 : 1 acids in bovine milkfats and partially hydrogenated edible fats." Milchwissenschaft-Milk Science International **52**(7): 380-385.

Applying a combination of argentation thin-layer chromatography (AS-TLC) and gas chromatography, contents of trans-hexadecenoic acids (trans-C16:1) have been determined in 27 German bovine milkfats and 62 German partially hydrogenated edible fats. It could be demonstrated that due to an overlap with C17 fatty acids frequently too high trans-C16:1 contents have been measured particularly for milkfats if no pre-separation by Ag-TLC was applied. According to the present studies, milkfats contain 0.13 % and partially hydrogenated margarines and cooking fats/shortenings of vegetable origin 0.04 % resp. 0.01 % trans-C16:1, on average. In contrast, products containing partially hydrogenated fish oil (n = 6) exhibited relatively high trans-C16:1 contents of 1.89 %, on average. Moreover, besides the widespread trans-octadecenoic acids (trans-C18:1) these products additionally contain high amounts of trans-elcosaenoic acids (trans-C20:1) of 4.49 %, on average. The presented results could be of use for future considerations concerning theories of an association of trans-C16:1 contents in human lipids with the incidence of coronary heart diseases.

Money, D. F. L., et al. (1976). "TOCOPHEROL LEVELS IN MARGARINE AND BUTTER - RELEVANCE TO CORONARY HEART-DISEASE." New Zealand Journal of Science **19**(4): 403-405.

Mortensen, A., et al. (1992). "THE INFLUENCE OF DIETARY OLIVE OIL AND MARGARINE ON AORTIC CHOLESTEROL ACCUMULATION IN CHOLESTEROL-FED RABBITS MAINTAINED AT SIMILAR PLASMA-CHOLESTEROL LEVEL." Atherosclerosis **96**(2-3): 159-170.

The present study compares the atherogenicity of a standard diet and diets with 10% olive oil or 10% margarine added, in rabbits maintained at a mean plasma cholesterol level of about 20 mM for 13 weeks. Each group consisted of 15 animals. The distribution of cholesterol in plasma between VLDL, IDL, LDL and HDL was similar in the 3 groups. The thoracic aortic cholesterol accumulation was 16.6 +/- 1.6, 11.4 +/- 1.0 (P < 0.05) and 12.6 +/- 1.7 (P > 0.05) nmol/mg wet weight for the group receiving standard diet, diet with 10% olive oil added and diet with 10% margarine added, respectively. There was no significant difference between groups in the occurrence of the atherosclerotic changes in the proximal and distal parts of coronary arteries, abdominal aorta and renal arteries. The occurrence of atherosclerotic changes in the pulmonary arteries was equal in the groups receiving standard diet and diet with 10% margarine added while it was significantly lower (P < 0.05) in the group receiving diet with 10% olive oil added. The atherosclerotic changes at the aortic orifice of coronary arteries were quanticated morphometrically and were most severe in the group on the standard diet. The results indicate a comparable atherogenic effect of 10% olive oil or margarine addition to standard diet on development of atherosclerosis in rabbits maintained at a similar plasma cholesterol level. The study also suggests that supplementation of olive oil or margarine to standard rabbit diet leads to lower cholesterol accumulation in the thoracic aorta compared with standard diet, an effect not modulated by changes in plasma cholesterol concentrations.

Mosca, L. J. (2002). "Contemporary management of hyperlipidemia in women." Journal of Womens Health & Gender-Based Medicine **11**(5): 423-432.

Objective: The objective of this paper is to review prospective, large-scale studies of lipid-lowering therapy and hormone replacement therapy, and to provide clinical recommendations for the management of hyperlipidemia in women within the context of the revised National Cholesterol Education Program (NCEP) guidelines. Methods: Recent English language literature derived from a MEDLINE search (January 1990-July 2001) and bibliographies of relevant papers were reviewed, and data were abstracted from identified papers. Results: Hyperlipidemia is largely undertreated in women. Previously, hormone replacement therapy (HRT) was considered first-line treatment for the,management of hypercholesterolemia to prevent coronary artery disease (CAD) in women. Recent studies, however, show no benefit of HRT for secondary prevention of coronary events, despite its beneficial effects on lipids. Large-scale, controlled clinical trials indicate that women, even those with only moderately elevated. cholesterol, benefit from the lipid-lowering effects of statins for both high-risk primary and secondary prevention of CAD. Based on this evidence, the recently revised NCEP guidelines recommend statins as first-line therapy for women with hyperlipidemia, an approach that is supported by the American Heart Association and the American College of Cardiology. With its emphasis on aggressive intervention for persons with multiple risk factors, the new guidelines substantially increase the number of women eligible for pharmacological therapy. Conclusions: All women with hyperlipidemia should receive counseling regarding lifestyle approaches for lowering cholesterol. The decision to use HRT should be made in the context of other conditions hormones may affect. Alternative hormonal regimens for lipid management may include selective estrogen receptor modulators and phytoestrogens, but results of randomized clinical trials are necessary before firm recommendations can be made regarding their clinical value in preventing CAD.

Moss, J. (2006). "Labeling of trans fatty acid content in food, regulations and limits - The FDA view." Atherosclerosis Supplements **7**(2): 57-59.

With the scientific evidence associating trans fatty acid (TFA) intake with an increased risk of coronary heart disease (CHD), the U.S. Food and Drug Administration (FDA) issued a final rule that requires the declaration of the amount of TFA present in foods, including dietary supplements, on the nutrition label by January 1, 2006. The addition of TFA to the nutrition label will lead to the Prevention of 600 to 1200 cases of CHD and 240-480 deaths each year saving, $900 million to $1.8 billion per year in medical costs, lost productivity, and pain and suffering. For the purpose of nutrition labeling, TFA are defined as the sum of all unsaturated fatty acids that contain one or more isolated (i.e. non-conjugated) double bonds in a trans configuration. There are many, issues that FDA has vet to resolve: (1) defining nutrient content claims for "free" and "reduced" levels of trans fat, (2) placing limits oil the amount of TFA in conjunction with saturated fat limits for nutrient content claims, health claims, and disclosure and disqualifying levels, (3) a daily value, and (4) a possible footnote or disclosure statement to enhance consumer understanding of cholesterol raising lipids. FDA issued all Advanced Notice of Proposed Rulemaking (ANPR) requesting comments on the unresolved issues. FDA will also be conducting consumer research to determine consumer understanding of various TFA labeling possibilities. Comments to the ANPR, results of consumer research and current science will be used by FDA to resolve these issues and to determine future rulemaking for TFA labeling. (c) 2006 Elsevier Ireland Ltd. All rights reserved.

Moyad, M. A. (2006). "Step-by-step lifestyle changes that can improve urologic health in men, part I: What do I tell my patients?" Primary Care **33**(1): 139-+.

Heart-healthy recommendations have been tantamount to prostate-healthy recommendations, and there may even be a relationship between the two conditions. Clinicians need to provide a simplistic and realistic set of lifestyle changes to men not only to attempt to reduce prostate cancer risk and mortality, but also to attempt to reduce the more important statistic known as "all-cause mortality." A list of recommendations or steps for men are provided in two articles (parts I and II) of this issue to assist the clinician and patient in their discussion of practical changes not only in the short-term, but also in order to provide some type of tangible long-term benefit for the man concerned about urologic conditions such as prostate cancer, benign prostatic hyperplasia (BPH), or erectile dysfunction (ED).

Moyad, M. A. and P. R. Carroll (2004). "Lifestyle recommendations to prevent prostate cancer, part I: time to redirect our attention?" Urologic Clinics of North America **31**(2): 289-+.

Cardiovascular disease is the primary cause of death in the United States and most countries worldwide, and the primary or secondary cause of death in prostate-cancer prevention trials and prostate-cancer patients. These findings place men's overall risk for death in perspective. In general, heart health is tantamount to prostate health. Clinicians need to provide simple and realistic lifestyle changes to patients to reduce prostate cancer risk and mortality and affect all-cause mortality. Parts I and II of this article summarize lifestyle recommendations that may reduce prostate cancer risk or improve patients' lives overall. These articles should help clinicians and patients discuss practical changes that may be accomplished quickly, and may impact risk for several diseases that affect men's health.

Mozaffarian, D., et al. (2013). "trans-Palmitoleic acid, other dairy fat biomarkers, and incident diabetes: the Multi-Ethnic Study of Atherosclerosis (MESA)." American Journal of Clinical Nutrition **97**(4): 854-861.

Background: Dairy consumption is linked to a lower risk of type 2 diabetes, but constituents responsible for this relation are not established. Emerging evidence suggests that trans-palmitoleate (trans 16:1n-7), a fatty acid in dairy and also partially hydrogenated oils, may be associated with a more favorable metabolic profile and less incident diabetes. Objective: We investigated the association of trans-palmitoleate with metabolic risk and incident diabetes in a multiethnic US cohort. Design: Phospholipid fatty acids and metabolic risk factors were measured in 2000-2002 among 2617 adults in the Multi-Ethnic Study of Atherosclerosis (MESA), a cohort of white, black, Hispanic, and Chinese Americans. In 2281 participants free of baseline diabetes, we also prospectively assessed the risk of new-onset diabetes (205 cases) from baseline to 2005-2007. Results: trans-Palmitoleate concentrations correlated positively with self-reported consumption of whole-fat dairy, butter, margarine, and baked desserts and with other circulating biomarkers of both dairy fat and partially hydrogenated oil consumption, which suggested mixed dietary sources. After multivariable adjustment, trans-palmitoleate concentrations were associated with higher LDL cholesterol (quintile 5 compared with quintile 1: +6.4%; P-trend = 0.005), lower triglycerides (-19.1%; P-trend < 0.001), lower fasting insulin (-9.1%; P-trend = 0.002), and lower systolic blood pressure (-2.4 mm Hg; P-trend = 0.01). In prospective analyses, trans-palmitoleate was independently associated with lower incident diabetes (P-trend = 0.02), including a 48% lower risk in quintile 5 compared with quintile 1 (HR: 0.52; 95% CI: 0.32, 0.85). All findings were similar between men and women and between different race-ethnic subgroups. Conclusions: Circulating trans-palmitoleate is associated with higher LDL cholesterol but also with lower triglycerides, fasting insulin, blood pressure, and incident diabetes in a multiethnic US cohort. Our findings support the need for further experimental and dietary intervention studies that target circulating trans-palmitoleate. The MESA trial was registered at clinicaltrials.gov as NCT00005487. Am J Clin Nutr 2013;97:854-61.

Mozaffarian, D., et al. (2004). "Dietary intake of trans fatty acids and systemic inflammation in women." American Journal of Clinical Nutrition **79**(4): 606-612.

Background: trans Fatty acid (TFA) intake predicts risks of coronary artery disease and diabetes. Systemic inflammation may be involved in the pathogenesis of such conditions; however, relations between TFA intake and systemic inflammation are not well established. Objective: We investigated the relations between TFA intake and inflammatory markers. Design: In 823 generally healthy women in the Nurses' Health Study I and II, concentrations of soluble tumor necrosis factor a receptors 1 and 2 (sTNF-R1, sTNF-R2), interleukin 6 (IL-6), and C-reactive protein (CRP) were measured. Usual dietary intakes assessed from 2 semiquantitative food-frequency questionnaires were averaged for each subject. Results: In age-adjusted analyses, TFA intake was positively associated with sTNF-R1 and sTNF-R2 (P for trend < 0.001 for each): sTNF-R1 and sTNF-R2 concentrations were 10% (+ 108 pg/mL; 95% CI: 50,167 pg/mL) and 12% (+258 pg/mL; 138,377 pg/mL) higher, respectively, in the highest intake quintile than m the lowest. These associations were not appreciably altered by adjustment for body mass index, smoking, physical activity, aspirin and nonsteroidal antiinflammatory drug use, alcohol consumption, and intakes of saturated fat, protein, n-6 and n-3 fatty acids, fiber, and total energy. Adjustment for serum lipid concentrations partly attenuated these associations, which suggests that they may be partly mediated by effects of TFAs on serum lipids. TFA intake was not associated with IL-6 or CRP concentrations overall but was positively associated with IL-6 and CRP in women with higher body mass index (P for interaction = 0.03 for each). Conclusions: TFA intake is positively associated with markers of systemic inflammation in women. Further investigation of the influences of TFAs on inflammation and of implications for coronary disease, diabetes, and other conditions is warranted.

Mueller, A., et al. (2010). "Trans Fatty Acids in Human Milk are an Indicator of Different Maternal Dietary Sources Containing Trans Fatty Acids." Lipids **45**(3): 245-251.

The trans fatty acid (TFA) patterns in the fats of ruminant meat and dairy products differ from those found in other (processed) fats. We have evaluated different TFA isomers in human breast milk as an indicator of dietary intake of ruminant and dairy fats of different origins. Breast milk samples were collected 1 month postpartum from 310 mothers participating in the KOALA Birth Cohort Study (The Netherlands). The study participants had different lifestyles and consumed different amounts of dairy products. Fatty acid methyl esters were determined by GC-FID and the data were evaluated by principal component analysis (PCA), ANOVA/Post Hoc test and linear regression analysis. The two major principal components were (1) 18: 1 trans-isomers and (2) markers of dairy fat including 15: 0, 17: 0, 11(trans) 18: 1 and 9(cis), 11(trans) 18: 2 (CLA). Despite similar total TFA values, the 9(trans) 18: 1/11(trans) 18: 1-ratio and the 10(trans) 18: 1/11(trans) 18: 1-ratio were significantly lower in milk from mothers with high dairy fat intake (40-76 g/day: 0.91 +/- 0.48, P < 0.05) compared to low dairy fat intake (0-10 g/day: 1.59 +/- 0.48), and lower with strict organic meat and dairy use ([90% organic: 0.92 +/- 0.46, P < 0.05) compared to conventional origin of meat and dairy (1.40 +/- 0.61). Similar results were obtained for the 10(trans) 18:1/11(trans) 18: 1-ratio. We conclude that both ratios are indicators of different intake of TFA from ruminant and dairy origin relative to other (including industrial) sources.

Muller, H., et al. (1998). "Effect on plasma lipids and lipoproteins of replacing partially hydrogenated fish oil with vegetable fat in margarine." British Journal of Nutrition **80**(3): 243-251.

We have compared the effects on lipoproteins and haemostatic variables of two hard margarines with similar functional properties, one traditional margarine containing partially hydrogenated fish oil (PHFO), and one experimental margarine based on vegetable oil (VO). Both were all-purpose cooking margarines with nearly identical functional properties. Trans fatty acids from PHFO in the traditional margarine were replaced mostly by saturated, monounsaturated and trans fatty acids of vegetable origin in the new formulation. Both test margarines contained approximately the same amount of cis polyunsaturated fatty acids. Sixteen female normolipidaemic students consumed each diet with the two test margarines for 14 d in random order (crossover design). The amount of fat was 31% energy in the PHFO diet and 32% energy in the VO diet. The test margarines provided approximately 26% energy in both diets. In the PHFO diet 7.8% of the energy was derived from trans fatty acids and 9.2% from saturated fatty acids (12:0, 14:0 and 16:0) while in the VO diet, 11% energy was derived from trans fatty acids and 13.3% from saturated fatty acids (12:0, 14:0 and 16:0). The natural content of cholesterol in PHFO was deliberately not balanced by addition of cholesterol to the VO diet, thus the PHFO diet contained 215 mg and the VO diet 86 mg cholesterol per 8.5 MJ. LDL-cholesterol concentration was 19% higher in subjects on the PHFO diet compared with the VO diet (P<0.01). The ratio LDL-cholesterol:HDL-cholesterol was 12.6% higher in subjects on the PHFO diet compared with the VO diet (P < 0.01). The level of apolipoprotein (apo)A-I was 6% lower in subjects on the PHFO diet compared with the VO diet (P<0.01). The ratio apoB:apoA-I was 10.4% higher in subjects on the PHFO diet than on the VO diet (P < 0.01). There were no significant differences in total cholesterol, HDL-cholesterol, triacylglycerols, apoB, lipoprotein(a) and haemostatic variables between the diets. Our results demonstrate that PHFO, with its unfavourable effects on plasma lipids, can be replaced by vegetable oils in margarine without appreciable loss of functional properties but with significant improvement in the effects on plasma lipoproteins.

Muller, H., et al. (2001). "Partially hydrogenated soybean oil reduces postprandial t-PA activity compared with palm oil." Atherosclerosis **155**(2): 467-476.

The effects of dietary trans fatty acids on fasting and diurnal variation in hemostatic variables are not known. This study compares the effects of three diets with three different margarines, one based on palm oil (PALM-diet), one based on partially hydrogenated soybean oil (PHSO, TRANS-diet) and one with a high content of polyunsaturated fatty acids (PUFA-diet) on diurnal postprandial hemostatic variables. A strictly controlled dietary Latin square study was performed and nine young female participants consumed each of the diets for 17 days in a random order. The sum of the cholesterol-increasing fatty acids (C12:0. C14:0. C16:0) was 36.3% of total fatty acids in the PALM-diet, the same as the sum of saturated-(C12:0, C14:0, C16:0) (12.5%) and trans fatty acids (23.1%) in the TRANS-diet. The sum of C12:0. C14:0 and C16:0 was 20.7% in the PUFA-diet. The amount of fat made up 30-31% of energy in all diets. Nine participants completed the study. The diurnal postprandial state level of tissue plasminogen activator (t-PA) activity was significantly decreased on the TRANS-diet compared with the PALM-diet. t-PA activity was also decreased on the PUFA-diet compared with PALM-diet but the difference was below statistical significance (P = 0.07. Bonferonni adjusted). There were no significant differences in either fasting levels or in circadian variation of t-PA antigen, PAI-1 activity, PAI-antigen, factor VII coagulant activity or fibrinogen between the three diets. Our results indicate that dietary trans fatty acids from PHSO has an unfavourable effect on postprandial t-PA activity and thus possibly on the fibrinolytic system compared with palm oil. (C) 2001 Elsevier Science Ireland Ltd. Ail rights reserved.

Mullie, P., et al. (2009). "Cultural, socioeconomic and nutritional determinants of functional food consumption patterns." European Journal of Clinical Nutrition **63**(11): 1290-1296.

Objectives: The aim of our research was to describe cultural, socioeconomic and nutritional determinants associated with functional food consumption. Methods: Cross-sectional design in 5000 military men. Using mailed questionnaires, the functional food consumption frequency was recorded. Results: Margarines fortified with phytosterols or phytostanols were used on a daily basis by 26.3% of the responders. Only 4.7% took a daily portion of probiotics, whereas 14.0% consumed one or more portions of nuts a week. One man out of three consumed one cup of tea daily, whereas 10.2% consumed one glass of red wine daily. Three or more portions of fruit a day were consumed by 19.1%, and two or more portions of vegetables a day by 26.6%. Only 12.3% consumed a portion of fatty fish weekly. After adjustment for age, body mass index, physical activity, use of vitamin supplements, smoking, marital status, cultural background, educational and income level, the daily consumption of fortified margarines increased with age. The consumption of fermented dairy products increased with physical activity and with the use of vitamin supplements. The consumption of fortified margarines, nuts, tea and fatty fish was strongly influenced by cultural background, with higher consumptions for Flemish-speaking men compared with French-speaking persons. Daily consumption of red wine was higher in French-speaking men and in higher educated men. Finally, functional food consumption was associated with a healthy dietary pattern. Conclusion: Age, physical activity, level of education, use of vitamin supplements and cultural background are predictors of functional food consumption patterns. European Journal of Clinical Nutrition (2009) 63, 1290-1296; doi: 10.1038/ejcn.2009.89; published online 26 August 2009

Munoz, M. A. B. (2004). "Olive oil in food spreads." Grasas Y Aceites **55**(1): 92-94.

Chemical hydrogenation of unsaturated fatty acids is a commonly applied reaction to food industries. The process may imply the movement of double bonds in their positions on the fatty acid carbon chain, producing positional and geometrical isomers (trans fatty acids). Through hydrogenation, unsaturated oils are converted to margarines and vegetable shortenings. The presence of trans fatty acids in foods is undesirable, as trans fatty acids raise the plasma levels of total and low-density lipoproteins (LDL), while decrease the plasma level of high-density lipoproteins (HDL), among other effects. The use of olive oil to prepare fat spread opens new insights into the commercial development of healthy novel foods with a positive image in terms of consumer appeal.

Murakami, K., et al. (2005). "Effect of dietary factors on incidence of type 2 diabetes: A systematic review of cohort studies." Journal of Nutritional Science and Vitaminology **51**(4): 292-310.

We systematically reviewed cohort studies on the effect of nutrient and food intake (except for alcohol) on the incidence of type 2 diabetes, which had been published in English as of May 2004. Using the MEDLINE (PubMed) database as well as reference lists of searched papers, 15 individual cohort studies (a total of 31 papers) were identified. The number of subjects (n=895-85,060), follow-up length (5.9-23 y), the number of diabetes cases (n= 74-4,085), dietary assessment method used (simple food questionnaire, food frequency questionnaire, food frequency interview, diet history interview, and 24-h recall), and method of case ascertainment (questionnaire, oral glucose tolerance test, fasting glucose level, death certificate, and nationwide registry) varied among studies. For nutrients, intakes of vegetable fat, polyunsaturated fatty acid, dietary fiber (particularly cereal fiber), magnesium, and caffeine were significantly inversely correlated and intakes of trans fatty acid and heme-iron, glycemic index, and glycemic load were significantly positively correlated with the incidence of type 2 diabetes in several papers. For foods and food groups, several papers showed significantly decreased risk for type 2 diabetes with the higher consumption of grain (particularly whole grain) and coffee, and significantly increased risk with processed meat consumption. Because all the studies, were carried-out in Western countries, however, research in non-Western countries including Japan is needed.

Musa-Veloso, K., et al. (2011). "A comparison of the LDL-cholesterol lowering efficacy of plant stanols and plant sterols over a continuous dose range: Results of a meta-analysis of randomized, placebo-controlled trials." Prostaglandins Leukotrienes and Essential Fatty Acids **85**(1): 9-28.

Purpose: To determine if plant stanols and plant sterols differ with respect to their low-density lipoprotein cholesterol (LDL-CH) lowering efficacies across a continuous dose range. Methods: Dose-response relationships were evaluated separately for plant stanols and plant sterols and reductions in LDL-CH, using a first-order elimination function. Results: Altogether, 113 publications and 1 unpublished study report (representing 182 strata) complied with the pre-defined inclusion and exclusion criteria and were included in the assessment. The maximal LDL-CH reductions for plant stanols (16.4%) and plant stanol ester (17.1%) were significantly greater than the maximal LDL-CH reductions for plant sterols (8.3%) and plant sterol ester (8.4%). These findings persisted in several additional analyses. Discussion and conclusions: Intakes of plant stanols in excess of the recommended 2 g/day dose are associated with additional and dose-dependent reductions in LDL-CH, possibly resulting in further reductions in the risk of coronary heart disease (CHD). (C) 2011 Elsevier Ltd. All rights reserved.

Mutanen, M. and A. Aro (1997). "Coagulation and fibrinolysis factors in healthy subjects consuming high stearic or trans fatty acid diets." Thrombosis and Haemostasis **77**(1): 99-104.

The effects of stearic acid (C18:0) and trans fatty acids on variables related to coagulation and fibrinolysis were studied in 80 healthy humans average age 29 +/- 9 years. All subjects consumed a baseline diet high in saturated fatty acids, mainly from dairy fat for 5 weeks. After this baseline diet they were allocated either to a diet high (8.7% of energy, En%) in trans fatty acids from partially hydrogenated vegetable oil (40 subjects) or a diet high (9.3 En%) in stearic acid (40 subjects) for 5 weeks. All diets contained 32.2-33.9 En% fat, 14.6-15.8 En% saturated plus trans fatty acids, 12.2-12.5 En% cis-monounsaturated and 2.9-3.5 En% polyunsaturated fatty acids and 216-250 mg/10 MJ cholesterol. The fats were mixed into solid foods and almost all daily food was provided. In comparison with the baseline dairy fat diet no change was observed in the concentrations of plasma fibrin degradation products and D-dimers. Also the factor VII coagulant activity (F VII:C), tissue type plasminogen activity (tPA) and plasminogen activator inhibitor activity (PAI-1) were not affected by the experimental diets. Small increase in plasma fibrinogen concentration during the stearic acid diet was statistically significant (from 3.49 to 3.63 g/l; p = 0.041), but probably without any biological significance. Both diets increased plasma level of lipoprotein Lp(a). It can be concluded that as far as coagulation and fibrinolysis are concerned there is no need to differentiate between stearic acid or trans monoenoic fatty acids. D-dimers were also associated with increased risk of future myocardial infarction, although their level was not an independent predictor when the other risk factors were considered (10). Some dietary factors are known to influence F VII:C, tPA and PAI-1 activities. The factors affecting F VII:C are: total fat, cholesterol and fibre (11-13); tPA is affected by total fat (11, 13); and PAI-1 is influenced by n-3 fatty acids (14) and total fat and fibre (13, 15). The effects of dietary factors on the levels of D-dimers has not been studied. Stearic acid (C18:0) is considered less harmful for CHD risk than saturated fatty acids with 12-16 carbon atoms, since it does not affect serum total or LDL-cholesterol (16-18). Furthermore, when compared with fatty acids with 12-16 chain length, stearic acid diet has been shown to lower F VII:C (15, 19). However, an increase in fibrinogen level in healthy subjects on a high stearic acid diet (19), as well as an observation that stearic acid can provide a contact surface that activates factor VII (20) suggest that stearic acid can be less favorable in terms of CHD risk than anticipated based on its effect on cholesterol metabolism. To find out if there are differences in the effects of trans fatty acids and stearic acid on the variables of coagulation and fibrinolysis we carried out a dietary intervention study in a strictly controlled way, so that besides stearic acid and trans fatty acids the amounts of cis monounsaturated and polyunsaturated fatty acids in the diets were kept constant.

Natarajan, S., et al. (2005). "Dietary trans fatty acids alter diaphragm phospholipid fatty acid composition, triacylglycerol content and glucose transport in rats." British Journal of Nutrition **93**(6): 829-833.

The present study evaluates the effect of dietary trans fatty acids on diaphragm phospholipid fatty acid composition, intramyocellular triacylglycerol content and insulin-stimulated glucose uptake in comparison with dietary saturated fatty acids. Male weanling WNIN rats were divided into three groups and fed for 3 months on one of the following diets containing 10 % oil differing in fatty acid composition: control diet, saturated fatty acid diet and trans fatty acid diet. Dietary trans fatty acids increased the intramyocellular triacylglycerols and decreased the ratio of 20 : 4n-6 to 18 : 2n-6 and long-chain PUFA levels (20 %) in diaphragm phospholipids, indicating inhibition of PUFA biosynthesis. However, saturated fatty acids decreased both 18 : 2n-6 and 20 : 4n-6 without change in the ratio. Trans fatty acid-induced alterations in diaphragm phospholipid fatty acid composition and intramyocellular triacylglycerol content were associated with decreased insulin-stimulated glucose transport in the diaphragm. These observations suggest that dietary trans fatty acids decrease diaphragm insulin sensitivity, possibly due to increased intramyocellular triacylglycerol accumulation and decreased long-chain PUFA in phospholipids.

Naumann, E., et al. (2008). "The baseline serum lipoprotein profile is related to plant stanol induced changes in serum lipoprotein cholesterol and triacylglycerol concentrations." Journal of the American College of Nutrition **27**(1): 117-126.

Objective: Baseline characteristics of subjects might be related to the effect of plant stanols on the serum lipoprotein profile. The aim of the study was to examine effects of subjects' baseline characteristics (baseline serum concentrations of lipids and lipoproteins at the start of the study, lathosterol, campesterol and sitosterol; gender, age, BMI, smoking, use of oral contraceptives and menopause) on the effects of plant stanol esters on the serum lipoprotein profile. Methods: We used data of five studies performed at our Department. A random intercept model was used for statistical analysis, using serum lipid and lipoprotein concentrations after plant stanol ester consumption, as dependent variables. Results: After plant stanol ester consumption, higher baseline serum concentrations of total and LDL cholesterol resulted in larger absolute decreases in their respective serum concentrations. For the ratio of total to HDL cholesterol and triacylglycerol, higher baseline serum levels resulted in larger absolute and relative decreases in their serum levels. HDL cholesterol concentrations increased in subjects with low baseline concentrations and decreased in those with high baseline concentrations. Effects however were small. No relationships were observed with baseline serum cholesterol-standardized lathosterol and campesterol concentrations, although LDL cholesterol concentrations tended to decrease more at higher baseline sitosterol concentrations. No effects of other baseline characteristics were found. Conclusions: People with an unfavorable serum lipid and lipoprotein profile benefit even more of plant stanols than people with a more favorable profile.

Naziroglu, M. and C. Brandsch (2006). "Dietary hydrogenated soybean oil affects lipid and vitamin E metabolism in rats." Journal of Nutritional Science and Vitaminology **52**(2): 83-88.

Fatty acids containing stearic acid. which are found in hydrogenated fat, may have a detrimental effect oil the cholesterol and triacylglycerol (TAG) content of plasma lipoproteins, and oil the absorption of fatty acids and fat-soluble vitamins. The aim of our study was to examine the tissue concentration of lipids and vitamins A and E after feeding a hydrogenated soybean on (HSO) diet to rats. Twenty male Sprague-Dawley rats were randomly divided into two groups. fed on Coconut Oil (control) and HSO. respectively in amounts corresponding to 15% of the total feed. Plasma total cholesterol. VLDL- and LDL-cholesterol, lipid peroxidation and daily excretion of the TAG and cholesterol in feces were higher in the HSO than in the control group. TAG values in plasma and liver. and HDL-cholesterol levels in plasma were lower in the HSO than in the control group. The same was true for phospholipids in plasma and for saturated fatty acids. mono- and polyunsaturated fatty acids levels in the liver and vitamin E in plasma, LDL and adipose tissue. The results of this study provide new evidence concerning the effect of dietary hydrogenated fat oil lipid. TAG and vitamin E Status, which are important for maintenance of good health. Consumption of dietary HSO may be associated with cardiovascular disease.

Nehir El, S. and S. Simsek (2012). "Food Technological Applications for Optimal Nutrition: An Overview of Opportunities for the Food Industry." Comprehensive Reviews in Food Science and Food Safety **11**(1): 2-12.

An increasingly important determinant in food choice is the growing consumer concern about nutrition and health. This focusing of consumer interest on the food supply, and also extensive research and technological developments in food science will provide further opportunities for new product development. The Food-Based Dietary Guidelines of the World Health Organization (WHO) and European Union (EU) legislation on health claims play an important role in regulating information to the public about a wholesome diet and for improving the availability and affordability of nutritious food choices to consumers. More specifically, the food industry can contribute by reducing the number of energy-dense products; by improving the nutrient profile of processed food through the reduction of salt, added sugar, trans-fatty acid, and saturated fat content. As a result, food science and technology are prompted to create a new framework for these food-based dietary guidelines, principally in the areas of food physics, methods of food storage and preservation, nutrient restoration and fortification of foods, and the development of health-focused designer foods and functional foods. The aim of this review is to provide an overview of some further opportunities for new product development and nutrition research. Some topics related to the energy reduction of foods include: dilution and structure design, carbohydrate and/or fat substitutes, and inhibition of enzymes in carbohydrate and/or fat digestion; additionally, regulation of some metabolic functions with food-derived bioactive peptides and probiotics, and enrichment of foods with bioactive compounds are reviewed in this overview as the most promising issues.

Neil, H. A. W. and R. R. Huxley (2002). "Efficacy and therapeutic potential of plant sterols." Atherosclerosis Supplements **3**(3): 11-15.

Nestel, P. J., et al. (2005). "Dairy fat in cheese raises LDL cholesterol less than that in butter in mildly hypercholesterolaemic subjects." European Journal of Clinical Nutrition **59**(9): 1059-1063.

Objective: To determine whether dairy fat in cheese raises low-density lipoprotein (LDL) cholesterol as much as in butter, since epidemiology suggests a different impact on cardiovascular disease. Design: A randomised crossover trial testing the daily consumption of 40 g dairy fat as butter or as matured cheddar cheese, each of 4 weeks duration, was preceded by and separated by 2-week periods when dietary fat was less saturated. Setting: Free-living volunteers. Subjects: A total of 14 men and five women of mean age 56 +/- 8 y, with mean total cholesterol of 5.6 +/- 0.8 mmol/l. Main outcome measures: Plasma cholesterol, LDL cholesterol (LDL-C), HDL cholesterol (HDL-C), triacylglycerol and glucose. Results: Saturated fat intake was significantly lower during the run-in than during the cheese and butter periods. Mean lipid values did not differ significantly between the cheese and run-in periods, but total cholesterol and LDL-C were significantly higher with butter: total cholesterol (mmol/l): butter 6.1 +/- 0.7; run- in 5.6 +/- 0.8 ( P<0.05; ANOVA with Bonferroni adjustment); vs cheese 5.8 +/- 0.6 (P>0.05); median LDL-C (mmol/l): butter 3.9 (3.5 - 4.1) vs run- in 3.4 (3.0 - 4.1) (P<0.05; Tukey test); vs cheese 3.7 (3.3 - 3.9) (P>0.05). Among 13 subjects whose initial LDL-C was >4 mmol/l, the difference between butter (4.4 +/- 0.3 mmol/l) and cheese (3.9 +/- 0.3 mmol/l) was significant ( P = 0.014). HDL-C was highest with butter and triacylglycerol with cheese ( neither was significant). Conclusion: A total of 40 g dairy fat eaten daily for 4 weeks as butter, but not as cheese, raised total and LDL cholesterol significantly compared with a diet containing significantly less saturated fat. Dietary advice regarding cheese consumption may require modification.

Ng, A. W. K., et al. (2003). "Development of novel water-soluble phytostanol analogs: Disodium ascorbyl phytostanyl phosphates (FM-VP4): Preclinical pharmacology, pharmacokinetics and toxicology." Cardiovascular Drug Reviews **21**(3): 151-168.

FM-VP4 is a novel inhibitor of cholesterol absorption that has lipid lowering and body weight reducing properties. In vitro and in vivo studies were performed to investigate the lipid-lowering effects, mechanism of action, pharmacokinetics, and toxicity of FM-VP4. FM-VP4 decreased cholesterol accumulation in Caco-2 cells by approximately 50%; its activity appeared to be independent of pancreatic lipase, p-glycoprotein, or cholesterol incorporation in micelles. In animal studies, FM-VP4 was added to the diet or drinking water and the following results were obtained. In gerbils 2% FM-VP4 produced mean 56 and 53% reduction in total cholesterol (TC) after 4 and 8 weeks, respectively. This reduction was entirely due to the loss of the low-density lipoprotein (LDL) pool, which was reduced to undetectable levels at either time point. At 8 weeks, high-density lipoprotein (HDL) concentration had risen by a mean of 34% whereas total triglyceride (TG) concentrations had decreased by a mean of 60%. FM-VP4 also had a profound effect on body weight in these animals. At 8 weeks, the mean body weight was in the 4% FM-VP4 treatment group 25% lower than in the control group. No hepatic or renal toxicity was associated with these changes. In Apo E-deficient mice, after 4- and 8-week treatments FM-VP4 caused a significant decrease in both TC and TG concentrations compared to controls. After 12 weeks, the areas of atherosclerotic lesion involvement in the aortic roots were decreased by a mean of 80% in the 0.5, 1, and 2% FM-VP4 treatment groups compared to controls. Taken together, these results suggest that FM-VP4 is a potential new drug with lipid-lowering and weight loss potential, without apparent toxicity.

Nicolosi, R. J. and E. J. Rogers (1997). "Regulation of plasma lipoprotein levels by dietary triglycerides enriched with different fatty acids." Medicine and Science in Sports and Exercise **29**(11): 1422-1428.

Saturated vegetable oils (coconut, palm, and palm kernel oil) containing predominantly saturated fatty acids, lauric (12:0) or myristic (14:0 and palmitic (16:0), raise plasma total cholesterol (TC) and low density lipoprotein cholesterol (LDL-C) levels in animals and humans, presumably by decreasing LDL receptor activity and/or increasing LDL-C production rate. Although stearic acid (18:0) is chemically a saturated fatty acid, both human and animal studies suggest it is biologically neutral (neither raising nor lowering) blood cholesterol levels. Although earlier studies indicated that medium chain fatty acids (8:0-10:0) were also thought to be neutral, more recent studies in animals and humans suggest otherwise. Unsaturated vegetable oils such as corn, soybean, olive, and canola oil, by virtue of their predominant levels of either linoleic acid (18:2) or oleic acid (18:1), are hypocholesterolemic, probably as a result of their ability to upregulate LDL receptor activity and/or decrease LDL-C production rate. Whether trans fatty acids such as trans oleate (t18:1), in hydrogenated products such as margarine, are hypercholesterolemic remains controversial. Studies in humans suggest that their cholesterol-raising potential falls between the native nonhydrogenated vegetable oil and the more saturated dairy products such as butter. Assessment of the magnitude of the cholesterolemic response of trans 18:1 is difficult because in most diet studies its addition is often at the expense of cholesterol-lowering unsaturated fatty acids, making an independent evaluation almost impossible.

Nicolosi, R. J., et al. (2001). "Dietary effects on cardiovascular disease risk factors: Beyond saturated fatty acids and cholesterol." Journal of the American College of Nutrition **20**(5): 421S-427S.

Hypercholesterolemia represents a significant risk for cardiovascular disease (CVD). While diet intervention remains the initial choice for the prevention and treatment of CVD, the nature of the dietary modification remains controversial. For example, reducing calories from total fat, without decreasing saturated fat intake results in insignificant changes in low density lipoprotein cholesterol (LDL-C). Similarly, diet interventions that focus solely on lowering dietary cholesterol and saturated fat intake not only decrease LDL-C, but also high density lipoprotein cholesterol (HDL-C) and therefore may not improve the lipoprotein profile. This brief review summarizes dietary interventions that lower LDL-C without affecting HDL-C levels. These interventions include soy protein, soluble fiber, soy lecithin and plant sterols. This review also includes some of the reported dietary interventions, such as polyphenols, isoflavones, folic acid and vitamins B-6 and B-12 which reduce the risk of CVD without changes in lipoprotein cholesterol.

Nielsen, H. (1992). "N-3 POLYUNSATURATED FISH FATTY-ACIDS IN A FISH-OIL-SUPPLEMENTED BREAD." Journal of the Science of Food and Agriculture **59**(4): 559-562.

White bread enriched in n-3 fatty acids in the form of gelatine-coated fish oil and marketed in Denmark since 1990 under the name of 'Omega Bread', was found to be a reliable and significant source of higher n-3 polyunsaturated fatty acids (with 20 and 22 C atoms). The bread from six bakeries contained 40-55 mg per 100 g more n-3 fatty acids. By eating 200 g daily of this bread one gets some 25-30% of the amount of higher n-3 polyunsaturated fatty acids present in 30 g of mixed fish. The daily ingestion of this amount of fish over a period of 20 years is known to reduce mortality from coronary heart disease by more than 50%. The supplement of n-3 polyunsaturated fatty acids obtained by eating Omega Bread daily in place of other types of white bread is expected to reduce coronary heart disease. In addition, such an increased daily ingestion of n-3 polyunsaturated fatty acids over a long-term period may possibly have other beneficial health effects. It is recommended that the intake of higher n-3 fatty acids in industrialised Western societies should be increased by more than can be obtained by a daily ration of Omega Bread. It is therefore advisable that consumption of Omega Bread is combined with an increased intake of fish and/or fish oil capsules and/or fish-oil-enriched substitutes for butter and margarine.

Nielsen, L. V., et al. (2013). "Effects of Elaidic Acid on Lipid Metabolism in HepG2 Cells, Investigated by an Integrated Approach of Lipidomics, Transcriptomics and Proteomics." Plos One **8**(9).

Trans fatty acid consumption in the human diet can cause adverse health effects, such as cardiovascular disease, which is associated with higher total cholesterol, a higher low density lipoprotein-cholesterol level and a decreased high density lipoprotein-cholesterol level. The aim of the study was to elucidate the hepatic response to the most abundant trans fatty acid in the human diet, elaidic acid, to help explain clinical findings on the relationship between trans fatty acids and cardiovascular disease. The human HepG2 cell line was used as a model to investigate the hepatic response to elaidic acid in a combined proteomic, transcriptomic and lipidomic approach. We found many of the proteins responsible for cholesterol synthesis up-regulated together with several proteins involved in the esterification and hepatic import/export of cholesterol. Furthermore, a profound remodeling of the cellular membrane occurred at the phospholipid level. Our findings contribute to the explanation on how trans fatty acids from the diet can cause modifications in plasma cholesterol levels by inducing abundance changes in several hepatic proteins and the hepatic membrane composition.

Nigon, F., et al. (2001). "Plant sterol-enriched margarine lowers plasma LDL in hyperlipidemic subjects with low cholesterol intake: Effect of fibrate treatment." Clinical Chemistry and Laboratory Medicine **39**(7): 634-640.

Phytosterols, found in fat-soluble fractions of plants, chemically resemble cholesterol and inhibit cholesterol absorption in the small intestine. Phytosterol consumption in human subjects reduces plasma total and low density lipoprotein-cholesterol (LDL-C) levels. The primary aim of this study was to determine the efficacy of a low-fat spread enriched with plant sterols in reducing total and LDL-C concentrations in primary hypercholesterolemia. The secondary objective was to evaluate whether patients receiving a lipid-lowering drug (fibrate) might differ in their response to plant sterols. The study was a randomized, double-blind, placebo-controlled two-period cross-over trial with two treatments and three periods. Both treatment periods lasted 2 months, with a washout period (2 months) between them. Spread enriched with plant sterols was compared to non-enriched control spread. Fortified fat spread provided 1.6 g/day of plant sterols derived from edible vegetable oils and fatty acids from sunflower seed oil. The plant sterol content consisted of sitosterol esters (50%), campesterol esters (25%), stigmasterol esters (20%) and 10% of other esters. Data in 53 hypercholesterolemic patients (31 females and 22 males) who completed the study were as follows: patients were 58 +/- 12 years of age with mean body mass index 23.5 +/- 2.8 kg/m(2) (mean +/- SD). No adverse side-effects of the diet were reported. Plasma total cholesterol and LDL-C concentrations were significantly reduced by 6.4% and 8.8%, respectively, after using the spread enriched in plant sterols, as compared to controls (0.0% and 1.3%, respectively). No effect on high density lipoprotein-cholesterol (HDL-C) and lipoprotein(a) concentrations was detected. When subjects were divided in two subgroups according to fibrate treatment, supplementation with phytosterols decreased plasma cholesterol and LDL-C by 8.5% and 11.1%, respectively in the subgroup of patients treated with fibrates. In the group of patients who did not receive fibrates, consumption of plant sterol margarine reduced plasma cholesterol and LDL-C by 5.5% and 7.7%, respectively. Spread enriched with plant sterol esters significantly lowers blood total and LDL-C levels without affecting HDL-C concentrations, in a hypercholesterolemic population following a strict low cholesterol diet (NCEP step1). In addition, a combination of fibrate treatment and plant sterol ester-supplemented spread offers a safe and effective measure to significantly decrease abnormally high cholesterol levels. We conclude that phytosterol-en rich ed spread is a useful adjunctive therapy for hypercholesterolemic patients.

Niu, S. L., et al. (2005). "Trans fatty acid derived phospholipids show increased membrane cholesterol and reduced receptor activation as compared to their cis analogs." Biochemistry **44**(11): 4458-4465.

The consumption of trans fatty acid (TFA) is linked to the elevation of LDL cholesterol and is considered to be a major health risk factor for coronary heart disease. Despite several decades of extensive research on this subject, the underlying mechanism of how TFA modulates serum cholesterol levels remains elusive. In this study, we examined the molecular interaction of TFA-derived phospholipid with cholesterol and the membrane receptor rhodopsin in model membranes. Rhodopsin is a prototypical member of the G-protein coupled receptor family. It has a well-characterized structure and function and serves as a model membrane receptor in this study. Phospholipid-cholesterol affinity was quantified by measuring cholesterol partition coefficients. Phospholipid-receptor interactions were probed by measuring the level of rhodopsin activation. Our study shows that phospholipid derived from TFA had a higher membrane cholesterol affinity than their cis analogues. TFA phospholipid membranes also exhibited a higher acyl chain packing order, which was indicated by the lower acyl chain packing free volume as determined by DPH fluorescence and the higher transition temperature for rhodopsin thermal denaturation. The level of rhodopsin activation was diminished in TFA phospholipids. Since membrane cholesterol level and membrane receptors are involved in the regulation of cholesterol homeostasis, the combination of higher cholesterol content and reduced receptor activation associated with the presence of TFA-phospholipid could be factors contributing to the elevation of LDL cholesterol.

Noakes, M. and P. M. Clifton (1998). "Oil blends containing partially hydrogenated or interesterified fats: differential effects on plasma lipids." American Journal of Clinical Nutrition **68**(2): 242-247.

We compared the effects on plasma lipids of margarines containing tither a trans fatty acid- (TFA)-free hard fraction achieved through interesterification (from primarily saturated fatty acids) or a partially hydrogenated hard fraction. Thirty-eight mildly hyperlipidemic subjects consumed a low-fat diet for 2 wk. They were then allocated to 2 groups and underwent 3 dietary interventions for 3 wk each in random order (diets contained 35% of energy as fat with 20% of energy as margarines or butter): group 1 (n = 18), butter, canola oil blend with TFAs, and TFA-free canola oil blend; group 2 (n = 19), butter, polyunsaturated oil blend with TFAs, and TFA-free polyunsaturated oil blend. Plasma LDL-cholesterol concentrations after consumption of all oil blends and after the low-Eat diet were not significantly different, but were 11-15% lower than after butter (P < 0.001). Whereas the canola oil blends did not differ from each other in their effects on lipoprotein profiles, the TFA-free polyunsaturated oil blend resulted in a significant 6% reduction (-0.25 mmol/L; 95% CI: -0,08, -0.42) in total and LDL cholesterol compared with the blend containing TFAs (P = 0.006). In the canola oil blend, 10% TFAs and 6% oleic acid were replaced by approximate to 14% saturated fatty acids plus a 2% increase in linoleic acid. In the polyunsaturated oil blend, 10% TFAs and 5% linoleic acid were replaced by a 10% increase in saturated fatty acids as well as 3% and 1% increases in oleic and linolenic acids, respectively. We conclude that, compared with butter, TFA-free margarines may be equal to or more effective than margarines containing TFAs in lowering LDL cholesterol.

Ntanios, F. Y., et al. (2002). "A spread enriched with plant sterol-esters lowers blood cholesterol and lipoproteins without affecting vitamins A and E in normal and hypercholesterolemic Japanese men and women." Journal of Nutrition **132**(12): 3650-3655.

The objective of the study was to investigate whether different initial baseline cholesterol levels modulate the efficacy of a spread enriched with plant sterol-esters (PS) in lowering blood cholesterol in a Japanese population consuming their usual diet. Healthy adults with a mean age of 45 y and mean plasma total cholesterol (TC) level of 6.5 mmol/L were recruited to participate in a double-blind trial comprised of a run-in period of 1 wk, followed by two intervention periods of 3 wks in a 2 X 2 crossover design and a post-trial follow-up of 3 wk. Volunteers consumed two spreads, one enriched with PS (12 g/100 g plant sterols) and a control spread not fortified with PS. Recommended spread intake was 15 g/d. Effects on plasma lipids, lipoproteins, beta-carotene and vitamins A and E were assessed. Plasma TC and LDL cholesterol (LDL-C) concentrations were 5.8 and 9.1% lower, respectively, when subjects consumed the PS spread than when they consumed the control spread (P < 0.001). Subjects were divided into two groups [normal and mildly cholesterolemic (TC <5.7 mmol/L) and hypercholesterolemic (TC greater than or equal to 5.7 mmol/L)]. Reductions (P < 0.001) in TC and LDL-C due to treatment in the former group were 4.9 and 7.9%, respectively. In the hypercholesterolemic group, the reductions (P < 0.001) were 7.1 and 10.6%, respectively. The decreases did not differ between normal/mildly cholesterolemic and hypercholesterolemic subjects. Plasma apolipoprotein B (apoB) and remnant-like particle (RLP) cholesterol (RLP-C) concentrations were lower when subjects consumed the PS spread (44.3 g/L) than the control spread (49.7 g/L). Plasma P-carotene concentration was lower (P < 0.001) in subjects consuming the PS spread than in the control. Changes in plasma vitamins A and E levels did not differ after intake of the PS and control spreads. In conclusion, consumption of a PS-enriched spread effectively lowered plasma TC, LDL-C, apoB and RLP-C regardless of baseline plasma TC at an intake of 1.8 g/d of plant sterols.

Ntanios, F. Y., et al. (2003). "Effects of various amounts of dietary plant sterol esters on plasma and hepatic sterol concentration and aortic foam cell formation of cholesterol-fed hamsters." Atherosclerosis **169**(1): 41-50.

Dietary intake of plant sterol esters (PSE) lowers plasma LDL-cholesterol (LDL-C), but can modestly increase plasma plant sterol concentrations. The objective of the present study was to investigate the impact of increasing doses of dietary PSE on plasma and liver sterol concentrations as well as on aortic foam cell development as a marker of atherogenesis. One-hundred and twenty FIB hybrid Syrian golden hamsters (20 per group) were fed a basal atherogenic diet containing 30% of energy as fat and 0.12% (w/w) cholesterol and supplemented with 0, 0.24, 0.48, 0.96, 1.92 and 2.84% (w/w) PSE. After 12 weeks, plasma total cholesterol (TC) and LDL-C were significantly lower in the groups fed PSE compared with control. Plasma plant sterol concentrations increased with increasing dietary PSE intake up to the dietary level of 1.92% and then reached a plateau. On the other hand, hepatic campesterol and sitosterol concentrations plateaued at 0.24% PSE. Foam cell presence in the aortic arch showed an inverse relationship with dietary PSE intake (P < 0.0001). Lipid-filled foam cell areas of hamsters receiving 0.24, 0.48 or 2.84% PSE were approximately 70, 90 and 100% smaller than in control hamsters fed no PSE. In summary, dietary PSE lowered plasma TIC and LDL-C. Despite an increase in plasma plant sterol concentrations they did not contribute to aortic foam cell development. In fact dietary PSE significantly inhibited aortic foam cell formation. This study supports the concept that PSE through their cholesterol-lowering action prevent development of atherogenesis in this animal model. (C) 2003 Elsevier Science Ireland Ltd. All rights reserved.

O'Donnell-Megaro, A. M., et al. (2011). "Survey of the fatty acid composition of retail milk in the United States including regional and seasonal variations." Journal of Dairy Science **94**(1): 59-65.

Consumers are increasingly aware that food components have the potential to influence human health maintenance and disease prevention, and dietary fatty acids (FA) have been of special interest. It has been 25 years since the last survey of US milk FA composition, and during this interval substantial changes in dairy rations have occurred, including increased use of total mixed rations and byproduct feeds as well as the routine use of lipid and FA supplements. :Furthermore, analytical procedures have improved allowing greater detail in the routine analysis of FA, especially trans FA.. Our objective was to survey US milk fat and determine its FA composition. We obtained samples of fluid milk from 56 milk processing plants across the US every 3 mo for one year to capture seasonal and geographical variations. Processing plants were selected based on the criteria that they represented 50% or more of the fluid milk produced in that area. An overall summary of the milk fat analysis indicated that saturated fatty acids comprised 63.7% of total milk FA with palmitic and stearic acids representing the majority (44.1 and 18.3% of total saturated fatty acids, respectively). Unsaturated fatty acids were 33.2% of total milk FA with oleic acid predominating (71.0% of total unsaturated fatty acids). These values are comparable to those of the previous survey in 1984, considering differences in analytical techniques. Trans FA represented 3.2% of total FA, with vaccenic acid being the major trans isomer (46.5% of total trans FA). Cis-9, trans-11 18:2 conjugated linoleic acid represented 0.55% total milk FA, and the major n-3 FA. (linolenic acid, 18:3) composed 0.38%. Analyses for seasonal and regional effects indicated statistical differences for some FA, but these were minor from an overall human nutrition perspective as the FA profile for all samples were numerically similar. Overall, the present study provides a valuable database for current FA composition of US fluid milk, and results demonstrate that the milk fatty acid profile is remarkably consistent across geographic regions and seasons from the perspective of human dietary intake of milk fat.

O'Neill, F. H., et al. (2004). "Comparison of the effects of dietary plant sterol and stanol esters on lipid metabolism." Nutrition Metabolism and Cardiovascular Diseases **14**(3): 133-142.

Background and Aim: To compare the cholesterol-lowering efficacy and other metabolic effects of plant sterol and stanol esters, both of which are commonly used in the dietary management of hypercholesterolaemia. Methods and Results: The cholesterol-lowering efficacy of equivalent intakes of sterol and stanol esters and of different intakes of stanol esters were compared at 1 and 2 months, both in normal subjects and treated patients with familial hypercholesterolaemia. Systemic effects were assessed by measuring serum levels of plant sterols and of lathosterol and 7alpha-hydroxy-cholestenone, indices of sterol absorption and of cholesterol and bile acid synthesis respectively. There were no significant differences during the study between 1.6g daily of sterol and stanol esters in reducing total cholesterol (by 3-7%) or low density lipoprotein cholesterol (by 4-8%), nor between 1.6 and 2.6 g daily of stanol. However, the cholesterol-lowering effect of plant sterol esters was attenuated between 1 and 2 months. This was accompanied by increased serum plant sterols and decreased levels of 7a-hydroxy-cholestenone, especially in statin-treated hypercholesterolaemic patients not taking bile acid sequestrants. Conclusions: These findings suggest that absorption of dietary plant sterols suppressed bile acid synthesis, thereby diminishing their cholesterol-lowering efficacy. In contrast, plant stanols reduced plant sterol absorption and maintained their cholesterol-lowering efficacy. (C) 2004, Medikal Press.

O'Sullivan, T. A., et al. (2011). "Dietary intake and food sources of fatty acids in Australian adolescents." Nutrition **27**(2): 153-159.

Background: Dietary fat consumed during childhood and adolescence may be related to the development of cardiovascular and other chronic diseases in adulthood; however, there is a lack of information on specific fatty acid intakes and food sources in these populations. Our study aimed to assess fatty acid intakes in Australian adolescents, compare intakes with national guidelines, and identify major food sources of fatty acids. Methods: Dietary intake was assessed using measured 3-d records in 822 adolescents aged 13-15 y participating in The Western Australian Pregnancy Cohort (Raine) Study, Australia. Results: Mean daily total fat intakes were 90 +/- 25 g for boys and 73 +/- 20 g for girls, with saturated fat contributing 14% of total energy intake. Mean contribution to daily energy intake for linoleic, alpha-linolenic, eicosapentaenoic, docosapentaenoic, and docosahexaenoic acids were 3.0%, 0.40%, 0.02%, 0.01%, and 0.04%, respectively, for boys, and 3.3%, 0.42%, 0.02%, 0.01%, and 0.05% for girls. To meet guidelines for chronic disease prevention, consumption of long-chain omega-3 fatty acids in this population may need to increase up to three-fold and the proportion of saturated fat decrease by one-third. Girls were more likely to achieve the guidelines. Major food sources were dairy products for total fat, saturated fat and alpha-linolenic acid, margarines for linoleic acid, and fish for long-chain omega-3 fatty acids. Conclusion: Results suggest that for this population, a higher dietary intake of long-chain omega-3 fatty acids, particularly for boys, and lower proportion of saturated fat is required to meet recommendations for prevention of chronic disease. (C) 2011 Elsevier Inc. All rights reserved.

Obara, N., et al. (2010). "Possible involvement and the mechanisms of excess trans-fatty acid consumption in severe NAFLD in mice." Journal of Hepatology **53**(2): 326-334.

Background & Aims: Excessive trans-fatty acids (TFA) consumption has been thought to be a risk factor mainly for coronary artery diseases while less attention has been paid to liver disease. We aimed to clarify the impact of TFA-rich oil consumption on the hepatic pathophysiology compared to natural oil. Methods: Mice were fed either a low-fat (LF) or high-fat (HF) diet made of either natural oil as control (LF-C or HF-C) or partially hydrogenated oil, TFA-rich oil (LF-T or HF-T) for 24 weeks. We evaluated the liver and body weight, serological features, liver lipid content and composition, liver histology and hepatic lipid metabolism-related gene expression profile. In addition, primary cultures of mice Kupffer cells (KCs) were evaluated for cytokine secretion and phagocytotic ability after incubation in cis- or trans-fatty acid-containing medium. Results: The HF-T-fed mice showed significant increases of the liver and body weights, plasma alanine-aminotransferase, free fatty acid and hepatic triglyceride content compared to the HF-C group, whereas the LF-T group did not differ from the LF-C group. HF-T-fed mice developed severe steatosis, along with increased lipogenic gene expression and hepatic TFA accumulation. KCs showed increased tumor necrosis factor secretion and attenuated phagocytotic ability in the TFA-containing medium compared to its cis-isomer. Conclusions: Excessive consumption of the TFA-rich oil up-regulated the lipogenic gene expression along with marked hepatic lipid accumulation. TFA might be pathogenic through causing severe steatosis and modulating the function of KCs. The quantity and composition of dietary lipids could be responsible for the pathogenesis of non-alcoholic steatohepatitis. (C) 2010 European Association for the Study of the Liver. Published by Elsevier B.V. All rights reserved.

Oie, E., et al. (2011). "Fatty acid composition in chronic heart failure: low circulating levels of eicosatetraenoic acid and high levels of vaccenic acid are associated with disease severity and mortality." Journal of Internal Medicine **270**(3): 263-272.

Oie E, Ueland T, Dahl CP, Bohov P, Berge C, Yndestad A, Gullestad L, Aukrust P, Berge RK (Research Institute for Internal Medicine, Department of Cardiology, Oslo University Hospital, Rikshospitalet, Oslo, Center for Heart Failure Research, University of Oslo, Oslo, Section of Endocrinology, Oslo University Hospital, Rikshospitalet, Oslo, Faculty of Medicine, University of Oslo, Oslo, Section of Medical Biochemistry, Institute of Medicine, University of Bergen, Bergen, Department of Heart Disease, Haukeland University Hospital, University of Bergen, Bergen; and Section of Clinical Immunology and Infectious Diseases, Oslo University Hospital, Rikshospitalet, Oslo; Norway). Fatty acid composition in chronic heart failure: low circulating levels of eicosatetraenoic acid and high levels of vaccenic acid are associated with disease severity and mortality. J Intern Med 2011; 270: 263-272. Objectives. Free fatty acids (FFAs) are the major energy sources of the heart, and fatty acids (FAs) are active components of biological membranes. Data indicate that levels of FAs and their composition may influence myocardial function and inflammation. The aim of this study was to investigate whether total levels and composition of FAs and FFAs in plasma are altered in clinical heart failure (HF) and whether any alterations in these parameters are correlated with the severity of HF. Subjects. Plasma from 183 patients with stable HF was compared with plasma from 44 healthy control subjects. Results. Our main findings are as follows: (i) patients with HF had decreased levels of several lipid parameters and increased levels of FFAs in plasma, compared with controls, which were significantly correlated with clinical disease severity. (ii) Patients with HF also had a decreased proportion in the plasma of several n-3 polyunsaturated FAs, an increased proportion of several monounsaturated FAs, and a decreased proportion of some readily oxidized long-chain saturated FAs. (iii) These changes in FA composition were significantly associated with functional class, impaired cardiac function (i. e., decreased cardiac index and increased plasma N-terminal pro-B-type natriuretic peptide levels) and enhanced systemic inflammation (i. e., increased high-sensitivity C-reactive protein levels). (iv) Low levels of C20:4n-3 (eicosatetraenoic acid) and in particular high levels of C18: 1n-7 (vaccenic acid) were significantly associated with total mortality in this HF population. Conclusions. Our data demonstrate that patients with HF are characterized by a certain FA phenotype and may support a link between disturbed FA composition and the progression of HF.

Ojieh, G. C., et al. (2009). "Hydrogenation impairs the hypolipidemic and antioxidant effects of palm oil in rats." International Journal of the Physical Sciences **4**(7): 407-411.

The effect of hydrogenated palm oil on lipid profiles and on activities of selected glutathione-dependent enzymes in rats was investigated. Male albino wistar rats were randomly divided into 2 groups, fed on fresh palm oil (control) and hydrogenated palm oil (HPO) supplemented (5% by weight) diets respectively for 10 weeks. Serum cholesterol, liver lipid peroxidation and daily excretion of triacyl glycerol ( TAG) and cholesterol in faeces as well as hepatic activities of glutathione transferase (GST), glutathione reductase (GSSG-Rx), glutathione peroxidase (GSH-Px) and gamma glutamyl transpeptidase (-GT) (also in serum) were monitored both at pre- and post-diet periods. Serum cholesterol, liver lipid peroxidation and daily excretion of TAG and cholesterol in faeces and -GT (serum and liver) were significantly (p < 0.05) higher in the HPO than in the control group. TAG values in the serum and liver and liver activities of GST, GSSG-Rx and GSH-Px were significantly (p < 0.05) lower in the HPO than in the control group. The data presented in this study show that consumption of dietary HPO may be associated with cardiovascular disease.

Okada, Y., et al. (2013). "Trans fatty acids in diets act as a precipitating factor for gut inflammation?" Journal of Gastroenterology and Hepatology **28**: 29-32.

Fatty acids in our daily diet are broadly classified into cis and trans fatty acids (TFAs). TFAs are formed during the manufacturing process of hydrogenated vegetable oils such as margarine. Modern diets such as deep-fried products, frozen foods, and packaged snacks commonly include large quantities of margarine containing TFAs. Although an increased report in the effects of the diet containing TFAs on a risk factor of metabolic syndrome, diabetes mellitus, and coronary heart disease has been observed in the recent years, influence on intestinal inflammation remains unknown. This review describes pro-inflammatory effects of TFAs in our diary diet on various systemic disorders and also discusses a possible role of TFAs on gut inflammation.

Ooi, E. M. M., et al. (2013). "Dietary fatty acids and lipoprotein metabolism: new insights and updates." Current Opinion in Lipidology **24**(3): 192-197.

Purpose of review Dyslipidemia is a powerful risk factor for cardiovascular disease (CVD). Dietary fatty acid composition regulates lipids and lipoprotein metabolism and may confer CVD benefit. This review updates understanding of the effect of dietary fatty acids on lipoprotein metabolism in humans. Recent findings High dietary fish-derived n-3 polyunsaturated fatty acid (PUFA) consumption diminished hepatic triglyceride-rich lipoprotein (TRL) secretion and enhanced TRL to LDL conversion. n-3 PUFA also decreased TRL-apoB-48 concentration by decreasing TRL-apoB-48 secretion. High n-6 PUFA intake decreased liver fat, and plasma proprotein convertase subtilisin/kexin type 9, triglycerides, total-cholesterol and LDL-cholesterol concentrations. Intake of saturated fatty acids with increased palmitic acid at the sn-2 position was associated with decreased postprandial lipemia, which might be due to decreased triglyceride absorption. Replacing carbohydrate with monounsaturated fatty acids increased TRL catabolism. Ruminant trans-fatty acid decreased HDL cholesterol, but the mechanisms are unknown. A new role for APOE genotype in regulating lipid responses was also described. Summary The major advances in understanding the effect of dietary fatty acids on lipoprotein metabolism have focused on n-3 PUFA. This knowledge provides insights into the importance of regulating lipoprotein metabolism as a mode to improve plasma lipids and potential CVD risk. Further studies are required to better understand the cardiometabolic effects of other dietary fatty acids.

Oomen, C. M., et al. (2001). "Association between trans fatty acid intake and 10-year risk of coronary heart disease in the Zutphen Elderly Study: a prospective population-based study." Lancet **357**(9258): 746-751.

Background Evidence on the relation between trans fatty acid intake and coronary heart disease is limited. We investigated this relation in a Dutch population with a fairly high trans fatty acid intake, including trans fatty acids from partly hydrogenated fish oils. Methods We prospectively studied 667 men of the Zutphen Elderly Study aged 64-84 years and free of coronary heart disease at baseline. We used dietary surveys to establish the participants' food consumption patterns. Information on risk factors and diet was obtained in 1985, 1990, and 1995. After 10 years of follow-up from 1985-95, there were 98 cases of fatal or non-fatal coronary heart disease. Findings Between 1985 and 1995, average trans fatty acid intake decreased from 43% to 1.9% of energy. After adjustment for age, body mass index, smoking, and dietary covariates, trans fatty acid intake at baseline was positively associated with the 10-year risk of coronary heart disease. The relative risk for a difference of 2% of energy in trans fatty acid intake at baseline was 1.28 (95% CI 1.01-1.61). Interpretation A high intake of trans fatty acids tall types of isomers) contributes to the risk of coronary heart disease. The substantial decrease in trans fatty acid intake, mainly due to industrial lowering of trans contents in Dutch edible fats, could therefore have had a large public-health impact.

Opie, L. H. (1994). "MARGARINE AND CORONARY HEART-DISEASE." South African Medical Journal **84**(6): 357-359.

Or-Rashid, M. M., et al. (2009). "Fatty Acid Profile of Bovine Milk Naturally Enhanced with Docosahexaenoic Acid." Journal of Agricultural and Food Chemistry **57**(4): 1366-1371.

Recent studies have shown that the fatty acid profile of dietary lipid has the potential for improving the health of consumers. The present study was conducted to determine the fatty acid composition of commercial milks, namely, Dairy-Oh! Homo-Milk (DOHM), which is naturally enhanced with docosahexaenoic acid (DHA), or regular Homo-Milk (HM). The milk was collected from local supermarkets. The most abundant saturated fatty acids in the milk were butyric (C4:0), lauric (Cl 2:0), myristic (Cl 4:0), palmitic (Cl 6:0), and stearic (Cl 8:0) acids. Among unsaturated fatty acids, oleic acid (cis-9-C18:1) was also considerably high (502.7 mg/100 mL of milk). The concentration of total trans-18:1 was higher (P < 0.05) in DOHM than in HM (134.7 vs; 107.0 mg/100 mL of milk, respectively), whereas total cis-18:1 was higher (P < 0.05) in HM than in DOHM (566.4 vs 508.4 mg/100 mL of milk, respectively). The concentration of DHA was 24.0 times higher (P < 0.05) in DOHM than in HM. DOHM contained 2.8 times higher (P < 0.05) eicosapentaenoic acid (EPA) compared to HM. Milk fat from DOHM contained a greater concentration of cis-9,trans-11 conjugated linoleic acid (CLA, 16.4 vs 11.6 mg/100 mL of milk, DOHM vs HM, respectively). The total omega-3 polyunsaturated fatty acids content was 2.23 times greater (P < 0.05) in DOHM compared with HM, due to an increase in C18:3n-3, EPA, and DHA. The result of the milk fatty acid analyses indicates that milk fat from DOHM had increased contents of EPA, DHA, and cis-9,trans-11 CLA, which could have a more favorable impact on diet composition and healthfulness.

Or-Rashid, M. M., et al. (2009). "Microbial fatty acid conversion within the rumen and the subsequent utilization of these fatty acids to improve the healthfulness of ruminant food products." Applied Microbiology and Biotechnology **84**(6): 1033-1043.

Consumers are aware of foods containing microcomponents that may have positive effects on health maintenance and disease prevention. In ruminant milk, meat, and milk products; these functional food components include eicosapentaenoic acid (20:5n3), docosahexaenoic acid (22:6n3), 9c11t-conjugated linoleic acid, and vaccenic acid (11t-18:1). Modifying ruminal microbial metabolism of fatty acid in rumen through animal diet formulation is an effective way to enhance these functional fatty acids in ruminant-derived food products. However, it requires an understanding of the interrelationship between supply of lipid through the diet and rumen fermentation. Lipids in ruminant diets undergo extensive hydrolysis and biohydrogenation in the rumen. Apparent transfer efficiency of eicosapentaenoic acid and docosahexaenoic acid from feed to milk is very low (1.9 to 3.3%), which is, to a large extent, related to their extensive biohydrogenation in the rumen. Therefore, feeding a rumen-protected supplement containing eicosapentaenoic acid and docosahexaenoic acid, can be used to bypass the rumen. Ruminant-derived foods also contain different types of conjugated linoleic acid isomers, which are intermediates of rumen biohydrogenation of linoleic acid (9c12c-18:2). The predominant isomer of conjugated linoleic acid is 9c11t, which has numerous health benefits in animal models. The concentration of conjugated linoleic acid in ruminant-derived food products can be significantly enhanced through animal diet modification. We conclude that most current functional food products from ruminants have potential for their health-supporting properties, and for this market to succeed, an evidence-based approach should be developed in humans.

Ortega, R. M., et al. (2006). "Improvement of cholesterol levels and reduction of cardiovascular risk via the consumption of phytosterols." British Journal of Nutrition **96**: S89-S93.

Hypercholesterolaemia is one of the main factors contributing to the appearance and progression of CVD, which is the main cause of death in the adult population of industrialized societies. By 2020, projections suggest that it will continue to hold first place, by then causing 37 % of all deaths. Therapeutic life-style changes to reduce cardiovascular risk include dietary modifications, such as the inclusion of phytosterols or plant sterols (known since the 1950s to reduce cholesterol levels). These help prevent the absorption of cholesterol and thus condition a reduction in total cholesterol and LDL-cholesterol levels, and ultimately in cardiovascular mortality. The fat-soluble nature of these sterols rendered margarine one of the best vehicles by which to supply them in the diet. Indeed, margarine was the first food to contain cholesterol-reducing phytosterols to be approved by the EU (in agreement with its regulations on new foods and food ingredients, 258/97/CE). Presently, phytosterols can be emulsified with lecithin and thus delivered in non-fat or low-fat foods and beverages. Margarine and dairy products (yoghurt and milk) enriched in phytosterols have proved better at lowering total cholesterol and LDL-cholesterol levels than have enriched cereals and their derivatives, although all can be of help, depending on the characteristics of each subject. The reduction in carotenoid bioavailability caused by sterols is minimized by increasing fruit and vegetable consumption. Individuals who habitually consume phytosterols should also follow traditional advice such as eating less dietary fat and increasing their physical activity. Phytosterols have been shown to be safe and effective in lowering cholesterol levels in many rigorous studies. In few areas of nutrition is there such consensus. Diet professionals should feel comfortable in prescribing phytosterols/stanols for the treatment of hypercholesterolaemia. They are safe whether taken alone or in combination with cholesterol-reducing drugs, such as statins and fibrates. Reinforcement counselling is essential, as therapy is effective only if compliance is good.

Ostlund, R. E. (2002). "Phytosterols in human nutrition." Annual Review of Nutrition **22**: 533-549.

Phytosterols are cholesterol-like molecules found in all plant foods, with the highest concentrations occurring in vegetable oils. They are absorbed only in trace amounts but inhibit the absorption of intestinal cholesterol including recirculating endogenous biliary cholesterol, a key step in cholesterol elimination. Natural dietary intake varies from about 167-437 mg/day. Attempts to measure biological effects in feeding studies have been impeded by limited solubility in both water and fat. Esterification of phytosterols with long-chain fatty acids increases fat solubility by 10-fold and allows delivery of several grams daily in fatty foods such as margarine. A dose of,2 g/day as the ester reduces low density lipoprotein cholesterol by 10%, and little difference is observed between Delta(5)-sterols and 5alpha-reduced sterols (stanols). Phytosterols can also be dispersed in water after emulsification with lecithin and reduce cholesterol absorption when added to nonfat foods. In contrast to these supplementation studies, much less is known about the effect of low phytosterol levels in the natural diet. However, reduction of cholesterol absorption can be measured at a dose of only 150 mg during otherwise sterol-free test meals, suggesting that natural food phytosterols may be clinically important. Current literature suggests that phytosterols are safe when added to the diet, and measured absorption and plasma levels are very small. Increasing the aggregate amount of phytosterols consumed in a variety of foods may be an important way of reducing population cholesterol levels and preventing coronary heart disease.

Ovesen, L., et al. (1996). "Fatty acid composition of Danish margarines and shortenings, with special emphasis on trans fatty acids." Lipids **31**(9): 971-975.

Trans fatty acids from hydrogenated vegetable and marine oils could be as hypercholesterolemic and atherogenic as saturated fatty acids. Hence, it is important to know the fatty acid composition in major food contributors, e.g., margarines and shortenings. In 1992 margarines were examined, and in 1995 brands covering the entire Danish market were examined. Significant amounts of trans-18:1 were found only in hard margarines (mean: 4.2 +/- 2.8%) and shortenings (mean: 6.8 +/- 3.1%), whereas the semisoft and soft margarines contained substantially less trans-18:1 in 1995 than in 1992. Where marine oils had been used to a larger degree the mean trans-monoenoic content was about 15%, of which close to 50% was made up of long-chain (C-20 and C-22) trans fatty acids. A note-worthy decrease in the content of trans-18:1 had occurred for the semisoft margarines, from 9.8 +/- 6.1% in 1992 to 1.2 +/- 2.2% in 1995. Calculated from sales figures, the supply of trans-18:1 plus saturated fatty acids from margarines has decreased over this three-year period by 1.4 g/day, which has been replaced by cis monounsaturated and polyunsaturated fatty acids.

Ovesen, L., et al. (1998). "Fatty acid composition and contents of trans monounsaturated fatty acids in frying fats, and in margarines and shortenings marketed in Denmark." Journal of the American Oil Chemists Society **75**(9): 1079-1083.

This study examined trans monounsaturated fatty acid contents in all margarines and shortenings marketed in Denmark, and in frying fats used by the fast-food restaurants Burger King and McDonald's. Trans C-18:1 content was 4.1 +/- 3.8% (g per 100 g fatty acids) in hard margarines, significantly higher than the content in soft margarines of 0.4 +/- 0.8%. Shortenings had an even higher content of trans C-18:1, 6.7 +/- 2.3%, than the hard margarines. Margarines and shortenings with high contents of long-chain fatty acids had about 20% total trans monoenoic of which close to 50% were made up of trans long-chain fatty acids. Both fast-food frying fats contained large amounts of trans C-18:1, 21.9 +/- 2.9% in Burger King and 16.6 +/- 0.4% in McDonald's. In Denmark the per capita supply of trans C-18:1 from margarines and shortenings and frying fats has decreased steadily during recent years. The supply of trans C-18:1 from margarines and shortenings in the Danish diet is now 1.1 g per day.

Ozturk, S., et al. (2009). "EFFECTS OF ZERO-TRANS INTERESTERIFIED AND NON-INTERESTERIFIED SHORTENINGS AND BREWER'S SPENT GRAIN ON COOKIE QUALITY." Journal of Food Lipids **16**(3): 297-313.

The effects of non-interesterified (non-in-es) and chemically interesterified (in-es) cottonseed oil (CO), palm oil (PO) and CO : PO blend (1:1, weight basis) and brewer's spent grain (BSG) on quality of cookies were studied. Incorporation of non-in-es and in-es CO and CO : PO blend improved the nutritional value of the cookies by altering the fatty acid composition. The experimental shortenings had zero-trans fatty acids (TFA) and considerably higher linoleic acid contents than hydrogenated shortening (HS). in-es PO and CO : PO blend samples had lower solid fat content than their non-in-es counterparts and this resulted in higher spread ratios in in-es incorporated cookies. As expected, addition of BSG significantly increased (P < 0.05) the total dietary fiber (TDF) content of cookies. Cookies with modified fatty acid composition and 4.4-fold higher TDF have been produced by using non-in-es and in-es CO and CO : PO with 15% BSG, without significant adverse effects on sensory properties. PRACTICAL APPLICATIONS Hydrogenated shortenings (HSs) are the most important source of fat in cookies and might have high proportions of trans fatty acids (TFAs). A high intake of TFA is associated with increased risk of coronary heart disease and the intake should be reduced to minimize health risks. In this work, the production of zero-trans interesterified and non-interesterified shortenings and their utilization in high-fiber cookies were investigated. The results indicated that some of the experimental in-es and non-in-es shortenings and 15% brewer's spent grain could be used for production of cookies with zero TFA and higher unsaturated fatty acids and total dietary fiber contents without detrimentally affecting their sensory properties. The in-es shortening incorporated cookies had higher spread ratios and color values than their non-in-es counterparts.

Panagiotakos, D., et al. (2009). "Dietary patterns and 5-year incidence of cardiovascular disease: A multivariate analysis of the ATTICA study." Nutrition Metabolism and Cardiovascular Diseases **19**(4): 253-263.

Background and aims: The 5-year incidence of cardiovascular disease (CVD) in relation to dietary habits, among men and women from Greece, was evaluated. Methods and results: From May 2001 to December 2002, 1514 men and 1528 women (> 18 years) without any clinical evidence of CVD, living in the Attica area, Greece, were enrolled in the ATTICA study. In 2006, a group of experts performed the 5-year follow-up (941 of the 3042 participants were lost). Development of CVD (coronary heart disease, acute coronary syndromes, stroke, or other CVD) during the follow-up period was defined according to WHO ICD-10 criteria. Principal. Components Analysis was applied, and 15 dietary patterns were extracted (71% of total information explained) from 26 foods or food groups. The 5-year incidence of CVD was 11.0% in men and 6.1% in women (p < 0.001); the case fatality rate was 1.6%. Multi-adjusted analysis revealed that the dietary pattern that was mainly characterized by cereals, small fish, hardtack and olive oil intake, was associated with tower CVD risk (HR per 1 unit = 0.72, 95% CI 0.52-1.00); the pattern that was characterized by fruits, vegetables intake and olive oil use in daily cooking was associated with lower CVD risk (HR per 1 unit = 0.80, 95% CI 0.66-0.97); while patterns that were mainly characterized by sweets, red meat, margarine, salty nuts intake, and hard cheese, as well as alcohol intake, were associated with higher CVD risk (HR per 1 unit = 1.26, 95% Cl 1.01-1.56, and HR per 1 unit = 1.32, 95% CI 1.05-1.66, respectively). Conclusions: Multivariate statistical methods revealed dietary patterns based on empirical epidemiological data which were associated with the development of CVD. (c) 2008 Elsevier B.V. All rights reserved.

Pande, G. and C. C. Akoh (2013). "Enzymatic synthesis of trans-free structured margarine fat analogs with high stearate soybean oil and palm stearin and their characterization." Lwt-Food Science and Technology **50**(1): 232-239.

High intake of trans fat is associated with several chronic diseases such as cardiovascular disease and cancer. Enzymatic synthesis of trans-free structured margarine fat analogs from high stearate soybean oil (HSSO) and palm stearin (PS) was optimized using response surface methodology (RSM). The independent variables considered for the design were substrate molar ratio (SR. PS:HSSO, 2-5), temperature (50-65 degrees C), time (6-22 h), and enzymes (Lipozyme (R) TLIM and Novozym (R) 435). The response was stearic acid incorporation. All linear parameters had a negative effect on stearic acid incorporation except Novozym (R) 435. Time was not significant but its interaction terms with temperature and SR had significant effect on the response. Desirable structured lipids (SL) containing 11.2 and 8.9 g/100 g stearic acid were obtained at 50 degrees C, 20 h, 2:1 SR with Novozym 435 (SL1) and 57 degrees C, 6.5 h, 2:1 SR with Lipozyme TLIM (SL2), respectively. Using optimal conditions, SLs were synthesized in 1 L stir-batch reactor and characterized for fatty acid profile, triacylglycerol species, polymorphism, thermal behavior, and solid fat content. The yield for SL1 and SL2 were 87.3 and 94.8%, respectively. Novozym 435 catalyzed SL had desirable fatty acid profile, physical properties, and suitable beta' polymorph for margarine formulation. (C) 2012 Elsevier Ltd. All rights reserved.

Pande, G., et al. (2012). "Production of trans-Free Margarine with Stearidonic Acid Soybean and High-Stearate Soybean Oils-Based Structured Lipid." Journal of Food Science **77**(11): C1203-C1210.

Omega-3 fatty acids (n-3 FAs) have been positively associated with prevention and treatment of chronic diseases. Intake of high amounts of trans fatty acids (TFAs) is correlated with increased risk of coronary heart disease, inflammation, and cancer. Structured lipid (SL) was synthesized using stearidonic acid (SDA) soybean oil and high-stearate soybean oil catalyzed by Lipozyme (R) TLIM lipase. The SL was compared to extracted fat (EF) from a commercial brand for FA profile, sn-2 positional FAs, triacylglycerol (TAG) profile, polymorphism, thermal behavior, oxidative stability, and solid fat content (SFC). Both SL and EF had similar saturated FA (about 31 mol%) and unsaturated FA (about 68 mol%), but SL had a much lower n-6/n-3 ratio (1.1) than EF (5.8). SL had 10.5 mol% SDA. After short-path distillation, a loss of 53.9% was observed in the total tocopherol content of SL. The tocopherols were lost as free tocopherols. SL and EF had similar melting profile, beta' polymorph, and oxidative stability. Margarine was formulated using SL (SLM) and EF (RCM, reformulated commercial margarine). No sensory difference was observed between the 2 margarines. The SL synthesized in this study contained no TFA and possessed desirable polymorphism, thermal properties, and SFC for formulation of soft margarine. The margarine produced with this SL was trans-free and SDA-enriched.

Papantoniou, K., et al. (2010). "trans Fatty acid consumption, lifestyle and type 2 diabetes prevalence in a Spanish population." European Journal of Nutrition **49**(6): 357-364.

To analyse the association of trans fatty acid (TFA) consumption with the risk of type 2 diabetes and lifestyle in a South European population. Data were obtained from two population-based cross-sectional surveys conducted in Gerona (Spain) in 2000 and 2005. The present analysis included 7,774 free-living Spanish men and women aged 35-74 years. Diet was assessed by a validated food frequency questionnaire. Fasting blood sugar was measured and history of diabetes recorded. trans Fatty acid intake was relatively low in our study population (1.5 g d(-1) for women and 1.8 g d(-1) for men). Multiple logistic regression analysis revealed a null association between TFA intake and risk of type 2 diabetes in men and women. Total energy intake, alcohol consumption and the prevalence of smoking increased across quartiles of TFA intake. An inverse association was found between TFA intake and the consumption of vegetables, fruit, fish, legumes, white bread and olive oil in both genders (p < 0.001) after adjusting for energy intake. In contrast, intakes of meat, sausages and pastry products increased across quartiles of TFA intake in both genders (p < 0.001). trans Fatty acid intake was not associated with a higher risk of type 2 diabetes. Higher TFA intake was associated with less healthy lifestyle and dietary habits in both sexes.

Paradis, A. M., et al. (2009). "Associations between dietary patterns and obesity phenotypes." International Journal of Obesity **33**(12): 1419-1426.

Objective: To examine whether dietary patterns are associated with obesity phenotypes. Design: Cross-sectional study. Subjects: We recruited 664 participants aged between 18 and 55 years. Dietary data were collected from a food frequency questionnaire. A factor analysis was performed to derive dietary patterns. Body mass index (BMI), weight and waist girth were recorded using standard procedures. Fat mass and fat-free mass were assessed by electrical bioimpedance. Obesity was defined as having a BMI >= 30 kg m(-2) and a positive FHO (FHO+) as having at least one obese first-degree relative. Results: Two dietary patterns were identified; Western and Prudent. The Western pattern was mainly characterized by a higher consumption of refined grains, French fries, red meats, condiments, processed meats and regular soft drinks whereas the Prudent pattern was mainly characterized by a higher consumption of non-hydrogenated fat, vegetables, eggs and fish and seafood. Subjects in the top tertile of the Western pattern had higher BMI, weight, waist girth, waist-to-hip ratio and fat mass than those in the lower tertile. In contrast, subjects in the top tertile of the Prudent pattern had lower BMI, weight, waist girth, fat mass, HDL-cholesterol levels, and lower triglyceride levels than those in the lowest tertile. Individuals in the upper tertile of the Western pattern were more likely to be obese ( obesity was defined as having a BMI >= 30 kg m(-2)) (OR = 1.82, 95% CI 1.16-2.87) whereas those in the upper tertile of the Prudent pattern were less likely to be obese (OR 0.62, 95% CI 0.40-0.96). These latter significant associations were only observed among those with FHO+. No such association was observed among FHO- individuals. Conclusion: Individuals having a high score of Western pattern were more likely to be obese and those having a high score of the Prudent pattern were less likely to be obese, and this is particularly among individuals with an FHO+. International Journal of Obesity ( 2009) 33, 1419-1426; doi: 10.1038/ijo.2009.179; published online 8 September 2009

Parillo, M. and G. Riccardi (2004). "Diet composition and the risk of type 2 diabetes: epidemiological and clinical evidence." British Journal of Nutrition **92**(1): 7-19.

In the last 10 years nutritional research on diabetes has improved dramatically in terms of both number of studies produced and quality of methodologies employed. Therefore, it is now possible to attempt to provide the evidence on which nutritional recommendations for the 1 prevention of type 2 diabetes could be based. We therefore performed a literature search and, among the papers published in indexed journals, we selected relevant epidemiological (mostly prospective) and controlled intervention studies. Lifestyle factors that have, so far, been consistently associated with increased risk of type 2 diabetes are overweight and physical inactivity. However, recent evidence from epidemiological studies has shown that the risk of type 2 diabetes is also associated with diet composition, particularly with: (1) low fibre intake; (2) a high trans fatty acid intake and a low unsaturated: saturated fat intake ratio; (3) absence of or excess alcohol consumption. All these factors are extremely common in Western populations and therefore the potential impact of any intervention on them is large: indeed, > 90 % of the general population has one or more of these risk factors. The ability to correct these behaviours in the population is estimated to reduce the incidence of diabetes by as much as 87 %. Recent intervention studies have shown that type 2 diabetes can be prevented by lifestyle changes aimed at body-weight reduction, increased physical activity and multiple changes in the composition of the diet. Within this context, the average amount of weight loss needed is not large, about 5 % initial weight, which is much less than the weight loss traditionally considered to be clinically significant for prevention of type 2 diabetes. In conclusion, new emphasis on prevention by multiple lifestyle modifications, including moderate changes in the composition of the habitual diet, might limit the dramatic increase in incidence of type 2 diabetes envisaged worldwide.

Park, D. J., et al. (2008). "Analysis of trans fatty acid content in retort food, powdered milk, biscuit and pizza products." Korean Journal for Food Science of Animal Resources **28**(2): 240-245.

The consumption of foods containing trans fatty acids (TFAs) is a matter of concern at present. According to many studies, trans fatty acids (TFAs) may cause illnesses such as the coronary heart disease, diabetes mellitus, large intestine cancer, and breast cancer. They can also raise low density lipoprotein (LDL) cholesterol and reduce high density lipoprotein (HDL) cholesterol. TFAs can also inhibit the synthesis of phospholipids containing polyunsaturated fatty acids in arterial cells. As a consequence the Food and Drug Administration has deemed that saturated fatty acid, cholesterol and trans fatty acid levels be listed on food labels as of 2006. The Korea Food and Drug Administration also has required the listing of trans fatty acid content on food labels since 2007. The aim of this study was to determine the total lipid and trans fatty acid (TFA) contents in retort food, powdered milk, biscuit and pizza products. The number of samples examined were 2 retort food, 6 powdered milk, 7 biscuit and 3 pizza products. The extraction of total lipids in retort food and powdered milk followed the chloroform-methanol method. The extraction of total lipids in biscuit and pizza was by the acid digestion method. All samples were analyzed by gas chromatography (GC) using a SP-2560 capillary column and a flame ionization detector. The TFA contents per 100 g of sample were 1-2.8% (1.9%) in retort foods, 0.4-2.4% (1.37%) in powdered milk products, 0-2.9% (1.23%) in biscuits, and 2.8-3.45% (3.03%) in pizzas.

Park, J. M., et al. (2007). "Analysis of trans fatty acid content in processed foods and meat products." Korean Journal for Food Science of Animal Resources **27**(4): 531-537.

Small amounts of trans fatty acids exist naturally in beef and dairy foods. Also, they can be produced in the process of partial hydrogenation to manufacture shortning or margarine. They can provide a better palatability and shelf life. According to the recently Studies, trans fatty acids call raise health risk such as heart diseases and coronary artery diseases. They can also increase low-density lipoprotein (LDL) cholesterol and decrease high-density lipoprotein (HDL) cholesterol in the blood plasma, therefore increasing the risk of atherosclerosis and diabetes. The aim of this study was to determine total lipids and trans fatty acids (TFAs) content in processed foods and meat products. The analysis of trans fatty acids was performed in 28 samples of donuts, 18 samples of bakeries, 4 samples of frozen doughs, 2 samples of popcorns, and 4 samples of meat products (ham, sausage, nuget, and bacon). Total lipids in processed foods and meat products were extracted by chloroform-Methanol method and acid digestion, respectively. They were analyzed by gas chromatography using a SP-2560 column and flame ionization detector. The amounts of TFAs per 100 g of foods were 0-3.3% (0.74% on average) in donuts, 0.2-5.8% (1.18% on average) in bakeries, 0.2-6.3% (1.93% on average) in frozen doughs, and 0-5.8% in popcorns. Meat products Such as ham, sausage, and nuget analyzed 0.1% of TFAs, respectively and trans fatty acids in bacon were not detected, As a result, the distribution Of TFAs in processed foods was widely ranged from 0% to 6.3% according to manufacturers and types of products, whereas the content of TFAs in meat products ranged from 0% to 0.1%.

Park, Y. (2009). "Conjugated linoleic acid (CLA): Good or bad trans fat?" Journal of Food Composition and Analysis **22**: S4-S12.

Even though trans fatty acids (TFAs) are present in natural sources such as foods from ruminant origins, the development of partially hydrogenated vegetable oil contributed to a significant increase in total TFAs consumption in humans. Currently, TFA consumption is considered to be a risk factor for coronary heart diseases. Researchers are now starting to discover that not all TFAs behave in a similar manner, that is, isomer specificity may be found. Among non-conjugated TFAs, plant originated TFAs (mainly elaidic and linolelaidic acids) are particularly linked to increased risk for coronary heart diseases, while animal originated TFAs (mainly vaccenic acid) are not. Among conjugated TFAs, two major isomers of conjugated linoleic acid (CLA), cis-9,trans-11 and trans-10,cis-12, show distinctive biological activities. A number of clinical trials of CLA with effects on body composition have been reported, but effects on coronary heart disease risk factors have been inconsistent. Meanwhile, safety concerns regarding CLA, in particular isomer specificity, have also been raised. Thus, it is critical to identify isomer specific effects of TFAs on particular risk factors, to determine their health impact. (C) 2009 Elsevier Inc. All rights reserved.

Park, Y., et al. (2009). "Correlation of erythrocyte fatty acid composition and dietary intakes with markers of atherosclerosis in patients with myocardial infarction." Nutrition Research **29**(6): 391-396.

The purpose of this study was to examine the hypothesis that erythrocytes that are low in n-3 fatty acids and high in trans-fatty acids and nutrient intakes are associated with the risk of atherosclerosis. Fifty patients with acute nonfatal myocardial infarction were recruited to measure their dietary intake, erythrocyte fatty acid composition, intima medial thickness (IMT), and the Gensini score, which are markers of atherosclerosis. Trans-oleic acid of erythrocytes was positively (P = .05) correlated with the carotid IMT. After adjusting for age, sex, and energy intake, the IMT was negatively associated with the intake of protein, fat, phosphate, zinc, vitamin B(1), vitamin B(2), vitamin B(6), niacin, linoleic acid, linolenic acid, total fatty acids, total n-3 fatty acids, and total n-6 fatty acids. The Gensini score was also negatively associated with the intake of protein, fat, phosphate, sodium, zinc, vitamin E, vitamin B I, vitamin B(2), vitamin B(6), niacin, linolenic acid, total fatty acids, and total n-3 fatty acids. In conclusion, lower levels of trans-oleic acid (elaidic acid) in erythrocytes and higher intakes of vitamins, minerals, and n-3 fatty acids were associated with the decreased risk of atherosclerosis. However, these findings need further investigation in randomized controlled clinical trials before public health recommendations for atherosclerosis prevention can be made. (c) 2009 Elsevier Inc. All rights reserved.

Park, Y. and M. W. Pariza (2009). "Bioactivities and Potential Mechanisms of Action for Conjugated Fatty Acids." Food Science and Biotechnology **18**(3): 586-593.

Since conjugated linoleic acid (CLA) was identified as a principal anticancer component from ground beef in the 1980s, CLA research has discovered that CLA has a wide range of biologically beneficial effects. Clinical studies with CLA are on the rise, and it is apparent that CLA may not be as effective in humans as in rodents, in particular its anti-obesity aspect. In addition, research with regard to other conjugated fatty acids as well as CLA metabolites is still in its infancy. Investigation of bioactivities for other conjugated fatty acids and CLA metabolites may help to extend the understanding of CLA and its mechanisms of actions. This may pose an opportunity to use CLA more efficiently and expand the future use of other conjugated fatty acids as pharmacological agents to assist current treatments.

Parodi, P. W. (2004). "Milk fat in human nutrition." Australian Journal of Dairy Technology **59**(1): 3-59.

Milk fat contains a number of components of nutritional significance. The first section of the review outlines the composition, structure and certain biochemical and physiological characteristics of these components. In recent times the nutritional image of milk fat has suffered adversely because of the association of saturated fat and cholesterol with coronary heart disease. The various elements that are used to justify this 'lipid-heart disease' hypothesis are discussed and the strength of the evidence is assessed. Contrary evidence, which is mostly overlooked in authoritative reviews, is presented. Trans fatty acid consumption is associated with an increased risk of coronary heart disease; however, the associations generally do not apply to trans acids of animal origin. These acids are mainly vaccenic and rumenic, acids that may possess anti-atherogenic properties. Other health related benefits for rumenic acid, particularly its role in the prevention of mammary tumorigenesis are outlined. Milk fat contains other potential anticancer agents such as sphingomyelin and other sphingolipids, butyric acid, 13-methyltetradecanoic acid, ether lipids and vitamin A. Pasture-derived compounds like beta-carotene, beta-ionone, gossypol and phytol may also help prevent cancer. Finally, the review discusses the antimicrobial action of milk fat and its role in long-chain polyunsaturated fatty acid metabolism, bone growth, ulcerogenesis, and energy metabolism.

Pedersen, J. I., et al. (2005). "Palm oil versus hydrogenated soybean oil: effects on serum lipids and plasma haemostatic variables." Asia Pacific Journal of Clinical Nutrition **14**(4): 348-357.

The purpose of this study was to test if replacement of trans fatty acids by palmitic acid in an experimental margarine results in unfavourable effects on serum lipids and haemostatic factors. We have compared the effects of three different margarines, one based on palm oil (PALM-margarine), one based on partially hydrogenated soybean oil (TRANS-margarine) and one with a high content of polyunsaturated fatty acids (PUFA-margarine), on serum lipids in 27 young women. In nine of the participants fasting levels and diurnal postprandial levels of haemostatic variables on the 3 diets were compared. The sum of 12:0, 14:0, 16:0 provided 11% of energy (E%) in the PALM diet, the same as the sum of 12:0, 14:0, 16:0 and trans fatty acids in the TRANS-diet. Oleic acid provided 10-11E% in all three diets, while PUFA provided 5.7, 5.5 and 10.2 E%, respectively. Total fat provided 30-31% and the test margarines 26% of total energy in all three diets. Each of the diets was consumed for 17 days in a crossover design. There were no significant differences in total cholesterol, LDL-cholesterol and apoB between the TRANS- and the PALM-diet. HDL-cholesterol and apoA-I were significantly higher on the PALM-diet compared to the TRANS-diet while the ratio of LDL- to HDL-cholesterol was lower, although not significantly (P = 0.077) on the PALM-diet. Total cholesterol, LDL-cholesterol and apoB were significantly lower on the PUFA-diet compared to the two other diets. HDL-cholesterol was not different on the PALM- and the PUFA-diet while it was significantly lower on the TRANS-diet compared to the PUFA-diet. Triglycerides and Lp(a) were not different among the three diets. The diurnal postprandial state level of tissue plasminogen activator (t-PA) activity was significantly decreased on the TRANS-diet compared to the PALM-diet. t-PA activity was also decreased on the PUFA-diet compared to PALM-diet although not significantly (P=0.07). There were no significant differences in neither fasting levels or in circadian variation of t-PA antigen, PAI-1 activity, PAI-1 antigen, factor VII coagulant activity or fibrinogen between the three diets. Our results suggest that dietary palm oil may have a more favourable effect on the fibrinolytic system compared to partially hydrogenated soybean oil. We conclude that from a nutritional point of view, palmitic acid from palm oil may be a reasonable alternative to trans fatty acids from partially hydrogenated soybean oil in margarine if the aim is to avoid trans fatty acids. A palm oil based margarine is, however, less favourable than one based on a more polyunsaturated vegetable oil.

Pedersen, J. I., et al. (2000). "Adipose tissue fatty acids and risk of myocardial infarction - a case-control study." European Journal of Clinical Nutrition **54**(8): 618-625.

Objectives: To study the association between content in adipose tissue of very long-chain n-3 fatty acids, tr-ans fatty acids, linoleic acid and alpha-linolenic acid and risk of a first myocardial infarction. Design and subjects: A case-control design among 100 patients and 98 population controls both men and postmenopausal women, age 45-75 y. Adipose tissue fatty acids were determined by gas-liquid chromatography. Intake data were obtained through interview using a validated food frequency questionnaire. Results: Dietary intake and adipose tissue content of the fatty acids studied correlated significantly. Adipose tissue contents of eicosapentaenoic acid (20:5n-3), docosapentaenoic acid (22:5n-3) and docosahexaenoic acid (22:6n-3) were significantly lower while those of trans fatty acids, linoleic and alpha-linolenic acid were significantly higher in patients than in controls. Age and sex adjusted odds ratios (OR) were significantly reduced with increasing quintiles of very long-chain n-3 fatty acids, thus the OR in the fifth compared to the first quintile was 0.23 (95% CI 0.08-0.70). After further adjustment for waist-to-hip ratio, smoking, family history of CHD and content of trans fatty acids, the OR in the highest quintile was 0.17 (95% CI 0.04-0.76) and the P for trend 0.016. Age and sex adjusted OR was increased in the fifth compared to the first quintile of trans fatty acids (OR 2.81, 95% CI 1.16-6.84), linoleic acid (OR 2.10, 95% CI 0.87-5.07) and alpha-linolenic acid (OR 1.96, 95% CI 0.83-4.61), and P for trend was 0.002. 0.005 and 0.020, respectively. The trends remained significant after adjustment for waist-to-hip ratio, smoking, and family history of coronary heart disease. Trans fatty acids, linoleic acid and alpha-linolenic acid in adipose tissue were strongly correlated, indicating a common source, most likely margarine. When each of these fatty acid species were adjusted for the two others the trends were no longer significant. Conclusion: Intake of very long-chain n-3 Fatty acids as reflected in adipose tissue content is inversely associated with risk of myocardial infarction. Trans fatty acids, linoleic and alpha-linolenic acid were intercorrelated and associated with increased risk. It is suggested that the increased risk may be connected to trans fatty acids or to some other factor associated with margarine consumption.

Pella, D., et al. (2002). Can a Indo-Mediterranean type of diet rich in n-3 fatty acids provide protection against coronary artery disease?

Objective: To review published and unpublished data on the role of IndoMediterranean diet rich in n-3 fatty acids in decreasing coronary artery disease and inhibiting the development of atherosclerosis. Design and Methods: Internet search of studies on n-3 fatty acids, fish oil, rape seed oil and diet rich n-3 fatty acid; Mediterranean diet including whole grains, fruits, vegetables, walnuts, mustard oil, soysbean oil in relation to coronary artery disease. Results: In 1976,for the first time, epidemiologic study showed a low mortality from myocardial infarction in Eskimos. However, the prevalence of stroke was similar to Danish population. Further studies showed a dose related correlation between ingestion of fish and reduced mortality from cardiovascular disease (CVD). The diet and reinfarction trial showed that eating 100-200g fish, 3-4 times in a week can cause significant reduction in cardiac mortality and total mortality. The Indian experiment of infarct survival revealed that treatment with 600g/day of fruits, vegetable, legumes, walnuts, inconjunction with mustard or soyabean oil may be protective within one year of treatment. The Lyon heart study showed that treatment with fish, alpha-linolenic acid rape seed oil margarine can protect against sudden death, total cardiac deaths and total mortality in patients with postmyocardial infarction. The Indian experiment of infarct survival-4 showed that fish oil and mustard oil therapy was associated with significant reduction in the cardiac events in the intervention group than control group. Study of electrocardiographic score indicating myocardial infarct size revealed that low score was associated with small infarct, moderate score with medium infarct and high score with large infarct in both fish oil and placebo groups. Incidence of enlarged heart, arrhythmias and total cardiac events were significantly more common in patients with moderate and large infarct compared to small infarct; significantly more in fish oil than control group. The diet experiment showed that the intake of n-3 fatty acids rich foods was significantly higher in the diet intervention group both initially as well as after 2 years of follow-up in the IndoMeditirranian diet heart study. Eating 400g/day of fruits, vegetable and nuts and another 400g/day of whole grains in conjunction with 25-30g/day of mustard or soyabean oil was associated with significant reduction in cardiac events. Conclusion: It is possible that both short chain (alpha linolenic acid) and long chain (fish oil) n-3 fatty acids may protect against cardiac events and decrease infarct size and inhibit atherosclerosis due to their independent beneficial effects. More studies are necessary for confirmation of these results.

Pelloso, T. (2001). Margarines and spreads.

Margarines and spreads were introduced as low-cost replacements for butter many years ago. Although some margarines are still produced, spreads are the predominant products in this category of products. They have gone through many evolutionary changes since they were introduced more than six decades ago. Products have gone from the original 80% fat to 0% fat, with varying degrees of success in the marketplace. Manufacturers of margarines and spreads have also taken advantage of the many new innovations in both the processing and the use of newer oils. We have gone from the use of soy/cottonseed, to all soy, to the use of newer oils such as canola, sunflower, safflower, and olive oil, to name a few. The coming of spreads and their preparation has also spearheaded advances in the emulsifier sector of the food industry. Even though it is much easier to make a full-fat (80%) margarine than its lower fat version, the availability of special high monoemulsifiers, polyglycerol esters (PGE) of regular or special fatty acids, and other emulsifiers has made the preparation and processing easier. Further, the availability of fat replacers, gums, and hydrocolloids has made it easier to satisfy the ever-increasing need for lower fat products. Lower fat margarines, better known as spreads, have filled the need to reduce the fat intake recommended by the American Heart Association in the effort to lower low-density lipoproteins and incidence of cardiovascular disease. Further, margarines and spreads have been under attack recently because they contain trans fatty acids. The industry, as a whole, has done well in reducing the levels of this "villain." What is next for margarines and spreads? Are genetically modified organisms (GMO) the answer to hydrogenation? Are tropical oils an option? What is worse, saturates or trans? Will industry develop a special way to hydrogenate oils so as to minimize the trans level? Many of our colleagues are hard at work to solve some of these problems.

Peng, J. B., et al. (2012). "Studies on the Total Synthesis of 8-epi-Liphagal." Acta Chimica Sinica **70**(21): 2232-2235.

The tetracyclic meroterpenoid natural product (+)-liphagal is one of a number of natural inhibitors of phosphatidylinositol 3-kinase (PI3K), which plays a central role in regulation of cell proliferation, cell survival, adhesion, membrane trafficking, glucose transport and neurite growth. Liphagal also shows inhibitory activity against PI3K alpha with an IC50 of 100 nmol.L-1 making it as an agent for the treatment of inflammatory and autoimmune disorders as well as cancer and cardiovascular diseases. From a structural point of view, liphagal has an unprecedented [6-7-5-6] tetracyclic skeleton, and has attracted significant attention from the synthetic chemists. Starting from cheap and commercially available 2,4,5-trimethoxylbenzaldehyde and alpha-ionone, an advanced intermediate 10 for the synthesis of 8-epi-liphagal was achieved in the longest linear 7 steps and 8.72% yield. The key reactions include: Wittig reaction, Cu-catalyzed cyclization, chemoselective hydrogenation and Friedel-Crafts reaction.

Peng, S., et al. (2004). "Synthesis of site-specifically labeled arachidonic acids as mechanistic probes for prostaglandin H synthase." Organic Letters **6**(3): 349-352.

Prostaglandin H synthase catalyzes the first committed step in the biosynthesis of prostaglandins and thromboxane. Herein we report the synthesis of four site-specifically labeled arachidonic acids for investigation of the radical intermediate formed during this enzymatic reaction. Two compounds were prepared using a common C9-C11 fragment, while another target was synthesized using a previously reported advanced intermediate. An alkyne coupling followed by hydrogenation and Wittig reaction was used to prepare the final labeled substrate.

Perova, N. V., et al. (2013). "Trans isomers of unsaturated fatty acids increase the risk of atherosclerosis-related circulatory system diseases." Terapevticheskii Arkhiv **85**(9): 113-117.

The paper provides a review of the literature on a relevant non-drug prevention problem, namely the negative effect of trans isomers of unsaturated fatty acids (trans-UFA) on the risk of circulatory system diseases (CSD) and other chronic noncommunicable diseases. It gives data on the specific features of the structure and ability of trans-UFA to elevate the plasma levels of atherogenic low-density lipoproteins and to lower those of non/antiatherogenic high-density lipoproteins. The natural sources of their moderate content in the animal fats from ruminants and those of their redundant content in the margarines manufactured by hydrogenation of liquid vegetable oils are described. A new technology for preparing soft margarines (spreads) is presented, which can produce fatty products that do not virtually contain trans-UFA. There is evidence that trans-UFA can considerably raise the risk of CSD and their acute complications. It is concluded that the manufacture of fatty products with low and even no trans-UFA levels should be expanded in Russia to improve its population's health.

Pfeuffer, M. and J. Schrezenmeir (2006). "Impact of trans fatty acids of ruminant origin compared with those from partially hydrogenated vegetable oils on CHD risk." International Dairy Journal **16**(11): 1383-1388.

There is a considerable overlap of trans fatty acid (TFA) isomers in fats of ruminant origin and partially hydrogenated vegetable oils (PHVOs), with many isomers in common. However, there is a considerable difference in the amount of individual TFAs in both sources. At present it is uncertain as to which component(s) of TFAs created by chemical hydrogenation are responsible for their negative metabolic effects. There is evidence of unfavourable effects of TFAs from hydrogenated vegetable oils on LDL and other risk factors of atherosclerosis. There is no evidence that the predominant TFA in milk, vaccenic acid, exerts these unfavourable effects. Prospective studies addressing the effect of TFA intake on coronary heart disease risk, whose estimate of TFA intake was based on dietary protocols, were mostly carried out in populations with a relatively low intake of dairy or ruminant TFAs. Nevertheless, several of them showed a significantly or non-significantly decreased risk with increasing intake of animal TFAs, or at least no increased risk. Up to now there is no human study available that investigates the effect of different TFAs under "Ceteris paribus" conditions (isoenergetic diets with otherwise identical fatty acid profile). By now the production of milk fat samples differing mainly in TFA content is feasible and would allow such controlled intervention studies. (c) 2006 Elsevier Ltd. All rights reserved.

Piironen, V., et al. (2000). "Plant sterols: biosynthesis, biological function and their importance to human nutrition." Journal of the Science of Food and Agriculture **80**(7): 939-966.

Plant sterols are an essential component of the membranes of all eukaryotic organisms. They are either synthesised de novo or taken up from the environment. Their function appears to be to control membrane fluidity and permeability, although some plant sterols have a specific function in signal transduction. The phytosterols are products of the isoprenoid pathway. The dedicated pathway to sterol synthesis in photosynthetic plants occurs at the squalene stage through the activity of squalene synthetase. Although the activity of 3-hydroxymethyl-3-glutaryl coenzyme A (HGMR) is rate-limiting in the synthesis of cholesterol, this does not appear to be the case with the plant sterols. Up-regulation of HGMR appears to increase the biosynthesis of cycloartenol but not the Delta(5)-sterols. A decline in sterol synthesis is associated with a suppression of squalene synthetase activity, which is probably a critical point in controlling carbon flow and end-product formation. The major post-squalene biosynthetic pathway is regulated by critical rate-limiting steps such as the methylation of cycloartenol into cycloeucalenol. Little is known about the factors controlling the biosynthesis of the end-point sterol esters or stanols. The commonly consumed plant sterols are sitosterol, stigmasterol and campesterol which are predominantly supplied by vegetable oils. The oils are a rich source of the steryl esters. Less important sources of sterols are cereals, nuts and vegetables. The nutritional interest derives from the fact that the sterols have a similar structure to cholesterol, and have the capacity to lower plasma cholesterol and LDL cholesterol. Since the morbidity and mortality from cardiovascular disease have been dramatically reduced using cholesterol-lowering drugs (statins), the interest in plant sterols lies in their potential to act as a natural preventive dietary product. Stanols (saturated at C-5) occur in low amounts in the diet and are equally effective in lowering plasma cholesterol and do not cause an increase in plasma levels, unlike the sterols which can be detected in plasma. (C) 2000 Society of Chemical Industry.

Pinedo, S., et al. (2007). "Plasma levels of plant sterols and the risk of coronary artery disease: the prospective EPIC-Norfolk Population Study." Journal of Lipid Research **48**(1): 139-144.

Some studies have suggested that a modest increase of plant sterol levels is a risk factor for coronary artery disease (CAD). We studied the relationship between plant sterol levels and CAD risk in a prospective nested case-control study consisting of 373 cases and 758 controls. Sitosterol and campesterol concentrations did not differ between cases and controls [sitosterol, 0.21 vs. 0.21 mg/dl (P = 0.1); campesterol, 0.31 vs. 0.32 mg/dl (P = 0.5)]. The sitosterol-to-cholesterol ratio was significantly lower in cases than in controls (1.19 vs. 1.29 mu g/mg; P = 0.008), whereas the campesterol-to-cholesterol ratio did not differ significantly (1.78 vs. 1.88 mu g/mg; P = 0.1). Plant sterol concentrations correlated positively with cholesterol levels and inversely with body mass index and triglyceride and lathosterol concentrations. Among individuals in the highest tertile of the sitosterol concentration, the unadjusted odds ratio (OR) for future CAD was 0.75 [95% confidence interval (CI) = 0.56-1.01]. After adjustment for traditional risk factors, the OR was 0.79 (95% CI = 0.56-1.13). For the campesterol concentration, the unadjusted OR was 0.95 (95% CI = 0.71-1.29) and the adjusted OR was 0.97 (95% CI = 0.68-1.39). In this large prospective study, higher levels of plant sterols, at least in the physiological range, do not appear to be adversely related to CAD in apparently healthy individuals.

Pintauro, P. N., et al. (2005). "Electrochemical hydrogenation of soybean oil with hydrogen gas." Industrial & Engineering Chemistry Research **44**(16): 6188-6195.

Soybean oil has been partially hydrogenated in a proton exchange membrane (PEM) electro-chemical reactor, with H-2 gas as the anode feed and source of hydrogen. The reactor is similar in design to that used in a H-2/O-2 fuel cell, with a membrane electrode assembly composed of a Pd-black powder cathode and a Pt-black powder anode fixed to the opposite surfaces of a Nafion 117 cation-exchange membrane. The PEM reactor was operated at a moderate temperature (60-90 degrees C) and 1 atm of pressure using commercial-grade soybean oil as the cathode feed. The effects of the current density, temperature, and oil flow rate on oil hydrogenation current efficiency and product selectivity were investigated. The oil hydrogenation current efficiency (the efficiency of electrogenerated H-2 addition to fatty acid double bonds) increased with temperature, decreased with current density, and ranged from 45 to 97%. Partially hydrogenated oil products were characterized by a low percentage of trans-fatty acid isomers (which are known contributors to coronary heart disease) and a moderately high concentration of saturated stearic acid (typical of nonselective, precious metal hydrogenation catalysts). An improvement in fatty acid hydrogenation selectivity was achieved by increasing the oil feed flow rate and inserting a turbulence promoter into the oil feed channel of the PEM reactor. The use of a bimetallic cathode (Pd/Co or Pd/Fe) increased the selectivity of the hydrogenation process, at the expense of a drop in current efficiency and an increase in the trans isomer content of hydro-oil products.

Pintus, S., et al. (2013). "Sheep cheese naturally enriched in alpha-linolenic, conjugated linoleic and vaccenic acids improves the lipid profile and reduces anandamide in the plasma of hypercholesterolaemic subjects." British Journal of Nutrition **109**(8): 1453-1462.

Intake of dairy fat has long been considered as a risk factor for CVD. Pasture and dietary lipid supplementation have been reported to be reliable strategies in ruminant nutrition, in order to increase the content of a-linolenic acid (ALA), conjugated linoleic acid (CLA) and vaccenic acid (VA), and decrease SFA in milk fat. In the present study, we aimed at verifying whether consumption of a sheep cheese, naturally enriched in ALA, CLA and VA, would modify the plasma lipid and endocannabinoid profiles in mildly hypercholesterolaemic subjects. A total of forty-two adult volunteers (nineteen males and twenty-three females) with diagnosed mildly hypercholesterolaemia (total cholesterol 5.68-7.49 mmol/l) were randomly assigned to eat 90 g/d of a control or enriched cheese for 3 weeks, with a cross-over after 3 weeks of washout. Plasma lipids, endocannabinoids, adipokines and inflammatory markers were measured. The intake of enriched cheese significantly increased the plasma concentrations of CLA, VA, the n-3 fatty acids ALA and EPA, and more remarkably decreased that of the endocannabinoid anandamide. LDL-cholesterol decreased significantly (7 %). No changes were detected in the levels of inflammatory markers; however, a significant correlation was found between the plasma levels of anandamide and leptin. The control cheese modified none of the parameters measured. The results obtained do not support the view that intake of dairy fat is detrimental to hypercholesterolaemic subjects. Indeed, they show that a naturally enriched cheese possesses beneficial properties, since it ameliorates the plasma lipid profile, and more remarkably reduces endocannabinoid biosynthesis.

Pisani, L. P., et al. (2008). "Hydrogenated fat diet intake during pregnancy and lactation modifies the PAI-1 gene expression in white adipose tissue of offspring in adult life." Lipids in Health and Disease **7**.

We examine whether feeding pregnant and lactating rats hydrogenated fats rich in trans fatty acids modifies the plasma lipid profiles and the expression of adipokines involved with insulin resistance and cardiovascular disease in their 90-day-old offspring. Pregnant and lactating Wistar rats were fed with either a control diet (C group) or one enriched with hydrogenated vegetable fat (T group). Upon weaning, the male pups were sorted into four groups: CC, mothers were receiving C and pups were kept on C; CT, mothers were receiving C and pups were fed with T; TT, mothers were receiving T and pups were kept on T; TC, mothers were receiving T and pups were fed with C. Pups' food intake and body weight were quantified weekly and the pups were killed at day 90 of life by decapitation. Blood and carcass as well as retroperitoneal, epididymal, and subcutaneous white adipose tissues were collected. Food intake and body weight were lower in TC and TT, and metabolic efficiency was reduced in TT. Offspring of TT and TC rats had increased white adipose tissue PAI-1 gene expression. Insulin receptor was higher in TT than other groups. Ingestion of hydrogenated vegetable fat by the mother during gestation and lactation could promote deleterious consequences, even after the withdrawal of the causal factor.

Pisani, L. P., et al. (2008). "Hydrogenated fat intake during pregnancy and lactation modifies serum lipid profile and adipokine mRNA in 21-day-old rats." Nutrition **24**(3): 255-261.

Objective: We examined whether feeding pregnant and lactating rats hydrogenated fats rich in trans-fatty acids modifies the plasma lipid profiles and the expression of adipokines involved with insulin resistance and cardiovascular disease in their 21-d-old offspring. Methods: Pregnant and lactating Wistar rats were fed with a control diet (C group) or one enriched with hydrogenated vegetable fat (T group). After delivery, male offspring were weighed weekly and killed at day 21 of life by decapitation. Blood and retroperitoneal, epididymal, and subcutaneous white adipose tissues were collected. Results: Offspring of T-group rats had increased serum triacylglycerols and cholesterol, white adipose tissue,plasminogen activator inhibitor-1, and tumor necrosis factor-a gene expression, and carcass lipid content and decreased blood leptin and adiponectin and adiponectin gene expression. Conclusion: Ingestion of hydrogenated vegetable fat by the mother during gestation and lactation alters the blood lipid profiles and the expression of proinflammatory adipokynes by the adipose tissue of offspring aged 21 d. (C) 2008 Elsevier-Inc. All rights reserved.

Plat, J., et al. (2005). "Common sequence variations in ABCG8 are related to plant sterol metabolism in healthy volunteers." Journal of Lipid Research **46**(1): 68-75.

Polymorphisms; in the ATP binding cassette (ABC) transporters ABCG5 and ABCG8 are related to plasma plant sterol concentrations. It is not known whether these polymorphisms are also associated with variations in serum plant sterol concentrations during interventions affecting plant sterol metabolism. We therefore decided to study changes in serum plant sterol concentrations with ABCG5/G8 polymorphisms after consumption of plant stanol esters, which decrease plasma plant sterol concentrations. Cholesterol-standardized serum campesterol and sitosterol concentrations were significantly associated with the ABCG8 T400K genotype, as were changes in serum plant sterol concentrations after consumption of plant stanols. The reduction of -57.1 +/- 38.3 10(2) X mumol/mmol cholesterol for sitosterol in TT subjects was significantly greater compared with the -36.0 +/- 18.7 reduction in subjects with the TK genotype (P = 0.021) and the -16.9 +/- 13.0 reduction in subjects with the KK genotype (P = 0.047). Changes in serum campesterol concentrations showed a comparable association. No association with serum LDL cholesterol was found. Genetic variation in ABCG8 not only explains cross-sectional differences in serum plant sterol concentrations but also determines a subject's responsiveness to changes in serum plant sterols during interventions known to affect plant sterol metabolism.

Plat, J. and R. P. Mensink (2001). "Effects of plant sterols and stanols on lipid metabolism and cardiovascular risk." Nutrition Metabolism and Cardiovascular Diseases **11**(1): 31-40.

Functional foods enriched with plant sterols and stanols are on sale in many countries. Due to their structural similarity with cholesterol, these additives lower intestinal absorption of cholesterol, resulting in a 10-15% reduction in LDL-cholesterol when their daily intakes are 2-3 g. They are also effective as part of a cholesterol-lowering diet and in combination with cholesterol-lowering drugs. Estimates for the absorption of plant sterols (sitosterol and campesterol) and of campestanol are around 10%, and for sitostanol less than 5%. Lipid-standardized plasma levels are very low, but increase when statins are used. Extensive toxicological evaluation studies have not revealed any harmful side-effects. In human studies, side-effects were comparable to placebo treatment. However, lipid-standardized levels of the hydrocarbon carotenoids may decrease, without leaving the normal range. Together these findings indicate that these functional foods have great potential in the prevention of coronary heart disease. However, post-marketing surveillance for example for functional foods in general is necessary to monitor possible adverse effects and describe consumers and consumption patterns. (C) 2001, Medikal Press.

Plat, J. and R. P. Mensink (2005). "Plant stanol and sterol esters in the control of blood cholesterol levels: Mechanism and safety aspects." American Journal of Cardiology **96**(1): 15D-22D.

Incorporation of plant stanol esters into margarine is among the first examples of a functional food with proven low-density lipoprotein (LDL) cholesterol-lowering effectiveness. Recently, there have been many studies on the effects of plant stanols/sterols on cholesterol metabolism. It has been found that the serum LDL cholesterol-lowering effect of plant stanols/sterols originates from reduced intestinal cholesterol absorption, a process in which changes in micellar composition are thought to play a major role. However, recent findings suggest that there is an additional process in which plant stanols/sterols actively influence cellular cholesterol metabolism within intestinal enterocytes. Furthermore, in response to the reduced supply of exogenous cholesterol, receptor-mediated lipoprotein cholesterol uptake is probably enhanced, as shown by increased LDL receptor expression. At recommended intakes of about 2 to 2.5 g/day, products enriched with plant stanol/sterol esters lower plasma LDL cholesterol levels by 10% to 14% without any reported side effects. Thus, plant stanols/sterols can be considered to be effective and safe cholesterol-lowering functional food ingredients. (c) 2005 Elsevier Inc. All rights reserved.

Pogozheva, A. V. (2010). "Contemporary Approaches to Nondrug Correction of Hypercholesterolemia." Kardiologiya **50**(4): 86-91.

Hypercholesterolemia (HCE) together with arterial hypertension and smoking belongs to three most powerful risk factors of cardiovascular diseases. Dietetic correction of HCE includes limitation of consumption of animal fat containing cholesterol, saturated and trans-fatty acids, limitation of other cholesterol containing products and simple carbohydrates, increase in consumption of mono- and polyunsaturated acids, plant protein, nutritional fibers, vitamins, mineral substances, and minor food components. Efficacy of such minor components of food as phytosterols has been demonstrated. Their use as supplements to fermented dairy product has facilitated significant lowering of total and low density lipoprotein cholesterol without negative action on the state of hepato-biliary system.

Prache, S., et al. (2011). "Comparison of meat and carcass quality in organically reared and conventionally reared pasture-fed lambs." Animal **5**(12): 2001-2009.

The 'Organic' product label guarantees a production process that avoids the use of synthetic fertilisers, pesticides and hormones and minimises recourse to pharmaceuticals or veterinary drugs; however, the product's quality remains an issue that needs to be addressed in response to consumer demand. Consequently, this study was conducted to compare the sensory and nutritional qualities of meat and carcasses from pasture-fed lambs reared organically (O) or conventionally (C). Mean lamb growth profile was kept similar between the two treatments to avoid confounding effects with lamb age or weight at slaughter. The experiment was conducted over 3 years (2005 to 2007) with 12 O and 12 C lambs each year. The O and C treatments differed in the level of on-pasture mineral N fertilisation inducing a higher proportion of white clover in the organic pasture than the conventional pasture. Lambs were slaughtered when they attained a fat class of 2 to 3, and carcass and meat quality were evaluated. Lambs were slaughtered at an average weight and age of 35.3 kg and 156 days in the O treatment, respectively, and 35.2 kg and 155 days in the C treatment, respectively. Sensory evaluation indicated that loin chops from the O treatment had a higher level of abnormal fat odour compared with the C treatment. Carcasses from the O treatment had a softer subcutaneous fat one among 3 years (2007) compared to the C treatment. These results are probably due to a higher proportion of white clover in the diet. Organically reared lambs did offer the slight advantage of muscle fatty acid containing a higher level of stearic acid, which may have positive effects in the prevention of cardiovascular disease in humans. This may be the result of a higher rumen bio-hydrogenation of C18: 3n-3 due to differences in the botanical composition between the O and the C pasture. Production system had no effect on the colour characteristics of the meat and subcutaneous fat, except lightness of subcutaneous dorsal fat, which was slightly higher in the O lambs. There were no differences between O and C lambs in terms of colour stability and lipid oxidation of the meat during the 6-day refrigerated storage under gas-permeable film.

Precht, D. (1995). "VARIATION OF TRANS-FATTY-ACIDS IN MILK FATS." Zeitschrift Fur Ernahrungswissenschaft **34**(1): 27-29.

Trans fatty acids are discussed in connection with an increased risk of atherosclerosis. Therefore, the development of a rapid and exact measuring method for the determination of trans fatty acids in milk fat is of great interest. Using gas chromatographic analysis of the trans-octadecenoic fatty acids as well as of the triglycerides of 100 different milk fat samples a formula consisting of different triglycerides for the quick determination of trans contents was developed by means of statistical methods (standard deviation = 0.293 %, r = 0.9977). Subsequently, the seasonal variations of the trans contents in milk fat samples from a large milk collection area were determined using rapid triglyceride analyses. For the trans fatty acid contents of the 100 milk fat samples and the samples from the milk collection area scattering ranges of 1.91-6.34 wt% resp. 1.97-4.37 wt% were found; the mean contents were 3.83 and 3.18 wt%, and the median values 3.67 and 3.30 wt%, respectively.

Precht, D. and J. Molkentin (1997). "Comparison of the fatty acids and the isomeric distribution of trans-C18:1 fatty acids of milk fat, margarine, shortenings, cooking and dietetic fats." Kieler Milchwirtschaftliche Forschungsberichte **49**(1): 17-34.

Especially in recent years, trans fatty acids have been correlated with health risks such as atherosclerosis and cardiovascular diseases. For that reason, 1756 milk fats and 123 German edible fats of vegetable origin were analyzed gas chromatographically for the contents of all major fatty acids as well as 10 positional isomers of trans-C18:1 and compared. Using optimized GC conditions, even a separation of trans Delta 13 and Delta 14 as well as of nearly baseline resolved peaks of the individual isomers was achieved for the first time. On the basis of analyses of different batches of the same brands, the average content of trans-C18:1 in partially hydrogenated margarines was found to have decreased from August 1994 till December 1994 and January 1996 by 22 % and 52 %, respectively, while trans contents in partially hydrogenated cooking fats and shortenings remained on a high level. According to current analyses milk fats, margarines and cooking fats/shortenings) show, on average, trans-C18:1 contents of 3.6 %, 4.6 % and 11.9 %, respectively. Moreover, the examinations exhibited that elaidic acid (C18:1-trans Delta 9), that is frequently used in clinical studies, only occurs in relatively small amounts of 0.23 %, on average, in bovine milk fat. Compared with that, partially hydrogenated margarines with 2.04 % (1994) and ca. 1 % (1996) and partially hydrogenated cooking fats/shortenings with 2.28 %, on average, contain considerably higher concentrations. On the other hand, with 1.72 % vaccenic acid (trans Delta 11) is the main isomer in milk fat, whereas with 1.38 % (1994) and 0.7 % (1996) margarines and with 1.45 % cooking fats contain smaller amounts. These differences could be important for the discussion on the different atherogenic potential of animal and vegetable fats. Finally, the obtained data were used to discuss the daily intake of the different positional isomers of trans-C18:1 from bovine milk fat, margarine and cooking fats/shortenings.

Prestes, R. A., et al. (2007). "A rapid and automated low resolution NMR method to analyze oil quality in intact oilseeds." Analytica Chimica Acta **596**(2): 325-329.

Oilseeds with modified fatty acid profiles have been the genetic alternative for high quality vegetable oil for food and biodiesel applications. They can provide stable, functional oils for the food industry, without the hydrogenation process that produces trans-fatty acid, which has been linked to cardiovascular disease. High yield and high quality oilseeds are also necessary for the success of biodiesel programs, as polyunsatured or saturated fatty acid oil produces biofuel with undesirable properties. In this paper, a rapid and automated low resolution NMR method to select intact oilseeds with a modified fatty acid profile is introduced, based on H-1 transverse relaxation time (T-2). The T-2 weighted NMR signal, obtained by a CPMG pulse sequence and processed by chemometric methods was able to determine the oil quality in intact seeds by its fatty composition, cetane number, iodine value and kinematic viscosity with a correlation coefficient r > 0.9. The automated system has the potential to analyze more than 1000 samples per hour and is a powerful tool to speed up the selection of high quality oilseeds for food and biodiesel applications. (c) 2007 Elsevier B.V. All rights reserved.

Pritchard, P. H., et al. (2003). "Comparison of cholesterol-lowering efficacy and anti-atherogenic properties of hydrogenated versus non-hydrogenated (Phytrol (TM)) tall oil-derived phytosterols in apo E-deficient mice." Cardiovascular Drugs and Therapy **17**(5-6): 443-449.

The cholesterol-lowering and anti-atherogenic effects of non-hydrogenated (FCP-3P1 containing 69% beta-sitosterol, 16% sitostanol, and 13% campesterol) and hydrogenated (FCP-3P2 containing 77% sitostanol, 11% campestanol, and 8% beta-sitosterol) Phytrol(TM) have been compared in apo E-deficient mice. After consumption of 0.2% (w/w) cholesterol-enriched diet, the elevated plasma cholesterol levels observed in controls was significantly reduced by the addition of either 0.5%, 1% or 2% FCP-3P1 or FCP-3P2 at week 4. Compared to controls, the treatment of 0.5%, 1%, and 2% FCP-3P1 in the diet resulted in reduction in cholesterol concentrations by 33.6%, 46.8% and 52.4% at week 8, respectively, whereas the reduction in plasma cholesterol levels by 0.5%, 1%, and 2% FCP-3P2 was only 20.5%, 38.7% and 31.7% indicating lower cholesterol-lowering effect of the hydrogenated phytosterols at all doses as compared with non-hydrogenated phytosterols (FCP-3P1). By contrast, FCP-3P1 and FCP-3P2 showed comparable nonsignificant anti-atherogenic properties in treated animals after 14-week treatment. 0.5%, 1%, and 2% FCP-3P1 treated apo E-deficient mice had a mean aortic lesion area that was smaller than controls although the reduction of atherosclerotic lesions did not reach the statistical significance. In conclusion, this study did not show statistically significant differences between hydrogenated and non-hydrogenated plant sterols with regard to their cholesterol-lowering and anti-atherosclerotic properties in apo E-KO mice.

Ptok, S. and H. Heseker (2010). "Trans fatty acids." Ernahrungs Umschau **57**(9): 472-480.

Although trans fatty acids of natural origin have obviously been a part of our diet for a long time, exposure to trans-fatty acids has changed with the industrial hardening of vegetable oils. Trans fatty acids of natural origin are found in milk fat and in the meat of ruminants and products made from them. They are produced primarily through biohydrogenation in the rumen. Trans fatty acids of industrial source are produced during partial hydrogenation and deodorisation of vegetable oils. Natural and industrial trans fatty acids share common features, but differ in their trans fatty acid distribution. It is now thought that trans fatty acids made from fats of industrial origin may enhance unfavourable risk factors for coronary heart disease. Natural and industrial trans fatty acids contain many structurally identical compounds, so that it would be expected that the physiological effects would be similar. There have been few studies comparing the patterns of trans fatty acids (natural versus industrial) and their physiological effects. The contents of trans fatty acids in commercially available plant margarines has significantly decreased in the last two decades. The results of the state monitoring plan of 2008 showed, however, that there are other problematical food groups and these counteract the desired reduction in the intake of industrial trans fatty acids. National authorities in some other countries have demonstrated that a general reduction in industrial trans fatty acids in our foods can be achieved by regulation.

Radzik-Rant, A., et al. (2012). "The fatty acid composition of longissimus lumborum muscle of suckling and early-weaned dual-purpose wool/meat lambs." Archiv Fur Tierzucht-Archives of Animal Breeding **55**(3): 285-293.

Twenty-four dual purpose (wool/meat) suckling and early weaned ram lambs were used to study the fatty acid profile in intramuscular fat of longissimus lumborum muscle and lipid oxidation in blood serum. At 60 days of age 12 rams were slaughtered as suckling lambs. The other 12 early weaned and fed according to standards by grass hay and concentrate, and slaughtered at 90 days of age. Suckling lambs had more polyunsaturated fatty acids (P <= 0.01) than early-weaned lambs. Younger lambs obtained also higher values of n-3 fatty acids (P <= 0.01) and lower n-6/n-3 ratio (P <= 0.01) appropriate in relation to their contribution to human health. Muscle tissue of early-weaned lambs compared to suckling group was characterised by significantly higher c9,t11C18:2 content (P <= 0.01), which is desirable in human diet with regard to its peculiarities. The higher amount (P <= 0.01) of vaccenic acid, which is the substrate for rumenic acid formation, has been observed in early-weaned lambs also.

Raitakari, O. T., et al. (1994). "RELATIONS OF LIFE-STYLE WITH LIPIDS, BLOOD-PRESSURE AND INSULIN IN ADOLESCENTS AND YOUNG-ADULTS, THE CARDIOVASCULAR RISK IN YOUNG FINNS STUDY." Atherosclerosis **111**(2): 237-246.

The associations of life-style variables, namely type of dietary fat, alcohol use, smoking, obesity, physical activity and oral contraceptive use with serum lipids, insulin and blood pressure were studied in 1398 adolescents and young adults aged 15-24 years. Smokers were more often physically inactive and regular users of alcohol compared to nonsmokers, In females, smoking and alcohol use were more prevalent among oral contraceptive users. Independent effects of life-style variables on lipids, blood pressure and insulin were assessed with multiple linear regression models. In both sexes, body mass index was positively related to low density lipoprotein cholesterol (LDL-C), triglycerides (TG), systolic (SEP) and diastolic (DBP) blood pressure and insulin, and negatively with high density lipoprotein cholesterol (HDL-C), Leisure time physical activity was associated with lower levels of insulin among males. Smoking was related with 0.07 mmol/1 lower HDL-C levels and about 0.09 mmol/1 higher TG levels in males. In both sexes, smoking was related with lower levels of SEP. In males, alcohol use was associated with 0.05 mmol1 higher level of HDL-C (P = 0.06). In females, alcohol use was associated with lower levels of LDL-C and TG. Oral contraceptive use was associated with approximately 0.15 mmol/1 higher levels of TG and about 4.0 mmHg higher SEP. Preferring butter associated with approximately 0.15 mmol/1 higher levels of TG and about 4.0 mmHg higher SEP. Preferring butter over margarine as dietary fat was associated with 0.26 and 0.19 mmol/1 higher levels of LDL-C in males and females, respectively. Accumulation of adverse life-habits contributed to the clustering of an atherogenic lipid profile and high blood pressure. In males, those with 4 selected life-habits present, namely obesity, smoking, inactivity and the use of butter, had 5.5 times greater risk (95% confidence interval 1.4-20.7) of belonging to the group with high LDL-C, low HDL-C and high DBP compared to those with zero or one life-habits present. These data demonstrate that life-habits show clustering in adolescents and young adults. Individuals with many adverse life-style risk factors present are at increased risk of having an atherogenic lipid and blood pressure profile.

Raitakari, O. T., et al. (2008). "Carotid artery compliance in users of plant stanol ester margarine." European Journal of Clinical Nutrition **62**(2): 218-224.

Objective: To investigate the effects of stanol ester margarine use in healthy subjects on arterial compliance, endothelial function and intima-media thickness. Design: Case-control study comparing regular stanol ester margarine users to non-users. Setting: Occupational health service clinic. Subjects: We recruited 50 cases and 50 controls (mean age 51 +/- 8, range 26-65 years). All subjects were non-smokers and the study groups were matched for age and sex. As cases, we invited subjects who had been using regularly (daily) plant stanol ester margarine for a period of 2 years or longer. Non-invasive ultrasound was used to measure carotid artery compliance, carotid intima-media thickness and brachial artery flow-mediated endothelial dependent vasodilatation. Results: The carotid artery compliance was non-significantly higher in cases compared with controls, 1.84 +/- 1.02 vs 1.58 +/- 0.76 %/10mm Hg (P = 0.13). The difference in compliance became statistically significant (P = 0.04) when the unbalance between the groups in family history of coronary artery disease and years of education were taken into account. There was also a significant dose-response relationship between stanol margarine use and carotid compliance, longer use being associated with higher compliance. Serum lipoproteins, blood pressure, flow-mediated dilation and intima-media thickness values did not differ between cases and controls. Conclusion: These data raise the possibility that regular stanol ester margarine use may be associated with beneficial changes in arterial compliance. Intervention studies are needed to test this hypothesis and to reveal possible mechanisms.

Ramazauskiene, V., et al. (2011). "Diet and serum lipids: changes over socio-economic transition period in Lithuanian rural population." Bmc Public Health **11**.

Background: Since regaining of independence in 1990, Lithuania has been undergoing substantial political, economic, and social changes that affected the nutrition habits of population. Dietary changes might have impact on the trends of dietary related risk factors of chronic diseases. The aim of the study was to compare trends in diet and lipid profile of Lithuanian rural population aged 25-64 during two decades of transition period (1987-2007). Methods: Four cross-sectional surveys were conducted within the framework of the Countrywide Integrated Noncommunicable Diseases Intervention Programme in five regions of Lithuania in 1987, 1993, 1999, and 2007. For each survey, a stratified independent random sample was drawn from the lists of the inhabitants aged 25-64 years registered at the primary health care centres. Altogether 3127 men and 3857 women participated in the surveys. 24-hour recall was used for evaluation of dietary habits. Serum lipids were determined using enzymatic methods. Predicted changes of serum cholesterol were calculated by Keys equation. Results: The percentage of energy from saturated fatty acids has decreased from 18.0 to 15.1 among men and from 17.6 to 14.8 among women over the period of 20 years. The average share of polyunsaturated fatty acids in total energy intake increased from 5.3% to 7.1% among men and from 4.9% to 7.3% among women. The mean intake of cholesterol declined among women. Favourable trends in fatty acids composition were caused by increased use of vegetable oil for cooking and replacement of butter spread with margarine. Since 1987, the mean value of total cholesterol has decreased by 0.6 mmol/l. Total dietary effect accounts for a 0.26 mmol/l (43.3%) decline in serum cholesterol among men and 0.31 mmol/l (50.8%) decline among women. Conclusions: Improvement in the quality of fat intake was observed in Lithuanian rural population over two decades of transition period. Positive changes in diet, mainly reduction in saturated fatty acids intake, contributed to decline in serum cholesterol level. Strengthening of favourable trends in nutrition habits in Lithuanian population should be one of the most important strategies of cardiovascular diseases prevention.

Ramsden, C. E., et al. (2013). "Use of dietary linoleic acid for secondary prevention of coronary heart disease and death: evaluation of recovered data from the Sydney Diet Heart Study and updated meta-analysis." Bmj-British Medical Journal **346**.

Objective To evaluate the effectiveness of replacing dietary saturated fat with omega 6 linoleic acid, for the secondary prevention of coronary heart disease and death. Design Evaluation of recovered data from the Sydney Diet Heart Study, a single blinded, parallel group, randomized controlled trial conducted in 1966-73; and an updated meta-analysis including these previously missing data. Setting Ambulatory, coronary care clinic in Sydney, Australia. Participants 458 men aged 30-59 years with a recent coronary event. Interventions Replacement of dietary saturated fats (from animal fats, common margarines, and shortenings) with omega 6 linoleic acid (from safflower oil and safflower oil polyunsaturated margarine). Controls received no specific dietary instruction or study foods. All non-dietary aspects were designed to be equivalent in both groups. Outcome measures All cause mortality (primary outcome), cardiovascular mortality, and mortality from coronary heart disease (secondary outcomes). We used an intention to treat, survival analysis approach to compare mortality outcomes by group. Results The intervention group (n=221) had higher rates of death than controls (n=237) (all cause 17.6% v 11.8%, hazard ratio 1.62 (95% confidence interval 1.00 to 2.64), P=0.05; cardiovascular disease 17.2% v 11.0%, 1.70 (1.03 to 2.80), P=0.04; coronary heart disease 16.3% v 10.1%, 1.74 (1.04 to 2.92), P=0.04). Inclusion of these recovered data in an updated meta-analysis of linoleic acid intervention trials showed non-significant trends toward increased risks of death from coronary heart disease (hazard ratio 1.33 (0.99 to 1.79); P=0.06) and cardiovascular disease (1.27 (0.98 to 1.65); P=0.07). Conclusions Advice to substitute polyunsaturated fats for saturated fats is a key component of worldwide dietary guidelines for coronary heart disease risk reduction. However, clinical benefits of the most abundant polyunsaturated fatty acid, omega 6 linoleic acid, have not been established. In this cohort, substituting dietary linoleic acid in place of saturated fats increased the rates of death from all causes, coronary heart disease, and cardiovascular disease. An updated meta-analysis of linoleic acid intervention trials showed no evidence of cardiovascular benefit. These findings could have important implications for worldwide dietary advice to substitute omega 6 linoleic acid, or polyunsaturated fats in general, for saturated fats. Trial registration Clinical trials NCT01621087.

Rasanen, M., et al. (2002). "Dietary patterns and nutrient intakes of 7-year-old children taking part in an atherosclerosis prevention project in Finland." Journal of the American Dietetic Association **102**(4): 518-524.

Objective To evaluate the dietary patterns of 7-year-old children participating in an atherosclerosis prevention project and the relationship of those dietary patterns to nutrient intakes and serum cholesterol values. Design In the randomized, prospective Special Turku Coronary Risk Factor Intervention Project (STRIP) 1,062 children were randomly assigned to all intervention group (n=540; low-saturated fat, low-cholesterol diet) or to a control group (n=522; unrestricted diet) at 7 months of age. Subjects/settings The intervention families received, at 6-month intervals, individualized counseling that focused on the known environmental atherosclerosis risk factors and aimed at reducing children's saturated fat and cholesterol intake. Nutrition counseling was targeted at the child but, because of the young age of the children, was given to the parents. When children were 7 years old, food and nutrient intakes of 307 intervention and 323 control children were studied using 4-day food records. Statistical analyses performed K-means cluster analysis was used to classify children into 4 groups on the basis of similarity of food intake. Differences in nutrient intakes and serum lipid concentrations between children in the 4 food intake clusters were evaluated using Tukey's multiple comparison test. Results Intervention children dominated the broad, skim milk, and margarine cluster and the cereals, rice, and pasta cluster whereas the 1.5%-fat milk and butter cluster included mainly control children. Saturated fat intake was nearest to the recommendations, that is 11.7% and 11.9% of energy, in the broad, skim milk, and margarine cluster and the cereals, rice, and pasta cluster, respectively. Children in the broad, skim milk, and margarine cluster had 20% to 27% higher fiber intakes (P<.001) whereas children in the sugar and sweets cluster had markedly higher sugar intakes than children in other clusters (P<.001). Serum cholesterol concentrations were lower in those. clusters with high dietary ratios of polyunsaturated to saturated fat. Conclusion Detailed and repeated dietary counseling of parents, starting when children are aged 7 months, that aims at decreasing children's exposure to known nutrition risk factors for coronary heart disease modifies children's food patterns and nutrient intakes toward expected values.

Ratnayake, W. M. N. (2004). "Reliable methods for the determination of trans fatty acids and conjugated linoleic acid isomers: An overview." Journal of Aoac International **87**(2): 520-522.

Ratnayake, W. M. N., et al. (2007). "trans fatty acid content of canadian margarines prior to mandatory trans fat labelling." Journal of the American Oil Chemists Society **84**(9): 817-825.

Dietary trans fatty acids (TFA) are of major concern because of their adverse effects on blood lipid levels and coronary heart disease. In Canada, margarines were significant sources of TFA during the 1980s and 1990s. However, this is expected to change with increased public awareness over their adverse health effects and the introduction of new legislature to include TFA content on the Nutritional Facts table of food labels. In this study, the TFA content of the top-selling 29 Canadian margarines, which represented 96.3% of the market share, was determined by capillary gas-liquid chromatography in order to assess the influence of regulatory development during the 3-year transition period between the announcement of new food labelling regulations in Canada that require mandatory declaration of the trans fat content in most prepackaged foods in January 2003 and its enforcement on 12 December 2005. The 29 margarines included 15 tub margarines made from non-hydrogenated vegetable oils (NHVO-tub margarines), 11 tub margarines made from partially hydrogenated vegetable oils (PHVO-tub margarines) and three print margarines, which were also made from partially hydrogenated vegetable oils (PHVOprint margarines). The 15 NHVO tub-margarines accounted for 71% of the total margarine market share and generally contained less than 2% TFA (mean value 0.9 +/- 0.3% of total fatty acids). The mean total TFA contents of PHVO-tub margarines and PHVO-print margarines, were 20.0 +/- 4.5% and 39.6 +/- 3.5%, and their market shares were 19.3 and 6.0%, respectively. Although during the last 10 years, increasing number of soft tub margarines that contained very little trans fats have been made available in Canada, the PHVO-tub- and -print margarines still contain high levels of trans fats similar to those margarines that were sold in the 1990s. The market share data suggest that the margarines prepared using NHVO and containing almost no TFA were preferred by Canadians over those margarines prepared using PHVO, even before the mandatory declaration of TFA content came into effect on 12 December 2005.

Ratnayake, W. M. N., et al. (2009). "Trans Fatty Acids: Current Contents in Canadian Foods and Estimated Intake Levels for the Canadian Population." Journal of Aoac International **92**(5): 1258-1276.

Research conducted in the mid-1990s indicated that the levels of trans fats in Canadian diets were among the highest in the world. The consumption of trans fats raises blood levels of low-density lipoprotein (LDL)-cholesterol, while reducing levels of high-density lipoprotein (HDL)-cholesterol. In June 2007, Health Canada called on the food industry to voluntarily reduce levels of trans fats in vegetable oils and soft (tub)-margarines to <2% of total fat, and in all other foods, to <5%. Industry must show satisfactory progress by June 2009, or Health Canada might have to introduce legislation to ensure that recommended limits are achieved. Since 2005, Health Canada has been performing a national assessment of prepackaged and restaurant foods that likely contain trans fats. From 2005 to 2009,1120 samples were analyzed, of which 852 or approximately 76% met the recommended trans fat limits. As a result of reformulation, most of the products had decreased trans + saturated fat content. The estimated average intake of trans fatty acids (TFA) in Canada significantly dropped from the high value of 8.4 g/day in the mid-1990s to 3.4 g/day (or 1.4% food energy) in 2008. However, this TFA intake of 1.4% of energy is still above the World Health Organization recommended limit of TFA intake of <1% of energy, which suggests that the Canadian food industry needs to put more effort into reducing the TFA content in its products, especially in tub-margarines, donuts, and bakery products.

Ratnayake, W. M. N., et al. (2003). "Comparative health effects of margarines fortified with plant sterols and stanols on a rat model for hemorrhagic stroke." Lipids **38**(12): 1237-1247.

There is increased acceptance of fortifying habitual foods with plant sterols and their saturated derivatives, stanols, at levels that are considered safe. These sterols and stanols are recognized as potentially effective dietary components for lowering plasma total and LDL cholesterol. Our previous studies have shown that daily consumption of plant sterols promote's strokes and shortens the life span of stroke-prone spontaneously hypertensive (SHRSP) rats. These studies question the safety of plant sterol additives. The present study was performed to determine whether a large intake of plant stanols would cause nutritional effects similar to those seen with plant sterols in SHRSP rats. Young SHRSP rats (aged 26-29 d) were fed semipurified diets containing commercial margarines fortified with either plant stanols (1.1 g/100 g diet) or plant sterols (1.4 g/100 g diet). A reference group of SHRSP rats was fed a soybean oil diet (0.02 g plant sterols/100 g diet and no plant stanols). Compared to soybean oil, both plant stanol and plant sterol margarines significantly (P < 0.05) reduced the life span of SHRSP rats. At the initial stages of feeding, there was no difference in the survival rates between the two margarine groups, but after approximately 50 d of feeding, the plant stanol group had a slightly, but significantly (P < 0.05), lower survival rate. Blood and tissue (plasma, red blood cells, liver, and kidney) concentrations of plant sterols in the plant sterol margarine group were three to four times higher than the corresponding tissue concentrations of plant stanols in the plant stanol group. The deformability of red blood cells and the platelet count of SHRSP rats fed the plant sterol margarine were significantly (P < 0.05) lower than those of the plant stanol margarine and soybean oil groups at the end of the study. These parameters did not differ between the soybean oil and plant stanol margarine groups. These results suggest that, at the levels tested in the present study, plant stanols provoke hemorrhagic stroke in SHRSP rats to a slightly greater extent than plant sterols. The results also suggest that the mechanism by which plant stanols shorten the life span of SHRSP rats might differ from that of plant sterols.

Reddy, S. Y. and T. Jeyarani (2001). "Trans-free bakery shortenings from mango kernel and mahua fats by fractionation and blending." Journal of the American Oil Chemists Society **78**(6): 635-640.

Bakery shortenings prepared by hydrogenation contain high levels or trans fatty acids, which are considered to be risk factors for cardiovascular disease. The shortenings prepared from mango kernel and mahua fats have no trans fatty acids. Mahua fat was fractionated by dry fractionation to obtain a high-melting fraction (10% yield, Mh1). Mango rat was fractionated by two-stage solvent fractionation, separating about 15% high-melting fraction (Mk1) in the first stage, followed by 40% stearin (Mk2) in the second stage. The formulation containing 80% Mh1 and 20% of mango middle stearin fraction (Mk2) showed melting characteristics and onset and enthalpy of crystallization similar to those of commercial hydrogenated shortenings designed for cakes and biscuits. The formulation suitable for purr pastry shortening was prepared by blending 50% mango 1st stearin (Mk1) and 50% mahua fat with addition of 5-7% of fully hydrogenated vegetable oil. The formulations having melting characteristics similar to those of commercial cake and biscuit shortenings were also prepared by blending 40% mango rat and 60% mahua rat with 5-7% incorporation of fully hydrogenated peanut oil. However, these formulations showed delayed transition to the stable forms compared to those of commercial samples. Fatty acid composition revealed that commercial hydrogenated shortenings consisted of 18-29% trans oleic acid, whereas the formulations we prepared did not contain any trans acids. The iodine values of commercial samples were 57-58, whereas the value for the formulations prepared were 47-53. The consistency of the prepared samples as measured by cone penetrometer was slightly harder than commercial samples. These studies showed that it is possible to prepare bakery shortenings with no trans fatty acids by using mango and mahua fats and their fractions.

Relas, H., et al. (2000). "Effect of stanol ester on postabsorptive squalene and retinyl palmitate." Metabolism-Clinical and Experimental **49**(4): 473-478.

Stanol ester dissolved in margarine inhibits cholesterol absorption in general and, despite increasing cholesterol synthesis, decreases serum total and low-density lipoprotein (LDL) cholesterol levels, but its effects on postprandial lipid metabolism are unknown. We performed fat tolerance tests in 11 men at baseline and during short-term stanol ester consumption without and with stanol esters added to the test meal also containing retinol and squalene. Cholesterol, triglycerides, retinyl palmitate, and squalene were analyzed in plasma, chylomicrons, and very-low-density lipoprotein (VLDL) at baseline and 3, 4, 6, 9, 12. and 24 hours after the test meal. Serum total and LDL cholesterol only tended to diminish after the 2-week stanol ester consumption. However, the proportion of plasma plant sterol and cholesterol-precursor sterol to cholesterol was significantly altered, suggesting that cholesterol absorption was diminished and cholesterol synthesis was increased. Postprandial peak times of squalene and retinyl palmitate in plasma, chylomicrons, and VLDL were significantly reduced by stanol esters, but their concentrations in chylomicrons were unchanged. Stanol esters reduced the VLDL squalene peak concentration by 23% (P <.05) and the incremental area under the curve (AUIC) in plasma and VLDL by 22% and 32% (P <.01 for both). Chylomicron remnant metabolism measured with triglycerides only tended to diminish. The effects of stanol esters in the diet only and both in the diet and with supplementation did not differ significantly. We conclude that dietary stanol esters reduce postprandial lipoproteins measured with dietary retinyl palmitate and especially squalene, and the reduction is observed even though serum total and LDL cholesterol are only inconsistently decreased after short-term stanol ester consumption. Copyright (C) 2000 by W.B. Saunders Company.

Renaville, B., et al. (2006). "Eicosapentaenoic acid and 3,10 dithia stearic acid inhibit the desaturation of trans-vaccenic acid into cis-9, trans-11-conjugated linoleic acid through different pathways in Caco-2 and T84 cells." British Journal of Nutrition **95**(4): 688-695.

Stearoyl-CoA desaturase (SCD) is a key enzyme that determines the composition and metabolic fate of ingested fatty acids, in particular the conversion of trans-vaccenic acid (TVA) to conjugated linoleic acid (CLA). The present study addressed the hypothesis that intestinal TVA absorption and biotransformation into CLA can be modulated by EPA and 3,10-dithia stearic acid (DSA) via altered SCD mRNA levels and desaturation indices (cis-9, trans-11-CLA:TVA and oleic acid:stearic acid ratios) in Caco-2 and T84 cells, two well-established in vitro models of the human intestinal epithelium. The study determined the effect of acute (3 h with 0(.)3 mm-EPA or 0(.)3 mm-DSA) and acute-on-chronic (1 week with 0(.)03 mm-EPA or -DSA, followed by respectively, 0(.)3 mm-EPA or -DSA for 3 h) treatments. In both cell lines, acute EPA treatment did not alter SCD desaturation indices, whereas the acute-on-chronic treatment affected these surrogate markers of SCD activity. This was associated with reduced sterol regulatory-element binding protein-1c and SCD mRNA levels. In contrast, acute and acute-on-chronic DSA treatments significantly reduced SCD desaturation indices without affecting SCD mRNA levels in Caco-2 cells. The present study on intestinal cells shows that the conversion rate of TVA to c9, t11-CLA is affected by other fatty acids present in the diet such as EPA, confirming previous observations in hepatic and mammary cell models.

Reynolds, C. M. and H. M. Roche (2010). "Conjugated linoleic acid and inflammatory cell signalling." Prostaglandins Leukotrienes and Essential Fatty Acids **82**(4-6): 199-204.

Conjugated linoleic acids (CLA) are a family of polyunsaturated fatty acids (PUFA), some isomers occurring naturally in beef and dairy products and others being formed as a result of bihydrogenation of vegetable oils to form margarine. Synthetic and natural sources of CLA may have beneficial effects in a range of inflammatory conditions including colitis, atherosclerosis, metabolic syndrome and rheumatoid arthritis. Most of the biological effects have been attributed to the cis9, trans11-(c9, t11-) and the trans10, cis12- (t10, c12-) isomers. Evidence suggests that c9, t11-CLA is responsible for the anti-inflammatory effect attributed to CLA while t10, t12-CLA appears to be responsible for anti-adipogenic effects. This review will focus on the effects of CLA on the inflammatory components associated with insulin resistance, atherosclerosis and Th1 mediated inflammatory disease, at a cellular, systemic and clinical level. Whist CLA may ameliorate certain aspects of the inflammatory response, particularly within cellular and animal models, the relevance of this has yet to be clarified within the context of human health. (C) 2010 Elsevier Ltd. All rights reserved.

Ribeiro, A. P. B., et al. (2010). INTERESTERIFICATION: ALTERNATIVE FOR OBTAINING ZERO TRANS FAT BASES FOR FOOD APPLICATIONS.

Trans fatty acids were recently included in the list of dietetic lipids acting as risk factors for coronary artery disease. In addition these compounds have been related to the etiology of various metabolic and functional disorders. Controversial questions concerning the role of trans fatty acids in catering have resulted in progressive modifications to the legislation and hence to industrial practices related to the production of fat bases for application in foods. Thus the search for zero trans fats has led researchers to test different raw materials and processes that could make a wide range of fats available for different industrial ends. Interesterification offers an important alternative to the partial hydrogenation process traditionally employed to modify the behavior of fats and oils, without, however, causing the formation of trans isomers. This chapter covers aspects related to interesterification processes and their effects on the physicochemical properties of fats and oils. Methods for obtaining interesterified fat bases from different raw materials and their combinations, the instrumental methodology associated with the analysis of interesterified fats, and the industrial application design for these compounds are also presented in detail and discussed.

Ricciuto, L., et al. (2009). "A comparison of the fat composition and prices of margarines between 2002 and 2006, when new Canadian labelling regulations came into effect." Public Health Nutrition **12**(8): 1270-1275.

Objective: To examine the effect of the new Canadian labelling regulations on the fat composition and prices of margarines. Study design., A survey of all margarines sold in major supermarkets in the Greater Toronto area was conducted in 2006, and results were compared with those of a similar survey conducted in 2002. Average fat composition, proportion of 'trans fat-free' margarines and average prices of margarines were compared. A general linear model procedure was used to compare the relationship between price and fat composition in 2002 and 2006. Results: Average amounts of trans fatty acids (TFA) and MUFA decreased, while average amounts of PUFA increased significantly from 2002 to 2006. The proportion of margarines with less than 0.2g TFA/10g serving rose significantly from 31% in 2002 to 69% in 2006. Margarines lower in TFA on average cost significantly more than margarines with greater amounts of these fats, and this relationship appeared stronger in 2006 relative to 2002. Conclusions: There is evidence of reductions in TFA in margarines since new labelling regulations came into effect in Canada; however, TFA reductions appeared to be restricted to higher-priced margarines. Results Suggest that voluntary approaches (i.e. manufacturer incentives via labelling) to reduce population intakes of TFA will yield little changes in TFA content of low-cost products and thus may have limited benefit for lower-income groups, who are at higher risk of heart disease.

Rice, B., et al. (2009). "Effect of trans-fatty acid source on indicators of coronary heart disease risk in male Hartley guinea pigs." Faseb Journal **23**.

Rice, B. H., et al. (2010). "Ruminant-Produced trans-Fatty Acids Raise Plasma Total and Small HDL Particle Concentrations in Male Hartley Guinea Pigs." Journal of Nutrition **140**(12): 2173-2179.

Although trans-fatty acid (tFA) intake has been positively associated with coronary heart disease (CHD) the relative effect of consuming industrially produced (IP)- compared with ruminant-produced (RP)-tFA on CHD risk factors is unclear This study was designed to examine the effects of feeding partially hydrogenated vegetable oil (PHVO) IP-tFA source and butter oil (BO) RP-tFA source on the development of atherosclerosis and risk factors associated with CHD Forty-eight male Hartley guinea pigs were fed a hypercholesterolemic diet containing (9% by weight) PHVO BO coconut oil (CO positive control) or soybean oil (SO negative control) for 8 or 12 wk (n = 6/group) Morphological analysis revealed that none of the groups developed atherosclerosis Plasma and hepatic lipids did not differ between the tFA groups but total and small HDL particles were significantly higher in the BO group than in the PHVO group and mean HDL particle size was significantly smaller in the BO group than in the PHVO group Compared with the other treatment groups the SO treatment resulted in significantly lower total cholesterol (TC) and LDL cholesterol in plasma whereas hepatic TC was significantly higher in the SO group than in the other treatment groups Plasma and hepatic cholesterol concentrations did not differ between the tFA and CO treatments These results demonstrate that when fed at a high dose IP- and RP-tFA had the same effect on established CHD risk factors in male Hartley guinea pigs The effects of RP-tFA on HDL particle sizes and concentrations warrant further investigation J Nutr 140 2173-2179 2010

Richter, E. K., et al. (2009). "Trans fatty acid content of selected Swiss foods: The TransSwissPilot study." Journal of Food Composition and Analysis **22**(5): 479-484.

The objective of this study was to analyse the trans fatty acid (TFA) content of a selection of foods sold on the Swiss market in order to get an overview of the situation and to find indicators to assess the origins of TFA. 119 food items from different food groups were purchased in the city of Zurich and analysed for their TFA content with gas chromatography. TFA were detected in all but two samples and the content ranged from 0 to 29% of the total fat. Nearly 40% of the analysed samples had more than 2% TFA. The highest mean value was observed in the fine bakery products (6% TFA) and the lowest with the breakfast cereals (<0.4% TFA). Trans-C18:1 was the predominant TFA in all samples except for the plant oils, in which trans-C18:2 and trans-C18:3 isomers made up the bigger part of the total TFA content. An analytical distinction of the TFAs according to their origin seems possible when concomitantly considering the amounts of t11-C18:1, c9,t11-C18:2, and total TFA. The situation regarding the TFA content in Swiss food was similar to many other countries worldwide. (C) 2009 Elsevier Inc. All rights reserved.

Riserus, U., et al. (2009). "Dietary fats and prevention of type 2 diabetes." Progress in Lipid Research **48**(1): 44-51.

Although type 2 diabetes is determined primarily by lifestyle and genes, dietary composition may affect both its development and complications. Dietary fat is of particular interest because fatty acids influence glucose metabolism by altering cell membrane function, enzyme activity, insulin signaling, and gene expression. This paper focuses on the prevention of type 2 diabetes and summarizes the epidemiologic literature on associations between types of dietary fat and diabetes risk. It also summarizes controlled feeding studies on the effects of dietary fats on metabolic mediators, such as insulin resistance. Taken together, the evidence suggests that replacing saturated fats and trans fatty acids with unsaturated (polyunsaturated and/or monounsaturated) fats has beneficial effects on insulin sensitivity and is likely to reduce risk of type 2 diabetes. Among polyunsaturated fats, linoleic acid from the n-6 series improves insulin sensitivity. On the other hand, long-chain n-3 fatty acids do not appear to improve insulin sensitivity or glucose metabolism. In dietary practice, foods rich in vegetable oils, including non-hydrogenated margarines, nuts, and seeds, should replace foods rich in saturated fats from meats and fat-rich dairy products. Consumption of partially hydrogenated fats should be minimized. Additional controlled, long-term studies are needed to improve our knowledge on the optimal proportion of different types of fats to prevent diabetes. (C) 2008 Elsevier Ltd. All rights reserved.

Roach, C., et al. (2004). "Comparison of Cis and Trans fatty acid containing phosphatidylcholines on membrane properties." Biochemistry **43**(20): 6344-6351.

The ever-increasing amount of trans fatty acids in the human diet has been linked to a variety of afflictions, most notably coronary heart disease and arteriosclerosis. The mechanism of why the replacement of cis fatty acids with their trans counterparts can be detrimental to the health of an individual remains a mystery. Here, we compare the differences in membrane physical properties including molecular dynamics, lateral lipid packing, thermotropic phase behavior, "fluidity", lateral mobility, and permeability between model membranes (lipid monolayers and bilayers) composed of cis- and trans-containing phosphatidylcholines (PCs). The PCs tested have a total of zero, one, two, or four cis (oleic or linoleic) or trans (elaidic or linoelaidic) double bonds. These experiments all confirm the basic hypothesis that trans fatty acids produce membrane properties more similar to those of saturated chains than to those of acyl chains containing cis double bonds; i.e., cis double bonds induce much larger membrane perturbations than trans double bonds.

Roberts, D. C. K. (1991). "DIETARY FACTORS IN THE FALL IN CORONARY HEART-DISEASE MORTALITY." Prostaglandins Leukotrienes and Essential Fatty Acids **44**(2): 97-101.

The role of dietary change in the fall in heart disease mortality has been hotly debated. Three countries, Australia, USA and UK with equal 'care' and sophistication of surgical techniques have shown different timing in the beginning of the decline of this 'epidemic'; around the mid 1960s in the first two countries, but not until the late 1970s for the UK. The cause of this difference may be the changing food habits of their populations. Using food disappearance data, apparent consumption of butter and margarine show opposite trends (butter down and margarine up) predating the decline in mortality in both the USA and Australia by at least 7 years and also in the UK, but at a later time, (about 1970). Changes in adipose tissue linoleate, a marker for polyunsaturated fat intake, support this indirect evidence, with depot levels rising in the USA from the 1960s and 10 years later in the UK. Other evidence supports the view of decreasing saturated fat intake and increasing polyunsaturated intake prior to 1960 in the USA. Although many factors must contribute to the decline in mortality from CHD, change in dietary P/S ratio would seem to be the major dietary contributor.

Roberts, T. L., et al. (1995). "TRANS ISOMERS OF OLEIC AND LINOLEIC ACIDS IN ADIPOSE-TISSUE AND SUDDEN CARDIAC DEATH." Lancet **345**(8945): 278-282.

Trans isomers of unsaturated fatty acids are formed by biological or industrial hydrogenation. A population case-control study of sudden cardiac death in men was done to test the hypothesis that trans isomers of oleic acid and linoleic acid increase the risk of sudden cardiac death due to coronary artery disease. In adipose tissue obtained at necropsy from 66 cases of sudden cardiac death and taken from 286 healthy age and sex matched controls, the proportions of trans isomers of oleic and linoleic acid were measured by gas-liquid chromatography. In cases, the mean (SE) percentage of total trans fatty acids (C18:1 plus C18:2), expressed as a proportion of all fatty acids, was significantly lower (2.68 [0.08]%) than in healthy controls (2.86 [0.04]%; p<0.05). Trans C18:1 was 2.1 (0.7)% in cases compared with 2.27 (0.04)% (p<0.05) in controls. The proportion of all trans isomers of linoleic acid was 0.58 (0.02)% in cases compared with 0.59 (0.01)% in controls (p=0.98). The estimated relative risk for sudden cardiac death of trans C18:1 and C18:2 fatty acids combined did not differ significantly from 1.0 in relation to the distribution of these trans isomers by quintile in the control population. The relative risk (95% CI) of sudden cardiac death in the top quintile was 0.40 (0.15-1.02) for C18:1 and 1.08 (0.48-2.74) for C18:2 compared with the bottom quintiles of their respective control distributions. When these univariate relations for irans fatty acids were adjusted for coronary risk factors, smoking was the only factor that remained independently associated with risk of sudden cardiac death (2.27 [1.23-4.17]). Overall, there was no evidence of a relation between trans isomers of oleic and linoleic acids combined and sudden cardiac death. However, trans oleic acid was negatively associated with risk of sudden cardiac death, whereas no association with trans forms of linoleic acid was seen. This study does not support the hypothesis that trans isomers increase the risk of sudden cardiac death.

Rodriguez-Alcala, L. M., et al. (2013). "CLA-enriched milk powder reverses hypercholesterolemic risk factors in hamsters." Food Research International **51**(1): 244-249.

Conjugated linoleic acid isomers (CLA) have been reported to exert anticarcinogenic effects, protection against atherosclerosis and decrease of body fat among others effects, in both animals and humans. However the mechanism of action of CLA remains still unknown, with various proposed pathways. Moreover previous works have reported ambiguous results and contradictory effects. The C18:2t10,c12 has been associated elsewhere to deleterious bioactivities. According to this, further data are needed to unravel the biological activities of CLA. The aim of this study was to evaluate the effects of CLA as part of the diet of adult hamsters in reversing hypercholesterolemia, a risk factor associated with atherosclerosis. The hypercholesterolemic condition was induced in male Syrian Golden hamsters, then divided into three groups receiving CLA pre-mixed in the diet (diet CLA1), administered separately (through gavage) as CLA oil, (diet CLA2), or not added (CD, control diet). All diets contained 0.1% cholesterol and were equivalent in lipid content. Blood physiological parameters, lipid profile, glucose, liver enzymes and body weight were monitored weekly. After 35 days, hamsters fed CLA2 diet reduced in great extension the body weight while CLA1 was more effective in lowering the concentration of triglycerides in plasma. Liver functions and glycemic status were not affected. The main outcomes of the present research work are that CLA in the form of oil or added to powder milk does not cause toxic effects or alter live functions or glycemia in hamsters. Furthermore, the results suggest that CIA formulated as a skimmed milk powder product can reverse hypercholesterolemic risk factors while high CIA oils is useful for weight control. (C) 2012 Elsevier Ltd. All rights reserved.

Roe, M., et al. (2013). "Trans fatty acids in a range of UK processed foods." Food Chemistry **140**(3): 427-431.

A survey to determine the trans fatty acid content of a range of processed foods was carried out in response to recent reformulation work by the food industry to lower the artificial trans fatty acid content of processed products. Sixty two composite samples, made up of between 5 and 12 sub-samples, were collected in 2010 and were analysed for fatty acids, and a range of nutrients. The foods analysed included pizza, garlic bread, breakfast cereals, quiche, fat spreads, a range of fish and meat products, chips, savoury snacks, confectionery and ice cream. Levels of trans fatty acids were reduced considerably compared with previous UK analyses of similar foods where comparisons are possible. Concentrations of trans elaidic acid (t9-C18:1) from hydrogenated oils in all samples were <0.2 g/100 g food. These results confirm information provided by the food industry in 2007 on the levels of trans fats in key processed food sectors. (C) 2012 Elsevier Ltd. All rights reserved.

Romanchik-Cerpovicz, J. E., et al. (2002). "Moisture retention and consumer acceptability of chocolate bar cookies prepared with okra gum as a fat ingredient substitute." Journal of the American Dietetic Association **102**(9): 1301-1303.

Low dietary fat intake may reduce the risk of developing atherosclerosis. This study determined the feasibility of using okra gum as a fat replacer in chocolate bar cookies. Fat-free cookies were prepared with okra gum (OK) or applesauce (AP), replacing margarine and egg yolk in high-fat cookies (CTL). The moisture content of cookies was determined by using a drying oven. The moisture contents of fresh OK (28.3 +/- 0.4%) and AP (27.6 +/- 1.1%) cookies were higher than CTL (8.5 +/- 0.3%) and remained higher after 48 hours (P<.001) (n=3). Fifty-two consumers evaluated the quality of cookies using a hedonic scale. Sensory scores for color, smell, flavor, aftertaste, moistness, and overall acceptability for fresh cookies were acceptable, yet lower for flavor and aftertaste in fat-free cookies than CTL (P<.01). After 48 hours, moistness ratings for fat-free cookies were acceptable and higher than CTL (P<.01). Okra gum is an acceptable fat replacer in chocolate bar cookies.

Romer, S. and N. Garti (2006). "The activity and absorption relationship of cholesterol and phytosterols." Colloids and Surfaces a-Physicochemical and Engineering Aspects **282**: 435-456.

Cholesterol is an essential lipid for mammalian life, but a high cholesterol level can almost guarantee the eventual onset of vascular diseases and, in some cases, can lead to death. It has been shown that there is a direct connection between hi-h cholesterol levels and vascular diseases. Some methods for lowering the serum cholesterol level, thereby preventing the development of these diseases, have been developed and those include drugs and food additives. Since both drugs and food additives act to inhibit the uptake of cholesterol. understanding the sterol absorption process is the key to understanding exactly how drugs and food additives reduce serum cholesterol levels. The major drawback of using anti-cholesterol drugs is related to their side effects, and therefore, natural food additives called plant sterols (phytosterols) have been developed as an attractive alternative. Phytosterols are sterols that are synthesized only in plants and that are structurally similar to cholesterol but with the inclusion of art extra hydrophobic carbon chain at the C-24 position. Phytosterols and their esters reduce cholesterol level in the blood in spite of the fact that they are poorly absorbed into the blood stream. The mechanism by which phytosterols/phytosterol esters interfere with cholesterol absorption is not completely clear, but based on the present understanding, three distinct features have been recognized: (1) physico-chemical effects (e.g. competitive solubilization and co-crystallization); (2) effects at the absorption site (e.g. hydrolysis by lipases and esterases); (3) effects on intracellular trafficking of sterols. Due to phytosterols' poor solubilization in oil and water, they must be taken in high doses to achieve a reduction in cholesterol level. One of the goals of the food and pharmaceutical industries, therefore, is to develop products that effectuate the same decrease in cholesterol level but in smaller sterol doses achieved by increasing sterol bioavailability. The first line of products to meet the increased bioavailability criterion was the oil-soluble esterified phytosterols combined with fatty acids, which exhibit solubility in oil 10 times higher than that of pure phytosterols. The three primary methods of phytosterol inclusion in food are suspension, precipitation and microemulsion. (c) 2005 Elsevier B.V. All rights reserved.

Ronne, T. H., et al. (2005). "Enzymatic interesterification of butterfat with rapeseed oil in a continuous packed bed reactor." Journal of Agricultural and Food Chemistry **53**(14): 5617-5624.

Lipase-catalyzed interesterification of butterfat blended with rapeseed oil (70/30, w/w) was investigated both in batch and in continuous reactions. Six commercially available immobilized lipases were screened in batch experiments, and the lipases, Lipozyme TL IM and Lipozyme RM IM, were chosen for further studies in a continuous packed bed reactor. TL IM gave a fast reaction and had almost reached equilibrium with a residence time of 30 min, whereas RM IM required 60 min. The effect of reaction temperature was more pronounced for RM IM. TL IM showed little effect on the interesterification degree when the temperature was raised from 60 degrees C to 90 degrees C, whereas RM IM had a positive effect when the temperature was increased from 40 degrees C to 80 degrees C. Even though TL IM is an sn-1,3 specific lipase, small changes in the sn-2 position of the triacylglycerol could be seen. The tendency was toward a reduction of the saturated fatty acid C14:0 and C16:0 and an increase of the long-chain saturated and unsaturated fatty acids (C18:0 and C18:1), especially at longer residence times (90 min). In prolonged continuous operation the activity of TL IM was high for the first 5 days, whereafter it dramatically decreased over the next 10 days to an activity level of 40%. In general, the study shows no significant difference for butterfat interesterification in terms of enzyme behavior from normal vegetable oils and fats even though it contains short-chain fatty acids and cholesterol. However, the release of short-chain fatty acids from enzymatic reactions makes the sensory quality unacceptable for direct edible applications.

Rossouw, J. E. (1985). "CORONARY HEART-DISEASE, VITAMIN-B6, ESSENTIAL FATTY-ACIDS AND MARGARINE." South African Medical Journal **67**(23): 918-919.

Rovirosa, A., et al. (1992). "FAT AND OIL INTAKE OF STUDENTS FROM THE UNIVERSITY-OF-BUENOS-AIRES." Archivos Latinoamericanos De Nutricion **42**(4): 389-394.

The purpose of this study was to evaluate the fat and oil intake and their distribution according to the dietary origin in students of the University of Buenos Aires. A 7 day dietary record of students (49 males and 127 females) attendant to the 1989 Course of Nutrition, School of Pharmacy and Biochemistry, to obtain in Pharmacy and Biochemistry was collected. This information was processed in a PC Computer (VAN Program, Lujan University, Argentina) to obtain the energy and fat daily intake, according to the Dietary Composition Tables compiled by INCAP; missing data were completed t with the German, Italian or Argentine Tables. The resuls obtained were (average daily intake +/- SD) for females and males, respectively: Energy (Kcal):1805 +/- 5431 and 2551 +/- 712,total fat(g):65.6 +/- 21.8 and 87.8 +/- 28.7; percentage of energy provided by fat: 33.0 and 3 1. 1. The distribution of fat intake according to its dietary source was (g/100 g): meat: 33.3; oils: 15.5; dairy products: 19.3; cakes and pasta: 11.6; cereals (bread crackers, etc.): 8.3; separate animal fat: 5. 1; legumes and oil seeds: 1.4; eggs: 2.9; poultry: 1.5; margarines: 0.6; fish: 0.3; viscera: 0.3 These data show that the fat intake is not excessive, about 30% of the energy intake, but the high percentage of animal fat might be one of the risk factors responsible for the high incidence of cardiovascular diseases in the population of Buenos Aires.

Rowsell, H. C., et al. (1958). "EFFECT OF FEEDING BUTTER AND MARGARINE ON THE DEVELOPMENT OF ATHEROSCLEROSIS IN SWINE." Circulation **18**(3): 509-509.

Roy, A., et al. (2007). "Butters rich either in trans-10-C18 : 1 or in trans-11-C18 : 1 plus cis-9, trans-11 CLA differentially affect plasma lipids and aortic fatty streak in experimental atherosclerosis in rabbits." Animal **1**(3): 467-476.

Dairy fat contains high amounts of saturated fatty acids (FA), which are associated with cardiovascular disease (CVD) risk. Manipulation of dairy cows nutrition allows to decrease the saturated FA content of milk fat, and is associated with increases either in conjugated linoleic acid (CLA) and trans-11-C18:1 contents, or in trans-10-C18:1 content. CLA putatively exhibits beneficial properties on CVD risk, whereas trans FA are suspected to be detrimental. The present study compared the effects of a trans-10-C18:1-rich buffer (T10 buffer), a trans-11-C18:1 + CLA-rich butter (T11-CLA buffer) and a standard butter (S butter) on lipid parameters linked to the CVD risk and fatty streaks. Thirty-six White New Zealand rabbits were fed one of the three butters (12% of the diet, plus 0.2% cholesterol) for 6 (experiment 1) or 12 (experiment 2) weeks. Liver lipids, plasma lipids and lipoprotein concentrations (experiments 1 and 2) and aortic lipid deposition (experiment 2) were determined. The T10 buffer increased VLDL-cholesterol compared with the two others, and total and VLDL-cholesterol compared with the T11-CLA buffer (P < 0.05). The T10 buffer also increased non-HDL/HDL ratio and aortic lipid deposition compared with the T11-CLA buffer (P < 0.05). The T11-CLA butter non-significantly reduced aortic lipid deposition compared with the S butter, and decreased HDL-cholesterol and increased liver triacyglycerols compared with the two other butters (P < 0.05). These results suggest that, compared with the S butter, the T10 butter had detrimental effects on plasma lipid and lipoprotein metabolism in rabbits, whereas the T11-CLA buffer was neutral or tended to reduce the aortic lipid deposition.

Roy, A., et al. (2006). "Production of butter fat rich in trans10-C18 : 1 for use in biomedical studies in rodents." Reproduction Nutrition Development **46**(2): 211-218.

Trans fatty acids are suspected to be detrimental to health, particularly to cardiovascular function. Trans fatty acids include a wide range of fatty acids, with isomers of C18: 1, conjugated and non-conjugated C18: 2 as major components. A vaccenic acid ( trans11-C18:1) + rumenic acid ( cis9,trans11-CLA)-rich butter has been shown previously to exhibit health beneficial effects, but less is known concerning another trans-C18: 1 present in hydrogenated vegetable oil-based products and sometimes in milk fat, the trans10-isomer. The present experiment was conducted to produce butters from milk of variable fatty acid composition for use in biomedical studies with rodents, with the overall aim of evaluating the specific effect of trans10-C18: 1 and trans11- C18: 1 + cis9, trans11CLA on cardiovascular function. Milks from lactating dairy cows fed two types of maize-based diets supplemented ( 5% of dry matter) - or not - with sunflower oil were collected, and used to manufacture butters either rich in trans10-C18: 1 ( 14% of total fatty acids, 64.5% of fat content) or rich in trans11-C18: 1 + cis9, trans11- CLA ( 7.4 and 3.1% of total fatty acids, respectively, 68.5% of fat content), or with standard fatty acid composition ( 70% of fat content). Additionally, total saturated fatty acid percentage was reduced by more than one third in the enriched butters compared with the standard butter. An understanding of the role of nutrition on milk fatty acid composition in cows allows for the production of dairy products of variable lipid content and composition for use in biomedical studies in animal models and human subjects.

Rush, J. W. E., et al. (2008). "Effect of food preparation on the structure and metabolic responses to a monostearin-oil-water gel-based spread." Food Research International **41**(10): 1065-1071.

Widespread recognition of the negative health effects of trans and saturated fats has prompted research to develop alternative structures that can structure liquid oils into semi-solid plastic pastes for food applications. We have recently developed and described the physical chemical properties of a unique a monostearin-oil-water gel (MAG) that achieves this goal. Furthermore, ingestion of this MAC in the form of a margarine-like spread resulted in beneficial Suppression of blood lipid and insulin responses in humans compared to compositionally-equivalent controls lacking the MAC structure. However, the integrity of this novel structure and its salubrious metabolic effects have not been previously evaluated under food processing conditions. The purpose of the current study was to evaluate the integrity of the MAC when applied to toasted bread and when mixed with a warm pasta meal, and to evaluate the metabolic effects over 6 h following ingestion of both types of meals with MAC compared to compositionally-equivalent unstructured oil preparations. MAC structure was maintained in the toast study, but the pasta meal destroyed the MAC structure. Triglyceride, free fatty acid, and insulin responses were Suppressed in the MAC trial compared to the unstructured oil trial of the toast study, whereas there was no difference in the responses of these variables between the two trials in the pasta study. The results demonstrate for the first time that the metabolic effects of MAC depend on maintenance of the MAC structural integrity throughout the food processing procedures leading up to ingestion. Thus, this study demonstrates the utility of MAC as a trans- and saturated fat-free vehicle to structure and deliver liquid oil as a semi-solid plastic paste, and establishes processing limits to the integrity of the additional beneficial metabolic effects of this novel structure. (C) 2008 Elsevier Ltd. All rights reserved.

Rush, J. W. E., et al. (2009). "Acute metabolic responses to butter, margarine, and a monoglyceride gel-structured spread." Food Research International **42**(8): 1034-1039.

Cardiovascular and metabolic health concerns have led to interest in development of saturated- and trans fat-free margarines, spreads, and other foods. We have recently characterized a novel monoglyceride gel (MAG GEL) that can structure liquid oil into a semi-plastic solid consistency in the absence of saturated and trans fats. Consumption of this MAG GEL resulted in tempered postprandial metabolic responses compared to those resulting from consumption of a compositionally equivalent but unstructured oil suspension, suggesting a structure-dependent metabolic response. The current study was designed to test the hypothesis that postprandial blood lipid and metabolite responses to MAG GEL would be tempered compared to the responses after ingestion of butter and tub-margarine of equal total fat content. Indeed, blood triglyceride response was tempered in MAG GEL compared to butter, margarine, and unstructured oil trials, all of which produced similar triglyceride responses. The blood free fatty acid, glucose, and insulin responses were not different in MAG GEL compared to butter or margarine trials; and interestingly, there were no differences between butter and margarine trials for any of the metabolic response variables. The MAG GEL is a useful structure for many applications, and produces salubrious postprandial metabolic effects compared to other spreadable fats. (C) 2009 Elsevier Ltd. All rights reserved.

Ruttenberg, H., et al. (1980). "INFLUENCE OF DIETARY TRANS FATTY-ACID ON ATHEROSCLEROSIS IN RABBITS." Federation Proceedings **39**(3): 1039-1039.

Ryff, C. D. and B. H. Singer (2005). "Social environments and the genetics of aging: Advancing knowledge of protective health mechanisms." Journals of Gerontology Series B-Psychological Sciences and Social Sciences **60**: 12-23.

We selectively review the literature in behavioral and molecular genetics, including both laboratory and epidemiologic studies, with emphasis on how social environments. particularly emotion in significant social relationships. influence gene expression. Attention is given to cross-talk between human and animal studies. Environments are pivotal in understanding phenotypic outcomes, and this demands research on gene-environment interactions. Illustrative interactions, involving both behavioral and molecular genetics. are provided. Many people with susceptibility genes for diverse diseases never proceed to disease status. Substantial associational evidence implicates social environmental factors as protective agents. Mechanistic understanding of these linkages is quite advanced in some animal populations and suggests new lines of inquiry in human studies. Developing the interface between genetics. social environments, and health will require close collaboration between those well versed in molecular biology and biochemistry and persons with expertise in genetic epidemiology and social psychology. Particularly important is the identification of environmental influences that protect susceptible persons from disease incidence.

Sabate, J., et al. (1993). "EFFECTS OF WALNUTS ON SERUM-LIPID LEVELS AND BLOOD-PRESSURE IN NORMAL MEN." New England Journal of Medicine **328**(9): 603-607.

Background. In a recent six-year follow-up study, we found that frequent consumption of nuts was associated with a reduced risk of ischemic heart disease. To explore possible explanations for this finding, we studied the effects of nut consumption on serum lipids and blood pressure. Methods. We randomly placed 18 healthy men on two mixed natural diets, each diet to be followed for four weeks. Both diets conformed to the National Cholesterol Education Program Step 1 diet and contained identical foods and macronutrients, except that 20 percent of the calories of one diet (the walnut diet) were derived from walnuts (offset by lesser amounts of fatty foods, meat, and visible fat [oils, margarine, and butter]). Results. With the reference diet, the mean (+/-SD) serum values for total, low-density lipoprotein (LDL), and high-density lipoprotein (HDL) cholesterol were, respectively, 182+/-23, 112+/-16, and 47+/-11 mg per deciliter (4.71+/-0.59, 2.90+/-0.41, and 1.22+/-0.28 mmol per liter). With the walnut diet, the mean total cholesterol level was 22.4 mg per deciliter (0.58 mmol per liter) lower than the mean level with the reference diet (95 percent confidence interval, 28 to 17 mg per deciliter [0.72 to 0.44 mmol per liter]); the LDL and HDL cholesterol levels were, respectively, 18.2 mg per deciliter (0.47 mmol per liter) (P<0.001) and 2.3 mg per deciliter (0.06 mmol per liter) (P = 0.01) lower. These lower values represented reductions of 12.4, 16.3, and 4.9 percent in the levels of total, LDL, and HDL cholesterol, respectively. The ratio of LDL cholesterol to HDL cholesterol was also lowered (P<0.001) by the walnut diet. Mean blood-pressure values did not change during either dietary period. Conclusions. Incorporating moderate quantities of walnuts into the recommended cholesterol-lowering diet while maintaining the intake of total dietary fat and calories decreases serum levels of total cholesterol and favorably modifies the lipoprotein profile in normal men. The long-term effects of walnut consumption and the extension of this finding to other population groups deserve further study.

Saigado, J. M., et al. (2008). "Effect of the hass avocado (American Persea Mill) on hipercolesterolemic rats." Ciencia E Tecnologia De Alimentos **28**(4): 922-928.

Phytonutrients can be found in fruits, and the avocado contains four times more beta-sitosterol (phytosterol) and it is one of the best glutathione sources. The phytosterol is a vegetable substance whose structure is very similar to the cholesterol one and its action mechanism involves the intestinal inhibition of cholesterol absorption and the synthesis of hepatic cholesterol. The effect has an influence on the values of total plasmatic cholesterol and LDL without affecting the levels of HDL and triglycerides. The present work had the objective to analyze the influence of the consumption of the Hass avocado on the levels of total cholesterol, HDL, LDL, triglycerides, and hepatic and excreted cholesterol. These parameters were investigated in hipercholesterolemic Wistar rats during 30 and 60 days of experiment. At the end of 30 days, the 15% avocado diet reduced the levels of total cholesterol and LDL in comparison to the control. It was observed that for the excreted cholesterol, the best diet was the 25% of avocado since the cholesterol excretion increased with the increase of the avocado concentration. The 15% avocado diet also influenced the levels of hepatic cholesterol.

Saldeen, T., et al. (1998). "Effects of a small dose of stable fish oil substituted for margarine in bread on plasma phospholipid fatty acids and serum triglycerides." Nutrition Research **18**(9): 1483-1492.

Fish oil concentrates, fluid or in capsules, have shown beneficial effects on several risk factors for cardiovasular disease, but their use implies addition of fat to the diet. In order to overcome this, substitution of fish oil for other fat in a food product was tried in the present investigation. The effects of a small dose of fish oil substituted for margarine in bread on plasma phospholipid fatty acids and serum triglycerides were determined in a parallel, single-blinded, randomized study in 17 healthy subjects. Daily intake of 1 g stable fish oil containing 38 percent n-3 fatty acids (Eskimo-3(R)) for 4 weeks increased long-chain n-3 fatty acids it. plasma phospholipids by almost 50 percent (p<0.05) and decreased serum triglycerides by 17 percent (p < 0.005). Plasma alpha-tocopherol and TEARS (thiobarbituric acid reactive substances), measured as malondialdehyde, a marker of lipid peroxidation, and blood glucose, were unchanged. In a blinded consumer sensory test only 2 out of 195 subjects perceived any taste of fish aroma in the bread containing fish oil. This study showed that by use of a stable fish oil preparation it is possible to substitute fish oil for margarine in bread, a food product consumed in large amounts, and that a small amount of this fish oil has significant effects on blood lipids, without any signs of lipid peroxidation. (C) 1998 Elsevier Science Inc.

Salo, P. and S. Rosin (2009). "Impact of plant stanol ester on risk of cardiovascular disease." Agro Food Industry Hi-Tech **20**(4): 15-17.

Plant stanol ester-containing foods have been available for consumers now for close to 14 years. Clinical research over the past decades has clearly shown the efficacy of plant stanol ester as a cholesterol-lowering food ingredient as part of a healthy diet. According to recent evaluation by European Food Safety Authority (EFSA), the available scientific evidence supports the use of a health claim "Plant stanol esters have been shown to lower/reduce blood cholesterol. Blood cholesterol lowering may reduce the risk of coronary heart disease".

Sambaiah, K. and B. R. Lokesh (1999). "Nutritional properties of trans fatty acids." Indian Journal of Biochemistry & Biophysics **36**(4): 211-220.

The role of trans fatty acids (TFA) present in partially hydrogenated fats widely consumed in food and their link with coronary heart disease has been examined in this review. Most of the studies carried out have been on the effects of TFA on blood-lipid profile. The perceived effects of TFA intake depend on the fat or oil with which they are compared and appears to be in between that of dietary saturated fats and monounsaturated fatty acids. When compared to saturated fat, TFA intake shows lower levels of total and LDL-cholesterol in blood. But when both TFA and saturated fatty acids are compared with cis fatty acids or native unhydrogenated oil, increase in total and LDL-cholesterol are noted. The effects of TFA on HDL cholesterol and Lp(a) are not clearly established. The undesirable effects of TFA can be overcome by inclusion of essential fatty acids at a minimum of 2 energy per cent level in the diet. The link between trans fatty acid intake and coronary heart disease (CHD) are not unequivocally established.

Sanadgol, N., et al. (2010). "Elaidic acid sustains LPS and TNF-alpha induced ICAM-1 and VCAM-I expression on human bone marrow endothelial cells (HBMEC)." Clinical Biochemistry **43**(12): 968-972.

Objectives: Elaidic acid, the predominant trans-fatty acid in industrially hydrogenated oils, exists on high levels in Iranian hydrogenated oils and margarines. This study was undertaken to investigate the effect of elaidic acid and its cis-counterpart oleic acid on expression of ICAM-1 and VCAM-1 on human bone marrow endothelial cells (HBMECs). Design and methods: HBMEC were pre-treated with TNF-alpha or LPS for induction of the adhesion molecules expression, and then treated with elaidic acid or oleic acid. Soluble and cell associated forms of ICAM-1 and VCAM-1 were quantified by ELISA and Western blot. Results: Our findings indicated that oleic acid suppresses VCAM-1 and ICAM-1 expression on HBMEC near to the basal level. Conversely, elaidic acid maintained the level of VCAM-1 and ICAM-1 up-regulated by TNF-alpha or LPS. Conclusions: It is suggested that elaidic acid could keep the HBMEC at the stimulated phenotype. These findings provide further support on the detrimental effects of elaidic acid in promotion and induction of cardiovascular diseases (CVD). (C) 2010 The Canadian Society of Clinical Chemists. Published by Elsevier Inc. All rights reserved.

Sanchez-Muniz, F. J., et al. (2004). "Phytosterols, a double-edged weapon?" Grasas Y Aceites **55**(3): 321-327.

Phytosterols are plant sterols structurally similar to cholesterol. The most common phytosterols are B-sitosterol, campesterol and stigmasterol. They are present in many foods but mainly in nuts and vegetable oils. They compete with cholesterol absorption decreasing the cardiovascular risk. Recent studies have associated the intake of 0.63-3g/day of phytosterols with lowering serum cholesterol and LDL-cholesterol levels. The same decrease has been observed in apolipoprotein B. These results suggest that dietary phytosterols are useful for protection against cardiovascular disease. Because of this they have been incorporated in relatively high quantities into spreads and margarines. However, negative effects have also been reported. Among them, a significant decrease in the absorption of several lypophilic antioxidant compounds such as carotenoids and tocopherols, which may counterbalance the protective cardiovascular effect of phytosterols. In this paper the results of several selected studies relating phytosterol consumption and plasma levels of lipids, lipoproteins and antioxidants are reviewed. More studies are needed to establish if it is necessary to supplement with such antioxidant compounds the diet of people consuming phytosterols for therapeutical purposes.

Sanchez-Villegas, A., et al. (2011). "Dietary Fat Intake and the Risk of Depression: The SUN Project." Plos One **6**(1).

Emerging evidence relates some nutritional factors to depression risk. However, there is a scarcity of longitudinal assessments on this relationship. Objective: To evaluate the association between fatty acid intake or the use of culinary fats and depression incidence in a Mediterranean population. Material and Methods: Prospective cohort study (1999-2010) of 12,059 Spanish university graduates (mean age: 37.5 years) initially free of depression with permanently open enrolment. At baseline, a 136-item validated food frequency questionnaire was used to estimate the intake of fatty acids (saturated fatty acids (SFA), polyunsaturated fatty acids (PUFA), trans unsaturated fatty acids (TFA) and monounsaturated fatty acids (MUFA) and culinary fats (olive oil, seed oils, butter and margarine) During follow-up participants were classified as incident cases of depression if they reported a new clinical diagnosis of depression by a physician and/or initiated the use of antidepressant drugs. Cox regression models were used to calculate Hazard Ratios (HR) of incident depression and their 95% confidence intervals (CI) for successive quintiles of fats. Results: During follow-up (median: 6.1 years), 657 new cases of depression were identified. Multivariable-adjusted HR (95% CI) for depression incidence across successive quintiles of TFA intake were: 1 (ref), 1.08 (0.82-1.43), 1.17 (0.88-1.53), 1.28 (0.97-1.68), 1.42 (1.09-1.84) with a significant dose-response relationship (p for trend = 0.003). Results did not substantially change after adjusting for potential lifestyle or dietary confounders, including adherence to a Mediterranean Dietary Pattern. On the other hand, an inverse and significant dose-response relationship was obtained for MUFA (p for trend = 0.05) and PUFA (p for trend = 0.03) intake. Conclusions: A detrimental relationship was found between TFA intake and depression risk, whereas weak inverse associations were found for MUFA, PUFA and olive oil. These findings suggest that cardiovascular disease and depression may share some common nutritional determinants related to subtypes of fat intake.

Sanders, T. H. (2001). Individual oils: Peanut oil.

Peanut production on a worldwide basis is almost 30 million tons per year, and more than 50% of this production is crushed for oil use. In some countries, more than 85% of the peanuts produced are crushed. Extraction efficiency and oil quality vary with use of equipment, from simple hand presses to hydraulics and heated solvent extractors. State-of-the-art extraction is generally accomplished with screw presses followed by solvent extraction. Extracted peanut oil is saponified, washed, bleached, and deodorized into an excellent cooking oil with a smoke point of 229.4degreesC. Peanut oil is used mainly for edible purposes in the preparation of shortenings, margarines, and mayonnaises as a cooking and frying oil, and as a salad oil. A new commercial invention incorporating a supercritical, low-pressure, liquefied gas extraction process using food-grade butane as the extraction gas is currently being used to extract chocolate liquor and peanuts, and the oil and residue solids are both edible products. New peanut lines incorporating high oleic-acid traits produce oil with greatly increased shelf-life qualities. Use of high-oleic oils in frying peanuts resulted in some increase in the shelf life of the various peanut varieties used, and the increases were highly correlated with the oleic/linoleic (OIL) ratio of individual varieties. The benefits of peanuts, peanut butter, and peanut oil alone in decreased cholesterol and low-density lipoprotein (LDL) cholesterol risk factors for cardiovascular disease have recently been explored. Peanut oil resulted in significant reduction of cholesterol and LDL cholesterol while producing no decrease in high-density lipoprotein (HDL) cholesterol and no increase in triglycerides.

Saravanan, N., et al. (2005). "Differential effects of dietary saturated and trans-fatty acids on expression of genes associated with insulin sensitivity in rat adipose tissue." European Journal of Endocrinology **153**(1): 159-165.

Objective: Trans-fatty acids (TFAs) are formed during partial hydrogenation of vegetable oils and are shown to be more atherogenic than saturated fatty acids (SFAs). Our previous study showed that dietary TFAs decrease adipose tissue insulin sensitivity to a greater extent than SFAs in rats. We hypothesized that the effects of these fatty acids on insulin sensitivity could be mediated through an alteration in gene expression. In the current study we have investigated the effects of dietary TFAs or SFAs on expression of genes associated with insulin sensitivity in rat adipose tissue. Design and methods: Male weanling Wistar/NIN rats were divided into four groups and fed one of the following diets containing 10% fat (g/100g diet) differing only in the fatty acid composition for 3 months: control diet (3.7% linoleic acid (LA)), SFA diet (5% SFA), TFA diet 1 (1.5% TFA + 1% LA) and TFA diet 2 (1.5% TFA + 2% LA). The mRNA expression of peroxisome proliferator-activated receptor gamma (PPAR gamma), lipoprotein lipase (LPL), glucose transporter-4 (GLUT4), resistin and adiponectin was analyzed in epididymal fat using RT-PCR. The effects of TFA were studied at two levels of LA to understand the beneficial effects of LA over the effects of TFA. Results: Both dietary SFA and TFA upregulated the mRNA levels of resistin. Dietary SFA downregulated adiponectin and GLUT4 and upregulated LPL, while TFA downregulated PPAR gamma and LPL. The effects of dietary TFA on PPAR gamma and resistin were not counteracted by increased LA (TFA diet 2). Conclusion: The effects of SFAs on the aforementioned genes except PPAR gamma could be extrapolated towards decreased insulin sensitivity, while only the alteration in the mRNA levels of PPAR gamma and resistin could be associated with insulin resistance in TFA-fed rats. These findings suggest that dietary SFAs and TFAs alter the expression of different genes associated with insulin sensitivity in adipose tissue.

Sargis, R. M. and P. V. Subbaiah (2003). "Trans unsaturated fatty acids are less oxidizable than cis unsaturated fatty acids and protect endogenous lipids from oxidation in lipoproteins and lipid bilayers." Biochemistry **42**(39): 11533-11543.

Epidemiological data suggest that dietary trans unsaturated fatty acids increase the risk of heart disease; however, the underlying mechanisms are unclear. In this study, we investigated one possible mechanism, namely, their effect on LDL oxidation. Supplementation of LDL with 10% 16:1 trans-cholesteryl ester (CE) inhibited the oxidation compared to that with 16:1 cis-CE. Total replacement of core lipids with 18:2 trans,trans-CE decreased the rate of LDL oxidation by 19% compared to replacement with 18:2 cis,cis-CE. When the surface phosphoglycerides were replaced with either 16:0-18:2 cis,cis-phosphatidylcholine (PC) or 16:0-18:2 trans,trans-PC, the latter was found to inhibit the rate and increase the lag time of oxidation to a greater extent than the former. To confirm these findings, we studied the oxidation of PC liposomes by assessing the formation of conjugated dienes or the degradation of a fluorescently labeled PC. By both methods, the 16:0-18:2 trans,trans-PC exhibited greater resistance to oxidation than the 16:0-18:2 cis,cis-PC. Eliminating the fluidity differences did not completely eliminate the differences in oxidation rates, suggesting that the trans double bond is inherently resistant to oxidation. The composition of the conjugated hydroperoxy products formed after oxidation differed markedly for the two 18:2 isomers. Supplementation of 16:0-18:2 cis,cis-PC liposomes with 20 mol % di16:1 trans-PC retarded oxidation rates to a greater extent than supplementation with di16:1 cis-PC. These studies show that dietary trans unsaturated fatty acids decrease the rate of lipid peroxidation, an effect that may mitigate the atherogenic effect of these fatty acids.

Sathivel, S. (2003). Fish oils: Properties and processing.

Natural fish oils contain omega-3 fatty acids which when part of a balanced diet are thought to have a number of positive effects on human health such as reducing heart diseases, increasing cardiovascular functions, and possible influences on brain growth during early infancy. Alaska fish processors annually produce only about 30,000 metric tons of unrefined fish oil from fish byproducts. Most of this oil is used for fuel and animal feed ingredients. Fish oil production in Alaska usually involves grinding, cooking of fish byproducts, decanting liquids from cooked solids, and separating the fish oil by centrifugation. Some smaller salmon processors have utilized a batch skimming operation for recovering oil from salmon heads. Unrefined fish oils contain non-triglycerides, such as free fatty acids and oxidized components that may reduce quality. These components need to be removed before use in the more lucrative markets. The longer these components remain in the oil, the greater their negative effect on final oil quality. Making high quality oils requires well-designed purification steps. Conventional fish oil refining is achieved through the following steps: degumming, neutralization, bleaching, and deodorizing. Adsorption technology is an alternative approach for effective removal of non-triglycerides and is gaining popularity as a cost effective non-thermal separation process.

Scherr, C. and J. P. Ribeiro (2009). "Cholesterol and Fats in Brazilian Foods: Implications for Prevention of Atherosclerosis." Arquivos Brasileiros De Cardiologia **92**(3): 190-195.

Background: In order to perform food surveys and prescribe diets, food composition tables have to be consulted. However, these tables are limited to the description of fatty acids and cholesterol contents and do not provide information on the different preparation methods. Objective: Based on data derived from an extensive analysis of the chemical composition of Brazilian foods, we assessed the impact of certain types of foods on diets recommended for the prevention of coronary disease. Methods: The fatty acid and cholesterol composition of some types of foods and different preparation methods were analyzed. These results were used according to the recommendations of the American Heart Association for an 1,800 calorie diet. Results: Cholesterol found in 100g of eggs (400mg) or fried beef liver (453mg) exceeds the amount recommended for secondary prevention, and there is no difference in cholesterol content between factory-farmed eggs and free-range eggs. The eggs had an average of 400mg of cholesterol per 100g, thus exceeding the recommended amount of up to 300mg. Each egg has 50g on average; one egg can be consumed provided that not more than 100mg of cholesterol are consumed per day. As regards saturated fat, butter (55.2g), margarine (19.4g), tilsit cheese (20.4g), Brazilian Dutch Edam cheese (19.9g), yellow (16.8g) and fresh white cheese (15.5g) exceed the 14g recommended if 100g or more are consumed. The same is true for soy oil (17.5g) and corn oil (16.1g). Conclusion: Better knowledge on fat and cholesterol contents in foods allows the prescription of amounts not exceeding the recommended values for prevention, and this may result in better compliance to diets. (Arq Bras Cardiol 2009; 92(3): 180-185)

Scherr, C. and J. P. Ribeiro (2010). "Fat Content of Dairy Products, Eggs, Margarines and Oils: Implications for Atherosclerosis." Arquivos Brasileiros De Cardiologia **95**(1): 55-60.

Background: For appropriate advising on a meal plan aimed at the prevention of ischemic heart disease, it is necessary to know the chemical composition of foods. Objective: To analyze the composition of fats, fatty acids and cholesterol in some Brazilian specimens of edible oils, butters, margarines, dairy products and eggs, using the limits of a diet to prevent coronary artery disease. Methods: We analyzed the composition of edible oils, butters, margarines, dairy products and eggs. The findings were used as recommended by the American Heart Association for a 1,800 calorie diet. Results: Comparing the edible oils, the canola oil was found to be the best. Among the milks, the skimmed milk is most advisable one, but no advantages were found over the semi-skimmed milk. For the eggs, no differences were found in the types of milk found in the market. For cheeses, the "minas" cheese had the lowest content of cholesterol and saturated fat. Comparing margarine and butter, the former was found to be better when trans fats do not exceed the recommended levels. Conclusion: The composition of foods used in Brazil indicates that diets designed to enable primary and secondary prevention of ischemic heart disease can prioritize the use of semi-skimmed milk, sunflower oil, margarines with low content of trans fats and "minas" cheese. (Arq Bras Cardiol. 2010; [online]. ahead print, PP.0-0)

Schmitt, B., et al. (2002). "Active substances of functional food in the prevention of arteriosclerosis - Part 3: Phytosterols." Ernahrungs-Umschau **49**(7): 266-+.

Phytosterols are a group of cyclic triterpenes frequently found in vegetable food, especially in oils, nuts and pulses where they are present at higher concentrations. Esterified phytosterols and -stanols have been found to lower the cholesterol level. They are added to special sorts of margarine. Intake of 2-3 g of phytosterol ester per day reduces total cholesterol by about 15 % and LDL plasma levels by 10-15 %. Phytosterols and -stanols inhibit the intestinal uptake of cholesterol by a competitive inhibition of cholesterol incorporation in micells. Systemic effects are discussed as well. From the toxicological point of view, the phytosterol and -stanol quantities contained in margarine are considered to be harmless; only a decrease of the plasma carotenoid concentration has been reported. Phytosterol and -stanol enriched preparations may be recommended to those individuals with hypercholesterinemia in particular whose eating habits cannot be modified or be modified only insignificantly.

Schneider, A. C., et al. (2012). "Conversion of t11t13 CLA into c9t11 CLA in Caco-2 Cells and Inhibition by Sterculic Oil." Plos One **7**(3).

Background: Conjugated linoleic acids (CLA), and principally c9t11 CLA, are suspected to have numerous preventive properties regarding non-infectious pathologies such as inflammatory diseases, atherosclerosis and several types of cancer. C9t11 CLA is produced in the rumen during biohydrogenation of linoleic acid, but can also be synthesized in mammalian tissues from trans-vaccenic acid (C18:1 t11) through the action of delta-9 desaturase (D9D). For several years, it is also known that c9t11 CLA can be synthesized from conjugated linolenic acids (CLnA), i.e. c9t11c13 CLnA and c9t11t13 CLnA. This study aimed at investigating to which extent and by which route c9t11 CLA can be produced from another isomer of CLA, the t11t13 CLA that is structurally very similar to c9t11t13 CLnA, in Caco-2 cells. Methodology/Principal Findings: Caco-2 cells were incubated for 24 h with 20 mu mol/l of t11t13 CLA in the absence or presence of sterculic oil used as an inhibitor of D9D. Caco-2 cells were able to convert t11t13 CLA into c9t11 CLA, and c9t11t13 CLnA was formed as an intermediate compound. In the presence of sterculic oil, the production of this intermediate was decreased by 46% and the formation of c9t11 CLA was decreased by 26%. No other metabolite was detected. Conclusions/Significance: These results not only highlight the conversion of t11t13 CLA into c9t11 CLA but demonstrate also that this conversion involves first a desaturation step catalysed by D9D to produce c9t11t13 CLnA and then the action of another enzyme reducing the double bond on the Delta 13 position.

Schroder, M., et al. (2009). "Effect of rapeseed oil-derived plant sterol and stanol esters on atherosclerosis parameters in cholesterol-challenged heterozygous Watanabe Heritable Hyperlipidaemic rabbits." British Journal of Nutrition **102**(12): 1740-1751.

Rapeseed oil (RSO) is a novel source of plant sterols, containing the unique brassicasterol in concentrations higher than allowed for plant sterol blends in food products in the European Union. Effects of RSO sterols and stanols on aortic atherosclerosis were studied in cholesterol-fed heterozygous Watanabe heritable hyperlipidaemic (Hh-WHHL) rabbits. Four groups (n 18 per group) received a cholesterol-added (2 g/kg) standard chow or this diet with added RSO stanol esters (17 g/kg), RSO stanol esters (34 g/kg) or RSO sterol esters (34 g/kg) for 18 weeks. Feeding RSO stanol esters increased plasma campestanol (P<0.001) and sitostanol (P<0.001) and aortic campestanol (P<0.05) compared with controls. Feeding RSO sterol esters increased concentrations of plasma campesterol (P<0.001), sitosterol (P<0.001) and brassicasterol (P<0.001) and aortic campesterol (P<0.01). Significantly lower plasma cholesterol (P<0.001) was recorded in the treated groups after 3 weeks and throughout the study. LDL-cholesterol was reduced 50% in the high-dose RSO sterol ester (P<0.01) and hi.-h-dose RSO stanol ester (P<0.001) groups compared with controls. Atherosclerotic lesions were found in three rabbits in each of the RSO stanol ester groups and in one in the RSO sterol ester group. Aortic cholesterol was decreased in the treated groups (P<0.001) in response to lowering of plasma cholesterol induced by RSO sterol and stanol esters. In conclusion, RSO stanol and sterol esters with a high concentration of brassicasterol were well tolerated. They were hypocholesterolaemic and inhibited experimental atherosclerosis in cholesterol-fed Hh-WHHL rabbits. A significant uptake of plant sterols into the blood and incorporation of campesterol and campestanol into aortic tissue was recorded.

Schulze, M. B. (2012). "Diet and dyslipidemia in diabetes." Diabetologe **8**(7): 556-561.

Dyslipidemia in diabetes is characterized by low high-density lipoprotein (HDL) cholesterol, high triglyceride levels and higher concentrations of atherogenic lipoprotein molecules. Various interventions are of importance in the nutritional therapy of dyslipidemia. An increased intake of unsaturated fatty acids from vegetable oils at the expense of saturated fatty acids lowers low-density lipoprotein (LDL) cholesterol. Trans-fatty acids (food sources: fat spreads and foods with partially hydrogenated fat, fried foods, fat-rich baked goods and sweets) cause an even more detrimental lipoprotein profile compared to saturated fatty acids and their intake should be limited. Significant reductions of LDL cholesterol are also achievable by fiber-rich foods and foods enriched with plant sterols and stanols. A reduction of body weight, an increase in physical activity and a limitation of alcohol consumption to moderate amounts are effective interventions to control triglyceride and HDL cholesterol levels. Triglycerides can also be reduced by supplementation with long-chain omega 3 fatty acids (fish oil). Higher proportions of dietary carbohydrates cause higher triglyceride levels, therefore, moderation of carbohydrates in favor of unsaturated fatty acids can be an effective dietary strategy and the major focus is to limit the consumption of foods and beverages with added saccharose or fructose.

Sebedio, J. L., et al. (2004). Fatty acid isomers in lipid metabolism. Metabolic Issues of Clinical Nutrition. S. P. Allison and V. L. W. Go. **9:** 125-139.

Sebedio, J. L., et al. (2000). "The effect of dietary trans alpha-linolenic acid on plasma lipids and platelet fatty acid composition: the TransLinE study." European Journal of Clinical Nutrition **54**(2): 104-113.

Objective: To collect (i) baseline data and (ii) execute a large multicentre study examining the effect of trans alpha-linolenic acid on its incorporation into plasma lipids and on risk factors for coronary heart disease. Design: Male volunteers were recruited and the habitual diet assessed by a 4-d weighed record. Fatty acid composition of plasma and platelet lipids were determined by gas chromatography at baseline. After a 6 week run-in period on a trans 'free' diet, male volunteers were randomised to consume 0.6% of energy trans alpha-linolenic acid or to continue with a diet 'low' in trans alpha-linolenic acid for 6 weeks. Setting: Three European university research departments supported by the research and development departments of the food industry. Subjects: Male volunteers (88) recruited by local advertisement. Methods: Replacement of 30% of the fat of the habitual diet by margarine, oil and foods. Rapeseed oil was deodorised especially to produce the trans 'free' and 'high' trans foods for this study. The incorporation and conversion of trans alpha-linolenic acid into plasma lipids and platelets was assessed by gas chromatography and dietary compliance was verified by 4-d weighed record. Results Less trans alpha-linolenic acid isomers are incorporated into human plasma lipids in French volunteers than in Dutch or Scottish volunteers consuming their habitual diets. Trans 'free' alpha-linolenic acid-rich oil can be produced by careful deodorization during refining. The 'high' trans diet provided 1410 +/- 42 mg/d trans isomers of alpha-linolenic acid, whilst the 'low' trans group consumed 60 +/- 75 mg/d. The change in plasma lipid and platelet fatty acid composition documented that trans linolenic isomers are incorporated and converted to a trans isomer of eicosapentaenoic acid. Only the 15-trans alpha-linolenic acid is incorporated into plasma cholesteryl esters. The group consuming low trans diet had a slightly higher intake of fat, especially saturated and monounsaturated fat. Conclusions: Trans 'free' rapeseed oil, rich in alpha-linolenic acid, can be produced by careful deodorization. Dietary records show good compliance. Dietary trans isomers of alpha-linolenic acid are incorporated in plasma lipids and converted to long-chain polyunsaturated fatty acids. Their effects on risk factors for coronary heart disease and their metabolism will be reported elsewhere.

Segall, J. J. (1994). "DIETARY LACTOSE AS A POSSIBLE RISK FACTOR FOR ISCHEMIC-HEART-DISEASE - REVIEW OF EPIDEMIOLOGY." International Journal of Cardiology **46**(3): 197-207.

International data show stronger correlations of mortality from ischaemic heart disease with per capita supply of dairy products excluding fat than with dairy fat, and of estimated lactose than with dairy fat or margarine and other processed fats (positively) and vegetable oils and fats, fat of fish or wine (negatively). Butter and cheese, which have a low content of lactose, show moderate and zero correlations, respectively. Populations with low or intermediate prevalence of adult lactose absorbers have a lower supply of dairy products excluding butter (and therefore of lactose), and a lower mortality from ischaemic heart disease, than populations with a high prevalence of absorbers. Specific national and ethnic data suggest that a diet low or relatively low in lactose, in populations with low or relatively low prevalence of lactose absorbers, is more consistently associated with protection against ischaemic heart disease than; are high intakes of unsaturated fatty acids, wine, alcohol or dietary fibre. In seven countries with a high consumption of dairy products (six at least with a high prevalence of lactose absorbers), trends in ischaemic heart disease mortality appear to have reflected changes in the supply of milk (and therefore of lactose), but not consistently of butter or inversely of unsaturated fatty acids. The findings reviewed in this paper call for further investigation of the subject, epidemiologically and biochemically.

Seidel, C., et al. (2005). "Effects of fat-modified dairy products on blood lipids in humans in comparison with other fats." Annals of Nutrition and Metabolism **49**(1): 42-48.

Background/Aim: Due to its high content of LDL-raising saturated fatty acids (SFA), milk fat has been considered to be hypercholesterolaemic, but it also contains fatty acids and other constituents which seem to have a hypocholesterolaemic effect. Milk fat was modified by feeding cows rapeseed cake, resulting in a reduced content of SFA and an increased content of unsaturated fatty acids. The objective of this study was to investigate the effects of modified milk fat (ModFat) on serum cholesterol fractions, triacylglycerides ( TAG) and lipoprotein( a) [ LP( a)], compared with regular milk fat (RegFat) and with soft margarine (Marg). Method: Fifteen women and 16 men were enrolled in the intervention study. Nine of the participants were hypercholesterolaemic. Nutrient intake parameters, serum lipids and LP( a) were determined. Results: The serum concentration of HDL cholesterol increased in the ModFat period, leading to a decreased LDL/HDL ratio in this period. The lowest LP( a) concentrations were measured at the end of the control phase and at the end of the ModFat period. A decreasing tendency of serum TAG concentration was observed in the ModFat period. Conclusion: The fat-modified milk seems to have positive effects on the LDL/HDL ratio and the LP( a) concentrations, both of which have been established as risk factors for coronary heart disease. Copyright (C) 2005 S. Karger AG, Basel.

Semma, M. (2002). "Trans fatty acids: Properties, benefits and risks." Journal of Health Science **48**(1): 7-13.

Trans fatty acids have several beneficial aspects for processed foods owing to their characteristic structures. These very characteristic structures, in turn, have been suspected to be associated with the possibility that traits fatty acids affect the development of several health problems, including coronary heart disease, and fetal and infant neurodevelopment and growth, and childhood allergies.

Seppanenlaakso, T., et al. (1992). "REPLACEMENT OF BUTTER ON BREAD BY RAPESEED OIL AND RAPESEED OIL-CONTAINING MARGARINE - EFFECTS ON PLASMA FATTY-ACID COMPOSITION AND SERUM-CHOLESTEROL." British Journal of Nutrition **68**(3): 639-654.

The effects of zero-erucic acid rapeseed oil and rapeseed oil-containing margarine on plasma fatty acid composition and serum cholesterol were studied in butter users (n 43). Compliance to the substitution was followed by fatty acid analysis of total plasma and plasma phospholipids. The amount of substitute fats represented, on average, 21 % of total fat and 8 % of total energy intake. Changes in the relative fatty acid composition of plasma phospholipids indicated further fatty acid metabolism, and were closely related to the serum cholesterol level. The reduction in saturated fatty acids led to a significant increase in the proportion of n-3 and n-6 polyunsaturated fatty acids (PUFA) with the rapeseed oil diet, whereas the margarine caused a significant rise in n-6 PUFA only. 'rhe increase in the proportions of the two PUFA families occurred in accordance with their competitive order, most completely with the rapeseed oil diet. When butter was replaced by rapeseed oil, low-density-lipoprotein-cholesterol decreased by an average of 9.1 % without a reduction in high-density-lipoprotein-cholesterol. During margarine substitution the reduction was 5.2 %, on average. Of the plasma phospholipids, alpha-linolenic acid and the linoleic:stearic acid ratio, but not oleic acid, were the components most significantly correlated with serum cholesterol levels or the decrease in these levels. The results show that rapeseed oil can act primarily as a source of essential fatty acids, rather than that of monoenes, in the diet of butter users.

Seppanenlaakso, T., et al. (1993). "REPLACEMENT OF MARGARINE ON BREAD BY RAPESEED AND OLIVE OILS - EFFECTS ON PLASMA FATTY-ACID COMPOSITION AND SERUM-CHOLESTEROL." Annals of Nutrition and Metabolism **37**(4): 161-174.

The effects of zero erucic acid rapeseed oil and olive oil on plasma fatty acid composition and serum cholesterol were studied in margarine users (n = 46). The replacement of margarine on bread by these oils accounted, on average, for 16% of the total fat and 7% of the total energy intake. Fatty acid analysis of total plasma indicated a dose-dependent rise in alpha-linolenic (alpha-LLA) and oleic acid (OA) levels during rapeseed and olive oil substitutions, respectively. Rapeseed oil substitution increased the proportion of eicosapentaenoic acid (0.4%-units, on average) in plasma phospholipids. A slight decrease in low-density lipoprotein cholesterol (LDL-C) and an increase in high-density lipoprotein cholesterol (HDLC, 4.5%, p < 0.01) led to a significantly higher HDL-C/total cholesterol (TC) ratio (1.9%-units). The results suggest a marked competitive effect for alpha-LLA, not only among plasma phospholipid fatty acids, but also in the relationships with serum lipids, since the changes in alpha-LLA, rather than in OA, were associated with those in LDL-C and the HDL-C/TC ratio. No competitive action of polyunsaturated acids comparable to rapeseed oil was found during olive oil substitution. In contrast to the rapeseed oil diet, the reduced proportion of linoleic acid (LA) in plasma phospholipids was not restored; this may be unfavorable if the habitual intake of LA is low. However, the effects on LDL-C levels were beneficial: the concentration decreased by 5.9% (p < 0.01), correlating inversely with the increase in OA. In addition, the concentration of HDL-C remained unchanged during olive oil substitution.

Serfontein, W. J., et al. (1985). "CORONARY HEART-DISEASE, VITAMIN-B6, ESSENTIAL FATTY-ACIDS AND MARGARINE." South African Medical Journal **67**(23): 918-918.

Shahin, A. M., et al. (2006). "Effects of margarine and butter consumption on distribution of trans-1 8 : 1 fatty acid isomers and conjugated linoleic acid in major serum lipid classes in lactating women." Lipids **41**(2): 141-147.

Trans FA (TFA) have at least one trans double bond and comprise several isomers and types, including many of the CLA (e.g., c9,t11-18:2 CLA). Some TFA may have adverse effects (e.g., cardiovascular disease), whereas some are thought to have beneficial effects (e.g., anticarcinogenicity). The presence of TFA in human tissues and fluids is related to dietary intake, although this relationship is not completely understood-especially in regard to serum lipid fractions. This study was conducted as part of an investigation designed to test the influence of butter (13), "low TFA" margarine (LT), and regular margarine (RM) on milk fat content. Here we tested the secondary hypothesis that consumption of B LT, and RM by lactating women would result in differential distribution of TFA and CLA in major serum lipid classes. Breastfeeding women (n = 11) participated in this randomized Latin-square study consisting of five periods: intervention 1 (5 d), washout i (7 d), intervention II (5 d), washout II (7 d), and intervention III (5 d). Extracted serum lipid was separated into cholesterol ester (CE), TAG, and phospholipid (PL) fractions and analyzed for total and isomeric TFA and CLA concentrations. Data indicate that TAG consistently contained the highest concentration of total t-18:1. No interaction between treatment and fraction was found for any of the t-18:1 isomers identified. Absolute concentration of each t-18:1 isomer was greatest during the RM period, regardless of fraction. On a relative basis, concentrations of t10-18:1 and t12-18:1 were most responsive to treatment in the CE fraction. The concentration of c9,t11-18:2 CLA was highest in the TAG fraction and lowest in the PL fraction, regardless of treatment. In summary, these results indicate (i) that there is a differential distribution of some isomeric TFA and CLA among human serum lipid fractions and (ii) that dietary TFA intake influences absolute and relative concentrations of some of the isomers in selected fractions.

Shankar, S., et al. (2007). "Chemoprevention by resveratrol: molecular mechanisms and therapeutic potential." Frontiers in Bioscience **12**: 4839-4854.

Resveratrol, a polyphenol found in numerous plant species, including mulberries, peanuts and grapes, has shown to possess chemopreventive properties against several cancers, and cardiovascular diseases. Recently, resveratrol has been shown to have positive effects on age longevity, lipid levels and a preventative quality against certain cancers and viral infections. Resveratrol induces apoptosis by up-regulating the expression of Bax, Bak, PUMA, Noxa, Bim, p53, TRAIL, TRAIL-R1/DR4 and TRAIL-R2/DR5 and simultaneously down-regulating the expression of Bcl-2, Bcl-XL, Mcl-1 and survivin. Resveratrol causes growth arrest at G1 and G1/S phases of cell cycle by inducing the expression of CDK inhibitors p21(/WAF1/CIP1) and p27(/KIP1). Resveratrol has also been shown to reduce inflammation via inhibition of prostaglandin production, cyclooxygenase-2 activity, and nuclear factor-kappa B activity. Modulation of cell signaling pathway by resveratrol explains its diverse bioactivities related with human health. Resveratrol also potentiates the apoptotic effects of cytokines, chemotherapeutic agents and gamma-radiation. Pharmacokinetic and pharmacodynamic studies demonstrated that the main target organs of resveratrol are liver and kidney, and it is metabolized by hydroxylation, glucuronidation, sulfation and hydrogenation. As a chemoprevention agent, resveratrol has been shown to inhibit tumor initiation, promotion, and progression. There is growing evidence that resveratrol can prevent or delay the onset of various cancers, heart diseases, ischemic and chemically induced injuries, pathological inflammation and viral infections. This review summarizes the molecular mechanisms of resveratrol and its clinical benefits for human diseases.

Shao, F. and D. A. Ford (2013). "Differential Regulation of ABCA1 and Macrophage Cholesterol Efflux by Elaidic and Oleic Acids." Lipids **48**(8): 757-767.

Trans fatty acid consumption is associated with an increased risk of coronary heart disease. This increased risk has been attributed to decreased levels of HDL cholesterol and increased levels of LDL cholesterol. However, the mechanism by which trans fatty acid modulates cholesterol transit remains poorly defined. ATP-binding cassette transporter A1 (ABCA1)-mediated macrophage cholesterol efflux is the rate-limiting step initiating apolipoprotein A-I lipidation. In this study, elaidic acid, the most abundant trans fatty acid in partially hydrogenated vegetable oil, was shown to stabilize macrophage ABCA1 protein levels in comparison to that of its cis fatty acid isomer, oleic acid. The mechanism responsible for the disparate effects of oleic and elaidic acid on ABCA1 levels was through accelerated ABCA1 protein degradation in cells treated with oleic acid. In contrast, no apparent differences were observed in ABCA1 mRNA levels, and only minor changes were observed in Liver X receptor/Retinoic X receptor promoter activity in cells treated with elaidic and oleic acid. Efflux of both tracers and cholesterol mass revealed that elaidic acid slightly increased ABCA1-mediated cholesterol efflux, while oleic acid led to decreased ABCA1-mediated efflux. In conclusion, these studies show that cis and trans structural differences in 18 carbon n-9 monoenoic fatty acids variably impact cholesterol efflux through disparate effects on ABCA1 protein degradation.

Shapiro, S. (1995). "TRANS FATTY-ACID AND CORONARY-DISEASE - THE DEBATE CONTINUES .2. CONFOUNDING AND SELECTION BIAS IN THE DATA." American Journal of Public Health **85**(3): 410-411.

Shapiro, S. (1997). "Do trans fatty acids increase the risk of coronary artery disease? A critique of the epidemiologic evidence." American Journal of Clinical Nutrition **66**: S1011-S1017.

On the basis of metabolic and epidemiologic data it has been claimed that trans fatty acid intake causes coronary artery disease (CAD), with greater than or equal to 30 000 deaths/y in the United States and a considerably greater number of nonfatal cases. The metabolic evidence is still controversial; the epidemiologic evidence is reviewed here. In most studies the likelihood that CAD ''caused'' margarine use, rather than the reverse, was not excluded. Uncontrolled confounding (particularly confounding by indication) was ubiquitous. Selection bias conditional on margarine use was common. The projection of 30 000 deaths/y is not justified. If the metabolic evidence, when fully evaluated, is deemed to be suggestive, then the question of whether trans fatty acids are indeed harmful to human populations will be resolved only by means of a randomized controlled trial.

Sharma, S., et al. (2008). "Dietary intake and development of a quantitative food-frequency questionnaire for a lifestyle intervention to reduce the risk of chronic diseases in Canadian First Nations in north-western Ontario." Public Health Nutrition **11**(8): 831-840.

Objective: To characterise the diet of First Nations in north-western Ontario, highlight foods for a lifestyle intervention and develop a quantitative food-frequency questionnaire (QFFQ). Design: Cross-sectional survey using single 24h dietary recalls. Setting. Eight remote and semi-remote First Nations reserves in north-western Ontario. Subjects: 129 First Nations (Oji-Cree and Ojibway) men and women aged between 18 and 80 years. Results: The greatest contributors to energy were breads, pasta dishes and chips (contributing over 20% to total energy intake). 'Added fats' such as butter and margarine added to breads and vegetables made Lip the single largest source of total fat intake (8.4%). The largest contributors to sugar were sugar itself, soda and other sweetened beverages (contributing over 45% combined). The mean number Of servings consumed of fruits, vegetables and dairy products were much lower than recommended. The mean daily meat intake was more than twice that recommended. A 119-item QFFQ was developed including seven bread items , five soups or stews, 24 meat- or fish-based dishes, eight rice or pasta dishes, nine fruits and 14 vegetables. Frequency of consumption was assessed by eight categories ranging from 'Never or less than one time in one month' to 'two or more times a day'. Conclusions: We were able to highlight foods for intervention to improve dietary intake based on the major sources of energy, fat and sugar and the low consumption Of fruit and vegetable items. The QFFQ is being used to evaluate a diet and lifestyle intervention in First Nations in north-western Ontario.

Sherazi, S. T. H., et al. (2009). "Application of transmission FT-IR spectroscopy for the trans fat determination in the industrially processed edible oils." Food Chemistry **114**(1): 323-327.

The amount of trans fatty acids (TFA) in fourteen industrially hydrogenated and deodorized oils was determined. To achieve better sensitivity 200 pm KCl cell was used in transmission Fourier transform infrared (FT-IR) spectroscopy. The results of transmission FT-IR spectroscopy were evaluated by gas chromatography (CC) with flame ionization detector (FID), and found to be comparable. All analyzed cooking oil samples had a lower trans content of 0.4-1.8%. Trans fatty acid contents of partially hydrogenated oil samples were relatively higher as comparable to those of the cooking oils. Among the samples examined, the highest level was found to be at 26.5% and 25.7% by the GC-FID and FT-IR spectroscopy, respectively. Due to harmful effects, high amounts of trans fatty acids in partially hydrogenated oils is an alarming issue for the consumer's health and quality control authorities. (C) 2008 Elsevier Ltd. All rights reserved.

Shrapnel, B. (2012). "Should trans fats be regulated?" Nutrition & Dietetics **69**(4): 256-259.

Aim: The aim of this paper is to critically assess recent calls for increased regulation to lower the level of trans fats in the Australian diet. Methods: Key milestones in the elucidation of the effects on trans fats on health were identified and reviewed. Trends in intakes of trans fats in Australia and factors affecting those trends were described and compared with those in Denmark, which has regulated to lower population intake of trans fats. Results: The scientific evidence demonstrating adverse effects of trans fats on human health is consistent and strong. Australian health authorities were quick to identify the potential risk of trans fats and communicate it to health professionals and the food industry. The response from the margarine industry resulted in large falls in the trans fat content of the Australian diet in the mid-1990s. A second wave of trans fat reduction across many foods categories has occurred subsequently. Total intake of trans fats in Australia is now low, half the upper limit recommended by the World Health Organization and lower than the intake in Denmark. Trans fats of industrial origin comprise just one-eighth of 1% of dietary energy. These falls in trans fat intake mirror the large falls that occurred in Denmark prior to regulation. Conclusions: The case for increased regulation to lower intake of trans fats in Australia cannot be sustained. The trans fat issue stands as a good example of self-regulation through collaboration between Australian health agencies, the food industry and the government.

Sialvera, T. E., et al. (2012). "Phytosterols supplementation decreases plasma small and dense LDL levels in metabolic syndrome patients on a westernized type diet." Nutrition Metabolism and Cardiovascular Diseases **22**(10): 843-848.

Background and aims: Several studies have observed a hypocholesterolemic effect of plant sterols in hypercholesterolemic patients on a balanced diet. The aim of this study was to examine the effect of phytosterol supplementation on risk factors of coronary artery disease in metabolic syndrome patients on a Westernized type diet. Methods and results: In a randomized placebo-controlled design 108 patients with metabolic syndrome were assigned to consume either 2 plant sterol-enriched yogurt mini drink which provided 4 g phytosterols per day, or a yogurt beverage without phytosterols (control). The duration of the study was 2 months and the patients in both groups followed their habitual westernized type diet and recording it on food diaries. Blood samples were drawn at baseline and after 2 months of intervention. After 2 months supplementation with phytosterols, a significant reduction in total cholesterol, LDL-cholesterol, small and dense LDL (sdLDL) levels, as well as, apoB and triglycerides concentrations were observed in the intervention group (P < 0.05) compared to the control group. In addition, phytosterol supplementation lowered serum total cholesterol by 15.9%, LDL-cholesterol by 20.3% and triglyceride levels by 19.1% (P = 0.02, P < 0.001 and P < 0.001, respectively), although the patients kept their habitual westernized type diet. No differences were observed in HDL cholesterol, apoA1, glucose, C-reactive protein, fibrinogen levels and blood pressure. Conclusions: Phytosterol supplementation improves risk factors of coronary artery disease even if the diet is a westernized type. (C) 2011 Elsevier B.V. All rights reserved.

Sigfusson, N., et al. (1991). "DECLINE IN ISCHEMIC-HEART-DISEASE IN ICELAND AND CHANGE IN RISK FACTOR LEVELS." British Medical Journal **302**(6789): 1371-1375.

Objective - To monitor trends in mortality and morbidity due to ischaemic heart disease and compare these with observed levels of risk factors from population surveys. Design - Analysis of trends in death rates from ischaemic heart disease in Iceland compared with expected rates computed from population surveys. Risk factor levels together with beta-factors obtained from Cox's regression analysis were used to compute expected death rates. Trends in morbidity due to acute myocardial infarction were assessed and secular trends in dietary consumption compared with trends in cholesterol concentrations. Setting - Reykjavik, Iceland (total population 250 000; over half the population live in Reykjavik). Subjects - 12 814 randomly selected residents in the Reykjavik area aged 45-64 (6623 men, 6191 women; 72% and 80% of those invited). Main outcome measures - Age adjusted rates of myocardial infarction and deaths from ischaemic heart disease. Expected risk from risk factor levels (smoking, total serum cholesterol concentration, systolic blood pressure) at each unique survey visit. Results - Mortality from ischaemic heart disease has decreased by 17-18% since 1970. During 1981-6 the myocardial infarction attack rate in men under 75 decreased by 23%. A decrease occurred in the level of all three major risk factors after 1968. The fall in the serum cholesterol concentration coincided with a reduction in consumption of dairy fat and margarine . The calculated reduction in risk for the age group 45-64 was about 35%, which was closely similar to the observed decrease in mortality due to ischaemic heart disease in that age group. Conclusion - The reduction in mortality from ischaemic heart disease was substantially due to a decreased incidence of myocardial infarction and could be attributed largely to the reduction in risk factors.

Siguel, E. N. and R. H. Lerman (1993). "TRANS-FATTY ACID PATTERNS IN PATIENTS WITH ANGIOGRAPHICALLY DOCUMENTED CORONARY-ARTERY DISEASE." American Journal of Cardiology **71**(11): 916-920.

The plasma trans-fatty acids of 47 patients with angiographically documented coronary artery disease were compared with those of 56 reference subjects using high-resolution capillary column gas-liquid chromatography to test the hypothesis that trans-fatty acid intake is a risk factor for cardiovascular disease. Individual and total trans-fatty acids were higher in patients than in reference subjects (1.38 vs 1.11% for total trans-fatty acids, p < 0.003; 0.40 vs 0.31% for palmitoleic acid trans, p < 0.001; and 0.28 vs 0.22% for linoleic acid trans, p < 0.007). High-density lipoprotein (HDL) cholesterol and HDL cholesterol/total cholesterol were negatively correlated (r = -0.29, p < 0.004; and r = -0.35, p < 0.001, respectively), whereas triglycerides, total cholesterol and low-density lipoprotein cholesterol were positively correlated (r = 0.47, p < 0.001; r = 0.22, p < 0.03; r = 0.20, p <0.05, respectively) with palmitoleic acid trans. The correlations were similar and significant for linoleic acid trans, but less strong for total transfatty acids (which is more difficult to measure and has greater variability). Saturated and transfatty acids and total cholesterol are positively associated, whereas HDL/total cholesterol and polyunsaturated fatty acids are negatively associated with coronary artery disease. These results are consistent with the hypothesis that dietary trans-fatty acids are a cardiovascular risk factor.

Siguel, E. N. and W. M. N. Ratnayake (1995). "TRANS-FATTY ACID PATTERNS IN PATIENTS WITH DEMONSTRATED CORONARY-ARTERY DISEASE." American Journal of Cardiology **75**(5): 424-424.

Silbernagel, G., et al. (2009). "The relationships of cholesterol metabolism and plasma plant sterols with the severity of coronary artery disease." Journal of Lipid Research **50**(2): 334-341.

Changes in the balance of cholesterol absorption and synthesis and moderately elevated plasma plant sterols have been suggested to be atherogenic. Measuring cholestanol, lathosterol, campesterol, and sitosterol, we investigated the relationships of cholesterol metabolism and plasma plant sterols with the severity of coronary artery disease (CAD) in 2,440 participants of the Ludwigshafen Risk and Cardiovascular health (LURIC) study. The coronary status was determined by angiography, and the severity of CAD was assessed by the Friesinger Score (FS). An increase in the ratio of cholestanol to cholesterol was associated with high FS (P = 0.006). In contrast, a high ratio of lathosterol to cholesterol went in parallel with low FS (P<0.001). Whereas the campesterol to cholesterol ratio significantly correlated with the FS (P = 0.026), the relationship of the sitosterol to cholesterol ratio with the FS did not reach statistical significance in the whole group. Increased campesterol, sitosterol, and cholestanol to lathosterol ratios were associated high FS (P<0.001). To conclude, there is a modest association of high cholesterol absorption and low cholesterol synthesis with an increased severity of CAD. An atherogenic role of plasma plant sterols themselves, however, seems unlikely in subjects without sitosterolaemia. - Silbernagel, G., G. Fauler, W. Renner, E. M. Landl, M. M. Hoffmann, B. R. Winkelmann, B. O. Boehm, and W. Marz. The relationships of cholesterol metabolism and plasma plant sterols with the severity of coronary artery disease. J. Lipid Res. 2009. 50: 334-341.

Silbernagel, G. and W. Marz (2008). "Plant sterols: Cardiovascular risk factors?" Laboratoriumsmedizin-Journal of Laboratory Medicine **32**(4): 209-218.

Plant sterols are commonly used as cholesterol lowering nutriceuticals. In subjects who regularly consume plant sterol enriched functional foods, plasma plant sterol concentration is modestly increased. Sitosterolemia, a very rare genetic disorder, is characterized by xanthomas and up to 100-fold elevation of plasma plant sterols. Because patients with sitosterolemia are at high risk to develop severe premature coronary artery disease, even modestly increased plasma plant sterols are suggested to be atherogenic. Thus, there is no consensus on the question if cardiovascular risk can be reduced by the use of plant sterol margarines. In addition to their efficacy to decrease plasma cholesterol, plant sterols together with other non-cholesterol sterols are important for the investigation of cholesterol metabolism. Analyzing plasma non-cholesterol sterols, cholesterol absorption from the intestine and endogenous cholesterol biosynthesis can be estimated. The present review offers an overview of the topic "Plant Sterols". In particular, the role of plant sterols and cholesterol metabolism in atherogenesis is discussed. We focus on cholesterol metabolism, sitosterolemia, and the use of plant sterols as cholesterol lowering agents. Furthermore, the significance of plasma plant sterol measurement is explained.

Silbernagel, G. and W. Marz (2008). "Plant sterols: cardiovascular risk factors?" Laboratoriumsmedizin-Journal of Laboratory Medicine **32**(4).

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Simojoki, M., et al. (2005). "Use of plant stanol ester margarine among persons with and without cardiovascular disease: Early phases of the adoption of a functional food in Finland." Nutrition Journal **4**.

Background: The plant stanol ester margarine Benecol(R) is a functional food that has been shown to lower effectively serum total and LDL-cholesterol. The purpose of this post-marketing study is to characterize users of plant stanol ester margarine with and without cardiovascular disease. Methods: A cohort of plant stanol ester margarine users was established based on a compilation of 15 surveys conducted by the National Public Health Institute in Finland between 1996-2000. There were 29 772 subjects aged 35-84 years in the cohort. The users of plant stanol ester margarine were identified by the type of bread spread used. Results: The plant stanol ester margarine was used as bread spread by 1332 (4.5%) subjects. Almost half (46%) of the users reported a history of cardiovascular disease. Persons with cardiovascular disease were more likely to use plant stanol ester margarine (8%) than persons without cardiovascular disease (3%). Users with and without cardiovascular disease seemed to share similar characteristics. In particular, they were elderly people with otherwise healthy life-styles and diet. They were less likely smokers, more likely physically active and less likely obese than nonusers. The users reported being in good or average health in general and having used cholesterol-lowering drugs. Conclusion: Plant stanol ester margarine seems to be used by persons for whom it was designed and in a way it was meant: as part of efforts for cardiovascular disease risk reduction.

Singh, R. B., et al. (1995). "Randomized, controlled trial of antioxidant vitamins and cardioprotective diet on hyperlipidemia, oxidative stress, and development of experimental atherosclerosis: The diet and antioxidant trial on atherosclerosis (DATA)." Cardiovascular Drugs and Therapy **9**(6): 763-771.

The effects of administration of guava and papaya fruit (100 g/day), vegetables, and mustard oil (5 g/day) (group A); antioxidant vitamins C (50 mg/day) and E (30 mg/day) plus betacarotene (10 mg/day) (group B); a high-fat (5-10 g/day) (group C); or a Low-fat (4-5 g/day) diet (group D) were compared over 24 diet weeks in a randomized fashion, while all groups of rabbits (five in each of four groups) received a hydrogenated fat diet (5-10 g/day) for a period of 36 weeks. After 12 weeks on the high-fat diet, each group of rabbits had an increase in blood lipoproteins. The fruit and vegetable-enriched prudent diet (group A) caused a significant decline in blood lipids at 24 and 36 weeks, whereas the lipid levels increased significantly in groups C and D. Group A also had a significant rise in vitamin E (2.1 Umol/l), C (10.5 Umol/l), A (0.66 Umol/l), and carotene (0.08 Umol/l) and a decrease in lipid peroxides (0.34 nmol/ml at 36 weeks, whereas the levels were unchanged in groups C and D. Group B rabbits had a significant and greater increase than group A in plasma vitamins E, C, A, and carotene; a rise in HDL cholesterol; and a greater decrease in lipid peroxides after 24 and 36 weeks of treatment. After stimulation of lipid peroxidation in all rabbits, 3 of 5 group C and 2 of 5 group D rabbits died due to coronary thrombosis, whereas in groups A and B there were no deaths, indicating that antioxidant therapy can provide protection against lipid peroxidation and free radical generation. Aortic lipids and sudanophilia, indicating atherosclerosis, were significantly higher in groups C and D than in groups A and B. Fatty streaks and atheromatous and fibrous plaques were noted in all the rabbits in groups C and D. Intimal fibrosis and medial degeneration were also present in the group C rabbits. While group A (36.4 +/- 4.4 mu m) and group B (37.1 +/- 4.2 rho m) rabbits had minimal coronary artery plaque sizes, group C (75.4 +/- 10.6 mu m) and group D rabbits (69.5 +/- 6.2 mu m) had significantly greater plaque sizes. Aortic plaque sizes were also greater in groups C and D than in groups A and B. It is possible that combined therapy with antioxidant vitamins C, E, and carotene, and a diet rich in antioxidants, could independently inhibit free radical generation and the development of atherosclerosis.

Singh, R. B., et al. (2000). "Effect of coenzyme Q10 on experimental atherosclerosis and chemical composition and quality of atheroma in rabbits." Atherosclerosis **148**(2): 275-282.

The effects of the administration of coenzyme Q10 (3 mg/kg per day) (group A, n = 10) and placebo (aluminum hydroxide, 3 mg/kg per day) (group B, n = 10) were compared over 24 weeks in a randomized, single-blind, controlled trial. There were two groups of rabbits receiving a trans fatty acid (TFA)-rich diet (5-8 g/day) for 36 weeks. Oxidized rabbit chow with vitamin C plus ferric chloride was administered for 4 weeks in all rabbits. Intervention with coenzyme Q10 after feeding of TFA-rich diet was associated with a significant decline in thiobarbituric acid reactive substances (TBARS), diene conjugates and malondialdehyde, and an increase in plasma levels of vitamin E in the coenzyme Q group compared to placebo group. These changes, which were indicators of a decrease in oxidative damage, were independent of lipid lowering. The aortic and coronary artery plaque sizes, coronary atherosclerosis index, aortic and coronary atherosclerosis scores were significantly lower in the coenzyme Q group than placebo group. Aortic and coronary plaque frequencies, as well as frequencies of ulceration. thrombosis or hemorrhage, and cracks and fissures, were also significantly lower in the coenzyme Q group, indicating a better duality of atheroma compared to those in the control group. Aortic cholesterol, triglycerides and sudanophilia were significantly lower and vitamin E significantly higher in the coenzyme Q group in comparison to the placebo group indicating that coenzyme Q10 can have beneficial effect on the chemical composition of atheroma. The findings suggest that antioxidant therapy with coenzyme Q10 may be used as an adjunct to lipid lowering for additional beneficial effects related to chemical composition and quality of atheroma independent of hypolipidemic agents. (C) 2000 Elsevier Science Ireland Ltd. All rights reserved.

Singh, R. B., et al. (1997). "Antioxidant effects of lovastatin and vitamin E on experimental atherosclerosis in rabbits." Cardiovascular Drugs and Therapy **11**(4): 575-580.

The effects of the administration of vitamin E (10 mg/day) plus lovastatin (2 mg/day; group A, n = 10), lovastatin alone (2 mg/day; group B, n = 10), and placebo (group C, n = 10) were compared over 24 weeks in a randomized, single-blind controlled trial. All groups of rabbits received a trans fatty acid (TFA)-rich diet (5-10 g/day) for 36 weeks. Treatment with vitamin E pins lovastatin (group A) and lovastatin (group B) started after 12 week of administration of TFA-rich diet was associated with a significant but similar decline in serum cholesterol, low-density lipoprotein (LDL) cholesterol, and triglycerides in both groups at 36 weeks. Lipid peroxides and diene conjugates showed a significant decline in association with a significant increase in the plasma level of vitamin E in group A rabbits at 36 weeks. However, the lovastatin group B showed a lesser but significant decrease in Lipid peroxides and diene conjugates at 36 weeks, indicating that lovastatin may have antioxidant activity. In control group C, the increase in blood Lipids and oxidative stress at 36 weeks was much greater than the decrease in groups A and 11. After experimental lipid peroxidation at 24 weeks in all of the rabbits, 2 of 10 group B and 3 of 10 group C rabbits died due to coronary thrombosis; there were no deaths in group A. Thus antioxidant therapy with vitamin E can provide protection against death due to free radical stress. Aortic Lipids and sudanophilia indicating athorosclorosis were significantly lower in groups A and B than in group C. The atherosclerotic coronary plaque sizes were significantly smaller in group A (18.5 +/- 3.6 mu m) than in groups B (41.6 +/- 4.2 mu m) and C (85 +/- 6.7 mu m). Aortic plaque sizes were also smaller in group A than in group B and C. It is possible that antioxidant therapy with vitamin E, as an adjunct to lipid lowering with lovastatin, can provide additional benefit in the inhibition of oxidative stress and atherosclerosis. The antioxidant activity of lovastatin has not been reported, to our knowledge.

Sioen, I., et al. (2008). "Fish consumption is a safe solution to increase the intake of long-chain n-3 fatty acids." Public Health Nutrition **11**(11): 1107-1116.

Objectives: Dietary intake of long-chain (LC) n-3 PUFA in developed countries is low compared with recommendations. Fish is naturally rich in LC n-3 PUFA, but is also a dietary source of heavy metals and organic pollutants. We investigated whether the recommendation for LC n-3 PUFA could be reached through fish consumption, without exceeding the provisional tolerable weekly intake of methylmercury (MeHg) and the tolerable weekly intake (TWI) of dioxin-like compounds. Also, the contribution of margarines enriched with LC n-3 PUFA was assessed. Design: Published nutrient and contaminant data were used in a probabilistic model to calculate the simultaneous nutrient and contaminant intake for different fish consumption scenarios. Results: The Belgian recommendation for EPA + DHA (0.3% of total energy intake) can be reached by consuming fatty fish a minimum of twice a week, or by varying between lean and fatty fish a minimum of three times a week. At this fish consumption level, MeHg intake is not an issue of toxicological concern. The intake of dioxin-like compounds approximates the TWI when consuming fatty fish more than twice a week, this being a potential toxicological risk because other food items also contribute to the weekly intake of dioxin-like compounds. Use of margarine enriched with LC n-3 PUFA can help to increase LC n-3 intake, on average by 159 mg/d. Conclusions: Combination of regular fish consumption (twice a week) with important contribution of fatty fish species, in combination with regular consumption of margarine enriched with EPA + DHA, can be advised to achieve the recommendation for LC n-3 intake.

Sioen, I., et al. (2006). "Effects of pan-frying in margarine and olive oil on the fatty acid composition of cod and salmon." Food Chemistry **98**(4): 609-617.

Effects on the fatty acid composition of cod (Gadus morhua) and salmon fillets (Salmo salar) after pan-frying in margarine and olive oil were determined. The fatty acids of the margarine used were 55.5% saturated (SFA), 33.0% mono-unsaturated (MUFA) and 11.5% polyunsaturated (PUFA). The olive oil used contained 15.4% SFA, 76.1% MUFA and 8.5% PUFA. Using margarine or olive oil increased the SFA and MUFA percentages, respectively, in both species. For cod fillets (lean), pan-frying increased the fat content (0.55-4.15 g/100 g and 0.55-2.30 g/100 g before and after pan-frying, with margarine and olive oil, respectively), whereas, for salmon fillets (fat), it decreased (13.91 to 10.57 g/100 g and 15.35 to 12.95 g/100 g before and after pan-frying with margarine and olive oil, respectively). In conclusion, the culinary fat selection affects the total fatty acid content and composition of the prepared fish fillet. (c) 2005 Elsevier Ltd. All rights reserved.

Sioen, I., et al. (2007). "n-6 and n-3 PUFA intakes of pre-school children in Flanders, Belgium." British Journal of Nutrition **98**(4): 819-825.

In this study, the intake of n-6 and n-3 PUFA of pre-school children in Flanders, Belgium, was evaluated, and recommendations to address the very low intake of long-chain PUFA are presented. Food consumption data (based on parentally reported 3 d dietary records obtained from October 2002 to February 2003) of 661 children (338 boys, 323 girls) between 2.5 and 6.5 years of age and the PUFA concentrations obtained from various food composition databases were used. The actual PUFA intake levels were compared to Belgian, European and American recommendations. Only the intake of linoleic acid (LA) fell within the recommended ranges. Margarine, bread, biscuits and chocolate products contributed most to LA intake. The intake of alpha-linolenic acid (LNA) was low compared to the recommendations and was obtained mostly from the consumption of margarines and fatty sauces. This resulted in a high LA/LNA ratio. The intake of all long-chain PUFA was far below the recommended levels. Meat and meat products were the most important sources of arachidonic acid. Consumption of fish and other seafood was very low, though these were the most important sources of long-chain n-3 PUFA. In conclusion, Flemish pre-school children should consume more n-3-rich products in order to increase their LNA intake and decrease their LA/LNA ratio. Furthermore, the replacement of meat products rich in SFA by poultry would increase the arachidonic acid intake. As well, fatty fish consumption needs to be increased, as it is a rich source of long-chain n-3 PUFA.

Sioen, I., et al. (2007). "Importance of seafood as nutrient source in the diet of Belgian adolescents." Journal of Human Nutrition and Dietetics **20**(6): 580-589.

Background Regular seafood consumption is recommended in dietary guidelines. The aim of this study was to investigate the importance of seafood as a nutrient source in adolescents' diet and the extent to which seafood consumption can increase the intake of omega-3 polyunsaturated fatty acids and vitamin D. Methods Consumption data recorded during seven consecutive days for 341 adolescents selected in Ghent (Belgium) were used to estimate the intake of vitamin D, linoleic (LA), alpha-linolenic (LNA), arachidonic (AA), eicosapentaenoic (EPA), docosapentaenoic (DPA) and docosahexaenoic (DHA) acid. Results The adolescents consumed on average 3.21 mu g/day vitamin D, 11.7 g/day LA and 1.4 g/day LNA. The mean intakes of AA, EPA, DPA and DHA were 83.2, 55.9, 18.4 and 111.4 mg/day respectively. The major source of vitamin D was fortified margarine. Fats and oils were the main sources for LA and LNA. The intake of AA was mainly contributed by meat, poultry and eggs. Fish and seafood contributed for 84.1%, 59.3% and 64.4% respectively for EPA, DPA and DHA. Conclusion Flemish adolescents would benefit from increased seafood consumption, as this would lead to a higher intake of EPA and DHA as well as of vitamin D. Moreover, replacement of foods rich in saturated fat (SFA) by seafood products can help to reduce SFA intake.

Sirnojoki, M., et al. (2004). "Consistency of use of plant stanol ester margarine in Finland." Public Health Nutrition **7**(1): 63-68.

Objective: The aims of this study were to investigate the consistency of use of plant stanol ester margarine and to characterise consistent and inconsistent users. Design: A cohort of plant stanol ester margarine users was established based on 14 national surveys conducted by the National Public Health Institute in Finland between 1996 and 1999. A follow-up study questionnaire was developed and sent to 1294 users in 2000. Setting: Subjects who reported using plant stanol ester margarine in both the original survey and the follow-up study were classified as consistent users, and the rest as inconsistent users. Subjects: The study population consisted of 1094 subjects aged 18-87 years, 590 men and 504 women. Results: There were 357 (33%) consistent and 737 (67%) inconsistent users of plant stanol ester margarine in the study population. Consistent users were more likely to be men and to have a higher household income than inconsistent users. Both consistent and inconsistent users were predominantly middle-aged persons with a healthy lifestyle and diet as well as a history of cardiovascular disease. Healthfulness was the main factor affecting bread spread choice among 94% of the consistent users and 59% of the inconsistent users. Conclusions: The use of plant stanol ester margarine is more often inconsistent than consistent. There is nevertheless a relatively large subgroup of long-term users of plant stanol ester margarine. It is important to examine the health effects especially among these regular users.

Sirtori, C. R., et al. (2007). "Nutritional and nutraceutical considerations for dyslipidemia." Future Lipidology **2**(3): 313-339.

Improved nutritional habits are a major target in the treatment of dyslipidemias and atherosclerosis prevention. A number of newer approaches have been developed in the last few years, leading to a better knowledge of nutrients as well as of novel functional foods, supplements or nutraceuticals, which may provide an alternative to lipid-lowering drugs. Functional foods are fortified or enriched products with potential health benefits, whereas nutraceuticals can be defined as diet supplements that deliver a presumed bioactive food component in a nonfood matrix. Specific areas of current interest are those of dietary proteins with specific effects on cholesterolemia, also leading to the identification of absorbable peptides and changes in fat intake, resulting in a larger consumption of monounsaturated fatty acids. Both approaches represent an improvement compared with the classical method based on a low-lipid intake. Relevant nutraceuticals include plant sterols/stanols for cholesterol reduction and polyphenols with an attractive capacity to reduce lipoprotein oxidation, platelet aggregability and thromboxane formation. In addition, new soluble fibers, fish oil and Chinese red-rice have provided significant lessons on the potential use of nutraceuticals in cardiovascular disease prevention. Long-term studies show that a 32 mg/dl serum cholesterol difference can lead to an estimated 18% cardiovascular risk reduction.

Sirtori, C. R., et al. (2009). "Functional foods for dyslipidaemia and cardiovascular risk prevention." Nutrition Research Reviews **22**(2): 244-261.

A food can be regarded as 'functional' if it can demonstrate a beneficial efficacy on one or more target functions in the body in a convincing way. Beyond adequate nutritional qualities, functional foods should either improve the state of health and wellbeing and/or reduce the risk of disease. Functional foods that are marketed with claims of heart disease reduction focus primarily on the major risk factors, i.e. cholesterol, diabetes and hypertension. Some of the most innovative products are designed to be enriched with 'protective' ingredients, believed to reduce risk. They may contain, for example, soluble fibre (from oat and psyllium), useful both for lowering cholesterol and blood pressure, or fructans, effective in diabetes. Phytosterols and stanols lower LDL-cholesterol in a dose-dependent manner. Soya protein is more hypocholesterolaemic in subjects with very high initial cholesterol and recent data indicate also favourable activities in the metabolic syndrome. n-3 Fatty acids appear to exert significant hypotriacylglycerolaemic effects, possibly partly responsible for their preventive activity. Dark chocolate is gaining much attention for its multifunctional activities, useful both for the prevention of dyslipidaemia as well as hypertension. Finally, consensus opinions about tea and coffee have not emerged yet, and the benefits of vitamin E, garlic, fenugreek and policosanols in the management of dyslipidaemia and prevention of arterial disease are still controversial.

Skeaff, C. M. (2009). "Feasibility of recommending certain replacement or alternative fats." European Journal of Clinical Nutrition **63**: S34-S49.

Expert groups and public health authorities recommend that trans-fatty acid (TFA) intakes from industrially produced partially hydrogenated vegetable oils (PHVOs) should be less than 1% of total energy intake. The starting point for any regulatory or nonregulatory response to this recommendation is to assess the extent of the problem by determining where in the food supply TFAs are found and the amounts consumed in the population. Unfortunately, this is a particularly difficult task using traditional methods of dietary assessment inasmuch as food composition databases with TFA data are either nonexistent or incomplete in most countries. Current evidence on estimates of intake suggests there is high variability in TFA intakes and their food sources between countries. The ubiquitous presence of PHVOs in the global food supply in bakery products, deep-fried foods, snack foods, confectionery products and table spreads attests to their commercial value and convenience. However, their common use is more the result of historical convenience from an industry infrastructure developed over 50 years based on efficient, cost-effective hydrogenation of vegetable oils rather than any inherent sensory or physical superiority of the hydrogenated fats over purpose-made zero-trans fats and oils. Current global supply of appropriate zero-trans replacement fats high in cis-unsaturated fatty acids is insufficient to meet the demand if all PHVOs in the food supply were replaced. Regulatory action needs to be coordinated with supply to maximize the opportunity for health gains by replacing partially hydrogenated fats with purpose-ready zero-trans vegetable oils low in saturates and high in cis-unsaturates rather than animal fats and tropical oils high in saturated fatty acids. European Journal of Clinical Nutrition (2009) 63, S34-S49; doi:10.1038/sj.ejcn.1602974

Skeaff, C. M. and S. Gowans (2006). "Home use of margarine is an important determinant of plasma trans fatty acid status: a biomarker study." British Journal of Nutrition **96**(2): 377-383.

The contribution of the home use of margarines, made with partially hydrogenated vegetables oils, to total trans fatty acid intake is difficult to determine using dietary assessment because food composition databases are incomplete for trans fatty acids; moreover, hidden fats in manufactured foods may be the predominant sources of trans fatty acids. The objective of our study was to determine, using plasma phospholipid trans fatty acid composition as a surrogate measure of exposure, whether the home use of margarine or butter is an important determinant of trans fatty acid status. We conducted a community-based (Dunedin, New Zealand), cross-sectional survey of people who consumed either margarine (n 65) or butter (n 64) but not both for home use. The levels of the 18 : 1 trans isomers commonly found in partially hydrogenated vegetable oils were all significantly higher in the plasma phospholipids of margarine compared with butter consumers, with the exception of 18 : 1n-7t, which did not differ. Among margarine consumers, the percentage of total fat from margarine was significantly correlated with levels of phospholipid 18 : 1n-6t, 18 : 1n-8t and 18 : 1n-12/9t isomers (r 0 center dot 57-0 center dot 63, P < 0 center dot 001) but only weakly with 18 : 1n-7t (r 0 center dot 30, P=0 center dot 016). The intake of fat from fast foods, bakery products or meat and meat products was not associated with plasma phospholipid trans isomeric composition. The home use of margarine, made with partially hydrogenated vegetable oils, is an important determinant of trans fatty acid exposure in New Zealand.

Skilton, M. R., et al. (2012). "Impaired Fetal Growth and Arterial Wall Thickening: A Randomized Trial of Omega-3 Supplementation." Pediatrics **129**(3): E698-E703.

OBJECTIVES: Impaired fetal growth is an independent cardiovascular risk factor and is associated with arterial wall thickening in children. No preventive strategy has been identified. We sought to determine whether dietary omega-3 fatty acid supplementation during early childhood prevents the association between impaired fetal growth and carotid arterial wall thickening. METHODS: The Childhood Asthma Prevention Study was a randomized, controlled single-blind trial in 616 children born at term, recruited antenatally from maternity hospitals in Sydney. Participants were randomized to either a 500-mg-daily fish oil supplement and canola-based margarines and cooking oil (omega-3 group), or a 500-mg-daily sunflower oil supplement and omega-6 fatty acid-rich margarines and cooking oil (control group), from the start of bottle-feeding or 6 months of age until 5 years of age. Carotid intima-media thickness (IMT), a noninvasive measure of subclinical atherosclerosis, was the primary endpoint of a cardiovascular substudy (CardioCAPS) at age 8 years. We examined the association of fetal growth with carotid IMT in children with birth weight <90th percentile (omega-3 group [n = 187], control group [n = 176]). RESULTS: In the control group, fetal growth was inversely associated with carotid IMT, but this was prevented in the omega-3 group (difference between groups of 0.041 mm [95% confidence interval 0.006, 0.075] per kg birth weight, adjusted for gestational age and gender, P-heterogeneity = .02). CONCLUSIONS: The inverse association of fetal growth with arterial wall thickness in childhood can be prevented by dietary omega-3 fatty acid supplementation over the first 5 years of life. Pediatrics 2012; 129: e698-e703

Slimani, N., et al. (2009). "Contribution of highly industrially processed foods to the nutrient intakes and patterns of middle-aged populations in the European Prospective Investigation into Cancer and Nutrition study." European Journal of Clinical Nutrition **63**: S206-S225.

Objectives: To describe the contribution of highly processed foods to total diet, nutrient intakes and patterns among 27 redefined centres in the 10 countries participating in the European Prospective Investigation into Cancer and Nutrition (EPIC). Methods: Single 24-hour dietary recalls were collected from 36 034 individuals (aged 35-74 years) using a standardized computerized interview programme (EPIC-SOFT). Centre-specific mean food intakes (g/day) were computed according to their degree of food processing (that is, highly, moderately and non-processed foods) using a specifically designed classification system. The contribution (%) of highly processed foods to the centre mean intakes of diet and 26 nutrients (including energy) was estimated using a standardized nutrient database (ENDB). The effect of different possible confounders was also investigated. Results: Highly processed foods were an important source of the nutrients considered, contributing between 61% (Spain) and 78-79% (the Netherlands and Germany) of mean energy intakes. Only two nutrients, beta-carotene (34-46%) and vitamin C (28-36%), had a contribution from highly processed foods below 50% in Nordic countries, in Germany, the Netherlands and the United Kingdom, whereas for the other nutrients, the contribution varied from 50 to 91% (excluding alcohol). In southern countries (Greece, Spain, Italy and France), the overall contribution of highly processed foods to nutrient intakes was lower and consisted largely of staple or basic foods (for example, bread, pasta/rice, milk, vegetable oils), whereas highly processed foods such as crisp bread, breakfast cereals, margarine and other commercial foods contributed more in Nordic and central European centres. Conclusions: Highly industrially processed foods dominate diets and nutrient patterns in Nordic and central European countries. The greater variations observed within southern countries may reflect both a larger contribution of non/moderately processed staple foods along with a move from traditional to more industrialized dietary patterns. European Journal of Clinical Nutrition (2009) 63, S206-S225; doi: 10.1038/ejcn.2009.82

Slimani, N., et al. (2002). "Diversity of dietary patterns observed in the European Prospective Investigation into Cancer and Nutrition (EPIC) project." Public Health Nutrition **5**(6B): 1311-1328.

Objective.. To describe the diversity in dietary patterns existing across centres/regions participating in the European Prospective Investigation into Cancer and Nutrition (EPIC). Design and setting.. Single 24-hour dietary recall measurements were obtained by means of standardised face-to-face interviews using the EPIC-SOFT software. These have been used to present a graphic multi-dimensional comparison of the adjusted mean consumption of 22 food groups. Subjects: In total, 35 955 men and women, aged 35-74 years, participating in the EPIC nested calibration study. Results.. Although wide differences were observed across centres, the countries participating in EPIC are characterised by specific dietary patterns. Overall, Italy and Greece have a dietary pattern characterised by plant foods (except potatoes) and a lower consumption of animal and processed foods, compared with the other EPIC countries. France and particularly Spain have more heterogeneous dietary patterns, with a relatively high consumption of both plant foods and animal products. Apart from characteristics specific to vegetarian groups, the UK 'health-conscious' group shares with the UK general population a relatively high consumption of tea, sauces, cakes, soft drinks (women), margarine and butter. In contrast, the diet in the Nordic countries, The Netherlands, Germany and the UK general population is relatively high in potatoes and animal, processed and sweetened/refined foods, with proportions varying across countries/centres. In these countries, consumption of vegetables and fruit is similar to, or below, the overall EPIC means, and is low for legumes and vegetable oils. Overall, dietary patterns were similar for men and women, although there were large gender differences for certain food groups. Conclusions: There are considerable differences in food group consumption and dietary patterns among the EPIC study populations. This large heterogeneity should be an advantage when investigating the relationship between diet and cancer and formulating new aetiological hypotheses related to dietary patterns and disease.

Sluik, D., et al. (2014). "Lifestyle factors and mortality risk in individuals with diabetes mellitus: are the associations different from those in individuals without diabetes?" Diabetologia **57**(1): 63-72.

Aims/hypothesis Thus far, it is unclear whether lifestyle recommendations for people with diabetes should be different from those for the general public. We investigated whether the associations between lifestyle factors and mortality risk differ between individuals with and without diabetes. Methods Within the European Prospective Investigation into Cancer and Nutrition (EPIC), a cohort was formed of 6,384 persons with diabetes and 258,911 EPIC participants without known diabetes. Joint Cox proportional hazard regression models of people with and without diabetes were built for the following lifestyle factors in relation to overall mortality risk: BMI, waist/height ratio, 26 food groups, alcohol consumption, leisure-time physical activity, smoking. Likelihood ratio tests for heterogeneity assessed statistical differences in regression coefficients. Results Multivariable adjusted mortality risk among individuals with diabetes compared with those without was increased, with an HR of 1.62 (95% CI 1.51, 1.75). Intake of fruit, legumes, nuts, seeds, pasta, poultry and vegetable oil was related to a lower mortality risk, and intake of butter and margarine was related to an increased mortality risk. These associations were significantly different in magnitude from those in diabetes-free individuals, but directions were similar. No differences between people with and without diabetes were detected for the other lifestyle factors. Conclusions/interpretation Diabetes status did not substantially influence the associations between lifestyle and mortality risk. People with diabetes may benefit more from a healthy diet, but the directions of association were similar. Thus, our study suggests that lifestyle advice with respect to mortality for patients with diabetes should not differ from recommendations for the general population.

Smahelova, A., et al. (2005). "Effect of atorvastatin on non-cholesterol sterols in patients with type 2 diabetes mellitus and cardiovascular disease." Pharmacological Research **51**(1): 31-36.

An increased risk of cardiovascular morbidity and mortality in diabetes mellitus type 2 has been associated with disturbances of lipid homeostasis. Recently, decreased intestinal absorption of cholesterol and increased liver cholesterol production have been reported. To investigate the influence of cholesterol lowering therapy using statin on cholesterol turnover in diabetes mellitus type 2, the levels of non-cholesterol based sterols were studied. One hundred and thirty five patients with type 2 diabetes and non-diabetic controls with cardiovascular diseases were studied. Both groups were divided into two subgroups: treated with atorvastatin and without statin therapy. The diabetics showed significantly higher levels of lathosterol (6.97 mumol l(-1) versus 5.11 mumol l(-1),p = 0.012) and lower levels of sitosterol (5.03 mumol l(-1) versus 8.98 mumol l(-1) p < 0.001) and campesterol (6.35 mumol l(-1) versus 9.80 mumol l(-1), p < 0.001). Non-diabetics showed no significant differences in non-cholesterol based sterols in relation to atorvastatin therapy. A significantly lower level of lathosterol as well as a decrease in lathosterol/cholesterol ratio in the statin treated groups was found in diabetics (4.11 mumol l(-1) versus 7.83 Rmol I`, p < 0.001). The results based on ANOVA analysis show that the effect of atorvastatin on the lathosterol level is more pronounced in diabetics. Regression analysis showed the relationship between increased triglycerides levels and the increase in cholesterol synthesis. The calculated regression model for log lathosterol in diabetics has the following form: log(lathosterol) = 2.76 - 0.52-statin + 0. 22 -cholesterol (ANOVA,p < 0.001, R-2 = 34%, p = 0.005 for statin, p < 0.001 for cholesterol). We conclude that in spite the total cholesterol level in diabetics type 2 is not increased, its endogenous synthesis is enhanced. Our results show that the diabetics type 2 with increased serum lathosterol and expressed metabolic syndrome (mild increase of triglycerides) might represent a suitable group for intensive treatment with statins. (C) 2004 Elsevier Ltd. All rights reserved.

Smit, L. A., et al. (2010). "trans-Fatty Acid Isomers in Adipose Tissue Have Divergent Associations with Adiposity in Humans." Lipids **45**(8): 693-700.

The aim of this study was to evaluate the association between adipose tissue trans-fatty acid isomers and adiposity. This cross-sectional study included 1,785 subjects from Costa Rica. Fatty acid concentrations (as a percentage of the total fatty acids) in subcutaneous adipose tissue were assessed by gas-liquid chromatography. Dietary intakes were assessed with a food frequency questionnaire. Multivariate linear regression models were used to relate adipose tissue trans-fatty acid content to BMI, waist circumference, and skinfold thickness while adjusting for age, sex, and area of residence. To account for variations in lifestyle, we adjusted for smoking, physical activity, income, self-reported history of diabetes and hypertension, and for adipose tissue alpha-linolenic acid and energy intake in a third model. After adjustments, positive associations were found between 18:2t-fatty acids (primarily from partially hydrogenated oils) and BMI, waist circumference, and skinfold thickness (P for each association < 0.01). Rumenic acid was positively associated with skinfold thickness (P < 0.0001), but not with BMI or waist circumference (P > 0.05). Inverse associations were found between 16:1n-7t-fatty acids and skinfold thickness and between 18:1t-fatty acids and BMI and waist circumference (P < 0.0001). This study suggests that individual trans-fatty acid isomers may have divergent effects on adiposity. 18:2t-fatty acids show consistent positive associations with measures of adiposity. These isomer-specific associations are an interesting new finding. Other prospective and intervention studies are necessary to examine these relationships further.

Smith, B. K., et al. (2009). "Trans-fatty acids and cancer: a mini-review." British Journal of Nutrition **102**(9): 1254-1266.

The association between traps-fatty acids (TFA) and cancer risk is poorly understood and remains controversial. It is recognised that unique biological effects are associated with specific isoforms within families of fatty acids such as those belonging to the n-3 fatty acids. Furthermore, the interactions between diet and genetic polymorphisms are increasingly recognised for their potential risk-modifying effects on human health and disease. Therefore, the aim of the present review is to evaluate whether specific TFA isomers and genetic polymorphisms differentially modify cancer risk in prostate, colon and breast cancers in animal and human models. Potential mechanisms of action by which TFA may affect cancer development are also reviewed. Overall, across a number of experimental models and human studies, there is insufficient and inconsistent evidence linking specific TFA isomers to cancers of the prostate, colon and breast. A number of methodological limitations and experimental considerations were identified which may explain the inconsistencies observed across these studies. Therefore, further research is warranted to accurately assess the relationship between TFA and cancer risk.

Soares-Miranda, L., et al. (2012). "Trans-Fatty Acid Consumption and Heart Rate Variability in 2 Separate Cohorts of Older and Younger Adults." Circulation-Arrhythmia and Electrophysiology **5**(4): 728-738.

Background-Trans-fatty acid (TFA) consumption is associated with risk of coronary heart disease, and trans-18:2, but not trans-18:1, in red blood cell membranes has been associated with sudden cardiac arrest. Abnormal heart rate variability (HRV) reflects autonomic dysfunction and predicts cardiac death. Relationships between TFA consumption and HRV remain understudied. We determined whether total TFA consumption, as well as trans-18:1 and trans-18:2 TFA consumption, was independently associated with HRV in 2 independent cohorts in the United States and Portugal. Methods and Results-In 2 independent cohorts of older US adults (Cardiovascular Health Study [CHS], age 72 +/- 5 years, 1989/1995) and young Portuguese adults (Porto, age 19 +/- 2 years, 2008/2010), we assessed habitual TFA intake by food frequency questionnaires in CHS (separately estimating trans-18:1 and trans-18:2) and multiple 24-hour recalls in Porto (estimating total TFA only, which in a subset correlated with circulating trans-18:2 but not trans-18:1, suggesting that we captured the former). HRV was assessed using 24-hour Holters in CHS (n=1076) and repeated short-term (5-minute) ECGs in Porto (n=160). We used multivariate-adjusted linear regression to relate TFA consumption to HRV cross-sectionally (CHS, Porto) and longitudinally (CHS). In CHS, higher trans-18:2 consumption was associated with lower 24-hour SD of all normal-to-normal intervals both cross-sectionally (-12%; 95% CI, -19% to -6%; P=0.001) and longitudinally (-15%; 95% CI, -25% to -4%; P=0.009) and lower 24-hour SD of 5-minute average N-N intervals and mean of the 5-minute SD of N-N intervals calculated over 24 hours (P<0.05 each). Higher trans-18: 1 consumption in CHS was associated with more favorable 24-hour HRV in particular time-domain indices (24-hour SD of all normalto-normal intervals, SD of 5-minute average N-N intervals, mean of the 5-minute SD of N-N intervals calculated over 24 hours; P<0.05 each). In Porto, each higher SD TFA consumption was associated with 4% lower 5-minute 24-hour SD of all normal-to-normal intervals (95% CI, -8% to -1%; P=0.04) and 7% lower 5-minute square root of the mean of the squares of successive N-N differences (95% CI, -13% to -1%; P=0.04). Conclusions-Trans-18:2 consumption is associated with specific, less favorable indices of HRV in both older and young adults. Trans-18:1 consumption is associated with more favorable HRV indices in older adults. Our results support the need to investigate potential HRV-related mechanisms, whereby trans-18:2 may increase arrhythmic risk. (Circ Arrhythm Electrophysiol. 2012;5:728-738.)

Soderberg, L., et al. (2009). "The effects of lipophilic substances on the shape of erythrocytes demonstrated by a new in vitro-method." European Journal of Pharmaceutical Sciences **36**(4-5): 458-464.

Low aqueous solubility of lipophilic agents, such as free fatty acids, hampers proper in vitro demonstration of biological effects, yielding an ambiguous in vitro-in vivo correlation. We have therefore developed a method for evaluating the acute effects of lipophilic substances on the shape of erythrocytes and estimated EC(50) and Hill coefficient according to the sigmoidal Em model. The test substance dissolved in medium-chain triglyceride is coated on a polycarbonate slide which serves as a cover sheet of a Burker chamber. Freshly collected finger-tip blood is diluted with autologous EDTA-plasma and introduced into the chamber. After 10 min at 37 degrees C, the cells are photographed under microscope and the fractions of normal and defect cells are evaluated. No staining is needed and the cells are kept viable during the test period. With increasing chain length, fatty acids, aliphatic amines and alcohols all increased the fraction of defect erythrocytes in a concentration-dependent manner. The results indicate that several fatty acids are very potent in their acute actions on erythrocytes, and that this effect is due to chain length rather than conformation. Conclusion: The technique offers a screening method for testing the harmful effects of small amounts of lipophilic substances on erythrocytes. (c) 2008 Elsevier B.V. All rights reserved.

Sofi, F., et al. (2009). "Dietary intake of trans fatty acids as a cardiovascular risk factor in a population of Italian teenagers." Cardiology in the Young **19**(6): 589-593.

Trans fatty acids are unsaturated fatty acids produced by the partial hydrogenation of polyunsaturated oils. Over the last few years, an increasing interest on these fatty acids has been shown because of their role in the pathogenesis of cardiovascular diseases. To date, major scientific associations strongly recommend consuming a low intake of trans fatty acids for the prevention of cardiovascular diseases, but data on the consumption of these fatty acids in the general population are still lacking. We conducted this observational study on a population of Italian teenagers in order to evaluate the consumption of trans fatty acids in the diet. We studied 81 Italian teenagers, 45 males and 36 females, with a median age of 16 years. To assess their consumption of trans fatty acids, we used the "High School Survey'', a questionnaire prepared by the Harvard Medical School. Total calories of the studied population were 2359.2 +/- 591.5 kcal/day with a mean intake of trans fatty acids of 3.24 +/- 1.48 g/day, corresponding to 1.23% of the total energy. A relevant proportion of subjects, namely 51 (62.9%), exceeded the limit contribution of 1% of energy from trans fatty acids. Their intake of total calories and trans fatty acids significantly increased according to their increasing age (p = 0.0003 for trend). Our data, therefore, obtained in a limited population of Italian adolescents, showed that a consistent proportion of adolescents does not follow the nutritional recommendations for intake of trans fatty acids, likely increasing their risk of cardiovascular diseases.

Somerset, S., et al. (1996). "Quality and safety aspects of deepfryer oils in takeaway food outlets." Food Australia **48**(12): 559-562.

Takeaway food is a significant contributor to dietary fat intake in Australia. The deepfryer is an important appliance in Australian takeaway food outlets. If deepfryer oils are not managed appropriately, undesirable breakdown products accumulate. When 23 used oil samples and paired unused control oil samples from takeaway food outlets in north-eastern Australia were analysed for fatty acid profile and indicators of deterioration, oil identity and condition were found to differ greatly. Trans-fatty acid content was generally low, although one unused oil sample contained 43.8% (w/w). Two oil samples had polar compound contents above 25%, the highest being 28.7%. Peroxide values and acid values, both singularly and in combination, correlated poorly with polar compound levels. These low correlation levels seemed unrelated to antioxidant levels in unused oil samples. Concentrations of BHA and TBHQ in unused oil samples varied from nil to 180 mg/kg (legal limit 200 mg/kg). Improved deepfryer oil management in takeaway food outlets presents many opportunities to enhance the quality and safety of takeaway food.

Song, M. K. and J. J. Kennelly (2003). "Biosynthesis of conjugated linoleic acid and its incorporation into ruminant's products." Asian-Australasian Journal of Animal Sciences **16**(2): 306-314.

Bio-hydrogenation of C-18-unsaturated fatty acids released from the hydrolysis of dietary lipids in the rumen, in general, occurs rapidly but the range of hydrogenation is quite large, depending on the degree of unsaturation of fatty acids, the configuration of unsaturated fatty acids, microbial type and the experimental condition. Conjugated linoleic acid (CLA) is incompletely hydrogenated products by rumen microorganisms in ruminant animals. It has been shown to have numerous potential benefits for human health and the richest dietarv sources of CLA are bovine milk and milk products. The cis-9, trans-11 is the predominant CLA isomer in bovine products and other isomers can be formed with double bonds in positions 8/10, 10/12, or 11/13. The term CLA refers to this whole group of 18 carbon conjugated fatty acids. Alpha-linolenic acid goes through a similar bio-hydrogenation process producing trans-11 C-18:1 and C-18:0, but may not appear to produce CLA as an intermediate. Although the CLA has been mostly derived from the dietary C-18:2 alternative pathway may be existed due to the extreme microbial diversity in the reticulo-rumen. Regardless of the origin of CLA, manipulation of the bio-hydrogenation process remains the key to increasing CLA in milk and beef by dietary means, by increasing rumen production of CLA. Although the effect of oil supplementation on changes in fatty acid composition in milk seems to be clear its effect on beef is still controversial. Thus further studies are required to enrich the CLA in beef under various dietary and feeding conditions.

Soto, C. (2013). "Effect of isomalto-oligosaccharide and gentio-oligosaccharide on the growth and fatty acid profile of Lactobacillus plantarum." Electronic Journal of Biotechnology **16**(4).

Background: Lactobacillus sp. are probiotic microorganisms, and some of them are able to produce conjugated linoleic acid (CLA) via the bio-hydrogenation of linoleic acid (LA). Both CLA and LA are polyunsaturated fatty acids commonly used in the prevention and control of cardiovascular disease, high cholesterol, and cancer, among other ailments. The carbon source is one variable that can affect the growth and characteristics of these bacteria. Molecules called prebiotics are known to benefit human health by stimulating the growth and activity of probiotic bacteria present in the intestinal microflora. The aim of this study was to evaluate how different oligosaccharides affect the growth and fatty acid profile of Lactobacillus plantarum (NRRL - B4496). L. plantarum cultivation was performed in Man-Rogosa-Sharpe (MRS) medium, and the original carbon source (glucose) in this medium was partially or totally replaced by an oligosaccharide (isomalto-oligosaccharide (IMO) or gentiooligosaccharide (GTO)). Then, the biomass concentration and fatty acid profile were determined using spectrophotometry and gas chromatography, respectively. Results: When 50% of the glucose in the MRS medium was replaced with IMO, the maximum growth was 2.6 g/L at 37 degrees C. Under the same culture conditions, the incorporation of GTO only produced 2 g/L of biomass. At 45 degrees C, the growth of the bacterial culture was lower than that observed at 37 degrees C, reaching only 0.4 g/L. When cultivated at 37 degrees C in a mixture of glucose and GTO (1: 1), CLA (34%, c9t11) was obtained from cells of L. plantarum. However, when the cultivation was performed at 45 degrees C, CLA was not obtained. When IMO was used, differences in CLA content were not observed between L. plantarum cultivated with glucose or with IMO present; however, vaccenic acid was produced. Conclusions: Lactobacillus plantarum grow well when a mixture of IMO and glucose is used as the carbon source. However, this mixture does not improve the CLA content, most likely due to high enzymatic activity that promotes the conversion of CLA to vaccenic acid. Additionally, GTO is likely less readily metabolized by this strain. Thus, the enzymatic activity is likely lower and less CLA is converted to vaccenic acid, resulting in an accumulation of CLA.

St-Onge, M. P., et al. (2007). "Snack chips fried in corn oil alleviate cardiovascular disease risk factors when substituted for low-fat or high-fat snacks." American Journal of Clinical Nutrition **85**(6): 1503-1510.

Background: The perception that all high-fat snacks are unhealthy may be wrong. Objective: We aimed to assess whether replacing low-fat and high-fat snacks with snacks rich in polyunsaturated fatty acids (PUFAs) and low in saturated and trans fatty acids would improve cardiovascular health. Design: Thirty-three adults participated in a randomized crossover trial of 3 controlled feeding phases of 25 d each in which a different type of snack was provided: low-fat (30.8% of energy from fat, 5.2% of energy from PUFAs), high-PUFA (36.3% of energy from fat, 9.7% of energy from PUFAs), or high-fat (37.9% of energy from fat, 5.8% of energy from PUFAs) snack. Results: Each diet reduced LDL- and total cholesterol concentrations, but reductions were greater with the low-fat and the high-PUFA diets than with the high-fat diet: LDL cholesterol (11.8% and 12.5% compared with 8.8%, respectively; P = 0.03 and 0.01), total cholesterol (10.5% and 10.7% compared with 7.9%, respectively; P = 0.03 and 0.02). The high-PUFA diet tended to reduce triacylglycerol concentrations (9.4%; P = 0.06), and this change was greater than that with the low-fat (P = 0.028) and high-fat (P = 0.0008) diets. Conclusions: These data show that snack type affects cardiovascular health. Consuming snack chips rich in PUFA and low in saturated or trans fatty acids instead of high-saturated fatty acid and trans fatty acid or low-fat snacks leads to improvements in lipid profiles concordant with reductions in cardiovascular disease risk.

St-Onge, M. P. and P. J. H. Jones (2003). "Phytosterols and human lipid metabolism: Efficacy, safety, and novel foods." Lipids **38**(4): 367-375.

Plant sterols have been known for several decades to cause reductions in plasma cholesterol concentrations. These plant materials have been granted a conditional health claim in the United States regarding their effects in the prevention of cardiovascular disease and are being sold in functional foods in several countries in Europe as well as in the United States and Australia. It is generally suggested that daily consumption of similar to2 g of plant sterols can lower cholesterol concentrations as part of a dietary prevention strategy. However, phytosterols have been added and tested for their cholesterol-lowering effects mainly in spreads. Consumption of these high-fat foods seemingly flies in the face of current recommendations for the promotion of heart health, which suggest lowering total fat and energy intake to maintain weight. Hence, new food formulations are being evaluated using phytosterols incorporated into low-fat and reduced-fat food items. The purpose of this review is to examine the cholesterol-lowering efficacy of plant sterols, focusing on novel food applications, their mechanism of action, and safety. These novel food formulations include new solubilization processes that lead to improved uses for plant sterols, as well as new foods into which phytosterols have been incorporated, such as breads, cereals, and beef. Such new foods and formulations should pave the way for greater use of phytosterols in heart health promotion, increasing the longer-term potential for the creation of innovative functional foods containing plant sterols and their derivatives.

Stachowska, E., et al. (2004). "Dietary trans fatty acids and composition of human atheromatous plaques." European Journal of Nutrition **43**(5): 313-318.

Dietary fatty acids are incorporated into atheromatous plaques mainly in the form of cholesterol esters. Physicochemical properties of the plaque (e.g. mechanical strength) depend on its fatty acid composition. Trans isomers of unsaturated fatty acids (TFA) are known to reduce the availability of fatty acid precursors for the synthesis of anticoagulant PG(1) and PG(3) prostaglandins. The present study was undertaken to determine the content of trans isomers in atheromatous plaques and to search for correlations between trans isomers in the plaque and adipose tissue. Atheromatous plaques were obtained from 31 patients who underwent surgery due to atherosclerotic stenosis of the abdominal aorta, iliac or femoral arteries. Fatty acids were extracted and separated as methyl esters using gas chromatography (GC) with an internal standard. Correlations were searched for with statistical methods, taking the level of significance as p<0.05. We found spatial and positional isomers of sixteen- and eighteen-carbon fatty acids in plaques and adipose tissue, with elaidic acid (C18:1 trans-9) being the most abundant. Every plaque and adipose tissue sample contained linolelaidic acid (C18:2 trans-9 trans-12) which is derived exclusively from linoleic acid, as well as conjugated dienes of linoleic acid (CLA) produced during oxidative processes. The presence of trans isomers of fatty acids in the atheromatous plaque seems to be of relevance to plaque formation. Of much concern is the detection of elaidic and linolelaidic acids which adversely affect the physiologically important metabolism of eicosanoids. The TFA pool in adipose tissue has little effect on the amount of these acids in the atheromatous plaque. Apparently, the presence of TFA in atheromatous plaques is the result of processes taking place during plaque formation and maturation.

Stachowska, E., et al. (2004). "Isomers of trans fatty acids modify the activity of platelet 12-P lipoxygenase and cyclooxygenase/thromboxane synthase." Nutrition **20**(6): 570-571.

OBJECTIVES: Trans isomers of fatty acids (TFA) have been implicated in the initiation and progression of atherosclerosis. Previous studies have shown that trans-unsaturated fatty acids like their cis-unsaturated counterparts exert a modifying effect on platelet aggregation. The aim of this work was to determine the influence of TFA on the aforementioned enzymes: lipoxygenase and cycloxygenase/thromboxane synthase. METHODS: Two C18 cis-trans fatty acid pairs: oleic/elaidic and linoleic/linolelaidic were chosen. Fasting blood was sampled from 30 healthy volunteers without any lipid abnormalities and not on medication for at least 7 days prior to sampling. Platelet-rich plasma (PRP) was prepared and the platelet count was adjusted to 3 . 10(8) cells . ml(-1). Fatty acids in hexane were added to a final concentration of 7 muM and evaporated to dryness under nitrogen, 500 mul of PRP was pipetted into each tube, thoroughly mixed and incubated at 37degreesC for 60 min. 12-P LOX activity was measured with a spectrophotometric method and expressed per mg protein. Cycloxygenase/thromboxane synthase activity was determined by TXB2 production with an ELISA-based assay. Statistics were done with the Kruskal-Wallis test and Statistica software package. RESULTS: We have found that the activity of 12-P LOX was suppressed by all cis-trans fatty acids used by us. Cycloxygenase/thromboxane synthase activity was significantly inhibited by polyunsaturated fatty acids only. Linolelaidic acid was more potent in comparison to its monounsaturated (elaidic acid) counterpart. CONCLUSIONS: We believe that the effects of fatty acids are demonstrated at the membrane level where fatty acids may produce a perturbation in specific lipid domains. TFA are able to interact with the platelet membrane and transmembrane proteins just as the cis isomers. By interacting with proteins exposed on the cytoplasmic membrane, TFA may modify the activity of receptors and other membrane proteins. In this way, changes on the membrane surface are propagated into the cell affecting the activity of cytoplasmic enzymes like 12-P LOX and cycloxygenase/thromboxane synthase. (C) Elsevier Inc. 2004.

Stahlman, M., et al. (2012). "Clinical dyslipidaemia is associated with changes in the lipid composition and inflammatory properties of apolipoprotein-B-containing lipoproteins from women with type 2 diabetes." Diabetologia **55**(4): 1156-1166.

The aim of this study was to use lipidomics to determine if the lipid composition of apolipoprotein-B-containing lipoproteins is modified by dyslipidaemia in type 2 diabetes and if any of the identified changes potentially have biological relevance in the pathophysiology of type 2 diabetes. VLDL and LDL from normolipidaemic and dyslipidaemic type 2 diabetic women and controls were isolated and quantified with HPLC and mass spectrometry. A detailed molecular characterisation of VLDL triacylglycerols (TAG) was also performed using the novel ozone-induced dissociation method, which allowed us to distinguish vaccenic acid (C18:1 n-7) from oleic acid (C18:1 n-9) in specific TAG species. Lipid class composition was very similar in VLDL and LDL from normolipidaemic type 2 diabetic and control participants. By contrast, dyslipidaemia was associated with significant changes in both lipid classes (e.g. increased diacylglycerols) and lipid species (e.g. increased C16:1 and C20:3 in phosphatidylcholine and cholesteryl ester and increased C16:0 [palmitic acid] and vaccenic acid in TAG). Levels of palmitic acid in VLDL and LDL TAG correlated with insulin resistance, and VLDL TAG enriched in palmitic acid promoted increased secretion of proinflammatory mediators from human smooth muscle cells. We showed that dyslipidaemia is associated with major changes in both lipid class and lipid species composition in VLDL and LDL from women with type 2 diabetes. In addition, we identified specific molecular lipid species that both correlate with clinical variables and are proinflammatory. Our study thus shows the potential of advanced lipidomic methods to further understand the pathophysiology of type 2 diabetes.

Steel, F. (2005). "A source of our wealth, yet adverse to our health? Butter and the diet-heart link in New Zealand to c. 1990." Social History of Medicine **18**(3): 475-493.

The medical link between dietary saturated fat, serum cholesterol, and arteriosclerosis redefined meanings for butter in New Zealand, from a celebrated dietary staple to a potentially harmful substance to be closely monitored in the diet. The introduction of a nutritionally endorsed butter substitute, polyunsaturated margarine, heightened this shift. This article addresses the ways in which such links are taken up and negotiated outside the medical sphere. It examines the responses of government, nutritional organizations, the dairy industry, commercial interests, women responsible for feeding coronary heart disease sufferers, and everyday butter consumers. The article concludes that rearticulating meanings for butter along medicalized lines was a highly fraught undertaking, particularly in a country in which dairying was of central economic importance and underpinned national iconography.

Steinhart, H., et al. (2003). "Trans fatty acids (TFA): Analysis, occurrence, intake and clinical relevance." European Journal of Medical Research **8**(8): 358-362.

More than one quarter of total daily calories are normally provided by fatty acids which contain at least one double bond. The usual configuration of these double bonds is the cis configuration. Trans fatty acids (TFA) are formed in technological and microbiological processes by isomerization of cis double bonds to trans double bonds. In the 1990s, there was public health concern about epidemiological studies suggesting that TFA increase the risk of coronary heart disease. High intakes of TFA may have an influence on total cholesterol and other blood parameters; but on the other hand there have been a lot of studies which have not been able to confirm these results. TFA are formed in varying amounts during the industrial hydrogenation of vegetable oils and in the first stomach of ruminants. Regular margarines contain varying contents of partially hydrogenated vegetable oils, and therefore of TFA. The main dietary TFA are the trans octadecenoic acids, which contribute to approximately 80-90 % of total TFA content in foods. The predominant isomer of milk fat is trans vaccenic acid, which is directly influenced by ruminant feeding conditions. For a reliable identification and quantification of TFA in foods and other biological matrices it is necessary to use a combination of chromatographic methods (GC-FID, GC-MS, GC-FTIR, Ag+-HPLC).

Stock, J. (2014). "Focus on lifestyle: EAS Consensus Panel Position Statement on Phytosterol-added Foods." Atherosclerosis **234**(1): 142-145.

Sudhop, T. and K. von Bergmann (2002). "Cholesterol absorption inhibitors for the treatment of hypercholesterolaemia." Drugs **62**(16): 2333-2347.

The benefits of lipid lowering therapy on coronary heart disease have been clearly established in many clinical trials on primary and secondary prevention. Despite the availability of potent lipid lowering drugs, many patients do not reach the current treatment goals. This paper reviews new therapeutic approaches in lipid lowering drugs focusing on compounds which lower cholesterol absorption. The role of plant sterols and stanols, new acyl-CoA: cholesterol O-acyl transferase (ACAT) inhibitors, microsomal triglyceride transfer protein (MTP) inhibitors, and ezetimibe are summarised. Although the lipid lowering effect of plant sterols and plant stanols is only moderate, their use as functional foods is beneficial for patients with mild hypercholesterolaemia and is able to enhance the lipid lowering effect of HMG-CoA reductase inhibitors (statins). The role of ACAT inhibitors that might also inhibit cholesterol absorption remains unclear. Avasimibe, the first oral bioavailable ACAT inhibitor, has entered phase III trials. However, the presently available data in humans do not indicate a clear clinical benefit. The role of MTP inhibitors, which exhibit remarkable effects on all plasma lipids, also remains unclear, as safety concerns must first be addressed. Ezetimibe, the first available 2-azetidinone, succeeded in phase III trials showing remarkable effects in inhibition of cholesterol absorption as well as cholesterol lowering. The synergistic effect of co-administration of ezetimibe with statins seemingly offers a new approach in reaching the therapeutic goals.

Sudhop, T. and K. von Bergmann (2004). "Sitosterolemia - a rare disease." Zeitschrift Fur Kardiologie **93**(12): 921-+.

Elevated plasma plant sterol concentrations, xanthomatosis, and accelerated often fatal - atherosclerosis at young age are the major findings in patients with homozygous sitosterolemia. A defect in the ABCG5 or ABCG8 co-transporter gene locus (STSL) causes an increased intestinal absorption and a decreased biliary elimination of all sterols, plant sterols as well as cholesterol, leading to a 50 to 200-fold increase in plasma plant sterol concentrations. A few recent publications indicate that even moderately elevated plasma plant sterol levels might be associated with an increased risk of atherosclerosis. This raises the question whether plant sterols themselves might be atherogenic or whether elevated plasma levels are a marker for a decreased ABCG5/G8 transporter activity which itself causes an increased risk for atherosclerosis. However, current data are too few to conclude that elevated plant sterol concentrations in plasma are an additional risk factor for coronary heart disease. But especially young patients suffering from xanthomatosis and/or atherosclerotic diseases with only mildly or moderately elevated plasma cholesterol should be screened for sitosterolemia by measurement of plasma plant sterol levels.

Sultana, H., et al. (2008). "Effect of feeding Ca-salts of fatty acids from soybean oil and linseed oil on c9,t11-CLA production in ruminal fluid and milk of Holstein dairy cows." Asian-Australasian Journal of Animal Sciences **21**(9): 1262-1270.

The objective of this stud), was to investigate the effect of dietary supplementation with calcium salts of soybean oil fatty acids (CaSO) and linseed oil fatty acids (CaLO) on c9,t11-CLA production in ruminal fluid and milk fat from Holstein dairy cows. Rumen fermentation. lactational performances and fatty acid profiles in ruminal fluid and milk fat were also investigated. Twenty multiparous Holstein dairy cows were allotted randomly into two groups consisting of ten cows in each group according to calving date and average milk yield. The first group of cows was fed a control (without calcium salts) diet and a treatment as 1.0% of CaSO (on DM basis) for 30 days in each period. In the second group, cows were fed the same control diet and 1.0% of CaLO as a treatment in the same manner. The forage: concentrate ratio was 52:48, and diets were formulated to contain 17% crude protein (DM basis) for both groups. Ruminal pH, protozoal numbers and the concentration of total volatile fatty acids were unchanged, however, the ruminal ammonia-N decreased by feeding CaSO or CaLO treatment compared to the control diet. The vaccenic acid (trans-11C18:1; VA) in rumen fluid increased (p < 0.01) by 169% and 153%, and the c9,t11-CLA content of rumen fluid increased (p < 0.01) by 214% and 210% in the CaSO and CaLO treatments, respectively. compared to the control diet. In milk fatty acids, the VA content increased by 130% and 132% in the evening and morning milking times, respectively, and the c9,t11-CLA content increased by 125% in both milking times for the CaSO supplementation than that of control diet. In the case of CaLO supplementation, the VA increased by 117% and 114%, and the c9,t11-CLA increased by 96% and 94% in the evening and morning milking times, respectively, compared to the control diet. The contents of VA and c9.t11-CLA of milk fatty acids were numerically higher in the evening milking time compared to the morning milking time for control and both treatments. Finally, these results indicated that the supplementation of CaSO or CaLO treatment increased the VA and the c9,t11-CLA in both ruminal fluid and milk fat of Holstein dairy cows.

Sun, Q., et al. (2007). "Comparison between plasma and erythrocyte fatty acid content as biomarkers of fatty acid intake in US women." American Journal of Clinical Nutrition **86**(1): 74-81.

Background: Erythrocyte fatty acids may be superior to plasma fatty acids for reflecting long-term fatty acid intake because of less sensitivity to recent intake and a slower turnover rate. Objective: The objective was to compare the fatty acid content of erythrocytes with that of plasma with respect to their abilities to reflect usual fatty acid intake. Design: Fatty acids in plasma and erythrocytes were measured by capillary gas-liquid chromatography in 306 US women aged 43-69 y. Fatty acid intake was assessed with a food-frequency questionnaire, which was validated for measuring intakes of various fatty acids. Results: Docosahexaenoic acid (DHA, 22:6n-3) in erythrocytes and plasma provided the strongest correlations with its intake, but erythrocyte DHA concentrations [Spearman's partial correlation coefficient (r(s)) = 0.56] were better than plasma DHA concentrations (r(s) = 0.48) as a biomarker. Total trans fatty acids (r(s) = 0.43) and total 18:1 trans isomers (r(s) = 0.42) in erythrocytes were also more strongly correlated with intake than were those in plasma (r(s) = 0.30 and r(s) = 0.29, respectively). Moderate correlations were observed for linoleic acid (18:2n-6; erythrocytes, r(s) = 0.24; plasma, r(s) = 0.25), alpha-linolenic acid (18:3n-3; erythrocytes, r(s) = 0.18; plasma, r(s) = 0.23), and eicosapentaenoic acid (20:5n-3; erythrocytes, r(s) = 0.38; plasma, r(s) = 0.21). For polyunsaturated and trans fatty acids, correlations between intakes and biomarkers improved moderately when average intakes over previous years were used. Conclusion: Erythrocyte n-3 fatty acids of marine origin and trans fatty acid content are suitable biomarkers for long-term intake.

Sun, Q., et al. (2007). "A prospective study of Trans fatty acids in erythrocytes and risk of coronary heart disease." Circulation **115**(14): 1858-1865.

Background - High consumption of trans fat has been linked to the risk of coronary heart disease (CHD). We assessed the hypothesis that higher trans fatty acid contents in erythrocytes were associated with an elevated risk of CHD in a nested case-control study among US women. Methods and Results - Blood samples were collected from 32 826 participants of the Nurses' Health Study from 1989 to 1990. During 6 years of follow-up, 166 incident cases of CHD were ascertained and matched with 327 controls. Total trans fatty acid content in erythrocytes was significantly correlated with dietary intake of trans fat (correlation coefficient = 0.44, P < 0.01) and was associated with increased plasma low-density lipoprotein cholesterol (P for trend = 0.06), decreased plasma high-density lipoprotein cholesterol concentrations (P for trend < 0.01), and increased plasma low-density lipoprotein to high-density lipoprotein ratio (P for trend < 0.01). After adjustment for age, smoking status, and other dietary and lifestyle cardiovascular risk factors, higher total trans fatty acid content in erythrocytes was associated with an elevated risk of CHD. The multivariable relative risks (95% confidence intervals) of CHD from the lowest to highest quartiles of total trans fatty acid content in erythrocytes were 1.0 (reference), 1.6 (0.7 to 3.6), 1.6 (0.7 to 3.4), and 3.3 (1.5 to 7.2) (P for trend < 0.01). The corresponding relative risks were 1.0, 1.1, 1.3, and 3.1 (P for trend < 0.01) for a total of 18: 1 trans isomers and 1.0, 1.5, 2.5, and 2.8 (P for trend < 0.01) for a total of 18: 2 trans isomers. Conclusions - These biomarker data provide further evidence that high trans fat consumption remains a significant risk factor for CHD after adjustment for covariates.

Sundram, K., et al. (1997). "Trans (elaidic) fatty acids adversely affect the lipoprotein profile relative to specific saturated fatty acids in humans." Journal of Nutrition **127**(3): S514-S520.

Although dietary trans fatty acids can affect plasma lipoproteins negatively in humans, no direct comparison with specific saturated fatty acids has been reported, even though trans fatty acids were designed to replace saturates in foods and food processing. In this study, dietary trans 18:1 [elaidic acid at 5.5% energy (en)] was specifically exchanged for cis 18:1, 16:0 or 12:0 + 14:0 in 27 male and female subjects consuming moderate fat (31% en), low cholesterol (<225 mg/d) whole food diets during 4-wk diet periods in a crossover design. The trans-rich fat significantly elevated total cholesterol and LDL cholesterol relative to the 16:0-rich and 18:1-rich fats and uniquely depressed HDL cholesterol relative to all of the fats tested. Trans fatty acids also elevated lipoprotein (a) [Lp(a)] values relative to all dietary treatments. Furthermore, identical effects on lipoproteins were elicited by 16:0 and cis 18:1 in these subjects. The current results suggest that elaidic acid, one of the principal trans isomers produced during industrial hydrogenation of edible oils, adversely affects plasma lipoproteins. Thus, the negative effect of elaidic acid on the lipoprotein profile of humans appears to be unmatched by any other natural fatty acid(s).

Sundram, K., et al. (2003). "Palm fruit chemistry and nutrition." Asia Pacific Journal of Clinical Nutrition **12**(3): 355-362.

The palm fruit (Elaies guineensis) yields palm oil, a palmitic-oleic rich semi solid fat and the fat-soluble minor components, vitamin E (tocopherols, tocotrienols), carotenoids and phytosterols. A recent innovation has led to the recovery and concentration of water-soluble antioxidants from palm oil milling waste, characterized by its high content of phenolic acids and flavonoids. These natural ingredients pose both challenges and opportunities for the food and nutraceutical industries. Palm oil's rich content of saturated and monounsaturated fatty acids has actually been turned into an asset in view of current dietary recommendations aimed at zero trans content in solid fats such as margarine, shortenings and frying fats. Using palm oil in combination with other oils and fats facilitates the development of a new generation of fat products that can be tailored to meet most current dietary recommendations. The wide range of natural palm oil fractions, differing in their physicochemical characteristics, the most notable of which is the carotenoid-rich red palm oil further assists this. Palm vitamin E (30% tocopherols, 70% tocotrienols) has been extensively researched for its nutritional and health properties, including antioxidant activities, cholesterol lowering, anti-cancer effects and protection against atherosclerosis. These are attributed largely to its tocotrienol content. A relatively new output from the oil palm fruit is the water-soluble phenolic-flavono, id-rich antioxidant complex. This has potent antioxidant properties coupled with beneficial effects against skin, breast and other cancers. Enabled by its water solubility, this is currently being tested for use as nutraceuticals and in cosmetics with potential benefits against skin aging. A further challenge would be to package all these palm ingredients into a single functional food for better nutrition and health.

Svilaas, A., et al. (2002). "Reproducibility and validity of a short food questionnaire for the assessment of dietary habits." Nutrition Metabolism and Cardiovascular Diseases **12**(2): 60-70.

Background and Aim: Dietary changes such as reducing the consumption of foods high in saturated fat, and increasing the daily intake of unsaturated fat, fibre and vitamins may have beneficial effects on long-term health. Accurate dietary information is essential for dietary counselling. Most of the methods used to examine an individual's diet (food records, diet interview, food frequency questionnaires) are too complicated and time-consuming for routine clinical use. There is a need for a fast and simple tool for food assessment. The aim of this study was to evaluate a short and simple food questionnaire for use in clinical practice that emphasises the intakes of fat, fibre, fruit and vegetables representative of the usual diet of an individual or group. Methods and Results: A 15-item questionnaire was completed twice on the same day by 111 participants in order to study reproducibility, and its validity was checked by comparing the results with those of a 7-day food record for 101 subjects. The participants reported a positive attitude to the questionnaire. The reproducibility and validity studies comparing the sum scores of the questionnaire and food record gave correlation coefficients of respectively 0.95 and 0.73, thus indicating good agreement. The reproducibility study showed weighted Kappa coefficients ranging from 0.97 for milk and snacks to 0.75 for vegetables. In the validity assessment, the weighted Kappa coefficients ranged from 0.73 for butter and margarine to 0.14-0.25 for vegetables, fish and snacks, which is a less satisfactory result. The correlation coefficient between the sum score of the questionnaire and the percentage of dietary saturated fat was-0.59. Conclusions: This simple self-administered questionnaire allows for the rapid assessment of the constituents of the usual diet of an individual. It provides a good estimate of dietary fat and fibre but is less accurate in terms of the intake of vegetables, fish and snacks. It also offers an opportunity to discuss central points in the improvement Of dietary habits and may be a useful health educational tool in clinical practice. (C) 2002, Medikal Press.

Sydenham, E., et al. (2012). "Omega 3 fatty acid for the prevention of cognitive decline and dementia." Cochrane Database of Systematic Reviews(6).

Background Evidence from observational studies suggests that diets high in omega-3 long-chain polyunsaturated fatty acids (PUFA) may protect people from cognitive decline and dementia. The strength of this potential protective effect has recently been tested in randomised controlled trials. Objectives To assess the effects of omega-3 PUFA supplementation for the prevention of dementia and cognitive decline in cognitively healthy older people. Search methods We searched ALOIS - the Cochrane Dementia and Cognitive Improvement Group's Specialized Register on 6 April 2012 using the terms: "omega 3", PUFA, "fatty acids", "fatty acid", fish, linseed, eicosapentaenoic, docosahexaenoic. Selection criteria Randomised controlled trials of an omega-3 PUFA intervention which was provided for a minimum of six months to participants aged 60 years and over who were free from dementia or cognitive impairment at the beginning of the study. Two review authors independently assessed all trials. Data collection and analysis The review authors sought and extracted data on incident dementia, cognitive function, safety and adherence, either from published reports or by contacting the investigators for original data. Data were extracted by two review authors. We calculated mean difference (MD) or standardised mean differences (SMD) and 95% confidence intervals (CI) on an intention-to-treat basis, and summarised narratively information on safety and adherence. Main results Information on cognitive function at the start of a study was available on 4080 participants randomised in three trials. Cognitive function data were available on 3536 participants at final follow-up. In two studies participants received gel capsules containing either omega-3 PUFA (the intervention) or olive or sunflower oil (placebo) for six or 24 months. In one study, participants received margarine spread for 40 months; the margarine for the intervention group contained omega-3 PUFA. Two studies had cognitive health as their primary outcome; one study of cardiovascular disease included cognitive health as an additional outcome. None of the studies examined the effect of omega-3 PUFA on incident dementia. In two studies involving 3221 participants there was no difference between the omega-3 and placebo group in mini-mental state examination score at final follow-up (following 24 or 40 months of intervention); MD -0.07 (95% CI -0.25 to 0.10). In two studies involving 1043 participants, other tests of cognitive function such as word learning, digit span and verbal fluency showed no beneficial effect of omega-3 PUFA supplementation. Participants in both the intervention and control groups experienced either small or no cognitive declines during the studies. The main reported side-effect of omega-3 PUFA supplementation was mild gastrointestinal problems. Overall, minor adverse events were reported by fewer than 15% of participants, and reports were balanced between intervention groups. Adherence to the intervention was on average over 90% among people who completed the trials. All three studies included in this review are of high methodological quality. Authors' conclusions Direct evidence on the effect of omega-3 PUFA on incident dementia is lacking. The available trials showed no benefit of omega-3 PUFA supplementation on cognitive function in cognitively healthy older people. Omega-3 PUFA supplementation is generally well tolerated with the most commonly reported side-effect being mild gastrointestinal problems. Further studies of longer duration are required. Longer-term studies may identify greater change in cognitive function in study participants which may enhance the ability to detect the possible effects of omega-3 PUFA supplementation in preventing cognitive decline in older people.

Takeshita, M., et al. (2008). "Phytosterols dissolved in diacylglycerol oil reinforce the cholesterol-lowering effect of low-dose pravastatin treatment." Nutrition Metabolism and Cardiovascular Diseases **18**(7): 483-491.

Background and aims: Dietary therapy using phytosterols can reinforce statin treatment; however the value of a low-dose combination of those agents remains to be investigated. Plant sterols (PS), dissolved in diacylglycerol (DAG) oil, (PS/DAG) can be effective at a relatively low dose. The objective of the present study was to examine the effect of PS/DAG oil on blood cholesterol concentrations in hypercholesterolemic outpatients on Low-dose pravastatin (10 mg/day). Methods and results: The patients (n = 61) were randomly assigned to one of three groups, who consumed TAG (control), DAG or PS/DAG oil. The average intake of PS from the PS/DAG oil during the test period was significantly higher than that for TAG and DAG oils (502 vs. 49 and 38 mg/day, P < 0.05). Significant cholesterol-lowering effects from the baseline were observed in the case of the PS/DAG oil treatment alone. Changes in low-density lipoprotein (LDL) cholesterol were inversely correlated with baseline serum campesterol concentrations (r = -0.560, P < 0.05), but not baseline LDL cholesterol concentrations. In addition, serum apolipoprotein B concentrations were reduced to a greater extent in subjects with high versus low Levels of baseline campesterol (-13.2 mg/dL vs. -3.1 mg/dL, P < 0.05). Furthermore, there was a mild, but significant reduction in serum lipoprotein (a) concentration from the baseline (-5.9 mg/dL), which was correlated with the reduction in serum apolipoprotein B concentration (r = 0. 596, P < 0.05). Conclusion: A low-dose combination of PS/DAG oil and pravastatin may be a useful strategy for further ameliorating blood cholesterol and lipoprotein (a) concentrations for hypercholesterotemic patients with a low response to pravastatin. (C) 2007 Elsevier B.V. All rights reserved.

Takeuchi, H., et al. (2012). "Trans Fatty Acid Intake and Serum Cholesterol Levels in Young Japanese Women." Bioscience Biotechnology and Biochemistry **76**(9): 1627-1632.

There are very limited data concerning the influence of low-level trans fatty acid (TFA) intake on blood lipid levels. In this study, correlation of total and diene TFA intake with serum cholesterol levels was studied in young Japanese women. The mean intakes of total and diene TFAs were 0.36% and 0.05% of energy, respectively. There was a significant correlation between total fat intake and TFA intake. TFA intake was significantly correlated with erythrocyte TFA content. Total TFA intake was not correlated with total, LDL- or HDL-cholesterol levels. No correlatuon was found between diene TFA intake and cholesterol level. Total and diene TFA intake were not correlated with hemoglobin A1c or C-reactive protein levels. These results suggest that the average TFA intake of young Japanese women does not adversely affect serum cholesterol levels.

Takeuchi, H., et al. (2013). "Supplementation with 1% Energy Trans Fatty Acids Had Little Effect on Serum Cholesterol Levels in Healthy Young Japanese Women." Bioscience Biotechnology and Biochemistry **77**(6): 1219-1222.

The World Health Organization (WHO) has recommended that trans fatty acid (TFA) intake should be less than 1% of total energy intake, but few data are available as to the influence of energy TFA intake of as low as 1% on blood cholesterol levels. A randomized, double-blind, parallel trial was conducted to assess the effects of 1% TFA dietary supplementation on serum cholesterol levels in healthy young women. Sixty-five volunteers consumed cookies containing 1% (TFA) or 0.04% (control) energy of TFA for 4 weeks and blood was harvested after overnight fasting. There were no significant differences in serum LDL- or HDL-cholesterol levels between the two groups. The hemoglobin A(1c), level was not influenced by dietary TFA. These results suggest that energy of TFAs at less than 1% has little effect on serum cholesterol or hemoglobin A(1c) levels in healthy young women. This confirms the correctness of the WHO recommendation.

Talati, R., et al. (2010). "The Comparative Efficacy of Plant Sterols and Stanols on Serum Lipids: A Systematic Review and Meta-Analysis." Journal of the American Dietetic Association **110**(5): 719-726.

Background Plant sterols and stanols are plant steroids with a similar chemical structure and cellular function to human cholesterol, and are recommended as dietary modifiers of serum lipids. Plant sterols have a higher degree of absorption than plant stanols, suggesting differential efficacy between the two. Design A meta-analysis of randomized controlled trials was performed to summarize direct comparisons between the effect of plant sterols vs plant stanols on serum lipid levels in healthy patients and patients with hypercholesterolemia. Methods A systematic literature search of MEDLINE, EMBASE, Cochrane CENTRAL, and the Natural Medicines Comprehensive Database was conducted from January 1950 through January 2009. Trials were included in the analysis if they were randomized controlled trials evaluating the effect of plant sterols vs plant stanols in healthy patients or patients with hypercholesterolemia who reported efficacy data on total, low-density lipoprotein, and high-density lipoprotein cholesterols or triglycerides. The weighted mean difference (WMD) of the change from baseline (in mg/dL) with 95% confidence interval was calculated as the difference between the means in the plant sterol and plant stanol groups using a random-effects model. Results Fourteen studies (n=531 patients) met the inclusion criteria. Upon meta-analysis, the results showed that there is no statistically or clinically significant difference between plant sterols and plant stanols in their abilities to modify total cholesterol (WMD -1.11 mg/dL [-0.0286 mmol/L], 95% confidence interval [CI] -4.12 to 1.90, P=0.47), low-density lipoprotein cholesterol (WMD -0.35 mg/dL [-0.0091 mmol/L], 95% CI -2.98 to 2.28, P=0.79), high-density lipoprotein cholesterol (WMD -0.28 mg/dL [-0.00073 mmol/L], 95% CI -1.18 to 0.62, P=0.54), or triglycerides (WMD -1.80 mg/dL [-0.0203 mmol/L], 95% CI -6.80 to 3.21, P=0.48). Conclusions Plant sterols and plant stanols do not have statistically or clinically relevant differing effects on total cholesterol, low-density lipoprotein cholesterol, high-density lipoprotein cholesterol, or triglyceride levels. The selection of plant sterols vs plant stanols should then be based on potential differences in safety parameters and further study is required to elucidate such differences. J Am Diet Assoc. 2010;110:719-726.

Talegawkar, S. A., et al. (2007). "Total alpha-tocopherol intakes are associated with serum alpha-tocopherol concentrations in African American adults." Journal of Nutrition **137**(10): 2297-2303.

African Americans in the southern United States have a high prevalence of chronic disease. Tocopherol intake and status have been associated with protection against several chronic diseases. Our objectives were, therefore, to examine the association between tocopherol intakes as measured by 2 regional FFQ and their corresponding concentrations in serum and to report on dietary sources of tocopherols in 404 men and women participating in the cross-sectional Diet and Physical Activity Sub-Study of the Jackson Heart Study. A large proportion (49% of men and 66% of women) reported dietary supplement use. Only 5.8% of men and 4.5% of women met the estimated average requirement (EAR) for vitamin E from foods alone, whereas 44.2% men and 49.2% women met it from foods and supplements. Total (diet + supplement) intake of a-tocopherol was associated with its corresponding measure in serum. Vitamin E supplement use, sex, serum cholesterol, education, and BMI, but not gamma-tocopherol intakes, were associated with serum gamma-tocopherol. For delta-tocopherol, associated variables included sex and serum cholesterol. The top food sources of alpha- and gamma-tocopherol were snack chips and the top food source of delta-tocopherol was margarine. Despite prevalent vitamin E supplement use, more than one-half of this population did not meet the EAR for a-tocopherol intake and very few met it from food alone. Supplement use was associated with higher alpha- but lower gamma-tocopherol concentration in serum. The possible health implications of this difference in relative tocopherol subtypes require further study.

Tammi, A., et al. (2000). "Plant stanol ester margarine lowers serum total and low-density lipoprotein cholesterol concentrations of healthy children: The STRIP project." Journal of Pediatrics **136**(4): 503-510.

Objective: To investigate cholesterol-lowering efficacy and safety of plant stanol ester margarine in healthy 6-year-old children already consuming a low-saturated-fat, low-cholesterol diet. Study design: Eighty-one intervention children from the STRIP project, a randomized prospective trial aimed at reducing exposure of young children to the known environmental atherosclerosis risk factors, were recruited to this double-blind crossover study at 6 years of age. In randomized order the families were advised to replace daily 20 g of the child's dietary fat intake with plant stanol ester margarine or control margarine for 3 months. The washout period lasted 6 weeks. Statistical analysis was performed according to intention-to-treat principle with analysis of variance for crossover design. Results: The mean daily plant stanol ester margarine consumption was 18.2 g (1.5 g plant stanol). The well-tolerated plant stanol ester margarine reduced serum total and low-density lipoprotein cholesterol concentrations Ly 5.4% and 7.5%, respectively (P = .0001 for Loth). The serum high-density/lipoprotein cholesterol and triglyceride concentrations and alpha-tocophertol to low-density lipoprotein cholesterol ratio remained unchanged. The serum beta-carotene to low-density lipoprotein cholesterol ratio decreased by 19% (P =.003). Conclusion: Plant stanol ester margarine significantly diminishes serum total and low-density lipoprotein cholesterol concentration without adverse clinical effects in healthy children who already consume a low-saturated-fat, low-cholesterol diet but decreases the serum beta-carotene to low-dens;ty lipoprotein cholesterol ratio.

Tammi, A., et al. (2002). "Effects of gender, apolipoprotein E phenotype and cholesterol-lowering by plant stanol esters in children: The STRIP study." Acta Paediatrica **91**(11): 1155-1162.

Aim: To evaluate the effects of gender, apolipoprotein E phenotype and cholesterol absorption and synthesis (estimated as serum plant sterol and cholesterol precursor sterol concentrations) on the cholesterol-lowering effect of plant stanol esters in children. Methods: Eighty-one healthy, normocholesterolaemic 6-y-old children (45 boys) were recruited from the Special Turku Coronary Risk Factor Intervention Project (STRIP), a randomized prospective trial aiming at atherosclerosis prevention in childhood. This placebo-controlled, double-blind, cross-over study comprised two 3-mo study periods and a 6-wk wash-out period. During the study periods, 20 g of the children's daily dietary fat intake was replaced with plant stanol ester margarine or control margarine. Results: In boys, plant stanol esters reduced serum total and low-density lipoprotein cholesterol concentrations by 6% (0.09 to 0.42 mmol/L) and 9% (0.09 to 0.36 mmol/L), respectively (p < 0.01 for both). In girls, the decreases in concentrations were 4% (0.03 to 0.38 mmol/L) and 6% (0.02 to 0.32 mmol/l) (p < 0.05 for both). The response rate did not differ between the genders. Serum total and low-density lipoprotein cholesterol concentrations decreased by 6% and 8% (p < 0.01 for both), respectively, in both children with the apolipoprotein E 3/4 or 4/4 (apoE4-) phenotype and the apolipoprotein E 2/3 or 3/3 (apoE4-) phenotype. Cholesterol absorption decreased both in the apoE4+ children and in the apoE4- children, but cholesterol synthesis consistently increased in the apoE4+ children only. Conclusion: Plant stanol esters reduce serum cholesterol concentration in healthy children irrespective of their gender or apoE4 phenotype.

Tammi, A., et al. (2001). "Dietary plant sterols alter the serum plant sterol concentration but not the cholesterol precursor sterol concentrations in young children (The STRIP study)." Journal of Nutrition **131**(7): 1942-1945.

Plant sterol supplementation reduces serum cholesterol concentration but may increase serum plant sterol concentrations, especially in children. We determined whether natural dietary plant sterols derived mainly from vegetable oil or margarine in early childhood affect serum concentrations of plant sterols (campesterol and sitosterol) and cholesterol precursor sterols (Delta -8 cholestenol, desmosterol, and lathosterol), reflecting endogenous cholesterol synthesis. We measured the serum sterol concentrations using gas liquid chromatography in 20 healthy 13-mo-old intervention children in a randomized, prospective study designed to decrease exposure of the children to known environmental atherosclerosis risk factors and in 20 control children. The diet of the intervention children was rich in plant sterols due to replacement of milk fat with vegetable fat, whereas the diet of the control children contained only small amounts of plant sterols, The intervention children consumed twice as much plant sterols as the control children (P < 0.001). Their serum concentrations of campesterol and sitosterol were 75% and 44% higher, respectively, than those in the control children (P < 0.001 for both), but serum cholesterol precursor sterol concentrations did not differ between the two groups. We conclude that doubling dietary plant sterol intake almost doubles serum plant sterol concentrations in 13-mo-old children, but has no effect on endogenous cholesterol synthesis. Relative intestinal absorption of natural plant sterols from the diet in early childhood is similar to that in adults.

Tanaka, S., et al. (2013). "Altered Fatty Acid Profile in the Liver and Serum of Stroke-Prone Spontaneously Hypertensive Rats: Reduced Proportion of cis-Vaccenic Acid." Journal of Oleo Science **62**(11): 933-948.

Stroke-prone spontaneously hypertensive rats (SHRSP) are utilized as models for study of the pathogenesis of not only stroke and cardiovascular disorders but also atherosclerosis and metabolic syndrome. Basic information on the profiles of fatty acids and lipid classes in the liver is indispensable to use SHRSP as a model of disorder of lipid metabolism; nevertheless, detailed information on the metabolism of triacylglycerols (TAGs) and fatty acids in the liver of SHRSP is lacking. This study aimed to characterize profiles of lipid classes and fatty acids and to explore the mechanism underlying the characteristic alterations in metabolism of TAGs and fatty acids in the liver of SHRSP, in comparison with spontaneously hypertensive rats (SHR). The characteristic changes observed in SHRSP were (1) markedly lower hepatic TAG contents; (2) altered expressions of genes encoding three enzymes responsible for the control of TAG level, namely, adipose triglyceride lipase (for TAG degradation; up-regulated), carnitine palmitoyltransferase la (for fatty acid beta-oxidation; up-regulated) and long-chain acyl-CoA synthetase 3 (for glycerolipid synthesis; down-regulated); (3) evidently lower contents and proportions of monounsaturated fatty acids, in particular cis-vaccenic acid (18:1n-7), in the liver and serum; and (4) down-regulation of palmitoleoyl-CoA chain elongase, which is necessary for the biosynthesis of 18:1n-7, in the liver. From the above observations, we concluded that there are significant differences in profiles of lipid classes and fatty acids between SHRSP and SHR, and that altered characteristics in SHRSP are likely responsible for increases in TAG hydrolysis and beta-oxidation, and decreases in TAG synthesis and 18:1n-7 synthesis.

Tapiero, H., et al. (2003). "Phytosterols in the prevention of human pathologies." Biomedicine & Pharmacotherapy **57**(8): 321-325.

Coronary heart disease is a major health problem in developed countries. Many studies have shown that elevated serum concentrations of total or low-density-lipoprotein cholesterol (LDL cholesterol) are high risk factors, whereas high concentrations of high-density-lipoprotein cholesterol (HDL cholesterol) or a low LDL to HDL cholesterol ratio may protect against coronary heart disease. Plant sterols and stanols derived from vegetable oils or wood pulp have been shown to lower total and LDL cholesterol levels in humans by inhibiting cholesterol absorption from the intestine. These findings may lead to new therapeutic options to treat hypercholesterolemia. In addition, phytosterols may influence cell growth and apoptosis of tumor cells. However, they can interfere with the absorption of fat soluble vitamins and carotenoids. (C) 2003 Editions scientifiques et medicales Elsevier SAS. All rights reserved.

Taratukhin, E. O. (2011). "Atherosclerosis and fatty acids: important association and new therapeutic approach." Russian Journal of Cardiology(5): 77-80.

The paper is focused on the role of polyunsaturated fatty acids (PUFA) in the prevention of atherosclerosis and its complications. The description of PUFA chemical structure, their position in the lipid sub-class of fatty acids, and their main dietary sources is presented. The data from numerous studies confirm the beneficial role of PUFA in the treatment and prevention of atherosclerosis and its complications. The strategies to increase PUFA intake are outlined.

Tardy, A. L., et al. (2011). "Ruminant and industrial sources of trans-fat and cardiovascular and diabetic diseases." Nutrition Research Reviews **24**(1): 111-117.

The various positional isomers of oleic acid (18 : 1 Delta 9c or 9c-18 : 1) may have distinct biological effects. Detrimental effects of consumption of industrial trans-fatty acids (TFA) (elaidic acid; 18 : 1 Delta 9t) from partially hydrogenated vegetable oils on CVD risk factors are well documented. In addition, epidemiological data suggest that chronic consumption of industrial sources of TFA could alter insulin sensitivity and predispose for type 2 diabetes. However, intervention studies on this issue have remained inconclusive. Moreover, very little information is available on the effect of natural sources of TFA (vaccenic acid; 18 : 1 Delta 11t) coming from dairy products and ruminant meat on the development of CVD and type 2 diabetes. The review focuses on the impact of the consumption of ruminant TFA in relation to cardiovascular risk factors, inflammation and type 2 diabetes.

Tarrago-Trani, M. T., et al. (2006). "New and existing oils and fats used in products with reduced trans-fatty acid content." Journal of the American Dietetic Association **106**(6): 867-880.

The US Food and Drug Administration's final ruling on trans-fatty acid labeling issued in 2003 has caused a rapid transformation in the fat and oil industries. Novel ingredients and improved technologies are emerging to replace partially hydrogenated fats in foods. We present an overview of the structure and formation of trans fatty acids in foods, and a comprehensive review of the newly formulated products and current procedures practiced by the edible oil industry to reduce or eliminate trans fatty acids in response to the Food and Drug Administration's regulations mandating trans fat labeling of foods.

Tatematsu, K., et al. (2004). "Nutritional evaluation of an inter-esterified perilla oil and lard in comparison with butter and margarine based on the survival of stroke-prone spontaneously hypertensive (SHRSP) rats." Journal of Health Science **50**(1): 108-111.

Some kinds of vegetable oil and a partially-hydrogenated oil shorten the survival of the stroke-prone spontaneously hypertensive (SHRSP) rats compared with perilla seed oil, soybean oil and lard. The n-3/n-6 ratio of constituent fatty acids, phytosterol content and other factors in these oils have been proposed to affect the survival of this strain. Here, we examined the safety of a fat produced by the inter-esterification of perilla oil and lard (Perilla-Lard) on the bases of the survival of SHRSP rats. The mean survival time decreased in the order of the butter, the Perilla-Lard, the lard, the margarine and the partially-hydrogenated soybean oil (Hyd.Soy) group. The correlations between survival time and cholesterol content or phytosterol content in the diet were analyzed, and the probable health benefits of the new margarine-type fats made of animal fats and oils with high n-3/n-6 ratios were discussed.

Tavani, A., et al. (1997). "Margarine intake and risk of nonfatal acute myocardial infarction in Italian women." European Journal of Clinical Nutrition **51**(1): 30-32.

Objectives: Since a relation between trans-fatty acids and cardiovascular diseases has been described, we examined the relationship between margarine intake and nonfatal acute myocardial infarction (AMI) in Italian women. Design: Hospital-based case-control study. Setting: Northern Italy between 1983 and 1992. Subjects: Cases were 429 women, aged 18-74 y, in hospital with diagnosis of AMI and 866 controls in hospital for acute, non-cardiovascular, non-neoplastic, non-digestive, non-hormone-related conditions. Analysis: Odds ratios (OR), with their 95% confidence intervals (CI), were computed by unconditional multiple logistic regression analysis, including terms for age, education, body mass index, smoking, alcohol and coffee drinking, menopausal status, hormone replacement therapy and history of diabetes, hypertension and hyperlipidemia. Results: Medium or high intake of margarine was associated with an increased risk of AMI (multivariate OR 1.5, 95% CI 1.0-2.2). Analysis in separate strata of covariates indicated that the association was independent of body mass index, history of hypertension and hyperlipidemia, and was greater in older women and in current smokers. Conclusions: If real, the association with margarine could explain about 6% of AMI in this population of Italian women.

Tavella, M., et al. (2000). "Trans fatty acid content of a selection of foods in Argentina." Food Chemistry **69**(2): 209-213.

Several studies have reported an association between consumption of trans fatty acids and risk of cardiovascular disease (CVD). These fatty acids enter the human diet most commonly as byproducts of hydrogenation of polyunsaturated fats. The amount of trans fats in foods exhibit great variation, due to differences in hydrogenation methods and intensity. In order to quantify the level of trans fats available in widely consumed commercial food items in Argentina, we measured total fat, saturated fat, and the trans fatty acid elaidic acid in 46 food items. As an example from most common items, total fat was 2.0-3.4% in sliced bread, 2.9-25% in cookies and crackers, 50-80% in margarines, 85% in butter, and 34-39% in snack products. In the same items, content of the trans fatty acid elaidic acid was: 2.35-27.7% in sliced bread, 2.85-25.95% in cookies and crackers, 18.15-31.84% in margarines, 4.63% in butter, and 0-10.58% in snacks. In order to compare the results on the fatty-acid composition by using different analysis methods, the same food items mentioned were analyzed in a column of lower polarity and shorter length, and we found trans fatty acids were masked by cis unsaturated fatty acids. A comparison with available data from similar products from other parts of the world indicates that Argentinian products in the categories studied have higher content of trans fatty acids. (C) 2000 Elsevier Science Ltd. All rights reserved.

Teegala, S. M., et al. (2009). "Consumption and Health Effects of Trans Fatty Acids: A Review." Journal of Aoac International **92**(5): 1250-1257.

Consumption of industrially produced trans fatty acids (TFA) remains high in many populations, particularly in developing nations where partially hydrogenated vegetable oils are frequently used for home cooking and among individuals in developed countries having high intakes of bakery or processed foods. Well-controlled observational studies and randomized trials indicate that TFA consumption adversely affects multiple risk factors for chronic diseases, including numerous blood lipids and lipoproteins, systemic inflammation, endothelial dysfunction, and possibly insulin resistance, diabetes, and adiposity. Growing evidence for the latter effects is particularly concerning given the worldwide obesity pandemic and high contents of industrially produced TFA in many foods marketed toward children. Consistent evidence from prospective observational studies of habitual TFA consumption and retrospective observational studies using TFA biomarkers indicates that TFA consumption increases risk of clinical coronary heart disease (CHD). Based on the adverse effects of risk factors and consistent relationships with clinical endpoints, the evidence that TFA consumption increases CHD risk is convincing. Some evidence suggests that TFA consumption may also increase other disease outcomes, but further investigation is needed to confirm the presence and magnitude of such effects. More research is also needed to understand how specific TFA isomers of varying chain length and double bond location may affect different biologic pathways of disease. Both individual- and policy-level initiatives to decrease TFA consumption should continue, particularly in population subgroups and in developing nations with high consumption of partially hydrogenated vegetable oils.

Temple, N. J. (1996). "Dietary fats and coronary heart disease." Biomedicine & Pharmacotherapy **50**(6-7): 261-268.

The prevention and treatment of coronary heart disease (CHD) necessitates vigorous dietary intervention so as to lower the serum cholesterol level by at least 6%. Greater decreases in serum cholesterol can bring about reversal of atherosclerosis. The critical dietary change is the reduction in intake of saturated fat and cholesterol. Some of this fat may be replaced by unsaturated fats, especially monounsaturated fat (olive or canola oil). Fish and the omega-3 fats they contain may also be useful for the prevention of CHD. The benefits of omega-3 fats occur within a few months and probably involve an anti-thrombotic effect. There is evidence that the intake of trans-fatty acids formed by the hydrogenation of oils should be reduced as they are associated with CHD. Hypolipidaemic drugs may be useful for persons at very high risk of CHD but should generally be avoided for primary prevention.

Teng, K. T., et al. (2010). "Effects of Partially Hydrogenated, Semi-Saturated, and High Oleate Vegetable Oils on Inflammatory Markers and Lipids." Lipids **45**(5): 385-392.

Knowledge about the effects of dietary fats on subclinical inflammation and cardiovascular disease risk are mainly derived from studies conducted in Western populations. Little information is available on South East Asian countries. This current study investigated the chronic effects on serum inflammatory markers, lipids, and lipoproteins of three vegetable oils. Healthy, normolipidemic subjects (n = 41; 33 females, 8 males) completed a randomized, single-blind, crossover study. The subjects consumed high oleic palm olein (HOPO diet: 15% of energy 18:1n-9, 9% of energy 16:0), partially hydrogenated soybean oil (PHSO diet: 7% of energy 18:1n-9, 10% of energy 18:1 trans) and an unhydrogenated palm stearin (PST diet: 11% of energy 18:1n-9, 14% of energy 16:0). Each dietary period lasted 5 weeks with a 7 days washout period. The PHSO diet significantly increased serum concentrations of high sensitivity C-reactive protein compared to HOPO and PST diets (by 26, 23%, respectively; P < 0.05 for both) and significantly decreased interleukin-8 (IL-8) compared to PST diet (by 12%; P < 0.05). In particular PHSO diet, and also PST diet, significantly increased total:HDL cholesterol ratio compared to HOPO diet (by 23, 13%, respectively; P < 0.05), with the PST diet having a lesser effect than the PHSO diet (by 8%; P < 0.05). The use of vegetable oils in their natural state might be preferred over one that undergoes the process of hydrogenation in modulating blood lipids and inflammation.

Theuwissen, E., et al. (2009). "Plant Stanol Supplementation Decreases Serum Triacylglycerols in Subjects with Overt Hypertriglyceridemia." Lipids **44**(12): 1131-1140.

Evidence is accumulating that high serum concentrations of triacylglycerols (TAG) are, like LDL cholesterol, causally related to cardiovascular disease. A recent meta-analysis has indicated that plant stanol ester (PSE) intake not only lowered LDL cholesterol, but also serum TAG concentrations, especially in subjects with high baseline TAG concentrations. We therefore evaluated the effects of PSE supplementation on lipid metabolism in a population with elevated fasting TAG concentrations. In a randomized, placebo-controlled, parallel study, 28 subjects with elevated TAG concentrations (> 1.7 mmol/L) were studied. After a 1-week run-in period during which a control margarine was used, subjects consumed for 3 weeks either control or PSE-enriched margarine (2.5 g/day of plant stanols). Serum plant stanol concentrations increased in all subjects receiving the PSE-enriched margarines, demonstrating good compliance. PSE supplementation significantly decreased serum total (6.7%, P = 0.015) and LDL cholesterol (9.5%, P = 0.041). A significant interaction between baseline TAG concentrations and PSE intake was found; PSE intake lowered TAG concentrations, particularly in subjects with high baseline TAG concentrations (> 2.3 mmol/L; P = 0.009). Additionally, a significant interaction between baseline total number of LDL particles (LDL-P) and PSE intake was found (P = 0.020). PSE consumption lowered LDL-P, primarily in subjects with elevated baseline values; this was mainly due to a non-significant decrease in the number of atherogenic small LDL-P. Circulating levels of hs-CRP, glucose, and insulin were not changed after PSE intake. Taken together, PSE supplementation not only lowered LDL cholesterol, but also serum TAG concentrations, especially in subjects with overt hypertriglyceridemia.

Tholstrup, T., et al. (2006). "Effects of butter high in ruminant trans and monounsaturated fatty acids on lipoproteins, incorporation of fatty acids into lipid classes, plasma C-reactive protein, oxidative stress, hemostatic variables, and insulin in healthy young men." American Journal of Clinical Nutrition **83**(2): 237-243.

Background: Evidence suggests that ruminant trans fatty acids (FAs), such as vaccenic acid, do not increase the risk of ischemic heart disease (IHD). However, the effects of ruminant trans FAs on risk markers of IHD have been poorly investigated. Objective: The objective was to investigate the effect of butter with a naturally high content of vaccenic acid and a concomitantly higher content of monounsaturated FAs on classic and novel risk markers of IHD. Design: In a double-blind, randomized, 5-wk, parallel intervention study, 42 healthy young men were given 115 g fat/d from test butter that was high in vaccenic acid (3.6 g vaccenic acid/d) or a control butter with a low content of vaccenic acid. Blood and urine samples were collected before and after the intervention. Results: The intake of the vaccenic acid-rich diet resulted in 6% and 9% lower total cholesterol and plasma HDL-cholesterol concentrations, respectively, than did the intake of the control diet (P = 0.05 and 0.002, respectively), whereas the ratio of total to HDL cholesterol did not differ significantly between the groups. The FA composition of lipid classes reflected the FAs' proportion of the test butter. No other differences were observed. Conclusions: Butter high in ruminant trans and monounsaturated FAs resulted in significantly lower total and HDL cholesterol than did the control butter with higher amounts of saturated FAs. It may be that the differences were due to the greater content of monounsaturated FAs and the lesser content of saturated FAs in the butter rich in ruminant trans FAs, rather than to the content of vaccenic acid per se.

Tholstrup, T. and S. Samman (2004). "Postprandial lipoprotein(a) is affected differently by specific individual dietary fatty acids in healthy young men." Journal of Nutrition **134**(10): 2550-2555.

Lipoprotein(a) [Lp(a)] is considered a risk factor for coronary heart disease. Our aim was to investigate the effect of individual fatty acids on postprandial plasma Lp(a) and its association with lipemia and tissue plasminogen activator (t-PA). Five test fats dominated by (approximately 43% g/kg) stearic (S), palmitic (P), oleic, C18:1 trans M, or linoleic acid were produced by interesterification. Sixteen young healthy men were served the individual test fats incorporated into meals (1 g fat/kg body wt) after a 12-h fast in random order on different days, separated by 3-wk washout periods. Blood samples were drawn before and 2, 4, 6, and 8 h after eating. There was a pronounced increase in Lp(a) concentrations after intake of the test meals, and the test fats resulted in a difference in Lp(a) response (P < 0.001; diet X time interaction). However, T fat did not change Lp(a) during the time course studied. T fat resulted in less area under the plasma Lp(a) concentration curve compared to S and P fat (P less than or equal to 0.003). Test fat with saturated fatty acids resulted in the highest Lp(a) and lowest plasma triacylglycerol (TAG) response, with the reversed situation for T fat. There was no association between Lp(a) and t-PA. In conclusion, intake of meals high in individual dietary fatty acids increased postprandial plasma Lp(a) differently. There seems to be a complex regulatory role of plasma TAG on nonfasting plasma Lp(a) concentrations.

Tholstrup, T., et al. (2001). "Effect of 6 dietary fatty acids on the postprandial lipid profile, plasma fatty acids, lipoprotein lipase, and cholesterol ester transfer activities in healthy young men." American Journal of Clinical Nutrition **73**(2): 198-208.

Background: There is increasing evidence that postprandial triacylglycerol-rich lipoproteins may be related to atherogenic risk. Objective: The objective was to investigate the effect of individual fatty acid intakes on postprandial plasma lipoprotein triacylglycerol and cholesterol concentrations, plasma fatty acids, and preheparin lipoprotein lipase and cholesterol ester transfer protein (CETP) activities. Design: Six test fats high (approximate to 43% by wt) in stearic acid, palmitic acid, palmitic + myristic acid, oleic acid, elaidic acid (trans 18:1), and linoleic acid were produced by interesterification. After having fasted for 12 h, 16 healthy young men were served the individual test fats incorporated into meals (1 g fat/kg body wt) in random order on different days separated by washout periods. Blood samples were drawn before and 2, 4, 6, and 8 h after the meals. Results: Different responses to the test-fat meals were observed for plasma lipoprotein triacylglycerol and cholesterol concentrations, plasma fatty acid concentrations, and lipoprotein lipase and CETP activities (diet x time interaction: 0.001 < P < 0.05). Intake of the long-chain saturated fatty acids stearic and palmitic acids resulted in a relatively lower lipemic response than did intake of the unsaturated fatty acids, probably because the saturated fatty acids were absorbed less and at a lower rate; therefore, the lipemic response took longer to return to postabsorptive values. Conclusions: Fatty acid chain length and degree of saturation appear to affect the extent and duration of lipemia and affect hepatic output indirectly. These effects may not be mediated via effects on lipoprotein lipase and CETP activities.

Tholstrup, T., et al. (1998). "Effect of modified dairy fat on postprandial and fasting plasma lipids and lipoproteins in healthy young men." Lipids **33**(1): 11-21.

Fatty acid profile of milk fat can be modified by cow feeding strategies. Our aim was postprandially and after 4 wk to compare the effect of a modified milk fat (M diet) [with 16% of the cholesterolemic saturated fatty acid (C12-16) replaced by mainly oleic and stearic acids] with the effect of D diet, including a conventional Danish milk fat on plasma lipids and lipoproteins. A side effect of the cow feeding regime was a 5% (w/w) increase in trans fatty acid in M diet. Eighteen subjects were fed for two periods of 4 wk strictly controlled isoenergetic test diets with 40% of energy from total fat and the same content of dietary cholesterol in a randomized study with cross-over design. Contrary to expectations, fasting low density lipoprotein (LDL) cholesterol concentration did not differ after the experimental periods. However, M diet resulted in a higher fasting total triacylglycerol concentration compared to D diet (P = 0.009). Postprandial samples were taken at two different occasions (i) at day 21, after breakfast and lunch and (ii) on the last day of the study 2, 4, 6, and 8 h after a fat load. Postprandial plasma triacylglycerol and chylomicron triacylglycerol showed higher peak Values after D diet than M diet (interaction effect, diet x times P < 0.05). In conclusion, M diet did not lower LDL cholesterol compared to D diet. Thus any cholesterol-lowering effect of oleic and stearic acids may have been obscured by the high content of cholesterol-raising saturated fatty acids in mi Ik fat. A higher content of the trans fatty acids in M diet might have counteracted the cholesterol neutral/decreasing effect and increased plasma triacylglycerol.

Thomas, L. H. (1992). "ISCHEMIC-HEART-DISEASE AND CONSUMPTION OF HYDROGENATED MARINE OILS IN ENGLAND AND WALES." Journal of Epidemiology and Community Health **46**(1): 78-82.

Study objective - The aim was to examine the hypothesis that hydrogenated fats, particularly those obtained from marine oils, may present a health hazard. Design - Storage fat specimens obtained at necropsy were collected from several areas in England and Wales during 1975-1978. Cases (n = 136 samples) consisted of males dying of ischaemic heart disease, male deaths from unrelated causes acting as controls (n = 95 samples). The fatty acid compositions of the specimens were determined, and analysis included those acids-16:1 trans and "higher" C-20 plus C-22 (H)-highly characteristic of partially hydrogenated marine oils. Measurements and main results - The case samples, which had been shown to be the richer in 16:1 trans (p < 0.005), were now found to have a significantly higher value of the ratio 16:1 trans to H (p < 0.002), arising from consumption of differing hydrogenated marine oil types. Conclusions - It is concluded that the cases had consumed a greater amount (p < 0.001) of hydrogenated marine oils of a certain type, ie, that manufactured from certain highly unsaturated raw oils. The process of partial hydrogenation results in conversion to a product containing large amounts of polyunsaturated acids (PUFA) which are no longer in the natural all-cis methylene interrupted configuration. Such isomeric PUFA may obstruct or compete with utilisation of natural PUFA. It is further concluded that the case excess did not rise from medical advice favouring margarine or from any difference in social class status, but rather from fortuitous selection of margarine brand.

Thomas, L. H. and R. G. Scott (1981). "ISCHEMIC-HEART-DISEASE AND THE PROPORTIONS OF HYDROGENATED FAT AND RUMINANT ANIMAL FAT IN ADIPOSE-TISSUE AT POSTMORTEM EXAMINATION - A CASE-CONTROL STUDY." Journal of Epidemiology and Community Health **35**(4): 251-255.

Thompson, D. H. and D. M. Warburton (1992). "LIFE-STYLE DIFFERENCES BETWEEN SMOKERS, EX-SMOKERS AND NONSMOKERS, AND IMPLICATIONS FOR THEIR HEALTH." Psychology & Health **7**(4): 311-321.

Much evidence has been published in order to demonstrate that smoking cessation leads to a decrease in morbidity and mortality. Using data from the Health and Lifestyle Survey respondents were divided into three groups: smokers, ex-smokers and non-smokers and lifestyle characteristics such as diet and exercise were compared. Smokers were more likely to eat chips (French fries), fried food, butter and less likely to eat fresh fruit in winter, green vegetables and margarine high in polyunsaturated fats. Non-smokers were more likely than smokers and ex-smokers to take part in keepfit, jogging and swimming. Non-smokers in smoking households were more likely than non-smokers in non-smoking households to eat fried food, chips and butter and less likely to eat fruit in winter or margarine high in polyunsaturated fats. Results suggest that part of the assumed health benefits of smoking cessation are due to ex-smokers having a healthier diet than that of smokers.

Thompson, R. L., et al. (1995). "DIETARY CHANGE AFTER SMOKING CESSATION - A PROSPECTIVE-STUDY." British Journal of Nutrition **74**(1): 27-38.

A population sample of 375 men and women cigarette smokers were recruited to take part in a prospective study of smoking cessation to test the hypothesis that stopping smoking is associated with an increased consumption of the essential fatty acid linoleic acid, which explains the concomitant reduction in risk of coronary heart disease. Diet was assessed using a 10 d weighed record in 301 smokers at baseline, 153 at 4-month follow-up, of whom twenty-six had quit smoking, and 122 at 1-year follow-up, of whom twenty had quit. Compared with continuing smokers, those who had quit at the 4-month follow-up (mean 10 and 13 weeks for men and women respectively) had statistically significant increases in body weight (5%), energy intake (13%), total dietary fat (24%), all specific types of dietary fat (26% polyunsaturated fat, 26% linoleic acid, 30% eicosapentaenoic acid, 23% monounsaturated fat and 22% saturated fat) and vitamin E intake (19%). The foods which appeared to contribute to increases in energy and fat intakes at the 4-month follow-up were vegetable oils and polyunsaturated margarines, processed meats and meat pies. By follow-up at 1 year (mean time since quitting 31 and 41 weeks for men and women respectively) there were no detectable differences in energy and total fat intakes. However, intakes of eicosapentaenoic acid and pteroylglutamate (folate) were statistically significantly higher in the quitters compared with the continuing smokers (37% for eicosapentaenoic acid and 16% for folate). We conclude that the short-term increase in dietary intake of linoleic acid, which is not sustained by 1 year, cannot explain the reduction in risk of coronary disease following smoking cessation.

Tiepolt, S., et al. (2003). "Alcohol consumption by diabetics in Germany." Ernahrungs-Umschau **50**(9): 332-+.

Aims: The present study was to inform about alcohol consumption in 1988 persons with diabetes who had been recruited in 18 centres of Germany in the year 2000, and to reveal potential differences in the daily dietary intakes and other characteristics between those regularly taking alcoholic drinks and those never or rarely drinking alcohol. Methods: A standardized questionnaire was used to assess demographic data, risk factors and medication of the patients. Intakes of alcoholic drinks, i.e. of beer, wine and spirits, as well as daily food intakes were evaluated by employing a validated food frequency questionnaire. Results: 16 % of the persons with diabetes (26 % male, 7.5 % female) reported to regularly consume alcoholic drinks (3-6 times/week, once/day or several times/day) while 38 % (25 % male, 50 % female) reported no or very little (less than once/month) alcohol intake. Total alcohol intake was significantly higher in men than in women (7.7 g/day vs. 2.8 g/day, p <0.0001). The non-diabetic German population, according to the 1998 National Health Survey, consumed more alcohol than the diabetic subgroup of the survey (males: 11.6 vs. 9.3 g alcohol/day, females: 5.3 vs. 2.9 g alcohol/day) and the persons with diabetes included in the present study. Persons with diabetes regularly drinking alcohol have been found to consume less frequently vegetables, salads, fruit, whole-meal bread and margarine, but more often butter, sausages, fast food, chocolate and chips. Those who preferred wine ate more frequently whole-meal bread, cheese, fruit and low-fat food than those who preferred beer. The upper limit of alcohol intake per day, according to the recommendations of the German Diabetes Association, was exceeded by 4.8 % of the female and 2.3% of the male persons with diabetes. Conclusions: It is supposed that about 3.6 % of the persons with diabetes regularly exceed the upper limit of admissible alcohol intake. Compared with those who never or rarely drink alcohol, the diet of regular drinkers contains less carbohydrates and dietary fibre, but more fat. Persons with diabetes who prefer wine show a more favourable dietary pattern than those who prefer beer. Alcohol consumption by persons with diabetes is lower than in the non-diabetic population.

Tittelbach, T. J. and R. D. Mattes (2001). "Oral stimulation influences postprandial triacylglycerol concentrations in humans: Nutrient specificity." Journal of the American College of Nutrition **20**(5): 485-493.

Objective: To determined whether the nature of the lipid in an oral stimulus modifies postprandial triacylglycerolemia, Methods: Sixteen healthy adults (eight male, eight female) participated in six test sessions conducted weekly. The test sessions were administered randomly after overnight fasts and included: ingestion of 50 grams of butter in capsules (to avoid oral stimulation with lipids) and 500 mL of water in 15 minutes followed by oral stimulation with one of the following foods on a cracker: butter, unsaturated fatty acid (UFA) margarine, jelly, UFA margarine + jelly, cracker alone or no oral stimulation. Sensory stimulation entailed masticating and expectorating similar to5.0 g samples of each stimulus every three minutes for 110 minutes. Blood was drawn immediately after preload ingestion and at minutes 35, 851 200, 320, and 440 post loading and analyzed for serum triacylglycerol (TAG), insulin and glucose concentrations. Results: Only the oral samples containing the UFA margarine led to significant elevations of serum TAG concentration compared to baseline (p < 0.05). Maximum change of TAG concentrations were greater following orosensory stimulation with UFA margarine compared to orosensory stimulation with butter, jelly or UFA margarine + jelly. No differences were observed relative to vehicle alone or no orosensory stimulation, but this is due to lower nadir values for these treatments. Insulin and glucose concentrations were not different between treatments. Conclusion: Oral exposure specifically to an unsaturated dietary lipid augments the postprandial rise of TAG, compared to baseline.

Tokumura, A., et al. (2000). "Structural identification of phosphatidylcholines having an oxidatively shortened linoleate residue generated through its oxygenation with soybean or rabbit reticulocyte lipoxygenase." Journal of Lipid Research **41**(6): 953-962.

Phosphatidylcholines (PCs) with platelet-activating factor (PAF)-like biological activities are known to be generated by fragmentation of the sn-2-esterified polyunsaturated fatty ac;vl group, The reaction is free radical-mediated and triggered by oxidants such as metal ions, oxyhemoglobin, and organic hydroperoxides, In this study, we characterized the PAF-like phospholipids produced on reaction of PC having a linoleate group with lipoxygenase enzymes at low oxygen concentrations. When the oxidized PCs were analyzed by gas chromatography-mass spectrometry, two types of oxidatively fragmented PC were detected. One PC had an sn-2-short chain saturated or unsaturated acyl group (C(8)-C(13)) with an aldehydic terminal; the abundant species were PCs with C(9) and C(13). The other PC had a short chain saturated acyl group (C(6)-C(9)) with a methyl terminal, and the most predominant species was PC with C(8). When the extracts of oxidation products were subjected to catalytic hydrogenation, PCs having saturated acyl groups (C(6)-C(14)) were detected; the most abundant was C(12) species. The less regiospecific formation of PAF-like lipids suggests that they were generated by oxidative fragmentation of PC hydroperoxides formed by non-stereoselective oxygenation of the alkyl radical of esterified linoleate that escaped from the active centers of Lipoxygenases, One of the PAF-like PC with an aldehydic terminal was found to be bioactive; it inhibited the production of nitric oxide induced by lipopolysaccharide and interferon-gamma in vascular smooth muscle cells from rat aorta.

Tonetto, G. M., et al. (2009). "Partial hydrogenation of sunflower oil: Use of edible modifiers of the cis/trans-selectivity." Journal of Molecular Catalysis a-Chemical **299**(1-2): 88-92.

The partial hydrogenation of sunflower oil with minimum trans-isomer formation is studied, using a Pd/gamma-alumina catalyst modified with promoters apt for human consumption: ethyl benzoate and magnesium glycinate. It was found that the hydrogenation rate diminishes with the additions of the modifiers. Regarding the cis/trans-selectivity. significant differences were found: ethyl benzoate promoted the formation of trans-isomers, whereas magnesium glycinate diminished it. The results can be interpreted in terms of different effects: change in the electron density of palladium, which affects the relative adsorption strength of the reactant, intermediates and hydrogen, and a block of part of the surface by the modifiers. Theoretical calculations were performed to support this hypothesis. (C) 2008 Elsevier B.V. All rights reserved.

Toral, P. G., et al. (2010). "Milk fatty acid profile and dairy sheep performance in response to diet supplementation with sunflower oil plus incremental levels of marine algae." Journal of Dairy Science **93**(4): 1655-1667.

In an attempt to develop strategies for enhancing the nutritional value of sheep milk fat, dairy ewe diet was supplemented with 3 incremental levels of marine algae (MA), in combination with sunflower oil, to evaluate the effects of these marine lipids on milk fatty acid (FA) profile and animal performance. Fifty Assaf ewes in mid lactation were distributed in 10 lots of 5 animals each and allocated to 5 treatments (2 lots per treatment): no lipid supplementation (control) or supplementation with 25 g of sunflower oil/kg of DM plus 0 (SO), 8 (SOMA,), 16 (SOMA(2)), or 24 (SOMA(3)) 9 Of MA (56.7% ether extract)/kg of DM. Milk production and composition, including FA profile, were analyzed on d 0, 3, 7, 14, 21, and 28 of treatment. Neither intake nor milk yield were significantly affected by lipid addition, but all MA supplements decreased milk fat content from d 14 onward, reaching a 30% reduction after 28 d on SOMA3. This milk fat depression might be related not only to the joint action of some putative fat synthesis inhibitors, such as trans-9,cis-11 C18:2 and probably trans-10 C18:1, but also to the limited ability of the mammary gland to maintain a desirable milk fat fluidity, that would have been caused by the noticeable increase in trans-C18:1 together with the lowered availability of stearic acid for oleic acid synthesis through Delta(9)-desaturase. Furthermore, all lipid supplements, and mainly MA, reduced the secretion of de novo FA (C6:0-C14:0) without increasing the yield of preformed FA (>C16). Supplementation with sunflower oil plus MA resulted in larger increases in cis-9,trans-11 C18:2 than those observed with sunflower oil alone, achieving a mean content as high as 3.22% of total FA and representing a more than 7-fold increase compared with the control. Vaccenic acid (trans-11 C18:1) was also significantly enhanced (on average +794% in SOMA treatments), as was C22:6 n-3 (DHA) content, although the transfer efficiency of the latter, from the diets to the milk, was very low (5%). However, the highest levels of MA inclusion (SOMA(2) and SOMA(3)) reduced the milk n-6:n-3 ratio, but MA supplements caused an important increase in trans-10 C18:1, which would rule out the possibility that this milk has a healthier fat profile before determining the specific role of each individual FA and ensuring that this transm-FA is at least innocuous in relation to cardiovascular disease risk.

Torrejon, C. and R. Uauy (2011). "Quality of fat intake, atherosclerosis and coronary disease: effects of saturated and trans fatty acids." Revista Medica De Chile **139**(7): 924-931.

Epidemiological, clinical and metabolic research has shown a strong association between dietary fatty acids intake and cardiovascular disease (CVD) risk factors and clinical events. Saturated fatty acids (SPA) and trans fatty acids (TFA) derived from industrial hydrogenation of oils have been associated with an increased prevalence of CVD. However experimental results on the relationship between physiological/pathologic effects and specific functions of individual SFA are often contradictory. Therefore a more detailed exploration of the potential benefit and risks of specific saturated and trans fatty acids is needed in order to update dietary recommendations. In the case of TFAs, the deleterious effect on CVD has been well demonstrated and a maximum accepted level of 1 % of total energy has been agreed internationally. What is currently under discussion is what would be the best alternative to replace them in the diet. (Rev Med Chile 2011; 139: 924-931).

Trautwein, E. A., et al. (2010). "PLANT STEROLS - A DIETARY APPROACH FOR EFFECTIVE BLOOD LIPID LOWERING AS PART OF A HEART HEALTHY DIET." Current Topics in Nutraceutical Research **8**(4): 137-148.

Plant sterols (PS) are naturally occurring compounds found in foods of plant-based origin. Despite their structural similarity with cholesterol, PS are not absorbed in significant quantities; their intestinal absorption is less than 2% as compared to 30-60% for cholesterol, PS partly inhibit intestinal cholesterol absorption, which is the underlying mechanism of action responsible for their cholesterol-lowering dirt. The cholesterol-lowering action of PS was already known in the 1950s and to date several meta-analyses have summarised the evidence for their total and LDL-cholesterol (LDL-C) lowering effect in intervention studies with different populations consuming a variety of plant sterol-enriched foods. The effect is dose-dependent with an intake around 2 g/day resulting in a reduction in LDL-C of about 10% on average, while doses above 3 g/day do not add much additional benefit. The cholesterol-lowering effect of PS is established within a few weeks and is maintained over longer periods as established in long-term efficacy studies lasting up to 85 months. The effect of PS is additive to that of a lipid-lowering diet and is also effective on top of treatment with lipid-lowering drugs like e.g. statins. PS-enriched foods can contribute to increasing the effectiveness of a heart healthy diet in lowering LDL-C and offer a valuable addition to coronary, heart disease risk reduction strategies. PS and stanols, the saturated counterparts of PS, are among the first food compounds for which the European Food and Safety Authority approved a disease risk reduction health claim.

Triantafillou, D., et al. (2003). "Fatty acid content of margarines in the Greek market (including trans-fatty acids): a contribution to improving consumers' information." International Journal of Food Sciences and Nutrition **54**(2): 135-141.

The fatty acid composition, including trans-fatty acids, of 15 margarine samples from the Greek market was determined by gas-liquid chromatography. Saturated, cis-monounsaturated and polyunsaturated fatty acids have been found in the ranges of 24.1-53.3%, 15.5-50.3%, and 14.3-50.2% of total fatty acids, respectively. The trans-fatty acid content of Greek margarines varied from 0.1 to 19% and was, on the average, lower than previously reported. The high content in saturated fatty acids of the samples examined is criticized. There is significant discrepancy between fatty acid composition and the description of the product on the label. A concise index to describe fatty acid composition is proposed. This index can appear on the label and would give the consumers a much more accurate picture of the fatty acid composition.

Tripathy, S. and D. B. Jump (2013). "Elovl5 regulates the mTORC2-Akt-FOXO1 pathway by controlling hepatic cis-vaccenic acid synthesis in diet-induced obese mice." Journal of Lipid Research **54**(1): 71-84.

Elevated hepatic expression of fatty acid elongase-5 (Elovl5) induces FoxO1 phosphorylation, lowers FoxO1 nuclear content, and suppresses expression of genes involved in gluconeogenesis (GNG). In this report, we define the molecular and metabolic basis of Elovl5 control of FoxO1 phosphorylation. Adenoviral-mediated (Ad-Elovl5) induction of hepatic Elovl5 in diet-induced obese, glucose-intolerant mice and HepG2 cells increased the phosphorylation of Akt2-S-473 [mammalian target of rapamycin complex-2 (mTORC2) site], but not Akt2-T-308 (PDK1 site). The Akt2 inhibitor Akti1/2 blocked Elovl5 induction of FoxO1-S-256 phosphorylation in HepG2 cells. Elevated Elovl5 activity in liver and HepG2 cells induced rictor mRNA, rictor protein, and rictor-mTOR interaction, whereas rictor knockdown (siRNA) attenuated Elovl5 induction of Akt2-S-473 and FoxO1S(256) phosphorylation in HepG2 cells. FA analysis revealed that the abundance of cis-vaccenic acid (18:1,n-7) was increased in livers of obese mice and HepG2 cells following Ad-Elovl5 infection. Treating HepG2 cells with Elovl5 substrates established that palmitoleic acid (16:1,n-7), but not gamma-linolenic acid (18:3,n-6), induced rictor protein, Akt-S-473, and FoxO1-S-256 phosphorylation. Inhibition of FA elongation blocked 16:1,n-7 but not 18:1,n-7 induction of rictor protein and Akt-S-473 and FoxO1-S-256 phosphorylation. These results establish a novel link between Elovl5-mediated synthesis of 18:1,n-7 and GNG through the control of the mTORC2-Akt-FoxO1 pathway.-Tripathy, S. and D. B. Jump. Elovl5 regulates the mTORC2-Akt-FOXO1 pathway by controlling hepatic cis-vaccenic acid synthesis in diet-induced obese mice. J. Lipid Res. 2013. 54: 71-84.

Troisi, R., et al. (1992). "TRANS-FATTY-ACID INTAKE IN RELATION TO SERUM-LIPID CONCENTRATIONS IN ADULT MEN." American Journal of Clinical Nutrition **56**(6): 1019-1024.

The relation of trans-fatty acid intake to fasting serum lipid concentrations was evaluated in a cross-sectional study of 748 men aged 43-85 y. Multiple-linear-regression analysis was used to adjust for age, body mass index, waist-to-hip circumference ratio, smoking status, physical activity, alcohol intake, total energy, dietary cholesterol and linoleic acid, and previous serum cholesterol concentration. Trans-fatty acid intake was directly related to total serum (r = 0.07, P = 0.04) and low-density-lipoprotein cholesterol (LDL) (r = 0.09, P = 0.01), and inversely related to high-density-lipoprotein (HDL) cholesterol (r = 0.08, P = 0.03). Trans-fatty acid intake was positively associated with the ratios of total to HDL cholesterol (r = 0.11, P = 0.002) and LDL to HDL cholesterol (r = 0.12, P = 0.001). The estimated ratios of total to HDL cholesterol were 4.4 and 4.9 for persons at the 10th (2.1 g/d) and 90th (4.9 g/d) percentiles of trans-fatty acid intake, respectively. On the basis of results from other studies, these ratios would correspond to a 27% increase in risk of myocardial infarction.

Tsai, C. J., et al. (2005). "Long-term intake of trans-fatty acids and risk of gallstone disease in men." Archives of Internal Medicine **165**(9): 1011-1015.

Background: The consumption of trans-fatty acids adversely affects blood lipid levels. The relationship with the incidence of gallstone disease is unknown. Methods: We prospectively studied consumption of trans-fatty acids in relation to the risk of gallstone disease in a cohort of 45 912 men. trans-Fatty acid consumption was assessed using a validated semiquantitative food frequency questionnaire. Newly diagnosed gallstone disease, by radiology or cholecystectomy, was ascertained biennially. Results: During 14 years of follow-up, we documented 2356 new cases of symptomatic gallstones. After adjusting for age and other potential risk factors, we found that compared with men in the lowest quintile of dietary intake of trans-fatty acids, the relative risk (RR) of gallstone disease for those in the highest quintile was 1.23 (95% confidence interval [CI], 1.04-1.44; P for trend, .03). Among individual trans-fatty acids, the RR for trans-oleic fatty acid, when extreme quintiles were compared, was 1.24 (95% CI, 1.06-1.45; P for trend, .02). Intakes of trans-palmitoleic fatty acid (RR, 1.09; 95% CI, 0.90-1.31), trans,trans 18:2 fatty acid (RR, 1.14; 95% CI, 0.96-1.34), and cis-trans 18:2 fatty acid (RR, 1.00; 95% CI, 0.86-1.16) were not significantly associated with the risk. Conclusions: Our results suggest that a higher intake of trans-fatty acids modestly increases risk of gallstone disease. This adds to the concern that partial hydrogenation of vegetable oils to form shortening and margarine can lead to adverse health effects.

Tsuzuki, W. (2012). "trans Fatty Acid Problem in Japan." Food Hygiene and Safety Science **53**(1): J13-J17.

Tsuzuki, W., et al. (2010). "Formation of trans fatty acids in edible oils during the frying and heating process." Food Chemistry **123**(4): 976-982.

To assess an impact of heated edible oils on intake of trans fat, the formations of trans fatty acids (TFAs) in cooking conditions was estimated by a frying and heating model system. For the frying model, sliced raw potatoes (10% of the frying oil (w/w)) were fried in commercially available canola oil at 160, 180 and 200 degrees C, and the 10 frying cycles were performed. The TFAs contained both in fried potatoes and in frying oils were measured by gas chromatography (GC). Lipids content of raw potatoes was about 0.1% (w/w) and TFAs in the raw potatoes were negligible. On the other hand, fried potatoes contained lipids at the level of 8.8%-9.2% and their fatty acid composition was mostly in correspondence with that of the frying oil. The TFAs amount of potatoes fried by the tenth frying operation was at the level of 0.99-1.05 g/100 g lipids. When 100 g potatoes fried in this process were consumed, the TFAs intake was estimated at less than 0.1 g. After 10 frying operations, TFAs content, acid values and peroxide values of the frying oils were measured and compared with those of corresponding heated canola oils without food. The amounts of trans 18:1 FM contained both in the frying oil and in heated oil were less than the quantitative limit (0.047 g/100 g oil). The increases of trans 18:2 FAs and trans 18:3 FAs of the used frying oil were 0.02 g/100 and 0.05 g/100 g, respectively, compared with those of the fresh oil. trans 18:2 FAs accumulation in the heated oil was slightly less than that in the frying oil. To elucidate TFAs accumulation in various edible oils during cooking, six kinds of commercially available edible vegetable oils were heated to 180 degrees C in glass test tubes. Small changes in TFAs amounts were observed after four hours heating. These results suggested that an ordinary frying process using unhydrogenated edible oils has little impact on TFAs intake from edible oils. (C) 2010 Elsevier Ltd. All rights reserved.

Turner, K. (2009). "A Review of US Patents in the Field of Organic Process Development Published During February and March 2009." Organic Process Research & Development **13**(4): 669-682.

In the current review there are 19 patents from an initial list of 285 that met the search criteria. Despite there being slightly fewer than usual, there is probably more chemistry described because several of the patents contain some detailed process schemes. Antidepressants are regular subjects in patents, and an enantioselective hydrogenation is described for preparing aminoalcohols that are used as intermediates in producing duloxetine and related drugs. A second patent on antidepressants describes a new demethylation method that can be used in the preparation of desvenlafaxine, the active metabolite in venlafaxine. Those readers who are trying to stop smoking may be interested in two patents. One is a process to produce chinazoline alkaloids that can be used to treat nicotine addition. The second one is a synthetic route to lobelin that is found in certain plants and also helps with smoking cessation as well as treating asthma attacks, Simulated moving bed methods are usually found in the separation of close boiling isomers in the petrochemicals industry or, more recently, enantiomers. A patent uses the technique in a novel reactor for the preparation of acetals using ion-exchange catalysis. Processes for preparing drugs for the treatment of a number of neurological disorders are described in a number of patents. One covers the isolation of aminoindane intermediates for the production of Azilect, a drug used for treating Parkinsonism. The process describes various crystallisation, methods. In another patent improvements in the yields of tetrafluorobenzylanilines are described that claim to give lower levels of a dimer impurity without providing analytical details. Olanzapine is used to treat schizophrenia, and a method of preparing the compound is described that avoids using expensive or toxic reagents employed in alternative processes. The HCl salt of atomoxetine is available as the drug Strattera and is used to treat hyperactivity; a high yield process to produce the salt is disclosed that includes a racemisation step. Drugs to treat or prevent. coronary problems are covered in this selection of patents, and a very comprehensive one deals with intermediates for producing statins. It describes the stereoselective preparation of a C7 side chain that is common in the statins. A stereoselective process for the preparation of chiral azetidinones is described, and these can be used to treat atherosclerosis. Factor Xa inhibitors are also used to treat coronary diseases, and a patent describes the production of pyrrolidine carboxylic acids that can be useful in preparing these important drugs. The process uses the cheap bulk chemical urea although half of it is wasted. Patents are reviewed that describe processes to prepare drugs for die treatment of viral infections. One of these covers a very large amount of work on entecavir for hepatitis B and involves preparing several novel intermediates, using a C-Si oxidation step. The other describes dioxolones that are HIV integrase inhibitors. It uses a K-containing base in a coupling reaction that would nromally be expected to require a stronger base, The drug Gleevec is used for treating leukaemia, and the Usual synthetic methods require the use of the toxic reagent, cyanamide. A new process avoids using this compound, and like another one mentioned above, uses urea. A very long and detailed patent describes a new method for producing the antihistamine carebastine. Despite the amount of information on the proposed process there is a lack of experimental detail to support many of the claims Another detailed patent describes an improved method of producing the veterinary antibiotic ceftiofur. Methionine is a very important amino acid, and a new preparation of a alpha-hydroxyketone is described using a carbene-catalysed umpolung reaction of aldehydes. An interesting feature of this patent is that from over 3.6 million U.S. patents issued since 1976 this is the only one containing the word umpolung in the title. A patent details improvements in preparing pioglitazone and rosiglitazone, drugs that are used for treating type It diabetes. A catalytic hydrogenation process for reducing a C=C bond is replaced by using dithionite in water and reduces the safety issues associated with H, under pressure. There is no legal or commercial significance in the choice of patents in this review although a number of patents describe experiments on kilo scale and above. One in particular has only one example, but it does report making 50 kilo of material, and so it is clearly at an advanced stage of development if not in commercial operation. The advantages mentioned in this review are those claimed in the patent, unless this reviewer has personal knowledge of the subject.

Tyburcz, C., et al. (2009). "Individual Trans Octadecenoic Acids and Partially Hydrogenated Vegetable Oil Differentially Affect Hepatic Lipid and Lipoprotein Metabolism in Golden Syrian Hamsters." Journal of Nutrition **139**(2): 257-263.

Trans fatty acids (TFA) from industrial sources [i.e. partially hydrogenated vegetable oil (PHVO)] have been associated with several chronic human diseases, especially coronary heart disease (CHD). The possible contribution of individual TFA to overall CHD risk remains largely unknown. The objective of the present study was to investigate the effects of 2 major trans 18:1 isomers, trans-9 18:1 lelaidic acid (EA)] and trans-11 18:1 [vaccenic acid (VA)] on plasma lipid biomarkers of CHID risk. Thirty-two male Golden Syrian hamsters were randomly assigned to 1 of 4 dietary treatments: 1) control "Western" diet; 2) PHVO supplement; 3) EA supplement; and 4) VA supplement. Fat supplements were incorporated into the respective treatment diets at 2.5 g/100 g of diet. Compared with the control diet, the PHVO diet increased the plasma ratios of total: HDL-cholesterol and non HDL:HDL-cholesterol by 17 and 23%, respectively. In contrast, these values decreased by 27 and 46% after the EA treatment and 8 and 14% after the VA treatment, respectively, indicating an improvement (reduction) in CHD risk. With regard to liver lipids, the EA diet reduced the content of (n-3) and (n-6) PUFA relative to the other treatments, suggesting an inhibition of enzymes common to the 2 biosynthesis pathways. Overall, results demonstrate that the hypercholesterolemic effects of PHVO are not dependent on the presence of EA or VA and that other bioactive components in PHVO must be responsible for its associated adverse health effects. J. Nutr. 139: 257-263, 2009.

Tzonou, A., et al. (1993). "DIET AND CORONARY HEART-DISEASE - A CASE-CONTROL STUDY IN ATHENS, GREECE." Epidemiology **4**(6): 511-516.

We conducted a case-control study in Athens, Greece, between January 1990 and April 1991 to examine the association between diet and coronary heart disease. The case series comprised 329 patients with electrocardiographically confirmed first coronary infarct or a first positive coronary arteriogram, or both, who were admitted to a major teaching hospital during a 16-month period. Controls were 570 patients admitted to the same hospital for major conditions believed to be unrelated to nutrition. Total energy intake was inversely associated with coronary heart disease risk, a quintile energy increase corresponding to a relative risk of 0.96. After controlling for total energy intake, dietary fat was positively related to coronary heart disease, and total carbohydrates were negatively related to coronary heart disease, the nutrient-specific relative risks for a quintile increase being 1.19 (95% confidence interval = 0.96-1.48) and 0.81 (95% confidence interval = 0.67-0.97), respectively. Major fat components (saturated, monounsaturated, and polyunsaturated fat) did not appear to have differential risk implications for coronary heart disease; however, cooking with margarine was associated with an increased relative risk (1.87; 95% confidence interval = 0.82-4.28). Dietary proteins, cholesterol, and vitamin C were not associated with coronary heart disease.

Ubhayasekera, S., et al. (2010). "Effect of Feed Fat By-Products with Trans Fatty Acids and Heated Oil on Cholesterol and Oxycholesterols in Chicken." Journal of the American Oil Chemists Society **87**(2): 173-184.

Chicken is the most widely consumed meat all over the world due to chickens being easy to rear, their fast growth rate and the meat having good nutritional characteristics. The main objective of this paper was to study the effects of dietary fatty by-products in low, medium and high levels of oxidized lipids and trans fatty acids (TFAs) on the contents of cholesterol and oxycholesterols in meat, liver, and plasma of chickens. A palm fatty acid distillate, before and after hydrogenation, and a sunflower-olive oil blend (70/30, v/v) before and after use in a commercial frying process were used in feeding trials after adding 6% of the fats to the feeds. Highly oxidized lipid and TFA feeds significantly increased the contents of cholesterol and oxycholesterols in all tissues of chicken (0.01 < p a parts per thousand currency sign 0.05). The contents of oxycholesterols in chicken meat, liver and plasma obtained from TFA feeding trials varied between 17 and 48 mu g/100 g in meat, 19-42 mu g/100 g in liver and 105-126 mu g/dL in plasma. In contrast, in the oxidized lipid feeding trials, oxycholesterols varied between 13 and 75 mu g/100 g in meat, 30-58 mu g/100 g in liver and 66-209 mu g/dL in plasma. Meat from chickens fed with feeds containing high levels of TFAs or oxidized lipids may contribute to higher ingestion of cholesterol and oxycholesterols by humans.

Upritchard, J. E., et al. (2005). "Modern fat technology: what is the potential for heart health ?" Proceedings of the Nutrition Society **64**(3): 379-386.

Saturated and trans-fatty acids raise total cholesterol and LDL-cholesterol and are known to increase the risk of CHD, while dietary unsaturated fatty acids play important roles in maintaining cardiovascular health. Replacing saturated fats with unsaturated fats in the diet often involves many complex dietary changes. Modifying the composition of foods high in saturated fat, particularly those foods that are consumed daily, can help individuals to meet the nutritional targets for reducing the risk of CHD. In the 1960s the Dutch medical community approached Unilever about the technical feasibility of producing margarine with a high-PUFA and low-saturated fatty acid composition. Margarine is an emulsion of water in liquid oil that is stabilised by a network of fat crystals. In-depth expertise of fat crystallisation processes allowed Unilever scientists to use a minimum of solid fat (saturated fatty acids) to structure a maximum level of PUFA-rich liquid oil, thus developing the first blood-cholesterol-lowering product, Becel. Over the years the composition of this spread has been modified to reflect new scientific findings and recommendations. The present paper will briefly review the developments in fat technology that have made these improvements possible. Unilever produces spreads that are low in total fat and saturated fat, virtually free of trans-fatty acids and with levels of n-3 and n-6 PUFA that are in line with the latest dietary recommendations for the prevention of CHD. Individuals with the metabolic syndrome have a 2-4-fold increased risk of developing CHD; therefore, these spreads could make a contribution to CHD prevention in this group. In addition, for individuals with the metabolic syndrome the spreads could be further modified to address their unique dyslipidaemia, i.e. elevated blood triacylglycerols and low HDL-cholesterol. Research conducted in the LIPGENE study and other dietary intervention studies will deliver the scientific evidence to justify further modifications in the composition of spreads that are healthy for the heart disease risk factors associated with the metabolic syndrome.

Uusitalo, U., et al. (2005). "Dietary Westernisation: conceptualisation and measurement in Mauritius." Public Health Nutrition **8**(6): 608-619.

Objectives: The aims of the study were to provide information that will contribute to conceptualising what is called 'dietary Westernisation', and to provide an example of measuring it on an individual level. Design: Food consumption frequency and demographic data on adults in Mauritius were examined in 1988, 1992 and 1998. In 1992, a 24-hour recall was also included. The cross-sectional samples consisted of 1115 (age 25-74 years) Mauritians in 1987/88, 1917 (age 30-74 years) in 1992 and 2239 (age 20-74 years) in 1998. Principal components analysis was carried out on daily consumption frequencies of 10 indicator foods (white rice, white bakery bread, pulses, processed meat, poultry, fresh/frozen fish, butter, margarine, whole milk and skimmed/low-fat milk). Correlations between dietary patterns and selected food consumption frequencies were examined in each survey year. Results: Four dietary patterns were identified as being related to dietary Westernisation. The Traditional dietary pattern was characterised by higher consumption frequencies of Indian breads, salted/smoked fish and sugar-sweetened tea. The Western dietary pattern was characterised by higher consumption frequencies of cakes/pastries, meat and many Western fast foods like burgers, but, surprisingly, also by brown bread, breakfast cereals and salad. The Bread/butter dietary pattern predominantly described more frequent consumption of bread compared with rice. The Margarine/milk dietary pattern was inconsistently related with staple foods. Younger, educated and wealthier Mauritians appeared to adopt Western dietary patterns earlier. Conclusions: This study suggests that relatively few indicator foods are needed for measuring dietary Westernisation. Dietary Westernisation in a non-Western country may also include shifts towards voluntary consumption of healthier foods.

Uusitupa, M. and M. Hallikainen (1999). "Efficacy of plant stanol esters in subjects consuming NCEP diets." European Heart Journal Supplements **1**(S): S91-S95.

Increased concentrations of serum cholesterol, and in particular low-density lipoprotein (LDL) cholesterol, constitute the main risk factor for atherosclerotic vascular diseases (ASVD). Dietary modification, increased physical activity, weight reduction in overweight people, and moderate alcohol consumption form the first line of treatment for hypercholesterolaemia. Combining the cholesterol-lowering effect of foods containing plant stanol esters with a low-fat, low-cholesterol diet makes it possible to achieve a clinically significant additional reduction in serum cholesterol concentrations beyond that obtained with a low-fat diet alone. Based on recent studies, serum LDL cholesterol decreases by 18-24% with this approach. To achieve the optimal cholesterol-lowering effect with foods containing stanol esters, consumers should be counselled about the principles of making healthy food choices and appropriate use of food products containing plant stanol esters.

Valeille, K., et al. (2006). "The natural concentration of the conjugated linoleic acid, cis-9,trans-11 in milk fat has antiatherogenic effects in hyperlipidemic hamsters." Journal of Nutrition **136**(5): 1305-1310.

Milk fat is usually considered to be proatherogenic, although its fatty acid composition can vary, due mainly to farming conditions. No study has evaluated whether such variation can modify the atherogenic properties of dairy fat. Aortic lipid deposition and related risk factors were examined in Syrian hamsters fed diets for 12 wk containing 200 g/kg of 2 commercial milk fats [high content of saturated fatty acids (HSF) and low content of saturated fatty acids (LSF)] contrasting, respectively, in total saturated fatty acids (72 vs. 67 g/100 g), 18:1, trans (4.24 vs. 7.26 g/100g), and conjugated linoleic acid (mainly cis-9, trans-11 or rumenic acid; 0.39 vs. 2.59 g/100 g). Hamsters fed the LSF-diet had 25% less aortic cholesteryl-ester deposition than those fed the HSF-diet; this was accompanied by an improved plasma cholesterol profile (lower LDL cholesterol and LDL:HDL cholesterol ratio), a lower local inflammatory status (aortic gene expression of cyclooxygenase-2), and lower aortic gene expression of vascular cell adhesion molecule-1 (all P < 0.05). Supplementation of the LSF-diet with rumenic acid (up to 9 g/kg) amplified the antiatherogenic effect of the original LSF-diet compared with the HSF-diet, i.e., less aortic cholesterol loading, increased reverse cholesterol transport potential (higher plasma HDL cholesterol concentration and ATP-binding cassette, subfamily A, transporter 1 gene expression in aorta), and decreased LDL-peroxidability index and gene expression of proinflammatory IL-1 beta in the aorta (all P < 0.05). In conclusion, our results suggest that the atherogenic potential of milk fat can be greatly reduced in products with a naturally high abundance of rumenic acid, and argue for increasing this fatty acid in milk.

Valsta, L. M., et al. (2004). "Estimation of plant sterol and cholesterol intake in Finland: quality of new values and their effect on intake." British Journal of Nutrition **92**(4): 671-678.

The Finnish national food composition database Fineli(R) was updated with recent analytical values for plant sterols (PS) (sitosterol, campesterol, stigmasterol, avenasterol, brassicasterols and stanols) and cholesterol. The quality of the new analytical data was assessed. The aims of the present study were: (1) to compare the effect of old and new database values on PS and cholesterol intakes based on average per capita food consumption data; (2) to estimate the current intake and major sources of these compounds in various population groups according to the national FINDIET 1997 survey data. The intake of total PS was 305 mg/d for men and 237 mg/d for women. The respective intakes for cholesterol were 284 mg/d and 201 mg/d. Women had a higher density of PS in their diets than men, whereas the cholesterol density in the diets did not differ between genders. Cereals, margarine, vegetables and vegetable oils were the main food sources of PS. Meat, meat products and eggs were the main sources of cholesterol. A 9% greater PS intake estimate was obtained with the new PS database compared with the old PS database, probably due to minor methodological differences between the new and old analyses. Notable changes in analytical methods suggest a lower value (- 19 %) for cholesterol intake calculated from the new database compared with the old one. We conclude that researchers can have confidence in the new values for PS and cholesterol, because systematic evaluation of the new analytical values showed them to be of high quality.

Valsta, L. M., et al. (2010). "Explaining the 25-year decline of serum cholesterol by dietary changes and use of lipid-lowering medication in Finland." Public Health Nutrition **13**(6A): 932-938.

Objective: To assess to what extent the observed dietary changes and increased use of lipid-lowering medication can explain the almost 20% decline in serum cholesterol (referring to serum total cholesterol) level observed from 1982 to 2007 in Finland. Design: Predicted changes of serum cholesterol were calculated by the Keys' equation assuming the effect of trans fatty acids to be similar to SFA and using the dietary intake data of the national dietary surveys between 1982 and 2007. The effect of medication was estimated based on the information on use of lipid-lowering medication among survey participants. The predicted serum cholesterol levels were compared with observed changes in analysed serum cholesterol levels. Setting: Four cross-sectional population surveys, in 1982, 1992, 2002 and 2007, in the provinces of North Karelia, Northern Savo and Southwestern Finland. Subjects: A total of 2325 men and 2638 women aged 26-64 years selected randomly from the national population register for the four surveys. Results: Changes in dietary fat quality and cholesterol intake explain 0.70 mmol/l (65%) of the decrease in men and 0.65 mmol/l (60%) of the decrease in women in all subjects. Decline in dietary SFA intake is the main explanatory factor (47% in men and 41% in women) for the changes. The impact of lipid-lowering medication on observed cholesterol levels was found to be 16% among men and 7% among women. Conclusions: The decrease in serum cholesterol levels in Finland can be explained mainly by dietary changes, especially changes in fat quality. The effect of lipid-lowering medication is less significant.

van de Vijver, L. P. L., et al. (2000). "Association between trans fatty acid intake and cardiovascular risk factors in Europe: the TRANSFAIR study." European Journal of Clinical Nutrition **54**(2): 126-135.

Background: High intakes of trans fatty acids (TFA) have been found to exert an undesirable effect on serum lipid profiles, and thus may increase the risk fur cardiovascular disease. Objective: Investigation of the association between TFA intake and serum lipids. Design: Cross-sectional study in eight European countries (Finland, France. Greece, Iceland, The Netherlands. Portugal Spain, Sweden) among 327 men and 299 women (50-65 y). Using a dietary history method, food consumption was assessed and TFA intake was calculated with recent figures on TFA levels of foods, collected in the TRANSFAIR study. Results: Mean (+/-s.d.) TFA intake was 2.40+/-1.53 g/day for men and 1.98+/-1.49 g/day for women (0.87+/-0.4896 and 0.95+/-0.55% of energy, respectively), with the highest consumption in Iceland and the lowest in the Mediterranean countries. No associations were found between total TFA intake and LDL, HDL or LDL/HDL ratio after adjustment for cardiovascular risk factors. Additional adjustment for other fatty acid clusters resulted in a significant inverse trend between total TFA intake and total cholesterol (P-trend < 0.03). The most abundantly occuring TFA isomer, C18:1 t, contributed substantially to this inverse association. The TFA isomers C14:1 t9. C16:1 t9 and C22:1 t were nut associated or were positively associated with LDL or total cholesterol, Conclusions: From this Study We conclude that at the: current European intake levels of trans fatty acids they are not associated with an unfavourable serum lipid profile. Sponsorship: Unilever Research Laboratorium. the Dutch Dairy Foundation on Nutrition and Health. Cargill BV. the Institute of Food Research Norwich Laboratory. the Nutrition Branch of the Ministry of Agriculture, Fisheries and Food. the international Fishmeal and Oil Manufacturers' Association, Kraft Foods, NV Vandemoortele Coordination Center. Danone Group, McDonalds Dc Deutschland Ins, Danish Veterinary and Food Administration. Valio Ltd. Raisio Group. Descriptors: trans fatty acids: dietary intake; cholesterol level; cardiovascular risk factors.

Van Duijn, G. (2000). "Technical aspects of trans reduction in margarines." Ocl-Oleagineux Corps Gras Lipides **7**(1): 95-98.

The opinion of nutritional science on the effect of trans fatty acids on blood cholesterol has drastically changed during the last decode. As a reaction to these new findings, the European margarine industry decided in the mid nineties to eliminate trans containing components from their margarine fat phase compositions. This excluded practically the use of partially hydrogenated oils and fats. Trans-free margarines have been introduced with optimised fat crystal structures stabilising a maximum of water in oil emulsion with a minimum of solid fat phase. These fat crystal structures ore formed by fat phase components obtained from interesterification and/or fractionation of non-hydrogenated and/or fully hydrogenated feedstocks.

van Eijsden, M., et al. (2008). "Maternal n-3, n-6, and trans fatty acid profile early in pregnancy and term birth weight: a prospective cohort study." American Journal of Clinical Nutrition **87**(4): 887-895.

Background: Maternaln-3, n-6, and trans fatty acids are claimed to affect fetal growth, yet evidence is limited. Objective: We investigated the association between maternal n-3, n-6, and trans fatty acids measured early in pregnancy and fetal growth. Design: Amsterdam pregnant women (n = 12 373) were invited to complete a questionnaire (response 67%) and donate blood around the 12th pregnancy week for nutrient analysis. For 4336 women, fatty acid concentrations were measured in plasma phospholipids (gas-liquid chromatography). Associations of these concentrations with birth weight and small-for-gestational-age (SGA) risk were analyzed (liveborn singleton term deliveries, n = 3704). Results: Low concentrations of individual n-3 fatty acids and 20:3n-6, the precursor of arachidonic acid (20:4n-6), but high concentrations of the other n-6 fatty acids and the main dietary trans fatty acid (18: 1 n - 9t) were associated with lower birth weight (estimated difference in univariate analysis -52 to - 172 g for extreme quintile compared with middle quintile). In general, SGA risk increased accordingly. After adjustment for physiologic, lifestyle-related and sociodemographic factors, low concentrations of most n-3 fatty acids and 20:3n-6 and high concentrations of 20:4n-6 remained associated with lower birth weight (-52 to -57 g), higher SGA risk, or both (odds ratios: 1.38-1.50). Infants of the 7% of women with the most adverse fatty acid profile were on average 125 g lighter and twice as likely to be small for gestational age. Conclusion: An adverse maternal fatty acid profile early in pregnancy is associated with reduced fetal growth, which, if confirmed, gives perspective for the dietary prevention of lower birth weight.

van Greevenbroek, M. M. J., et al. (1998). "Lipoprotein secretion by intestinal Caco-2 cells is affected differently by trans and cis unsaturated fatty acids: effect of carbon chain length and position of the double bond." American Journal of Clinical Nutrition **68**(3): 561-567.

The effects of trans fatty acids on intestinal lipoprotein secretion were determined in polarized Caco-2 cells. Palmitic acid (16:0), palmitoleic acid (c-16:1 Delta 9), and palmitelaidic acid (t-16:1 Delta 9), as well as stearic acid (18:0), oleic acid (c-18:1 Delta 9), c-vaccenic acid (c-18:1 Delta 11), elaidic acid (t-18:1 Delta 9), and t-vaccenic acid (t-18:1 Delta 11) were studied. Compared with 18:0 (control), c- and t-18:1 Delta 9 increased triacylglycerol secretion (2.7- and 3.6-fold, respectively) as well as apolipoprotein (apo) B-48 and apo B-100 secretion (both 1.6-fold compared with 18:0); c- and t-18:1 Delta 11 caused a modest 1.7-fold increase in triacylglycerol secretion with no significant effect on secretion of apo B. Thus, the position of the double bond in the 18:1 isomers, but not its geometrical configuration, affected lipoprotein secretion by Caco-2 cells. In contrast, the effects of the geometrical isomers (cis and trans) of C-16 fatty acids were not comparable: t-16:1 Delta 9 did not affect triacylglycerol and apo B secretion (compared with 16.0, as control) whereas c-16:1 Delta 9 was a potent stimulator of secretion of triacylglycerol (2.4-fold higher than 16:0), apo B-48 (1.3-fold higher than 16:0), and apo B-100 (1.5-fold higher than 16.0). We conclude that the carbon chain length of fatty acids, as well as the position of double bonds and their stereochemical configuration, are important determinants of the unique effects of various species of dietary tr ails fatty acids on lipoprotein secretion and composition in Caco-2 cells.

vandeVijver, L. P. L., et al. (1996). "Trans unsaturated fatty acids in plasma phospholipids and coronary heart disease: A case-control study." Atherosclerosis **126**(1): 155-161.

A high intake of trans fatty acids (TFAs) has been shown to have an undesirable effect on serum lipid profiles and lipoprotein(a) (Lp(a)) levels and may thereby increase the risk for coronary heart disease (CHD). We performed a study in CHD patients, and measured the TFA concentration of the plasma phospholipid fraction. Comparison was made between a case group with angiographically documented severe CHD (> 80% stenosis in one coronary vessel, n = 83) and a control group of patients who had just minor stenosis on the coronary angiography (< 50% stenosis in all three major vessels, n = 78). All subjects were under 68 years of age and were prestratified on age, gender and smoking habits. The two groups were comparable according to the prestratification criteria, body mass index, blood pressure, number of cigarettes smoked and total fat intake. Controls had higher plasma HDL levels (P < 0.001) and lower, albeit not significantly lower, (P = 0.07) plasma LDL levels. No significant correlations were found between percentages of TFAs in plasma phospholipids and plasma LDL or HDL cholesterol levels. Of the major Fatty acid classes, only the percentage of saturated fatty acids was significantly higher in cases (46.2 +/- 0.92%) than in controls (45.8 +/- 1.07% (means +/- S.D.)). The difference in total TFA content between cases and controls (0.32 +/- 0.02% versus 0.35 +/- 0.02%) was -0.03% (P = 0.2). For the specific TFAs C16:1n - 7tr, C18:1n - 9tr and C18:2n - 6tr, just minor differences were found. Adjusted odds ratios for tertiles of TFA percentages were 0.56 (0.25-1.23) and 0.76 (0.36-1.61) for the highest and middle tertile compared to the lowest. These findings do not support an association between TFA intake and risk for coronary heart disease.

Vantol, A., et al. (1995). "DIETARY TRANS-FATTY-ACIDS INCREASE SERUM CHOLESTERYLESTER TRANSFER PROTEIN-ACTIVITY IN MAN." Atherosclerosis **115**(1): 129-134.

The average diet may provide some 8-10 g/day of unsaturated fatty acids with a trans double bond. Previous studies showed that dietary trans fatty acids may simultaneously raise low-density lipoprotein (LDL) cholesterol and reduce high-density lipoprotein (HDL) cholesterol. Human plasma contains a protein (CETP) which transfers cholesterylesters from HDL to lipoproteins of lower density. We hypothesized that CETP could play a role in the effect of trans fatty acids on lipoproteins and measured the activity levels of CETP in serum samples from a 9-week study in which 55 volunteers were fed three controlled diets with different fatty acid profiles. Mean activity was 114 (% of reference serum) after consumption of a high trans fatty acid diet, as opposed to 96 after linoleic acid and 97 after stearic acid (P < 0.02). We conclude that the increased activity of CETP may contribute to the rise in LDL cholesterol and the fall in HDL cholesterol seen on diets with high contents of trans fatty acids.

Vaquero, M. P., et al. (2010). "Major diet-drug interactions affecting the kinetic characteristics and hypolipidaemic properties of statins." Nutricion Hospitalaria **25**(2): 193-206.

Concomitant administration of statins with food may alter statin pharmacokinetics or pharmacodynamics, increasing the risk of adverse reactions such as myopathy or rhabdomyolysis or reducing their pharmacological action. This paper reviews major interactions between statins and dietary compounds. Consumption of pectin or oat bran together with Lovastatin reduces absorption of the drug, while alcohol intake does not appear to affect the efficacy and safety of Fluvastatin treatment. Grapefruit juice components inhibit cytochrome P-4503A4, reducing the presystemic metabolism of drugs such as Simvastatin, Lovastatin and Atorvastatin. Follow-up studies on the therapeutic effect of statins in patients consuming a Mediterranean-style diet are necessary to assure the correct prescription because the oil-statin and minor oil compound-statin possible interactions have been only briefly studied. Preliminary study suggests that olive oil can increase the hypolipaemiant effect of Simvastatin with respect sunflower oil. The consumption of polyunsaturated rich oils, throughout the cytochrome P450 activation could decrease the half-life of some statins and therefore their hypolipaemic effects. The statins and n-3 fatty acids combined therapy gives rise to pharmacodinamic interaction that improves the lipid profile and leads greater cardioprotection. Although statins are more effective in high endogenous cholesterol production subjects and plant sterols are more effective in high cholesterol absorption efficacy subjects, plant esterols-statins combined therapy generates very positive complementary effects. This review ends suggesting possible diet-stain interactions that require further investigations (e.g. types of olive oils, fruit juices other than grapefruit, fibre or consumption of alcoholic beverages rich in polyphenols or ethanol).

Vargas-Bello-Perez, E. and P. C. Garnsworthy (2013). "Trans fatty acids and their role in the milk of dairy cows." Ciencia E Investigacion Agraria **40**(3): 449-473.

Lipids obtained from dairy products are an important part of the human diet in many countries. Approximately 75% of the total consumption of fat from ruminant animals comes from bovine milk fat. Trans fatty acids (tFA) are produced during biohydrogenation of mono- and poly-unsaturated FA in the rumen. They are mixtures of positional and geometrical isomers that are incorporated into the milk fat of lactating cows. The most important sources of tFA in the human diet are partially hydrogenated vegetable oils and ruminant milk and meat products. Ruminant-derived lipids often contain 1-8% of total fatty acids as tFA, which are predominantly 18:1 isomers. The most common FA in ruminant fat is vaccenic acid (18:1 trans-11) (VA), accounting for 60-80% of total tFA. Unlike other tFA, VA can be converted to rumenic acid (RA) through the action of stearoyl coenzyme-A desaturase. Today, consumers are becoming aware of the relationship between dietary fat, health maintenance, and disease prevention. These concerns have increased the need to investigate the metabolic fate and bioactivity of dietary FA. By altering the nutrition of cows, farmers can markedly and rapidly modulate the FA composition of milk FA. The largest changes can be obtained either by feeding animals high-quality forage, particularly fresh pasture, or by adding plant or marine oils to the diet. Given that economic factors define future profits for farmers, diet manipulation may be the most practical and appropriate approach to change milk's FA composition.

Vasanthi, H. R., et al. (2010). Dietary Supplements, Cholesterol and Cardiovascular Disease.

Vega-Lopez, S., et al. (2006). "Palm and partially hydrogenated soybean oils adversely alter lipoprotein profiles compared with soybean and canola oils in moderately hyperlipidemic subjects." American Journal of Clinical Nutrition **84**(1): 54-62.

Background: Partially hydrogenated fat has an unfavorable effect on cardiovascular disease risk. Palm oil is a potential substitute because of favorable physical characteristics. Objective: We assessed the effect of palm oil on lipoprotein profiles compared with the effects of both partially hydrogenated fat and oils high in monounsaturated or polyunsaturated fatty acids. Design: Fifteen volunteers aged >= 50 y with LDL cholesterol >= 130 mg/dL were provided with food for each of 4 diets (35 d/phase) varying in type of fat (partially hydrogenated soybean, soybean, palm, or canola; two-thirds fat, 20% of energy). Plasma fatty acid profiles, lipids, lipoproteins, apolipoprotein A-I, apolipoprotein 13, lipoprotein(a), glucose, insulin, HDL subtractions, and indicators of lipoprotein metabolism (HDL-cholesterol fractional esterification rate, cholesteryl ester transfer protein, phospholipid transfer protein, and paraoxonase activities) were measured at the end of each phase. Results: Plasma fatty acid profiles reflected the main source of dietary fat. Partially hydrogenated soybean and palm oils resulted in higher LDL-cholesterol concentrations than did soybean (12% and 14%, respectively; P < 0.05) and canola (16% and 18%; P < 0.05) oils. Apolipoprotein B (P < 0.05) and A-I (P < 0.05) concentrations mirrored the pattern of LDL- and HDL-cholesterol concentrations, respectively. No significant effect on the total-to-HDL cholesterol ratio was observed for palm oil compared with the other dietary fats. HDL3 cholesterol was higher after palm oil than after partially hydrogenated and soybean oils (P < 0.05). Differences in measures of glucose and HDL intravascular processing attributable to dietary fat were small. Conclusion: Palm and partially hydrogenated soybean oils, compared with soybean and canola oils, adversely altered the lipoprotein profile in moderately hyperlipidemic subjects without significantly affecting HDL intravascular processing markers.

Vega-Lopez, S., et al. (2009). "Substitution of vegetable oil for a partially-hydrogenated fat favorably alters cardiovascular disease risk factors in moderately hypercholesterolemic postmenopausal women." Atherosclerosis **207**(1): 208-212.

Objective: Compared to vegetable oils in their unmodified state, partially-hydrogenated fat is associated with less favorable effects on cardiovascular disease (CVD) risk factors. Acceptable alternatives must be adjudicated. Our objective was to assess the effect of a recent commercial fat substitution, corn oil for partially-hydrogenated soybean oil. Methods: Using a double-blind cross-over design, 30 postmenopausal women >= 50 years with LDLcholesterol concentrations >= 120 mg/dL were randomly assigned to each of two 35-day phases; all food and beverage was provided to maintain body weight. Corn or partially-hydrogenated soybean oil was incorporated throughout the diet and contributed two-thirds of fat. Primary outcomes included fasting and non-fasting lipid, lipoprotein, apolipoprotein, and fasting high sensitivity C-reactive protein (hsCRP) concentrations; secondary outcomes included fasting small dense LDL (sdLDL)-cholesterol, remnant lipoprotein cholesterol (RemLC), glycated albumin, adiponectin and immunoreactive insulin concentrations, and endogenous cholesteryl ester transfer protein ( CETP) and lecithin: cholesterol acyl transferase (LCAT) activities. Results: Relative to the partially-hydrogenated soybean oil enriched diet, the corn oil enriched diet resulted in lower fasting total cholesterol (7%; P < 0.0001), LDL-cholesterol (10%; P < 0.0001), VLDL-cholesterol ( 7%; P = 0.052), apo B ( 9%; P < 0.0001), lipoprotein ( a) [Lp(a)] (5%; P = 0.024), sdLDL-cholesterol (17%; P = 0.001), and RemLC (20%; P = 0.007) concentrations, and no significant effect on the other outcomes. Changes in postprandial (4-h post-meal) lipid, lipoprotein and apolipoprotein concentrations were similar to the fasting state. Conclusion: The replacement of partially-hydrogenated soybean oil with corn oil favorably affects a range of CVD risk factors and is an appropriate option to decrease cardiovascular disease risk factors in moderately hypercholesterolemic individuals. (C) 2009 Elsevier Ireland Ltd. All rights reserved.

Vermunt, S. H. F., et al. (2001). "Dietary trans alpha-linolenic acid from deodorised rapeseed oil and plasma lipids and lipoproteins in healthy men: the TransLinE Study." British Journal of Nutrition **85**(3): 387-392.

Trans isomers of alpha -linolenic acid, which are formed by deodorization of refined vegetable oils, can be found in significant amounts in edible oils. Effects of trans ol-linolenic acid on plasma lipoproteins are unknown. We therefore investigated the effects of trans alpha -linolenic acid on plasma lipids and lipoproteins in healthy European men. Eighty-eight healthy men from three European countries (France, Scotland, UK and the Netherlands) first consumed for 6 weeks a diet with experimental oils 'free' of trans fatty acids (run-in period). For the next 6 weeks, they were randomly allocated to a diet with experimental oils 'high' or 'low' in trans alpha -linolenic acid. Daily total trans alpha -linolenic acid intake in the high trans group was 1410 (range 583-2642) mg. Experimental oils were provided as such, or incorporated into margarines, cheeses, muffins and biscuits. The high trans alpha -linolenic acid diet significantly increased the plasma LDL-:HDL-cholesterol ratio by 8.1 % (95 % CI 1.4, 15.3; P = 0.02), and the total cholesterol:HDL-cholesterol ratio by 5.1 % (95 % CI 0.4, 9.9; P = 0.03) compared with the low-trans diet. This was largely explained by an increase in LDL-cholesterol on the high-trans diet, while no change was observed in the low-trans group (mean treatment effect of 4.7 % (95 % CI -0.8, 10.5; P = 0.10). No effects were found on total cholesterol and HDL-cholesterol, triacylglycerols, apolipoprotein B and A-1, and lipoprotein(a) concentrations. In conclusion, trans alpha -linolenic acid may increase plasma LDL-:HDL-cholesterol and total cholesterol:HDL-cholesterol ratios. Whether diet-induced changes in these ratios truly affects the risk for CHD remains to be established.

Vidgren, H. M., et al. (1998). "Divergent incorporation of dietary trans fatty acids in different serum lipid fractions." Lipids **33**(10): 955-962.

Trans fatty acids may be involved in atherosclerotic vascular diseases. We investigated the incorporation of dietary trans fatty acids and oleic acid into the serum triglycerides (TC), cholesterol esters (CE), and phospholipids (PL). Fourteen healthy female volunteers, aged 23.2 +/- 3.1 yr (mean +/- SD), body mass index 20.8 +/- 2.1 kg/m(2) participated in this study. All subjects consumed both a trans fatty acid-enriched diet (TRANS diet) and an oleic acid-enriched diet (OLEIC diet) for 4 wk according to a randomized crossover design. Both experimental diet periods were preceded by consumption of a baseline diet for 2 wk which supplied 37% of total energy (E%) as fat: 18 E% from saturated fatty acids (SFA), 12 E% from monounsaturated fatty acids, and 6 E% from polyunsaturated fatty acids. Five E% of the SFA in the baseline diet was replaced by trans fatty acids (18:1 t and 18:2c,t + 18:2t,t, where c is cis and t is trans) in the TRANS diet and by oleic acid (18:1 n-9) in the OLEIC diet. After the TRANS diet, the proportions of 18:it and 18:2t increased (P < 0.001) in all serum lipid fractions analyzed. The increase of 18:it in TC and PL (1.80 +/- 0.28 vs. 5.26 +/- 1.40; 1.07 +/- 0.34 vs. 3.39 +/- 0.76 mol% of total fatty acids, respectively) was markedly higher than that in CE (0.44 +/- 0.07 vs. 0.92 +/- 0.26), whereas that of 18:2t was nearly the same in all three fractions. The proportions of palmitic, stearic arachidonic, and eicosapentaenoic acids in TG, CE, and PL and that of oleic acid in TG and CE were decreased when compared with the baseline value, in contrast, the proportion of palmitoleic acid in TG and PL and that of linoleic acid in PL increased on the TRANS diet. After consumption of the OLEIC diet, the proportion of oleic acid increased in all three lipid fractions analyzed, and the percentage increase was nearly the same in all fractions. In contrast, the proportions of 18:1t in TG and PL and 18:2t in TG and CE decreased when compared with the baseline value. in conclusion, a moderate increase in dietary trans fatty acids resulted in a marked incorporation into serum lipids and decreased the conversion of linoleic acid to its more unsaturated long-chain metabolites. Analysis of 18:1t from serum TG and PL seems to reflect reliably the dietary intake of this fatty acid.

Volger, O. L., et al. (2001). "Dietary vegetable oil and wood derived plant stanol esters reduce atherosclerotic lesion size and severity in apoE\*3-Leiden transgenic mice." Atherosclerosis **157**(2): 375-381.

The hypolipidemic and anti-atherosclerotic effects of vegetable oil- and wood-based dietary plant stanol esters were compared in female apoE\*3-Leiden transgenic mice at relevant plasma cholesterol levels. The plant stanol esters derived from vegetable oil (sitostanol 65.7%, campestanol 30.1%) had different contents of sitostanol and campestanol than the plant stanol esters derived from wood (sitostanol 87.6%, campestanol 9.5%) or from a mixture of vegetable oil and wood (sitostanol 73.0%, campestanol 24.7%). The mice (10 per group) received for 38 weeks a control diet or diets containing 1.0% (w/w) plant stanol esters derived from either vegetable oil, wood or a mixture of both. Vegetable oil (-46%), wood (-42%) and vegetable oil/wood (-51%) plant stanol esters decreased the plasma cholesterol levels (P < 0.0001) by reducing the cholesterol content in plasma very low density-, intermediate density- and to a lesser extent in low density-lipoprotein. Plant stanol ester feeding did not change plasma triglyceride levels. Dietary plant stanol esters reduced the atherosclerotic lesion area by 91 +/- 13% (vegetable oil), 97 +/- 4% (wood) and 78 +/- 34% (vegetable oil/wood) (P < 0.0001) and the severity from regular intimal fatty streaks/mild plaques (on average type 2-3 lesions) in controls to individual intimal foam cells ( < type 1 lesions) in the treatment groups (P < 0.0001). Plant stanol esters had no effect on adherence of monocytes to the vessel wall. Feeding of plant stanol esters dramatically reduced, independent of its sources, the extent and severity of atherosclerotic lesions, by decreasing VLDL-, IDL- and to a lesser extent LDL-cholesterol in apoE\*3-Leiden transgenic mice. (C) 2001 Elsevier Science Ireland Ltd. All rights reserved.

Volpe, R., et al. (2001). "Effects of yoghurt enriched with plant sterols on serum lipids in patients with moderate hypercholesterolaemia." British Journal of Nutrition **86**(2): 233-239.

The objective of the present study was to assess the effect of consumption of a yoghurt-based drink enriched with 1-2 g plant sterols/d on serum lipids, transaminases, vitamins and hormone status in patients with primary moderate hypercholesterolaemia. Thirty patients were randomly assigned to one of two treatment groups: a low-fat low-lactose yoghurt-based drink enriched with 1 g plant sterol extracted from soyabean/d v. a low-fat low-lactose yoghurt, for a period of 4 weeks. After a 2-week wash-out period, patients were crossed over for an additional 4-week period. Second, after a 4-week wash-out period, eleven patients were treated with 2 g plant sterols/d in a second open part of the study for a period of 8 weeks. The yoghurt enriched with plant sterols significantly reduced, in a dose-dependent manner, serum total cholesterol and LDL-cholesterol levels and LDL-cholesterol:HDL-cholesterol (P <0.001), whereas no changes were observed in HDL-cholesterol and triacylglycerol levels, either in the first or the second part of the study. There were only slight, not statistically significant, differences in serum transaminase, vitamin and hormone levels. To conclude, a low-fat yoghurt-based drink moderately enriched with plant sterols may lower total cholesterol and LDL-cholesterol effectively in patients with primary moderate hypercholesterolaemia.

Voskuil, D. W., et al. (1996). "Intake and sources of alpha-linolenic acid in Dutch elderly men." European Journal of Clinical Nutrition **50**(12): 784-787.

Objective: Intake of alpha-linolenic acid may have a beneficial effect on coronary heart disease, but little information is available on the intake and sources of alpha-linolenic acid (C18:3 n - 3) in populations. We therefore assessed intake and sources of alpha-linolenic acid in Dutch elderly men. Design and Subjects: Dietary histories were obtained from participants of the Zutphen Elderly Study, a Dutch cohort study. Food consumption data were available from 876 men in 1985 and from 541 of the same men in 1990. Daily intakes of alpha-linolenic acid were assessed using a food table developed for this purpose. Alpha-linolenic acid content of edible fats, seafood and some commonly eaten dishes were mainly derived from chemical analyses of Dutch foods, and other values were obtained from published food tables. Results: Alpha-linolenic acid provided 0.5 +/- 0.1% of energy intake (mean +/- s.d.) or 1.30 +/- 0.46 g/day in 1985, and 1.21 +/- 0.52 g/day in 1990. The Pearson correlation coefficient for intake of alpha-linolenic acid in 1985 and 1990 was 0.34. Margarines were the main source (25.4%), followed by meat and the fats used in cooking meat (10.8%), bread (9.8%) and vegetables (7.8%). Conclusions: An increase in intake of alpha-linolenic acid, is most easily realized by the use of unhydrogenated oils rich in alpha-linolenic acid such as rapeseed and soybean oil, and of margarines and other fats containing such oils. Sponsorship: This research was supported by the Dutch 'Praeventie Fonds', The Hague, the National Institute of Public Health and the Environment, and the Department of Human Nutrition, Wageningen Agricultural University.

Vuorio, A. F., et al. (2001). "Familial hypercholesterolaemia in Finland: common, rare and mild mutations of the LDL receptor and their clinical consequences." Annals of Medicine **33**(6): 410-421.

Familial hypercholesterolaemia (FH) is an autosomal co-dominantly inherited condition resulting from mutations of the low-density lipoprotein (LDL) receptor which occur in heterozygous form in approximately one in 500 individuals. Clinically, FH is characterized by 2-3-fold elevation of serum LDL cholesterol levels, accelerated development of atherosclerotic vascular disease, and, if untreated, shortened lifespan. The Finnish population, which represents a genetic isolate, offers exceptional possibilities for genetic-epidemiological studies on FH, as a handful of founder gene mutations account for the majority of FH cases in Finland. This review summarizes data from our FH studies carried out since 1985. We wish to emphasize the continuum of genotype-phenotype relationships, the importance of molecular diagnosis, the detection of novel risk factors of vascular disease, and innovations inhibiting cholesterol absorption for the modern treatment of FH.

Vuorio, A. F., et al. (2000). "Stanol ester margarine alone and with simvastatin lowers serum cholesterol in families with familial hypercholesterolemia caused by the FH-North Karelia mutation." Arteriosclerosis Thrombosis and Vascular Biology **20**(2): 500-506.

In heterozygous familial hypercholesterolemia (FH), serum low density lipoprotein in (LDL) cholesterol levels are already elevated at birth. Premature coronary heart disease occurs in approximate to 30% of heterozygous untreated adult patients. Accordingly, to retard development of atherosclerosis, preventive measures for lowering cholesterol should be started even in childhood. To this end, 19 FH families consumed dietary stanol ester for 3 months. Stanol ester margarine lowers the serum cholesterol level by inhibiting cholesterol absorption. Each individual in the study replaced part of his or her daily dietary fat with 25 g of 80% rapeseed oil margarine containing stanol esters (2.24 g/d stanols, mainly sitostanol), The families who consumed this margarine for 12 weeks included 24 children, aged 3 to 13 years, with the North Karelia variant of FH (FH-NK), 4 FH-NK parents, and 16 healthy family members, and a separate group of 12. FH-NK adults who consumed the margarine for 6 weeks and who were on simvastatin therapy (20 or 40 mg/d). Fat-soluble vitamins were measured by high-pressure liquid chromatography, and cholesterol precursor sterols (indexes of cholesterol synthesis) and cholestanol and plant sterols (indexes of cholesterol absorption efficiency) were assayed by gas-liquid chromatography. No side effects occurred. Serum LDL cholesterol levels were reduced by 18% (P<0.001), 11%, 12% (P<0.001), and 20% (P<0.001) in the 4 groups, respectively. The serum campesterol-to-cholesterol rations fell by 31% (P<0.001), 29%, 23% (P<0.001), and 36% (P<0.001), respectively, suggesting that cholesterol absorption efficiency was inhibited. Serum lathosterol ratios were elevated by 38% (P<0.001). 11%, 15% (P<0.001), and 19% (P<0.001), respectively, suggesting that cholesterol synthesis was compensatorily upregulated. The FM-NK children increased their serum lathosterol ratio more than did the FH-NK adults treated with stanol ester margarine and simvastatin (P<0.01). In the FH-NK children, serum retinol concentration and alpha-tocopherol-to-cholesterol ratios were unchanged by stanol ester margarine, but alpha- and beta-carotene concentrations and ratios were decreased. As assayed in a genetically defined population of FH patients, a dietary regimen with stanol ester margarine proved to be a safe and effective hypolipidemic treatment for children and adults. In FH-NK adults on simvastatin therapy, serum LDL cholesterol levels could be reduced even further by including a stanol ester margarine in the regimen.

Wagner, K. H., et al. (2000). "Content of trans fatty acids in margarines, plant oils, fried products and chocolate spreads in Austria." European Food Research and Technology **210**(4): 237-241.

On the Austrian market a selection of the available margarines, refined and cold pressed plant oils, chocolate spreads, snacks and fast food products were collected and the content of trans-fatty acids (TFA) was determined by a GLC procedure. The highest levels of TFA were observed in fast food products (mean, 5.9%, maximum, 21% of fatty acids), chocolate spreads (mean, 4.9%, maximum, 8.9% of fatty acids) and snacks (mean, 2.9%, maximum, 16% of fatty acids). Margarines with a "<1% TFA" declaration contained low amounts (0.3-0.8%), while the content of margarines with no such declaration was much higher (3.0-3.7%). A 7 h oxidation of plant oils at 120 degrees C demonstrated that the higher levels of TFA in heated oils are not associated with oxidation processes at this temperature. Based on the analysed data, the mean TFA intake (currently < 4 g/day) has decreased due to a change in manufacturing conditions and the choice of unhydrogenated plant oils. In spite of this a diet high in snacks, fast food products or chocolate spreads, all products which are popular amongs children and adolescents, may increase the TFA intake up to >10 g/day.

Wagner, K. H., et al. (2008). "Comprehensive studies on the trans fatty acid content of Austrian foods: Convenience products, fast food and fats." Food Chemistry **108**(3): 1054-1060.

Due to reported detrimental health effects of diets high in trans fatty acids (TFA) in particular on blood lipids, convenience products, trade margarines, fats for cooking and frying and fast food products available on the Austrian market were comprehensively investigated on TFA, using gas chromatography. About half of the tested convenience products contained less than 1% TFA, one third less than 5%, but almost 5% of the tested products more than 20% TFA. A similar allocation could be found in fast food products, with the highest TFA level of 8.9%. Total TFA of household fats were lower (1.45 +/- 1.99%) than fats of industrial use (7.83 +/- 10.0%, p < 0.001). Compared to investigations in Austria and Germany around 10 years ago the TFA content of the tested foods had decreased significantly. About half of the investigated products contained less than 1% TFA/total fatty acids, however, very high amounts of TFA (> 15%) can still be detected and an intake of more that 5 g TFA/portion, which has been shown to significantly increase the risk for cardiovascular disease, is easily possible. (C) 2007 Elsevier Ltd. All rights reserved.

Wahle, K. W. J., et al. (2004). "Conjugated linoleic acids: are they beneficial or detrimental to health?" Progress in Lipid Research **43**(6): 553-587.

Conjugated linoleic acids (CLAs) comprise a family of positional and geometric isomers of linoleic acid (18:2n - 6; LA) that are formed by biohydrogenation and oxidation processes in nature. The major dietary sources of these unusual fatty acids are foods derived from ruminant animals, in particular dairy products. The main form of CLA, cis-9, trans- 11-18:2, can be produced directly by bacterial hydrogenation in the rumen or by delta-9 desaturation of the co-product vaccenic acid (trans-11-18:1) in most mammalian tissues including man. The second most abundant isomer of CLA is the trans-10, cis-12-18:2 form. Initially identified in grilled beef as a potential anti-carcinogen a surprising number of health benefits have subsequently been attributed to CLA mixtures and more recently to the main individual isoforms. It is also clear from recent studies that the two main isoforms can have different effects on metabolism and cell functions and can act through different cell signalling pathways. The majority of studies on body compositional effects (i.e. fat loss, lean gain), on cancer and cardiovascular disease attenuation, on insulin sensitivity and diabetes and on immune function have been conducted with a variety of animal models. Observations clearly emphasise that differences exist between mammalian species in their response to CLAs with mice being the most sensitive. Recent studies indicate that some but not all of the effects observed in animals also pertain to human volunteers. Reports of detrimental effects of CLA intake appear to be largely in mice and due mainly to the trans-10, cis-12 isomer. Suggestions of possible deleterious effects in man due to an increase in oxidative lipid products (isoprostanes) with trans-10, cis-12 CLA ingestion require substantiation. Unresponsiveness to antioxidants of these non-enzymatic oxidation products casts some doubt on their physiological relevance. Recent reports, albeit in the minority, that CLAs, particularly the trans-10, cis-12 isomer, can elicit pro-carcinogenic effects in animal models of colon and prostate cancer and can increase prostaglandin production in cells also warrant further investigation and critical evaluation in relation to the many published anticancer and anti-prostaglandin effects of CLAs. (C) 2004 Elsevier Ltd. All rights reserved.

Walker, A. R. P. (1985). "CORONARY HEART-DISEASE, VITAMIN-B6, ESSENTIAL FATTY-ACIDS AND MARGARINE." South African Medical Journal **67**(23): 919-920.

Wallace, S. K. and D. Mozaffarian (2009). "Trans-fatty acids and nonlipid risk factors." Current Atherosclerosis Reports **11**(6): 423-433.

Consumption of industrially produced trans-fatty acids (TFA) is associated with substantial risk of coronary heart disease (CHD). The magnitude of this relationship, as well as emerging associations with end points such as diabetes and sudden cardiac death, cannot be fully explained by the well-established adverse effects of TFA on serum lipids. We review the evidence for effects of TFA intake on nonlipid risk factors. Based on evidence from randomized controlled trials, observational studies, animal experiments, and in vitro studies, these include effects on systemic inflammation, endothelial dysfunction, visceral adiposity, insulin resistance, and arrhythmic risk. The types and strength of evidence for each of these nonlipid effects varies, but the overall constellation of findings is qualitatively and quantitatively unique among dietary fats. The multiple adverse effects and implicated pathways are consistent with the observed strong associations of TFA consumption with CHD risk. These nonlipid effects also explain why TFA consumption may adversely impact other non-CHD diseases and end points.

Walle, T., et al. (2004). "High absorption but very low bioavailability of oral resveratrol in humans." Drug Metabolism and Disposition **32**(12): 1377-1382.

The dietary polyphenol resveratrol has been shown to have chemopreventive activity against cardiovascular disease and a variety of cancers in model systems, but it is not clear whether the drug reaches the proposed sites of action in vivo after oral ingestion, especially in humans. In this study, we examined the absorption, bioavailability, and metabolism of C-14-resveratrol after oral and i.v. doses in six human volunteers. The absorption of a dietary relevant 25-mg oral dose was at least 70%, with peak plasma levels of resveratrol and metabolites of 491+/-90 ng/ml (about 2 muM) and a plasma half-life of 9.2+/-0.6 h. However, only trace amounts of unchanged resveratrol (<5 ng/ml) could be detected in plasma. Most of the oral dose was recovered in urine, and liquid chromatography/mass spectrometry analysis identified three metabolic pathways, i.e., sulfate and glucuronic acid conjugation of the phenolic groups and, interestingly, hydrogenation of the aliphatic double bond, the latter likely produced by the intestinal microflora. Extremely rapid sulfate conjugation by the intestine/liver appears to be the rate-limiting step in resveratrol's bioavailability. Although the systemic bioavailability of resveratrol is very low, accumulation of resveratrol in epithelial cells along the aerodigestive tract and potentially active resveratrol metabolites may still produce cancer-preventive and other effects.

Wandel, M., et al. (2008). "Changes in food habits after migration among South Asians settled in Oslo: The effect of demographic, socio-economic and integration factors." Appetite **50**(2-3): 376-385.

The aim is to explore changes in food habits after migration, and the resultant present food consumption patterns, as well as the effect of demographic, socio-economic and integration factors on these changes. Analyses were based on data collected through the Oslo Immigrant Health study. from 629 persons 30-60 years of age, born in Sri Lanka and Pakistan, and living in Oslo, Norway. A majority of the Sri Lankans reported increase in the consumption of meat, milk, butter, margarine and potatoes. Around half of those from Pakistan reported increased consumption of oil, meat, fish and potatoes. Both groups reported a decrease in bean and lentil consumption. Multivariate regression showed that age was negatively related to increases in butter and margarine consumption, and a good command of the Norwegian language reduced the likelihood of increased consumption of oil and butter. The likelihood of having present fat and sugar rich food patterns were reduced with age and years of education, whereas scoring high on an index of integration increased the likelihood of a fat rich food pattern. In conclusion, a number of demographic and socio-cultural factors may modify the changes in food habits after migration. Some of these may have Substantial health implications. (c) 2007 Elsevier Ltd. All rights reserved.

Wanders, A. J., et al. (2010). "Effect of a High Intake of Conjugated Linoleic Acid on Lipoprotein Levels in Healthy Human Subjects." Plos One **5**(2).

Background: Trans fatty acids are produced either by industrial hydrogenation or by biohydrogenation in the rumens of cows and sheep. Industrial trans fatty acids lower high-density lipoprotein (HDL) cholesterol, raise low-density lipoprotein (LDL) cholesterol, and increase the risk of coronary heart disease. The effects of trans fatty acids from ruminants are less clear. We investigated the effect on blood lipids of cis-9, trans-11 conjugated linoleic acid (CLA), a trans fatty acid largely restricted to ruminant fats. Methodology/Principal Findings: Sixty-one healthy women and men were sequentially fed each of three diets for three weeks, in random order, for a total of nine weeks. Diets were identical except for 7% of energy (approximately 20 g/day), which was provided either by oleic acid, by industrial trans fatty acids, or by a mixture of 80% cis-9, trans-11 and 20% trans-10, cis-12 CLA. After the oleic acid diet, mean (+/- SD) serum LDL cholesterol was 2.68 +/- 0.62 mmol/L compared to 3.00 +/- 0.66 mmol/L after industrial trans fatty acids (p < 0.001), and 2.92 +/- 0.70 mmol/L after CLA (p < 0.001). Compared to oleic acid, HDL-cholesterol was 0.05 +/- 0.12 mmol/L lower after industrial trans fatty acids (p = 0.001) and 0.06 +/- 0.10 mmol/L lower after CLA (p < 0.001). The total-to-HDL cholesterol ratio was 11.6% higher after industrial trans fatty acids (p < 0.001) and 10.0% higher after CLA (p < 0.001) relative to the oleic acid diet. Conclusions/Significance: High intakes of an 80:20 mixture of cis-9, trans-11 and trans-10, cis-12 CLA raise the total to HDL cholesterol ratio in healthy volunteers. The effect of CLA may be somewhat less than that of industrial trans fatty acids.

Wang, Y., et al. (2012). "The role of ruminant trans fat as a potential nutraceutical in the prevention of cardiovascular disease." Food Research International **46**(2): 460-468.

Dietary trans fat has received increasing attention over the last few years. It is now appreciated that trans fatty acids (TFA) produced by ruminants (rTFA) via 'a natural biohydrogenation reaction' may have disparate health effects from those produced as a by-product of industrial processing present in partially hydrogenated vegetable oils. In this review, we discuss the most recent findings from human and animal intervention studies in order to evaluate the health implications and potential mechanisms of two major rTFA (t11-vaccenic acid and c9,t11-conjugated linoleic acid) in their purified form as well as in the format of dairy fat with regard to the development of cardiovascular diseases, with the aim to assess the potential of developing rTFA as novel components for functional foods. (c) 2011 Elsevier Ltd. All rights reserved.

Wang, Y., et al. (2009). "Trans-11 Vaccenic Acid Reduces Hepatic Lipogenesis and Chylomicron Secretion in JCR: LA-cp Rats." Journal of Nutrition **139**(11): 2049-2054.

Trans-11 vaccenic acid (VA) is the predominant trans isomer in ruminant fat and a major precursor to the endogenous synthesis of cis9, trans11-conjugated linoleic acid in humans and animals. We have previously shown that 3-wk VA supplementation has a triglyceride (TG)-lowering effect in a rat model of dyslipidemia, obesity, and metabolic syndrome (JCR:LA-cp rats). The objective of this study was to assess the chronic effect (16 wk) of VA on lipid homeostasis in both the liver and intestine in obese JCR:LA-cp rats. Plasma TG (P < 0.001), total cholesterol (P < 0.001), LDL cholesterol (P < 0.01), and nonesterified fatty acid concentrations, as well as the serum haptoglobin concentration, were all lower in obese rats fed the VA diet compared with obese controls (P < 0.05). In addition, there was a decrease in the postprandial plasma apolipoprotein (apo)B48 area under the curve (P < 0.05) for VA-treated obese rats compared with obese controls. The hepatic TG concentration and the relative abundance of fatty acid synthase and acetyl-CoA carboxylase proteins were all lower (P < 0.05) in the VA-treated group compared with obese controls. Following acute gastrointestinal infusion of a VA-triolein emulsion in obese rats that had been fed the control diet for 3 wk, the TG concentration was reduced by 40% (P < 0.05) and the number of chylomicron (CM) particles (apoB48) in nascent mesenteric lymph was reduced by 30% (P < 0.01) relative to rats infused with a triolein emulsion alone. In conclusion, chronic VA supplementation significantly improved dyslipidemia in both the food-deprived and postprandial state in JCR:LA-cp rats. The appreciable hypolipidemic benefits of VA may be attributed to a reduction in both intestinal CM and hepatic de novo lipogenesis pathways. J. Nutt. 139:2049-2054,2009.

Wang, Y., et al. (2012). "The intestinal bioavailability of vaccenic acid and activation of peroxisome proliferator-activated receptor-alpha and -gamma in a rodent model of dyslipidemia and the metabolic syndrome." Molecular Nutrition & Food Research **56**(8): 1234-1246.

Scope Evidence suggests a neutral to beneficial role of certain trans fatty acids (TFA) from natural ruminant sources. Trans11-18:1 (vaccenic acid, VA), the most predominant ruminant TFA and a precursor to conjugated linoleic acid, has been shown to improve atherogenic dyslipidemia and symptoms of hepatic steatosis in animal models. The objective of this study was to assess the intestinal bioavailability of various VA sources including synthetic free fatty acid (FFA) and natural ruminant triglyceride forms, as well as the mechanistic pathways that mediate VA's bioactivity. Methods and results VA acts as a partial agonist to both peroxisome proliferator-activated receptors (PPAR)-alpha and PPAR-gamma in vitro, with similar affinity compared to commonly known PPAR agonists. It was further confirmed that VA at 30 and 100 mu M concentrations suppressed cardiomyocyte hypertrophy vitro in a PPAR-alpha- and PPAR-gamma-dependent manner. In vivo, feeding of VA (1%, w/w) resulted in increased mRNA and protein expression of PPAR-gamma in the mucosa of JCR:LA-cp rats, a model of the metabolic syndrome (p < 0.01 and p < 0.05, respectively) compared to control. In addition, VA from a triglyceride source had greater intestinal bioavailability in vivo compared to VA provided in an FFA form (p < 0.01). Conclusion The activation of PPAR-alpha- and PPAR-gamma-dependent pathways provides a mechanistic explanation of how VA improves blood lipids and related metabolic disorders during conditions of hyperlipidemia. This report also supports the consideration of differential reporting of industrially produced versus natural TFA on food nutrient labels.

Wang, Y., et al. (2008). "Trans-11 Vaccenic Acid Dietary Supplementation Induces Hypolipidemic Effects in JCR:LA-cp Rats." Journal of Nutrition **138**(11): 2117-2122.

Trans-11 vaccenic acid [VA, 18:1 (n-9)] is a positional and geometric isomer of oleic acid and is the precursor to conjugated linoleic acid (CLA) in humans. Despite VA being the predominant trans monoene in ruminant-derived lipids, very little is known about its nutritional bioactivity, particularly In conditions of chronic metabolic disorders, including obesity, insulin resistance, and/or dlyslipidemia, The aim of this study was to assess the potential of VA to improve dyslipidemia, Insulin sensitivity, or inflammatory status in obese and insulin-resistart JMLA-cp rats. The obese rats and age-matched lean littermates were fed a control diet or a control diet supplemented with 1.5% (wt:wt) VA for a period of 3 wk. The incorporation of VA and subsequent conversion to CLA in triglyceride was measured in adipose tissue. Glucose and insulin metabolism were assessed via a conscious adapted meal tolerance test procedure. Plasma lipids as well as serum inflammatory cytokine concentrations were measured by commercially available assays. VA supplementation did not result in any observable adverse health effects in either lean or obese JCR:LA-cp rats. After 3 wk of feeding, body weight, food intake, and glucose/insulin metabolism did not differ between VA-supplemented and control groups. The incorporation of VA and CLA into adipose triglycerides in obese rats fed VA increased by 1.5-fold and 6.5-fold, respectively, compared with obese rats fed the control diet. The most striking effect was a 40% decrease (P < 0.05) In fasting triglyceride concentrations in VA-treated obese rats relative to obese controls. Serum II-10 concentration was decreased by VA, regardless of genotype (P < 0.05) In conclusion, short-term dietary supplementation of 1.5% VA did not result in any detrimental metabolic effects in JCR:LA-cp rats. In contrast, dietary VA had substantial hypo-triglyceridemic effects, suggesting a new bioactivity of this fatty acid that is typically found in ruminant-derived food products, J. Nutr. 138: 2117-2122, 2008.

Wang, Y. and S. D. Proctor (2013). "Current issues surrounding the definition of trans-fatty acids: implications for health, industry and food labels." British Journal of Nutrition **110**(8): 1369-1383.

The definition of trans-fatty acids (TFA) was established by the Codex Alimentarius to guide nutritional and legislative regulations to reduce TFA consumption. Currently, conjugated linoleic acid (CLA) is excluded from the TFA definition based on evidence (primarily preclinical studies) implying health benefits on weight management and cancer prevention. While the efficacy of CLA supplements remains inconsistent in randomised clinical trials, evidence has emerged to associate supplemental CLA with negative health outcomes, including increased subclinical inflammation and oxidative stress (particularly at high doses). This has resulted in concerns regarding the correctness of excluding CLA from the TFA definition. Here we review recent clinical and preclinical literature on health implications of CLA and ruminant TFA, and highlight several issues surrounding the current Codex definition of TFA and how it may influence interpretation for public health. We find that CLA derived from ruminant foods differ from commercial CLA supplements in their isomer composition/distribution, consumption level and bioactivity. We conclude that health concerns associated with the use of supplemental CLA do not repudiate the exclusion of all forms of CLA from the Codex TFA definition, particularly when using the definition for food-related purposes. Given the emerging differential bioactivity of TFA from industrial v. ruminant sources, we advocate that regional nutrition guidelines/policies should focus on eliminating industrial forms of trans-fat from processed foods as opposed to all TFA per se.

Watson, A. D., et al. (1999). "Structural identification of a novel pro-inflammatory epoxyisoprostane phospholipid in mildly oxidized low density lipoprotein." Journal of Biological Chemistry **274**(35): 24787-24798.

One of the earliest steps in the development of the atherosclerotic lesion is the accumulation of monocyte/macrophages within:the vessel wall. Oxidized lipids present in minimally modified-low density lipoproteins (RIM-LDL) contribute to this process by activating endothelial cells to express; monocyte-specific adhesion molecules and chemoattractant factors. A major focus of our group has been the isolation and characterization of the biologically active oxidized lipids in MRI-LDL. We have previously characterized three oxidized phospholipids present in MM-LDL, atherosclerotic lesions of fat fed rabbits, and autoxidized 1-palmitoyl-2-arachidonoyl-sn-glycero-3-phosphocholine (Ox-PAPC) that induced human aortic endothelial cells to adhere human monocytes in vitro. We have used sequential normal and reverse phase-high performance liquid chromatography to isolate various isomers of an oxidized phospholipid from autoxidized 1-palmitoyl-2-arachidonoyl-sn-glycero-3-phosphocholine. The fatty acid in the sn-2 position of this biologically active isomer and its dehydration product was released by phospholipase A(2) and characterized. Hydrogenation with platinum(IV) oxide/hydrogen suggested a cyclic moiety, and reduction with sodium borohydride suggested two reducible oxygen-containing groups in the molecule. The fragmentation pattern produced by:electrospray ionization-collision induced dissociation-tandem mass spectrometry was consistent with a molecule resembling an E-ring prostaglandin with an epoxide at the 5,6 position. The structure of this lipid was confirmed by proton nuclear magnetic resonance spectroscopy analysis of the free fatty acid isolated from the dehydration product of m/z 828.5, Based on these studies, we arrived at the structure of the biologically active oxidized phospholipids as 1-palmitoyl-2-(5,6-epoxyisoprostane E-2)-sn-glycero-3-phosphocholine. The identification of this molecule adds epoxyisoprostanes to the growing list of biologically active isoprostanes.

Weggemans, R. M., et al. (2004). "Intake of ruminant versus industrial trans fatty acids and risk of coronary heart disease - what is the evidence?" European Journal of Lipid Science and Technology **106**(6): 390-397.

Several studies have reported a positive association between intake of trans fatty acids and risk of heart disease. It has been suggested that trans fatty acids from ruminant sources are less detrimental than trans fatty acids from industrial sources. Legislation or advice on limiting trans fatty acids has, in some instances, been restricted to trans fatty acids from industrial sources. However, comparisons of ruminant and industrial trans fatty acids have been based on few studies using relative intake data (e.g. quintiles of intakes). Therefore, we have reviewed data describing the associations between absolute intake (g eaten per day) of ruminant and industrial trans fatty acids and risk of coronary heart disease, and examined the associations graphically. Where direct comparison is possible, there are no differences in risk of coronary heart disease between total, ruminant and industrial trans fatty acids for intakes up to 2.5 g/d. At higher intakes (more than 3 g/d) total and industrial trans fatty acids are associated with an increased risk of coronary heart disease but there is insufficient data available on ruminant trans fatty acids at this level of intake. The scarce data do not support discrimination between ruminant and industrial trans fatty acids in dietary recommendations or legislation.

Weigensberg, B., et al. (1961). "ELAIDIC ACID - EFFECT ON EXPERIMENTAL ATHEROSCLEROSIS." Archives of Pathology **72**(2): 358-&.

Weingartner, O., et al. (2008). "Plant sterols as dietary supplements for the prevention of cardiovascular diseases." Deutsche Medizinische Wochenschrift **133**(22): 1201-1204.

Weingartner, O., et al. (2009). "Controversial role of plant sterol esters in the management of hypercholesterolaemia." European Heart Journal **30**(4): 404-409.

Weingartner, O., et al. (2008). "Vascular effects of diet supplementation with plant sterols." Journal of the American College of Cardiology **51**(16): 1553-1561.

Objectives The purpose of this study was to evaluate vascular effects of diet supplementation with plant sterol esters (PSE). Background Plant sterol esters are used as food supplements to reduce cholesterol levels. Their effects on endothelial function, stroke, or atherogenesis are not known. Methods In mice, plasma sterol concentrations were correlated with endothelial function, cerebral lesion size, and atherosclerosis. Plasma and tissue sterol concentrations were measured by gas-liquid chromatography-mass spectrometry in 82 consecutive patients with aortic stenosis. Results Compared with those fed with normal chow (NC), wild-type mice fed with NC supplemented with 2% PSE showed increased plant sterol but equal cholesterol plasma concentrations. The PSE supplementation impaired endothelium-dependent vasorelaxation and increased cerebral lesion size after middle cerebral artery occlusion. To test the effects of cholesterol-lowering by PSE, apolipoprotein E (ApoE)-/- mice were randomized to Western-type diet (WTD) with the addition of PSE or ezetimibe (EZE). Compared with WTD, both interventions reduced plaque sizes; however, WTD + PSE showed larger plaques compared with WTD + EZE (20.4 +/- 2.1% vs. 10.0 +/- 1.5%). Plant sterol plasma concentration strongly correlated with increased atherosclerotic lesion formation (r = 0.50). Furthermore, we examined plasma and aortic valve concentrations of plant sterol in 82 consecutive patients with aortic stenosis. Patients eating PSE-supplemented margarine (n = 10) showed increased plasma concentrations and 5-fold higher sterol concentrations in aortic valve tissue. Conclusions Food supplementation with PSE impairs endothelial function, aggravates ischemic brain injury, effects atherogenesis in mice, and leads to increased tissue sterol concentrations in humans. Therefore, prospective studies are warranted that evaluate not only effects on cholesterol reduction, but also on clinical endpoints. (Concentration of Plant Sterols in Serum and Aortic Valve Cusps; NCT00222950).

Weststrate, J. A. and G. W. Meijer (1998). "Plant sterol-enriched margarines and reduction of plasma total- and LDL-cholesterol concentrations in normocholesterolaemic and mildly hypercholesterolaemic subjects." European Journal of Clinical Nutrition **52**(5): 334-343.

Objectives: To compare effects on plasma total-, LDL-, and HDL-cholesterol concentrations of margarines enriched with different vegetable oil sterols or sitostanol-ester. Design: A randomized double-blind placebo-controlled balanced incomplete Latin square design with five treatments and four periods of 3.5 weeks. Margarines enriched with sterols From soybean, sheanut or ricebran oil or with sitostanol-ester were compared to a non-enriched control margarine. Sterol intake was between 1.5-3.3 g/d. Two thirds of the soybean oil sterols were esterified to fatty acids. Setting: Unilever Research Laboratory, Vlaardingen, The Netherlands. Subjects: One hundred healthy non-obese normocholesterolaemic and mildly hypercholesterolaemic volunteers aged 45 +/- 12.8 y, with plasma total cholesterol levels below 8 mmol/L at entry. Main outcome measures: Plasma lipid, carotenoid and sterol concentrations, blood clinical chemistry and haematology, fatty acid composition of plasma cholesterylesters and food intake. Results: Ninety-five volunteers completed the study. None of the margarines induced adverse changes in blood clinical chemistry, serum total bile acids or haematology. Plasma total-and LDL-cholesterol concentrations were significantly reduced by 8-13% (0.37-0.44 mmol/L) compared to control for margarines enriched in soybean oil sterol-esters or sitostanol-ester. No effect on HDL-cholesterol concentrations occurred. The LDL-to HDL-cholesterol ratio was reduced by 0.37 and 0.33 units for these margarines, respectively. Effects on blood lipids did not differ between normocholesterolaemic and mildly hypercholesterolaemic subjects. Plasma sitosterol and campesterol levels were significantly higher for the soybean oil sterol margarine and significantly lower for the sitostanol-ester margarine compared to control Dietary intake was very similar across treatments. The fatty acid composition of plasma cholesterylesters confirmed the good compliance to the treatment. All sterol enriched margarines reduced lipid-standardized plasma alpha-plus beta-carotene levels. Plasma lycopene levels were also reduced but this effect was not significant for all products. Conclusions: A margarine with sterol-esters from soybean oil, mainly esters from sitosterol, campesterol and stigmasterol, is as effective as a margarine with sitostanol-ester in lowering blood total-and LDL-cholesterol levels without affecting HDL-cholesterol concentrations. Incorporation in edible fat containing products of such substances may substantially reduce the risk of cardiovascular disease in the population. Sponsorship: Unilever Research.

Wietlisbach, V., et al. (1997). "Trends in cardiovascular risk factors (1984-1993) in a Swiss region: Results of three population surveys." Preventive Medicine **26**(4): 523-533.

Background This study attempted to assess the time trends in lifestyle and cardiovascular risk factors in the Swiss region of Vaud-Fribourg (population 784,000). Methods. Three surveys (1984/1985, 1988/1989, and 1992/1993), based on independent representative samples (n = 3,300) of the population ages 25 to 74, were conducted within the framework of the international WHO-MONICA Project. Results. The most favorable changes were observed in reported behaviors: increased physical activity in leisure time, healthier dietary habits (switch from un-skimmed milk, butter, and meat to skimmed milk, margarine, and fish, with no change for fruits and vegetables), and lower prevalence of regular smoking among men (from 32 to 28%). Body mass index did not vary significantly, apart from an increase in the prevalence of obesity among men (from 11 to 15%). Total cholesterol varied only slightly, while the HDL cholesterol levels decreased steadily (from 1.37 to 1.19 mmol/L among men; from 1.59 to 1.51 among women). Average systolic blood pressure regressed among women (from 127.2 to 124.4 mm Hg), while the prevalence of untreated hypertension increased among older men, Conclusion. The self-reported changes in lifestyle were only partially reflected by favorable trends in objective measurements. Physical activity, even at moderate intensity, and consumption of fruits, vegetables, and fiber in general should be promoted. (C) 1997 Academic Press.

Wijendran, V., et al. (2003). "Dietary trans-18 : 1 raises plasma triglycerides and VLDL cholesterol when replacing either 16 : 0 or 18 : 0 in gerbils." Journal of Nutritional Biochemistry **14**(10): 584-590.

To compare the relative impact of trans-18:1 with the two main dietary saturated fatty acids it replaces, plasma lipid response was assessed in Mongolian gerbils fed diets rich in 16:0 (24%en),18:0 (10%en), or trans-18:1 (4 or 6%en). The diets were designed such that the 18:0-rich diet substituted 7%en as 18:0 for 16:0, whereas 4%en and 6%en from trans-18:1 was substituted for 16:0 in the two trans diets. The control group was fed a diet formulated according to the fatty acid balance of American Heart Association (AHA), but provided 40%en, as fat. Gerbils (n = 10 per dietary group) were fed one of the five diets for 8 weeks. The control diet, with 4 times the polyunsaturated fatty acids (PUFA) content and a P:S ratio about 10 times greater than the test diets, resulted in the lowest plasma TC, LDL cholesterol (LDL-C) and VLDL cholesterol (VLDL-C). Among the test diets, plasma TC and TG were lowest with the 18:0-rich diet. TC in gerbils fed the 16:0-rich diet and 4%en-trans were 20% higher than the 18:0-rich diet, while the 6%en-trans diet was 35% higher. VLDL-C was significantly higher in the 6%en-trans diet compared to all other groups at 8 weeks. Both trans fatty acid diets elevated plasma TG approximately 2- and 3-fold, respectively, compared to the 16:0-rich and 18:0-rich, diets at 8 weeks. Further, plasma TG continued to rise over time with trans fatty acids compared to 16:0 or 18:0. Thus, in the fatty acid-sensitive gerbil, impaired TG metabolism represents a major aspect of the hyperlipemia. caused by trans fatty acid substitution for major saturated fatty acids. (C) 2003 Elsevier Inc. All rights reserved.

Willett, W. C. and A. Ascherio (1994). "TRANS-FATTY-ACIDS - ARE THE EFFECTS ONLY MARGINAL." American Journal of Public Health **84**(5): 722-724.

In the process of converting vegetable oils into solid fats, a process known as partial hydrogenation, some unsaturated bonds are converted to an unnatural Irans position, In humans, trans fatty acids increase low-density lipoprotein cholesterol and decrease high-density lipoprotein cholesterol. In addition, positive associations between intake of trans fatty acids and coronary heart disease have been observed in epidemiological studies. The combined results of metabolic and epidemiological studies provide strong evidence that trans fatty acid intake is causally related to risk of coronary disease. Because the consumption of partially hydrogenated fats is almost universal in the United States, the number of deaths attributable to such fats is likely to be substantial. Federal regulations should require manufacturers to include trans fatty acid content in food labels and should aim to greatly reduce or criminate the use of partially hydrogenated vegetable fats.

Willett, W. C. and A. Ascherio (1995). "TRANS FATTY-ACID AND CORONARY-DISEASE - THE DEBATE CONTINUES .4. WILLETT AND ASCHERIO RESPOND." American Journal of Public Health **85**(3): 412-413.

Willett, W. C., et al. (1993). "INTAKE OF TRANS-FATTY-ACIDS AND RISK OF CORONARY HEART-DISEASE AMONG WOMEN." Lancet **341**(8845): 581-585.

Trans isomers of fatty acids, formed by the partial hydrogenation of vegetable oils to produce margarine and vegetable shortening, increase the ratio of plasma low-density-lipoprotein to high-density-lipoprotein cholesterol, so it is possible that they adversely influence risk of coronary heart disease (CHD). To investigate this possibility, we studied dietary data from participants in the Nurses' Health Study. We calculated intake of trans fatty acids from dietary questionnaires completed by 85 095 women without diagnosed CHD, stroke, diabetes, or hypercholesterolaemia in 1980. During 8 years of follow-up, there were 431 cases of new CHD (non-fatal myocardial infarction or death from CHD). After adjustment for age and total energy intake, intake of trans isomers was directly related to risk of CHD (relative risk for highest vs lowest quintile 1.50 [95% CI 1.12-2.00], p for trend=0.001). Additional control for established CHD risk factors, multivitamin use, and intakes of saturated fat, monounsaturated fat, and linoleic acid, dietary cholesterol, vitamins E or C, carotene, or fibre did not change the relative risk substantially. The association was stronger for the 69 181 women whose margarine consumption over the previous 10 years had been stable (1.67 [1.05-2.66], p for trend=0.002). Intakes of foods that are major sources of trans isomers (margarine, cookies [biscuits], cake, and white bread) were each significantly associated with higher risks of CHD. These findings support the hypothesis that consumption of partially hydrogenated vegetable oils may contribute to occurrence of CHD.

Williams, C. M. (2000). "Dietary fatty acids and human health." Annales De Zootechnie **49**(3): 165-180.

A considerable amount of evidence has accumulated to support the view that the very long chain omega 3 fatty acids (eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA)) have beneficial cardiovascular and anti-inflammatory properties and that levels of their consumption are insufficient in most Western diets. More recently, attention has been given to the possibility that the precursor omega-3 PUFA, alpha linolenic acid (ALNA), may share some of the beneficial actions of EPA/DHA on human health. Further research into the metabolism and physiological actions of ALNA, and comparisons with EPA/DHA, is needed before conclusions regarding the optimal amounts and types of omega-3 PUFA for human health can be defined. Conjugated linoleic acid (CLA), which arises as a metabolic by-product of rumen hydrogenation and which is found in foods of animal origin, has been proposed to possess potent health promoting properties, but much of this research has been conducted in experimental animals. There is an urgent need for complementary studies in human volunteers, to confirm the putative anti-carcinogenic, anti-atherogenic, anti-lipogenic and immune-suppressive properties of CLA.

Williams, M. A., et al. (1998). "Risk of preeclampsia in relation to elaidic acid (trans fatty acid) in maternal erythrocytes." Gynecologic and Obstetric Investigation **46**(2): 84-87.

Objective: Trans fatty acids, formed by the partial hydrogenation of vegetable oils, are associated with increases in plasma concentrations of cholesterol, triglyceride, lipoprotein (a), and coronary heart disease risk. Trans fatty acids may also increase platelet aggregation and alter eicosanoid biosynthesis. We studied the relation between maternal dietary intake of trans fatty acids and risk of preeclampsia. Methods: Maternal intake of elaidic acid, one of the most abundant dietary trans fatty acids and other fatty acids were estimated using gas-liquid chromatography on erythrocytes from 22 women with preeclampsia and 40 normotensive controls. Fatty acids were expressed as the percentage of total fatty acids in erythrocytes. Logistic regression procedures were used to estimate odds ratios and 95% confidence intervals. Results: Mean levels of elaidic acid were 28% higher among preeclamptics (0.43 +/- 0.12) as compared with controls (0.31 +/- 0.12; p < 0.001). After adjusting for confounding factors, women with the highest levels of elaidic acid (median = 0.47) were 7.4 times (odds ratio = 7.4; 95% confidence interval 1.4-39.7) more likely to have had their pregnancy complicated by preeclampsia as compared with those women with the lowest levels (median 0.24). Risk of preeclampsia appeared to increase with increasing levels of elaidic acid (p value for linear trend = 0.05). Conclusion: These cross-sectional data suggest that diets high in elaidic acid may be associated with an increased risk of preeclampsia. This hypothesis should be examined in larger longitudinal studies.

Woldseth, B., et al. (1998). "Monounsaturated trans fatty acids, elaidic acid and trans-vaccenic acid, metabolism and incorporation in phospholipid molecular species in hepatocytes." Scandinavian Journal of Clinical & Laboratory Investigation **58**(8): 635-645.

The incorporation of [C-14]elaidic acid (trans18:1(n-9)) in phosphatidylcholine and phosphatidylethanolamine molecular species in isolated rat liver cells has been studied, and the results compared with the incorporation, previously published (B. Woldseth et al. Biochim Biophys Acta 1993;1167:296-302), of [C-14]palmitic acid (16:0) and [C-14]stearic acid (18:0) and with that of [C-14]oleic acid (cis18 : 1(n-9)). The pattern of incorporation in phospholipid molecular species is similar to that of [C-14]stearic acid and different from that of [C-14]palmitic acid. In phosphatidylcholine [C-14]trans18:1-18:2 and [C-14]trans18:1-20:4 were the most abundant species, and in phosphatidylethanolamine [C-14]trans18:1-20:4 was the predominant species. With increasing concentration of [C-14]elaidic acid increasing amounts of [C-14]trans18: 1-[C-14]trans18: 1 were found. The total incorporation in phospholipids was less than that of [C-14]stearic acid, but more than that of [C-14]palmitic acid. The distribution in percent of [C-14]elaidic acid in phospholipid classes was 8.8% in phosphatidylinositol, 1.8% in phosphatidylserine, 59.1% in phosphatidylcholine and 30.3% in phosphatidylethanolamine with 0.1 mmol l(-1) substrate concentration. More [C-14]elaidic acid than [C-14]palmitic acid or [C-14]stearic acid was oxidized. The incorporation in phospholipids of [C-14]elaidic acid was very different from that of[C-14]oleic acid. The main species with [C-14]oleic acid were 16:0-[C-14]cis18:1 in phosphatidylcholine, and [C-14]cis18:1-20:4 in phosphatidylethanolamine. In some experiments [C-14]18:2(n-6) was incubated together with unlabelled elaidic or unlabelled trans-vaccenic acid (trans18:1(n-7)). In these experiments, more trans18:1-18:2 was formed from elaidic acid than from trans-vaccenic acid, especially in phosphatidylethanolamine.

Wolever, T. M. S., et al. (2003). "Long-term effect of reduced carbohydrate or increased fiber intake on LDL particle size and HDL composition in subjects with type 2 diabetes." Nutrition Research **23**(1): 15-26.

To determine the long-term effect of reducing carbohydrate or increasing fiber intakes on LDL particle size and HDL composition, 69 subjects with type 2 diabetes randomly received similar to 10% energy from low-fiber breakfast cereal (LF), high-fiber cereal (HF), or monounsaturated fatty acid-rich oil/margarine (MUFA) for 6mo. Compared to LF, serum-triglyceride fell by similar to12% on MUFA and increased by similar to13% on HF (p<0.05). LDL-size fell significantly on both MUFA and HF. HDL-triglyceride did not change significantly on MUFA, but increased by similar to 20% on HF (p<0.05). Changes in HDL-triglyceride, but not changes in LDL-size, were significantly related to changes in serum triglyceride. Thus, modest long-term changes in carbohydrate and fiber intakes affected LDL particle size and HDL-triglyceride in type 2 diabetic subjects. The changes in HDL composition may have been driven by changes in serum triglyceride, but the changes in LDL particle size appear to have been caused by other factors, (C) 2003 Elsevier Science Inc. All rights reserved.

Wood, R. J., et al. (2006). "Effects of a carbohydrate-restricted diet on emerging plasma markers for cardiovascular disease." Nutrition & Metabolism **3**.

Background: Increasing evidence supports carbohydrate restricted diets (CRD) for weight loss and improvement in traditional markers for cardiovascular disease (CVD); less is known regarding emerging CVD risk factors. We previously reported that a weight loss intervention based on a CRD (% carbohydrate: fat: protein = 13: 60: 27) led to a mean weight loss of 7.5 kg and a 20% reduction of abdominal fat in 29 overweight men. This group showed reduction in plasma LDL-cholesterol and triglycerides and elevations in HDL-cholesterol as well as reductions in large and medium VLDL particles and increases in LDL particle size. In this study we report on the effect of this intervention with and without fiber supplementation on plasma homocysteine, lipoprotein ( a) [Lp( a)], C-reactive protein (CRP), interleukin-6 (IL-6), and tumor necrosis factor alpha (TNF-alpha). Methods: Twenty nine overweight men [ body mass index (BMI) 25 - 35 kg/m(2)] aged 20 - 69 years consumed an ad libitum CRD (% carbohydrate: fat: protein = 13: 60: 27) including a standard multivitamin every other day for 12 wk. Subjects were matched by age and BMI and randomly assigned to consume 3 g/d of either a soluble fiber supplement (n = 14) or placebo ( n = 15). Results: There were no group or interaction ( fiber x time) main effects, but significant time effects were observed for several variables. Energy intake was spontaneously reduced (- 30.5%). This was accompanied by an increase in protein intake (96.2 +/- 29.8 g/d to 107.3 +/- 29.7 g/d) and methionine intake (2.25 +/- 0.7 g/d, to 2.71 +/- 0.78 g/d; P < 0.001). Trans fatty acid intake was significantly reduced (- 38.6%) while dietary folate was unchanged, as was plasma homocysteine. Bodyweight (- 7.5 +/- 2.5 kg) was reduced as was plasma Lp( a) (- 11.3%). Changes in plasma Lp( a) correlated with reductions in LDL-cholesterol ( r =.436, P < 0.05) and fat loss ( r =.385, P < 0,05). At wk 12, both CRP (- 8.1%) and TNF-alpha (- 9.3%) were reduced ( P < 0.05) independently of weight loss. IL-6 concentrations were unchanged. Conclusion: A diet based on restricting carbohydrates leads to spontaneous caloric reduction and subsequent improvement in emerging markers of CVD in overweight/obese men who are otherwise healthy.

Woodward, M., et al. (1994). "DEFICIENT HEALTH KNOWLEDGE, DIET, AND OTHER LIFE-STYLES IN SMOKERS - IS A MULTIFACTORIAL APPROACH REQUIRED." Preventive Medicine **23**(3): 354-361.

Background. Data from the Scottish Heart Health Study, a random cross-sectional sample of middle-aged men and women, are used to compare health knowledge, behavior, and lifestyles between 4896 smokers and 4595 nonsmokers. Methods. Smokers are identified from self-reports with biochemical validation. They are compared with nonsmokers using analysis of covariance and logistic regression, adjusting for age and social class. Results. Smokers are found to have poorer dietary knowledge than nonsmokers, although both groups are well-informed on some aspects of diet. Knowledge of personal risk modifiers for coronary heart disease and recent intention to improve lifestyle are both worse among smokers. Smokers have lower intakes of the antioxidant vitamins and fiber, but higher intakes of dietary cholesterol and alcohol than nonsmokers. They also tend to have higher salt intake and eat a greater proportion of saturated fat, butter, or hard margarine, and full-fat milk. High-density lipoprotein cholesterol levels are lower, but triglycerides, fibrinogen, and, for women only, total serum cholesterol levels are higher among smokers. On the other hand, body mass index and diastolic blood pressure are lower among smokers. Conclusions. In addition to advice to give up smoking, smokers should be counseled to improve their diet. The positive message to eat more fresh fruit and vegetables would be particularly helpful. (C) 1994 Academic Press, Inc.

Wu, J. H. Y., et al. (2011). "Fatty acids in the de novo lipogenesis pathway and risk of coronary heart disease: the Cardiovascular Health Study." American Journal of Clinical Nutrition **94**(2): 431-438.

Background: De novo lipogenesis (DNL) is an endogenous pathway whereby carbohydrates and proteins are converted to fatty acids. DNL could affect coronary heart disease (CHD) or sudden cardiac arrest (SCA) via generation of specific fatty acids. Whether these fatty acids are prospectively associated with SCA or other CHD events is unknown. Objective: The objective was to investigate the relations of 4 fatty acids in the DNL pathway-palmitic acid (16:0), palmitoleic acid (16:1n-7), 7-hexadecenoic acid (16:1n-9), and cis-vaccenic acid (18:1n-7)-with incident CHD, including fatal CHD, nonfatal myocardial infarction (NFMI), and SCA. Design: A community-based prospective study was conducted in 2890 men and women aged >= 65 y, who were free of known CHD at baseline and who were followed from 1992 to 2006. Cardiovascular disease risk factors and plasma phospholipid fatty acids were measured at baseline by using standardized methods. Incident CHD was ascertained prospectively and was centrally adjudicated by using medical records. Risk was assessed by using multivariable-adjusted Cox proportional hazards. Results: During 29,835 person-years of follow-up, 631 CHD and 71 SCA events occurred. Both 18:1n-7 and 16:1n-9 were associated with a higher risk of SCA [multivariable-adjusted hazard ratio (95% CI) for the interquintile range: 7.63 (2.58, 22.6) for 18: 1n-7 and 2.30 (1.16, 4.55) for 16:1n-9] but not of total CHD, fatal CHD, or NFMI. In secondary analyses censored to mid-follow-up (7 y) to minimize the effects of changes in concentrations over time, 16:1n-9 was also associated with a significantly higher risk of total CHD (2.11; 1.76, 2.54), including a higher risk of CHD death, NFMI, and SCA; 16:0 and 16:1n-7 were not associated with clinical CHD outcomes. Conclusion: Higher plasma phospholipid 18: n-7 and 16:1n-9 concentrations were prospectively associated with an elevated risk of SCA but not of other CHD events, except in secondary analyses. Am J Clin Nutr 2011;94:431-8.

Yaghmur, A., et al. (2012). "Self-Assembled Nanostructures of Fully Hydrated Monoelaidin-Elaidic Acid and Monoelaidin-Oleic Acid Systems." Langmuir **28**(26): 10105-10119.

In recent years, there has been a surge of interest in exploring the effect of trans-fatty acids (TFAs) on biological membrane properties. The research studies are motivated by an increasing body of evidence suggesting that the consumption of TFAs increases the risk of developing negative health effects such as coronary heart disease and cancer. The ultimate goal of studying the lipid fatty acid interactions at the molecular level is to predict the biological role of fatty acids in cells. In this regard, it is interesting to elucidate the effect of loading TFAs and their counterpart cis-fatty acids (CFAs) on the physical properties of lipid model membranes. Here, the present study focuses on discussing the following: (1) the effect of mixing monoelaidin (ME, TFA-containing lipid) with its counterpart monoolein (MO, CFA-containing lipid) on modulating the fully hydrated self-assembled structure, and (2) the influence of solubilizing oleic acid (OA) and its trans counterpart elaidic acid (EA) on the fully hydrated ME system. The ME model membrane was selected due to its sensitivity to variations in lipid composition and temperature. Synchrotron small-angle X-ray scattering (SAXS) was applied for studying the temperature-dependent structural behavior of the fully hydrated ME/MO-based system prepared with an equal ME/MO weight ratio and also for characterizing the fully hydrated OA- and EA-loaded ME systems. Wide-angle X-ray (WAXS) experiments were also performed for characterizing the formed crystalline lamellar phases at ambient temperatures. The results demonstrate the significant influence of the partial replacement of ME by MO on the phase behavior. The addition of MO induces the lamellar-nonlamellar phase transitions at ambient temperatures and promotes the formation of the inverted type hexagonal (H-2) phase above 72 degrees C. The fully hydrated ME/EA and ME/OA systems with their rich polymorphism exhibit an interesting temperature-dependent complex behavior. The experimental findings show that the temperature-induced phase transitions are dictated by the solubilized fatty acid concentration and its configuration. Both EA and OA have a significant impact on the fully hydrated ME system. Similar to previous published studies, OA induces a significantly stronger mean negative membrane curvature as compared to EA. The two phase diagrams are discussed in terms of water lipid and lipid fatty acid interactions, membrane bending, and lipid packing concepts. A newly observed interesting epitaxial relationship for the lamellar hexagonal phase transition in the EA-loaded ME system is illustrated and discussed in detail.

Yamada, M., et al. (2010). "Estimation of Trans Fatty Acid Intake in Japanese Adults Using 16-Day Diet Records Based on a Food Composition Database Developed for the Japanese Population." Journal of Epidemiology **20**(2): 119-127.

Background: The Standard Tables of Food Composition in Japan do not include information on trans fatty acids. Previous studies estimating trans Fatty acid intake among Japanese have limitations regarding the databases utilized and diet assessment methodologies. We developed a comprehensive database of trans fatty acid food composition. and Used this database to estimate intake among a Japanese population. Methods: The database was developed using analytic values from the literature and nutrient analysis software encompassing roods in the US, as well as values estimated front recipes or nutrient compositions. We collected 16-day diet records from 225 adults aged 30 to 69 years living in 4 areas of Japan. Trans fatty acid intake was estimated based on the database and the 16-day diet records. Results: Mean total fat and trans fatty acid intake was 56.9 g/day (27.7% total energy) and 1.7 g/day (0.8%, total energy), respectively, for women and 66.8 g/day (25.5% total energy) and 1.7 g/day (0.7% total energy) for men. Trans fatty acid intake accounted For greater than 1% of total energy intake. which is the maximum recommended according to the World Health Organization, in 24.4% of women and 5.7% of men, and was particularly high among women living in Urban areas and those aged 30-49 years. The largest contributors to trans fatty acid intake were confectionaries in women and fats and oils in men. Conclusions: Although mean trans fatty acid intake was below the maximum recommended intake of the World Health Organization, intake among subgroups was of concern. Further public health efforts to reduce trans fatty acid intake should be encouraged.

Yamada, M., et al. (2009). "Association of trans fatty acid intake with metabolic risk factors among free-living young Japanese women." Asia Pacific Journal of Clinical Nutrition **18**(3): 359-371.

Objective: We examined cross-sectional associations of total, hydrogenated, and natural trans fatty acid intake with selected metabolic risk factors in young Japanese women. Methods: Subjects were 1136 Japanese female dietetic students aged 18-22 years. Dietary intake was estimated using a validated, self-administered diet history questionnaire. Associations between trans fatty acid intake and metabolic risk factors were examined with multivariate linear regression analysis, with control for potential covariates. Dietary covariates included intake of energy, total fat, and saturated fatty acids (model 1); monounsaturated fatty acids instead of saturated fatty acids (model 2), and polyunsaturated fatty acids instead of saturated fatty acids (model 3). Results: Mean (standard deviation) total trans fatty acid intake was 0.90% (0.30%) of total energy. Hydrogenated trans fatty acids contributed 77% of total trans fatty acid intake. Total trans fatty acid intake was significantly and positively associated with waist circumference, triacylglycerol, and glycated hemoglobin, except in the analysis of triacylglycerol with adjustment for monounsaturated fatty acids. No associations were found between total trans fatty acid intake and body mass index, cholesterol, or glucose. Hydrogenated trans fatty acid intake was significantly and positively associated only with waist circumference and glycated hemoglobin. No association was observed for natural trans fairly acid intake. Conclusion: hydrogenated trans fatty acid intake was positively associated with several metabolic risk factors among free-living young Japanese women with relatively low intake.

Yochum, L. A., et al. (2000). "Intake of antioxidant vitamins and risk of death from stroke in postmenopausal women." American Journal of Clinical Nutrition **72**(2): 476-483.

Background: Antioxidant vitamins may play a role in the prevention of stroke because they scavenge free radicals and prevent LDL oxidation. Epidemiologic studies that have examined this relation produced conflicting results. Objective: We examined the association between antioxidant vitamin intakes and death from stroke. Design: This was a prospective cohort study of 34492 postmenopausal women. Results: During follow-up, 215 deaths from stroke were documented. Total vitamin A, carotenoid, and vitamin E intakes were not associated with death from stroke after multivariate adjustment. Relative risks (RRs) and 95% CIs of the highest compared with the lowest category were 0.79 (0.45, 1.38; P for trend = 0.33) for vitamin A, 0.88 (0.45, 1.40; P for trend = 0.40) for carotenoids, and 0.91 (0.55, 1.52; P for trend = 0.86) for vitamin E. The test for trend for total vitamin C intake was significant, although the association appeared somewhat U-shaped, not monotonic. An inverse association was seen between death from stroke and vitamin E intake from food. RRs land 95% CIs) of death from stroke from the lowest to highest intake categories were 1.0. 0.80 (0.51, 1.26), 0.93 (0.58, 1.49), 0.67 (0.39, 1.14), 0.40 (0.20, 0.80); P for trend = 0.008. The results suggest inverse associations between death from stroke and intakes of the most concentrated vitamin E food sources consumed by this cohort: mayonnaise, nuts, and margarine. Conclusions: Our results suggest a protective effect of vitamin E from foods on death from stroke but do not support a protective role for supplemental vitamin E or other antioxidant vitamins. However, given the number of deaths from stroke in the present cohort, a small-to-moderate association could not be ruled out.

Yontem, M., et al. (2005). "Effects of highly consumed dietary oils on several hepatic transaminases and lipid oxidation in chick." Ecology of Food and Nutrition **44**(4): 295-305.

The incidence of cardiovascular disease is well correlated with diets high in saturated fatty acids (such as butter). On the other hand, oils, which are rich in unsaturated fatty acids (e.g., sunflower oil and corn oils), reduce cholesterol synthesis and thus show protective effects against arteriosclerosis. However, sunflower oil and corn oil are also considered as risk factors for their sensitivities to free radical formation because of their high contents of polyunsaturated fatty acids (PUFAs). The aim of the present study described herein was to investigate the production of reactive oxygen metabolites (an indicator of oxidative stress) and the activities of several transaminases (markers of hepatic injury) in chick liver treated with highly consumed dietary oils (differing in the degree of saturation). The animals were randomly assigned to six groups of 29 and fed dietary butter, margarine, olive oil, sunflower oil, or corn oil for 2 months. The results indicated that the level of reactive oxygen metabolites (ROM) was lowest in the dietary butter-fed group but highest in the corn oil-fed group. Similarly, the activities of all transaminases measured were lowest in the butter group, and in the margarine-fed group only the Gama-glutamyl transaminase activity was lowest as compared to the control group. From these findings, it was concluded that the dietary butter was the most resistant oil to lipid oxidation, whereas corn oil was the most susceptible one, which may thus challenge the antioxidant defense system and increase the susceptibility of tissues to degradation products of lipid oxidation.

Zacherl, J. R., et al. (2014). "Elaidate, an 18-Carbon trans-Monoenoic Fatty Acid, Inhibits beta-Oxidation in Human Peripheral Blood Macrophages." Journal of Cellular Biochemistry **115**(1): 62-70.

Consumption of trans-unsaturated fatty acids promotes atherosclerosis, but whether degradation of fats in macrophages is altered by trans-unsaturated fatty acids is unknown. We compared the metabolism of oleate (C18:19-10 cis; (Z)-octadec-9-enoate), elaidate (C18:9-10 trans; (E)-octadec-9-enoate), and stearate (C18:0, octadecanoate) in adherent peripheral human macrophages. Metabolism was followed by measurement of acylcarnitines in cell supernatants by MS/MS, determination of cellular fatty acid content by GC/MS, and assessment of -oxidation rates using radiolabeled fatty acids. Cells incubated for 44h in 100 mu M elaidate accumulated more unsaturated fatty acids, including both longer- and shorter-chain, and had reduced C18:0 relative to those incubated with oleate or stearate. Both C12:1 and C18:1 acylcarnitines accumulated in supernatants of macrophages exposed to trans fats. These results suggested -oxidation inhibition one reaction proximal to the trans bond. Comparison of [1-C-14]oleate to [1-C-14]elaidate catabolism showed that elaidate completed the first round of fatty acid -oxidation at rates comparable to oleate. Yet, in competitive -oxidation assays with [9,10-H-3]oleate, tritium release rate decreased when unlabeled oleate was replaced by the same quantity of elaidate. These data show specific inhibition of monoenoic fat catabolism by elaidate that is not shared by other atherogenic fats. J. Cell. Biochem. 115: 62-70, 2014. (c) 2013 Wiley Periodicals, Inc.

Zangenberg, M., et al. (2004). "Cultivar and year-to-year variation of phytosterol content in rye (Secale cereale L.)." Journal of Agricultural and Food Chemistry **52**(9): 2593-2597.

Intake of phytosterols (and -stanols) has been shown to decrease the level of low-density lipoprotein cholesterol and thus protect against development of cardiovascular diseases. Therefore, studies on the cultivar and year-to-year variation in phytosterol content in rye grains have been performed. The phytosterol content and composition of different rye cultivars, grown under identical conditions on the same field in three consecutive years, were analyzed. Both cultivar and year-to-year variation in sterol content were statistically significant (p < 0.0001). The total sterol content varied from 1007 +/- 21 mg/kg in the highest yielding cultivar, Tsulpan 3, to 761 +/- 10 mg/kg in the lowest yielding cultivar (Amando in the 1999 harvest). Because the meteorological conditions varied substantially between the different years, it was possible to deduce the impact of varying weather conditions on phytosterol content in the different cultivars. The studied cultivars had all the lowest phytosterol contents in the dry and warm harvest season of 1999. Although there were statistically significant cultivar and year-to-year variations in the sterol composition (p < 0.0001), these were only between 2 and 4% of the total sterol content.

Zapolska-Downar, D., et al. (2005). "Trans fatty acids induce apoptosis in human endothelial cells." Journal of Physiology and Pharmacology **56**(4): 611-625.

The present study was designed to investigate the hypothesis that trans fatty acids can induce apoptosis of human umbilical vein endothelial cells (HUVEC). To test this hypothesis apoptosis was measured in HUVEC treated with 0.1, 1.0 or 5.0 mM trans elaidic acid (t-18:1) or linoelaidic acid (t,t-18:2) for 24 hours. For the detection of apoptosis, TdT-mediated dUTP nick end labelling assay (TUNEL), cell binding of annexin V and propidium iodide uptake were measured. Active Caspase-3 and cleaved PARP (poly-ADP-ribose polymerase) were also measured in the cell lysate. Moreover, cellular ability to produce ROS (reactive oxygen species) was measured by DCF fluorescence Both acids studied induce both early (annexin-positive cells) and late stages of apoptosis (cells stained by propidium iodide) in a dose-dependent manner. Also the appearance of TUNEL-positive cells was induced by both trans fatty acids tested, in a dose dependent manner. Both trans acids induce apoptosis through their effect on Caspase-3 activity and on intracellular ROS production. It is worth emphasising that linoelaidic acid proved to be a more potent inducer of apoptosis and ROS production in endothelial cells than elaidic acid. The present studies suggest that trans fatty acids may play a role in damaging and death of vascular endothelial cells in atherosclerosis.

Zegarska, Z. and Z. Borejszo (2001). "Trans fatty acid content of some food products in Poland." Journal of Food Lipids **8**(4): 271-279.

The fatty acid composition of chips, cakes and ice creams was determined with particular attention to their trans fatty acid content. The trans C18:1 content was determined by a combined capillary gas-liquid chromatography (GLC) and silver thin-layer chromatography (Ag-TLC). Six of ten types of chips examined contained more than 10% trans C18:1 (in the range of 10.3 to 17.3% of the total fatty acids), and the other four had below 0.5%. In the lipids of cakes trans C18:1 isomers occurred at 1.49 to 41.44% and only four types of cakes contained less than 5% of trans C18:1. The cis-trans and trans-cis C18:2 isomers were present among the fatty acids of the majority of chips and cakes investigated. Six types of chips contained trans-trans 08:2 in the 1.2-1.6% range. Trans fatty acids were absent in the lipids of 6 types of ice cream, but two 4,pes contained 11.3 and 19.4% trans C18: 1.

Zegarska, Z., et al. (2005). "Content of trans C18 : 1 and trans C18 : 2 isomers and cis9trans11 C18 : 2 (CLA) in fat blends." Journal of Food Lipids **12**(4): 275-285.

The content of trans C18:1,Trans C18:2 and cis9trans11 C18:2 (CLA) in the marketed fat blends was evaluated by capillary gas chromatography and silver thin-layer chromatography. For comparison, the level of these acids was also determined in commercial butter, purchased at the same time. The content of trans C18:1 in fat blends showed that half of the examined products contained trans C18:1 at 1.9-4.4%, while the other half contained 8.2-24.2% trans fatty acids. The fat blends with a high total content of trans C18:1 were characterized by a high proportion of trans 6-8 and trans 9 isomers. The trans 9 C18:1 in these products constituted 15.0-22.5% of the total trans C18:1. The level of trans C18:2 in fat blends examined ranged from 0.3 to 1.1%. Seven of the 18 tested fat blends contained, apart from cis-trans and trans-cis C18:2, also trans-trans C18:2 in the 0.03-0.4% range. In all fat blends examined, CLA was present. The products with a low level of trans C18:1 contained CLA at 0.3-1.0%. The content of CLA in the fat blends with high level of trans C18:1 did not exceed 0.3%.

Zengin, G., et al. (2011). "The effect of pasteurisation temperature on the CLA content and fatty acid composition of white pickled cheese." International Journal of Dairy Technology **64**(4): 509-516.

In this study, the effect of pasteurisation temperature on fatty acid composition of cheese was investigated. The fatty acid composition of raw and different heat-treated milk, salt and salt-free cheese were determined using cheese made from raw milk at temperatures varying between 70 and 90 degrees C for 5 min. Generally, C 16: 0 palmitic acid was the major fatty acid present in all milk and cheese samples. C 18:1 t11 vaccenic acid was the major trans fatty acid (TFA) in all samples. C 18: 2 cis-9, trans-11 (Rumenic acid) was the major CLA isomer in these samples. Pasteurisation temperatures had no effect on TFA, CLA and fatty acid composition of the milk and cheese samples.

Zevenbergen, H., et al. (2009). "Foods with a High Fat Quality Are Essential for Healthy Diets." Annals of Nutrition and Metabolism **54**: 15-24.

Fat is generally a highly valued element of the diet to provide energy, palatability to dry foods or to serve as a cooking medium. However, some foods rich in fat have a low fat quality with respect to nutrition, i.e., a relative high content of saturated (SFA) as compared to unsaturated fatty acids, whereas others have a more desirable fat quality, i.e., a relative high content of unsaturated fatty acids as compared to SFA. High-fat dairy products and fatty meats are examples of foods with low fat quality, whereas vegetable oils (tropical oils such as palm and coconut oil excluded) are products with a generally high fat quality. The aim of this paper is to explore the nutritional impact of products made of vegetable oils, e. g. margarines and dressings, and how they can be designed to contribute to good health. Since their first industrial production, the food industry has endeavored to improve products like margarines, including their nutritional characteristics. With evolving nutrition science, margarines and cooking products, and to a lesser extent dressings, have been adapted to contain less trans fatty acids (TFA), less SFA and more essential (polyunsaturated, PUFA) fatty acids. This has been possible by using careful fat and oil selection and modification processes. By blending vegetable oils rich in the essential PUFAs alpha-linolenic acid (vegetable omega-3) or linoleic acid (omega-6), margarines and dressings with both essential fatty acids present in significant quantities can be realized. In addition, full hydrogenation and fat rearrangement have enabled the production of cost-effective margarines virtually devoid of TFA and low in SFA. Dietary surveys indicate that vegetable oils, soft margarines and dressings are indeed often important sources of essential fatty acids in people's diets, whilst providing negligible amounts of TFA and contributing modestly to SFA intakes. Based on empirical and epidemiological data, the public health benefit of switching from products with a low fat quality to products with a high fat quality can be predicted. For example, switching from butter or palm oil to a soft margarine shows a substantial improvement in the nutritional quality of the diet. These simple, practical dietary adaptations can be expected to contribute to the healthy growth and development of children and to reduce the burden of cardiovascular disease. Copyright (C) 2009 S. Karger AG, Basel

Zhao, M. L., et al. (2013). "Enzymatic Production of Zero-Trans Plastic Fat Rich in alpha-Linolenic Acid and Medium-Chain Fatty Acids from Highly Hydrogenated Soybean Oil, Cinnamomum camphora Seed Oil, and Perilla Oil by Lipozyme TL IM." Journal of Agricultural and Food Chemistry **61**(6): 1189-1195.

In the present study, zero-trans a-linolenic acid (ALA) and medium-chain fatty acids (MCFA)-enriched plastic fats were synthesized through enzymatic interesterification reactions from highly hydrogenated soybean oil (HSO), Cinnamomum camphora seed oil (CCSO), and perilla oil (PO). The reactions were performed by incubating the blending mixtures of HSO, CCSO, and PO at different weight ratios (60:40:100, 70:30:100, 80:20:100) using 10% (total weight of substrate) of Lipozyme TL IM at 65 degrees C for 8 h. After reaction, the physical properties (fatty acids profile, TAG composition, solid fat content, slip melting point, contents of tocopherol, polymorphic forms, and microstructures) of the interesterified products and their physical blends were determined, respectively. Results showed that the fatty acid compositions of the interesterified products and physical blends had no significant changes, while the content of MCFA in both interesterified products and physical blends increased to 8.58-18.72%. Several new types of TAG species were observed in interesterified products (SSL/SLS, PLO/LLS, and OLLn/LnLO/LOLn). It should be mentioned that no trans fatty acids (TFA) were detected in all products. As the temperature increased, the solid fat content (SFC) of interesterified products was obviously lower than that of physical blends. The SFCs of interesterified products (60:40:100, 70:30:100, and 80:20:100, HSO:CCSO:PO) at 25 C were 6.5%, 14.6%, and 16.5%, respectively, whereas the counterparts of physical blends were 32.5%, 38.5%, and 43.5%, respectively. Meanwhile, interesterified products showed more beta' polymorphs than physical blends, in which beta' polymorph is a favorite form for production of margarine and shortening. Such zero-trans ALA and MCFA-enriched fats may have desirable physical and nutritional properties for shortenings and margarines.

Zhao, X., et al. (2013). "Identification of metabolites in WZS-miniature pig urine after oral administration of Danshen decoction by HPLC coupled with diode array detection with electrospray ionization tandem ion trap and time-of-flight mass spectrometry." Biomedical Chromatography **27**(6): 720-735.

Danshen (DS) is a widely used traditional Chinese medicine for treating cardiovascular and cerebrovascular diseases. A simple, rapid and sensitive method was developed for identification of the in vivo metabolites in urine of WZS-miniature pigs after oral administration of DS decoction by HPLC coupled with diode array detection with electrospray ionization tandem ion trap and time-of-flight mass spectrometry. This method has been successfully applied to simultaneous identification of 50 compounds (including 11 new ones) in pig urine. In addition, one new compound, (3-hydroxyphenyl) crylic acid glycine methyl ester (C1), along with eight known ones were first isolated by column chromatography and identified by spectroscopic means, including 1D/2DNMR and mass spectrometry, as reference substances. Ten phenolic compounds (protocatechuic aldehyde, protocatechuic acid, caffeic acid, danshensu, ferulic acid, isoferulic acid, rosmarinic acid and salvianolic acid A/B/D) were found to be the main absorbed original constituents of DS decoction, which underwent the metabolic reactions of glucuronidation, sulfation, methylation, hydrogenation and glycine conjugation in vivo. In conclusion, the developed method is applicable to the analysis and identification of constituents in biological matrices after administration of DS decoction. Copyright (c) 2012 John Wiley & Sons, Ltd.

Zock, P. L. and M. B. Katan (1992). "HYDROGENATION ALTERNATIVES - EFFECTS OF TRANS-FATTY-ACIDS AND STEARIC-ACID VERSUS LINOLEIC-ACID ON SERUM-LIPIDS AND LIPOPROTEINS IN HUMANS." Journal of Lipid Research **33**(3): 399-410.

The objective of this study was to compare the effects of linoleic acid (cis,cis-C18:2(n-6)) and its hydrogenation products elaidic (trans-C18:1(n-9)) and stearic acid (C18:0) on serum lipoprotein levels in humans. Twenty-six men and 30 women, all normolipemic and apparently healthy, completed the trial. Three experimental diets were supplied to every subject for 3 weeks each, in random order (multiple cross-over). The Linoleate-diet provided 12.0% of total energy intake as linoleic acid, 2.8% as stearic acid, and 0.1% as trans fatty acids. The Stearate-diet supplied 3.9 energy % as linoleic acid, 11.8% Stearic acid, and 0.3% trans fatty acids. The Trans-diet provided 3.8 energy % as linoleic acid, 3.0% stearic acid, and 7.7% as monounsaturated trans fatty acids, largely elaidic acid (trans-C18:1(n-9)). Other nutrients were constant. Fasting blood was sampled at the end of each dietary period. Mean (+/- SD) serum LDL cholesterol was 109 +/- 24 mg/dl (2.83 +/- 0.63 mmol/l) on the Linoleate-diet. It rose to 116 +/- 27 mg/dl (3.00 +/- 0.71 mmol/l) on the Stearate-diet (change, 7 mg/dl or 0.17 mmol/l, P = 0.0008) and to 119 +/- 25 mg/dl (3.07 +/- 0.65 mmol/l) on the Trans-diet (change, 9 mg/dl or 0.24 mmol/l, P < 0.0001). High density lipoprotein (HDL) cholesterol decreased by 2 mg/dl (0.06 mmol/l, P < 0.0001) on the Stearate-diet and by 4 mg/dl (0.10 mmol/l, P < 0.0001) on the Trans-diet, both relative to linoleic acid. Our findings show that 7.7% of energy (mean, 24 g/day) of trans fatty acids in the diet significantly lowered HDL cholesterol and raised LDL cholesterol relative to linoleic acid. Combination with earlier results (Mensink, R. P., and M. B. Katan. 1990. N. Engl. J. Med. 323: 439-445) suggests a linear dose-response relation. Replacement of linoleic acid by stearic acid also caused somewhat lower HDL cholesterol and higher LDL cholesterol levels. Hydrogenation of linoleic acid to either stearic or trans fatty acids produces fatty acids that may increase LDL and decrease HDL cholesterol relative to linoleic acid itself.

Zock, P. L. and M. B. Katan (1997). "Butter, margarine and serum lipoproteins." Atherosclerosis **131**(1): 7-16.

Intake of trans fatty acids unfavorably affects blood lipoproteins. As margarines are a major source of trans, claims for the advantages of margarines over butter need to be scrutinized. Here we review dietary trials that directly compared the effects of butter and margarine on blood lipids. We identified 20 studies in which subjects had stable body weights, and margarine and butter were exchanged in the diet at constant energy and far intake. We calculated the chan in average blood lipid levels between study diets (49 comparisons) as a function of the percentage of calories as margarine substituted for butter. Replacing 10% of calories from butter by hard high-trans stick margarines lowered total serum cholesterol by 0.19: LDL by 0.11, and HDL by 0.02 mmol/l, and did not affect the total/HDL cholesterol ratio. Soft low-trans tub margarines decreased total cholesterol by 0.25 and LDL by 0.20 mmol/l, did not affect HDL, and decreased the total/HDL cholesterol ratio by 0.20. Based on the total/HDL cholesterol ratio, replacement of 30 g of butter per day by soft tub margarines would theoretically predict a reduction in coronary heart disease risk of 10%, while replacement of butter by hard, high-trans margarines would have no effect. Replacing butter by low-trans soft margarines favorably affects the blood lipoprotein profile and may reduce the predicted risk of coronary heart disease, but high-trans hard margarines probably confer no benefit over butter. (C) 1997 Elsevier Science Ireland Ltd.

Zock, P. L. and M. B. Katan (1997). "Trans fatty acids, lipoproteins, and coronary risk." Canadian Journal of Physiology and Pharmacology **75**(3): 211-216.

Most dietary fatty acids contain at least one double bond, which is usually in the cis configuration. However, biohydrogenation in the rumen of cows and sheep, or catalytic hydrogenation of vegetable oils in the food industries, will convert some of the cia double bonds to the trans configuration. Trans fatty acid intake in western Europe and North America probably ranges from 5 to 15 g/day. Major dietary sources are frying fats used in industrial food preparation, margarines, and other spreads. In the past, margarines contained up to 50% trans fatty acids; however, these are now being phased out. Trans fatty acids raise serum low density lipoprotein (LDL) cholesterol and lower high density lipoprotein (HDL) cholesterol in humans when substituted for cis unsaturated fatty acids in the diet. These effects may be mediated by the cholesteryl ester transfer protein. Trans fatty acids also increase lipoprotein (a) levels relative to other fatty acids. The effects of trans fatty acids on the risk profile for coronary heart disease are thus unfavorable, and labels of food products should state the trans fatty acid content.

Zong, G., et al. (2013). "Associations of erythrocyte fatty acids in the de novo lipogenesis pathway with risk of metabolic syndrome in a cohort study of middle-aged and older Chinese." American Journal of Clinical Nutrition **98**(2): 319-326.

Background: Experimental studies suggest that elevated de novo lipogenesis (DNL) might be involved in the pathogenesis of metabolic disorders. Few prospective studies have been conducted, especially among populations with a high carbohydrate intake, to determine whether DNL fatty acids are associated with the risk of the metabolic syndrome (MetS). Objective: We aimed to investigate associations of erythrocyte fatty acids in the DNL pathway-including myristic acid (14:0), palmitic acid (16:0), palmitoleic acid (16:1n-7), hexadecenoic acid (16:1n-9), stearic acid (18:0), vaccenic acid (18:1n-7), and oleic acid (18: 1n-9)-with the risk of MetS in a Chinese population with an average carbohydrate intake of >60% of energy. Design: A total of 1176 free-living Chinese men and women aged 50-70 y from Beijing and Shanghai were included in our analysis, giving rise to 412 incident MetS cases during 6 y of follow-up. Erythrocyte fatty acids and metabolic traits were measured in these participants. Results: Erythrocyte fatty acids in the DNL pathway were correlated with a high ratio of carbohydrate-to-fat intake, less favorable lipid profiles, and elevated liver enzymes at baseline. In comparison with the lowest quartile, RRs (95% CIs) of MetS in the highest quartile were 1.30 (1.04, 1.62; P-trend = 0.007) for 16:1n-7, 1.48 (1.17, 1.86; P-trend < 0.001) for 16:1n-9, 1.26 (1.01, 1.56; P-trend = 0.06) for 18:1n-7, and 1.51 (1.19, 1.92; P-trend < 0.001) for 18:1n-9 after multivariate adjustment for lifestyle factors and body mass index. Moreover, 16:0 and 16:1n-7 were associated with an elevated risk of diabetes. Conclusion: Our findings suggest that fatty acids in the DNL pathway are independently associated with an elevated risk of metabolic disorders.