## 1. Balanced Diet

A balanced diet is a diet that provides the body with all the nutrients, vitamins, and minerals that it needs to function properly. Fresh fruits and vegetables, whole grains, and lean protein are key components of a balanced diet.

In addition to regular physical activity, a balanced diet is essential for promoting and maintaining good health and body weight, as well as reducing the risk of chronic disease and all-cause mortality. The elements of a balanced diet and the solutions provided in this section rely on the principles of a healthy diet outlined in the previous section (Nourishment and the Human Body.

### I. Fresh Fruits and Vegetables

Fresh fruit and vegetable consumption is an essential component of a healthy diet, and sufficient intake of fruits and vegetables can not only ensure an adequate intake of most micronutrients, dietary fiber, and other essential non-nutrient substances, but also help prevent major chronic diseases, such as CVD and cancer. A higher intake of fruits and vegetables is also associated with a reduced risk of all-cause mortality (<http://www.bmj.com/content/349/bmj.g4490>). Various micronutrients (vitamins, flavonoids, carotenoids, and antioxidants) are involved behind the protective effects of fruits and vegetables, acting to suppress cancer-causing agents and prevent DNA damage (World Health Organization, 2002), leading to lower risk of disease.

The WHO’s World Health Report 2002 states that approximately 26.7 million (1.8%) disability-adjusted life years (DALYs, which is a measure of the potential life lost due to premature mortality and the potential years of productive life lost due to disability) and 2.7 million (4.9%) deaths worldwide are attributed to insufficient fruit and vegetable intake (World Health Organization, 2002). In addition, low fruit and vegetable consumption is among the top 10 risk factors contributing to global mortality (World Health Organization, 2002).

Increasing the consumption of fruits and vegetables is a national public health priority in the U.S. (<http://www.foodpolitics.com/wp-content/uploads/2010-GAP-Analysis.pdf>), as well as a global priority (<http://www.fao.org/english/newsroom/focus/2003/fruitveg1.htm>). The WHO and FAO expert consultation report on diet, nutrition, and chronic disease prevention recommends intake of a minimum of 400 grams of fruits and vegetables per day in order to prevent heart disease, cancer, diabetes, and obesity (<http://www.who.int/dietphysicalactivity/fruit/en/index2.html>). The CDC and DHHS recommend and encourage adults to consume at least 4-5 servings of fruit and 4-5 servings of vegetables per day (for a 2,000 kcal/day diet) (<http://www.health.gov/dietaryguidelines/dga2010/DietaryGuidelines2010.pdf>). However, as little as five servings of fruits and vegetables per day seems sufficient to produce significant outcomes; a systematic review and meta-analysis of 16 prospective cohort studies on fruit and vegetable consumption found that approximately five servings of fruits and vegetables per day was the threshold after which the risk of all-cause mortality was not reduced further (<http://www.bmj.com/content/349/bmj.g4490>).

Availability and access to fresh fruits and vegetables is an important factor in individual fruit and vegetable intake. The NYC Active Design Guidelines report on studies that suggest that the presence of a grocery store or a supermarket is associated with a lower rate of obesity in the neighborhood (New York City Department of City Planning. Going to market: New York City’s neighborhood grocery store and supermarket shortage. http://www.nyc.gov/html/dcp/html/supermarket/index.shtml); (Morland K, Diez Roux A, Wing S. Supermarkets, other food stores, and obesity: the atherosclerosis risk in communities study. *American Journal of Preventive Medicine.* 2006;30(4): p. 333–339), and that greater availability of fresh food is associated with lower levels of diet-related disease (Sallis JF and Glanz K. physical activity and food environments: solutions to the obesity epidemic. *Milbank Quarterly.* 2009;87(1): p. 123–154); (Larson NJ, Story MT, and Nelson MC. Neighborhood environments: Disparities in access to healthy foods in the U.S. *American Journal of Preventive Medicine.* 2009;36(1): p. 74–81).

#### Health Effects

##### Cardiovascular System

**Cardiovascular disease and mortality**. A systematic review and meta-analysis of 16 prospective cohort studies with more than 833,000 participants found that higher consumption of fruits and vegetables is associated with a lower rate of cardiovascular mortality, with each additional serving of fruits and vegetables per day reducing the risk by 4% (hazard ratio: 0.96) (<http://www.bmj.com/content/349/bmj.g4490>). In addition, the WHO estimates that low fruit and vegetable consumption causes about 31% of ischemic heart disease deaths and 11% of stroke deaths worldwide, emphasizing the fact that there is convincing evidence that fruit and vegetable consumption lower the risk for cardiovascular disease (World Health Organization, 2002).

##### Endocrine System

**Type 2 diabetes**. Higher fruit and vegetable consumption may decrease the risk of type 2 diabetes. A meta-analysis of seven studies with nearly 180,000 individuals (with more than 19,000 incident type 2 diabetes cases) found a 7% lower relative risk of developing type 2 diabetes in individuals who were in the highest compared to lowest quartile of fruit and vegetable consumption; the association was strongest for green leafy vegetables and root vegetables. However, no association was found between just fruit or just vegetable intake and diabetes (<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3652306/>).

##### Nervous System

**Depression**. In a cross-sectional study with over 296,000 individuals (aged 12 years or older), greater fruit and vegetable intake was associated with 27% lower odds of depression. Individuals with the greatest intake of fruits and vegetables were 13% less likely to suffer from distress compared to those with the lowest intake of fruits and vegetables. In addition, there was an inverse association between the intake of fruits and vegetables and perceived poor mental health status, as well as a previous diagnosis of a mood and anxiety disorder. In other words, higher fruit and vegetable intake was associated with a better perceived mental health status, and a lower odds of a diagnosis of a mood or anxiety disorder (<http://www.ncbi.nlm.nih.gov/pubmed/23295173>).

##### Muscular System

**Muscle power**. In a cross-sectional analysis of over 2,000 adolescents, individuals with the highest intakes of fruits and vegetables had higher muscle power compared to those with the lowest intakes of fruits and vegetables. In addition, higher vegetable intake was associated with muscle power in girls but not boys. However, no independent association was observed between fruit and vegetable intake and muscle strength after adjusting for physical activity (<http://www.ncbi.nlm.nih.gov/pubmed/25198233>).

**Grip strength**. In a 16-week randomized controlled intervention with 83 elderly participants, those consuming five or more servings of fruits and vegetables per day had a trend towards a greater change in grip strength compared to those who consumed two or less servings of fruits and vegetables. However, the trend was not statistically significant (p=0.06) and there was no effect on the overall physical function between the two groups (<http://www.ncbi.nlm.nih.gov/pubmed/23543264>).

##### Reproductive and Endocrine Systems

**Breast cancer**. In a case-control study with nearly 7,000 women, highest quintile of vegetable intake was associated with a 20% lower risk of breast cancer (adjusted OR: 0.80). In addition, high intake of allium vegetables, citrus fruits, and rosaceae fruits was also associated with a reduced risk of breast cancer. However, no consistent association was found between the total intake of fruit and breast cancer (<http://www.ncbi.nlm.nih.gov/pubmed/22860889>).

##### Skeletal System

**Bone mineral density**. In a cross-sectional study of over 200 male and female adolescents, and 700 young and postmenopausal women, higher fruit intake was associated with better bone mineral density and content. Participants in the top tertile had a 2.1% increase at the total body, 3.5% increase in lumbar spine, 3.0% increase in total hip, and 3.5% increase in femoral neck bone mineral density Z-score (comparison of the bone mineral density of an individual with that of a typical age-matched individual) compared to those in the bottom tertile of fruit intake. In addition, participants in the top tertile had a 5.7% increase at the total body, 5.8% increase in lumbar spine, 5.9% increase in total hip, and 4.7% increase in femoral neck bone mineral content Z-score compared to those in the bottom tertile of fruit intake. However, there was no association between the intake of vegetables and bone mass, except for total body bone mineral density (<http://www.ncbi.nlm.nih.gov/pubmed/22717072>).

##### Digestive and Endocrine Systems

**Gastrointestinal cancers**. The WHO’s World Health Report 2002 estimates that low fruit and vegetable consumption causes about 19% of gastrointestinal cancers worldwide (World Health Organization, 2002). A meta-analysis of 19 prospective cohort studies found that highest intake of fruits and vegetables combined, highest intake of fruits, and highest intake of vegetables were associated with an 8%, 10%, and 9% lower relative risks for colon cancer, respectively (<http://www.ncbi.nlm.nih.gov/pubmed/23295173>).

##### Digestive System

**Constipation**. In a study with 368 children aged 3-5 years, non-constipated children had higher intakes of fruits and total plant foods compared to those who were constipated. In addition, constipated children had lower intakes of fiber, vitamin C, folate, and magnesium, which was attributable to lower intake of plant foods (<http://www.ncbi.nlm.nih.gov/pubmed/17854410>).

##### Immune and Respiratory Systems

**Asthma and wheezing**. In a recent systematic review and meta-analysis of 12 cohorts, four population-based case-control studies, and 26 cross-sectional studies, higher intake of fruits and vegetables was associated with a lower risk of childhood wheezing, and a lower risk of asthma in adults and children. The authors concluded that a high intake of fruits and vegetables may reduce the risk of asthma and wheezing in both children and adults (<http://www.ncbi.nlm.nih.gov/pubmed/24947126>).

### Solutions

##### 1. Full-Service Grocery Stores Within Walking Distance

In the State Indicator Report on Fruits and Vegetables 2013, the CDC reports that “having access to stores that sell fruits and vegetables, as well as other healthier foods, may increase fruit and vegetable consumption among adults” (<http://www.cdc.gov/nutrition/downloads/State-Indicator-Report-Fruits-Vegetables-2013.pdf>); (<http://www.ajpmonline.org/article/S0749-3797(08)00838-6/fulltext>); (<http://www.ers.usda.gov/media/242654/ap036_reportsummary_1_.pdf>). Based on the existing research, the CDC notes that strategies to increase the access to fruits and vegetables can be expanding access to stores that have a variety of affordable fruits and vegetables (e.g., supermarkets, larger grocery stores), and improving the availability of fruits and vegetables in small stores (e.g., convenience and corner stores) (<http://www.cdc.gov/nutrition/downloads/State-Indicator-Report-Fruits-Vegetables-2013.pdf>); (<http://www.ajpmonline.org/article/S0749-3797(08)00838-6/fulltext>); (<http://www.ncbi.nlm.nih.gov/pubmed/15313074>); (<http://www.ncbi.nlm.nih.gov/pubmed/18031223>).

Similar to the CDC, the NYC Active Design Guidelines recommend to “develop full-service grocery stores within walking distance in all residential neighborhoods” that would offer a full range of fresh fruit and vegetables in order to increase access to fresh food options (<http://centerforactivedesign.org/dl/guidelines.pdf>); (Wrigley N, Warm D. Deprivation, diet, and food-retail access: findings from the Leeds ‘food deserts’ study. *Environment and Planning A.* 2003;35(1): p. 151–188.)

#### Well Features

Fruits and Vegetables

##### 2. Farmers’ Markets Near Workplaces and Residences

Research by Pitts et al. shows that individuals shopping at farmers’ markets are more likely to consume at least five servings of fruits and vegetables per day. In a survey of 400 low-income adult women in North Carolina who were accessing family planning services, a greater percentage (42%) of women shopping at farmers’ markets consumed five or more servings of fruits and vegetables per day compared to those who did not shop at farmers’ markets (24%). The average distance to the farmers’ market closest to the women’s’ place of residence was 4 km (2.5 miles) (<http://www.ncbi.nlm.nih.gov/pubmed/23701901>).

In addition, research by Thornton et al. found that having access to healthy foods near the workplace or home is associated with healthier food consumption in adult women. The presence of a supermarket within 0.8 km of the workplace was associated with higher odds of consuming two portions of fruits and vegetables per day, whereas a greater number of supermarkets within 2 km of the place of residence of vegetables per day was associated with a higher odds of consuming two portions of vegetables per day (<http://www.ncbi.nlm.nih.gov/pubmed/24071653>).

Based on available research, the CDC notes that fruit and vegetable intake can be increased by improving access to fruits and vegetables via “utilizing farm-to-consumer approaches such as markets at which farmers sell fruits and vegetables directly to consumers” (<http://www.cdc.gov/nutrition/downloads/State-Indicator-Report-Fruits-Vegetables-2013.pdf>); (<http://www.ajpmonline.org/article/S0749-3797(08)00838-6/fulltext>); (<http://www.ncbi.nlm.nih.gov/pubmed/15313074>); (<http://www.ncbi.nlm.nih.gov/pubmed/18031223>).

The NYC Active Design Guidelines also recommend introducing farmers’ markets or greenmarkets as a complement to grocery stores, as they have been shown to be valuable in areas that are densely populated but with limited access to supermarkets, or to fresh fruits and vegetables (<http://centerforactivedesign.org/dl/guidelines.pdf>); (<http://www.nyc.gov/html/doh/downloads/pdf/dpho/dpho-farmersmarket.pdf>). The farmers’ markets or greenmarkets could be located within walking distance from the workplace or residence places (<http://centerforactivedesign.org/dl/guidelines.pdf>), making it easier and more convenient for people to access them.

#### Well Features

Fruits and Vegetables

Responsible Food Production (Suggested Sub-feature: Farmers’ Markets)

##### 3. Healthy Foods-Only Check-Out Lines In School And Workplace Cafeterias

The Smarter Lunchroom Makeover study implemented a “healthy convenience line” (which only allowed purchases of submarine sandwiches, fruits, and vegetables), and placed fruit by the cash register in order to promote fruit and vegetable consumption in school students. Along with several other strategies, these interventions resulted in an 18% increase in fruit and a 25% increase in vegetable consumption. In addition, students were 13.4% more likely to take a fruit, 23% more likely to take a vegetable, 16% more likely to eat the entire serving of fruit, and 10% more likely to eat an entire serving of vegetables. The researchers concluded that the intervention was effective, inexpensive, and took little time to implement (less than $50 and 3 hours), and resulted in a significant impact on students’ choices toward healthier behaviors (http://www.jpeds.com/article/S0022-3476(12)01478-3/pdf). However, because multiple strategies were implemented at the same time, the exact contribution of each strategy towards the observed outcomes cannot be quantified.

A similar study conducted by the same researchers converted one of the two check-out lines in a school cafeteria into a healthy foods-only (submarine sandwiches, salad, vegetables, whole fruit, fruit parfait, and flavored milk) line for eight weeks, and observed the sales and consumption of healthy and unhealthy foods for eight weeks prior to the intervention, and eight weeks during the intervention. At the end of the eight-week period, sales of the healthy foods increased by 18%, and the percentage of healthier foods consumed (relative to total grams of food consumed) increased from 33% to 36.6% of total grams per student. In addition, the consumption of the less-healthy foods decreased by about 28% (<http://jpubhealth.oxfordjournals.org/content/early/2012/01/31/pubmed.fds003.full>).

Based on the research findings summarized above, healthy foods check-out lines could be implemented in cafeterias to promote the consumption of fruits and vegetables.

#### Well Features

Fruits and Vegetables

##### 4. Appealing Displays of Salads, Fruits, And Vegetables

The Smarter Lunchroom Makeover study served salads in see-through to-go containers, and displayed fresh fruit in nice bowls or tiered stands in order to promote fruit and vegetable consumption in school students. Along with several other strategies, these interventions resulted in an 18% increase in fruit and a 25% increase in vegetable consumption. In addition, students were 13.4% more likely to take a fruit, 23% more likely to take a vegetable, 16% more likely to eat the entire serving of fruit, and 10% more likely to eat an entire serving of vegetables. The researchers concluded that the intervention was effective, inexpensive, and took little time to implement (less than $50 and 3 hours), and resulted in a significant impact on students’ choices toward healthier behaviors (<http://www.jpeds.com/article/S0022-3476(12)01478-3/pdf>). However, because multiple strategies were implemented at the same time, the exact contribution of each strategy towards the observed outcomes cannot be quantified.

In addition, the USDA’s Meal Appeal food marketing guide, intended for school food-service professionals, recommends several strategies to make the presentation of fruits and vegetables more appealing. They include moving fresh fruits and vegetables to the front of the line; displaying whole fruits in baskets near the register keeping them fresh and appetizing, and providing an advertising sign for them; making the fruit and vegetable selections the most attractive and bountiful part of the line; and placing salad in clear plastic clamshells to increase visibility (<http://www.fns.usda.gov/sites/default/files/meal_appeal.pdf>).

#### Well Features

Fruits and Vegetables

Food Advertising

##### 5. Menus With Appealing Photos of Fruits and Vegetables, and Descriptive/Creative Names for Vegetable Options

The Smarter Lunchroom Makeover study provided lunch menus with nice color photos of the fruits and vegetables being served, and implemented descriptive/creative labeling of vegetables. Along with several other strategies, these interventions resulted in an 18% increase in fruit and a 25% increase in vegetable consumption. In addition, students were 13.4% more likely to take a fruit, 23% more likely to take a vegetable, 16% more likely to eat the entire serving of fruit, and 10% more likely to eat an entire serving of vegetables (http://www.jpeds.com/article/S0022-3476(12)01478-3/pdf). The researchers concluded that the intervention was effective, inexpensive, and took little time to implement (less than $50 and 3 hours), and resulted in a significant impact on students’ choices toward healthier behaviors. However, because multiple strategies were implemented at the same time, the exact contribution of each strategy towards the observed outcomes cannot be quantified.

Another 6-week cafeteria experiment with 140 customers found that people who ate foods with descriptive and evocative names (e.g., “Succulent Italian Seafood Filet”) rated it as tastier and more appealing compared to those who ate regularly-named foods (e.g., “Seafood Filet”) (<http://www.sciencedirect.com/science/article/pii/S0950329304000941>). The findings of this and the previous study suggest that using descriptive food names may help to improve fruit and vegetable perceptions.

In addition, USDA’s Meal Appeal food marketing guide intended for school food-service professionals recommends decorating the cafeteria area with posters of attractive fruits and vegetables in order to promote the idea that fruits and vegetables are optimal dietary choices. The guide also recommends to “jazz up the names of the menu items, and add signage to the service line” (<http://www.fns.usda.gov/sites/default/files/meal_appeal.pdf>).

#### Well Features

Fruits and Vegetables

Food Advertising

##### 6. Cut-Up Fruit

In a 2012 study by Cornell University’s Food and Brand Lab Research, interviews with children have shown that eating whole fresh fruit can be difficult due to the presence of braces or the absence of teeth, as well as due to being messy and unattractive to eat in the presence of other students ([http://www.ncbi.nlm.nih.gov/pubmed/?term=Pre-sliced+fruit+in+school+cafeterias%3A+Children’s+selection+and+intake](http://www.ncbi.nlm.nih.gov/pubmed/?term=Pre-sliced+fruit+in+school+cafeterias%3A+Children's+selection+and+intake)). In the study, elementary school children were more likely to eat fruit if the fruits were cut, because they were easier and tidier to eat. The study provided three out of six selected public elementary schools with a food slicer that cut apples in six pieces. In schools that cut the fruit, daily average apple sale increased by 71% compared to the three control schools. In addition, there was an increase of 73% in the percentage of students who selected apples and consumed more than half of the serving, and a decrease of 48% in the percentage of students who wasted half or more of the apple serving ([http://www.ncbi.nlm.nih.gov/pubmed/?term=Pre-sliced+fruit+in+school+cafeterias%3A+Children’s+selection+and+intake](http://www.ncbi.nlm.nih.gov/pubmed/?term=Pre-sliced+fruit+in+school+cafeterias%3A+Children's+selection+and+intake)).

#### Well Features

Fruits and Vegetables

##### 7. Nutrition Knowledge

Research by Wardle et al. shows that adults are more likely to have a higher intake of fruits and vegetables if they have better nutrition knowledge. In a study with 1,040 adults, those in the highest quintile of nutrition knowledge (assessed using a well-validated measure of nutrition knowledge) were nearly 25 times more likely to eat a healthy diet and meet the dietary recommendations for fruit and vegetable intake, compared to the participants in the lowest quintile of nutrition knowledge (J. Wardle, K. Parmenter, J. Waller. Nutrition knowledge and food intake. Appetite, 34 (2000), pp. 269–275). Another study on the relationship between adults’ knowledge of the recommended fruit and vegetable intake and the likelihood of consuming five or more servings of fruits and vegetables per day showed that adults who knew that the recommended intake was 7-13 servings of fruits and vegetables per day were 1.55 times more likely to consume five or more servings of fruits and vegetables per day, compared to the adults who did not know what the recommendation was (<http://www.sciencedirect.com/science/article/pii/S0195666312001444>).

In a 2012 study by Churchill and Pavey, researchers measured the autonomy levels of 177 college students, and exposed them to either a gain-framed or loss-framed message about fruit and vegetable consumption in order to examine the roll of message framing and autonomy on promoting fruit and vegetable intake. Gain-framed messages listed the benefits associated with consuming fruits and vegetables, whereas loss-framed messages described the detrimental health effects linked with insufficient fruit and vegetable intake. The participants were later surveyed about their fruit and vegetable intake over the course of the past seven days. The researchers found that individuals exposed to a gain-framed messages reported higher fruit and vegetable consumption during a seven-day period than those exposed to loss-framed messages; however, autonomy was a mediating factor for message framing. The study concluded that “gain-framed messages only prompted fruit and vegetable consumption amongst those with high levels of autonomy” (<http://www.ncbi.nlm.nih.gov/pubmed/23170848>).

Based on the findings of these studies, increasing people’s knowledge and awareness of the recommended fruit and vegetable intake may be a viable strategy for increasing the intake of fruits and vegetables. In addition, utilizing gain-framed messages to promote fruit and vegetable consumption may be more effective than using loss-framed messages.

##### 8. Visual Prompts to Encourage Optimal Daily Fruit And Vegetable Intake

The USDA’s Meal Appeal food marketing guide, intended for school food-service professionals, recommends decorating school cafeterias “with colorful visual images of fruits and vegetables to remind them of these healthful eating options” (<http://www.fns.usda.gov/sites/default/files/meal_appeal.pdf>). In addition, the Guide suggests using the materials that fruit and vegetable associations provide free of charge; using Team Nutrition’s *Feed Me* poster; purchasing the *5 A Day The Color Way* materials; adding posters that depict the fruits and vegetables featured in the cafeteria line; and working with teachers and having students draw fruits and vegetables for decorating the cafeteria walls and school hallways (<http://www.fns.usda.gov/sites/default/files/meal_appeal.pdf>).

#### Well Features

Fruits and Vegetables (Suggested sub-feature: Creative Displays of Recommended Fruit and Vegetable Intake)

##### 9. Promotion of Organic Fruits and Vegetables

In a survey of 566 individuals, researchers found that switching from conventional to organic food was “often accompanied by the use of more freshly prepared foods and other lifestyle changes.” However, the researchers noted that survey results do not allow making direct conclusions regarding the health effects of organic foods (<http://www.ncbi.nlm.nih.gov/pubmed/22331850>). Another study by Pelletier et al. examining the attitudes toward organic, local and sustainable foods in young adults found that those who “placed high importance on alternative production practices” had a 1.3 times higher intake of fruit and vegetable servings, consumed more fiber, fewer added sugars and fast foods, and fewer sugar-sweetened beverages than those who placed low importance on alternative production practices. The authors concluded that incorporating the topic of alternative food production practices into the health promotion efforts in college settings may promote healthy eating practices; however, they also acknowledge that more research is needed to see if “attitudes toward alternative production practices can be manipulated to improve dietary quality.” (<http://www.ncbi.nlm.nih.gov/pubmed/23260729>)

While the above-mentioned studies do not prove or imply that switching to/choosing to consume organic foods alone leads to a greater consumption of fruits and vegetables, they do note positive associations between attitudes towards organic foods/alternative food production practices/choosing to consume organic foods and the intake of fruits and vegetables. Based on these findings, promoting the consumption of organic fruits and vegetables and/or educating individuals about alternative production practices may be a potential strategy to increase the overall intake of fruits and vegetables.

#### Well Features

Food Advertising (Suggested sub-feature: Organic Foods)

##### 10. Growing Fruits and Vegetables at School

The CDC recommends growing vegetables in school gardens as one of the ways to increase the intake of fruits and vegetables in school students (<http://www.cdc.gov/healthyyouth/mih/pdf/approach3.pdf>). Several schools have already successfully implemented small-scale gardening, which has been associated with increased fruit and vegetable consumption. A study conducted in 115 second-grade students looked at the effectiveness of nutrition education only and nutrition education and gardening experience on fruit and vegetable knowledge, preference, and consumption. The researchers found that children in the nutrition education and gardening group were more likely to choose and consume vegetables in a lunchroom setting at the end of the intervention period compared to the children in the nutrition education-only and control groups. In addition, the children in both nutrition education and gardening group, as well as in the nutrition education-only group had a significantly improved knowledge of fruits and vegetables compared to the children in the control group (<http://www.ncbi.nlm.nih.gov/pubmed/19411056>).

Other studies are currently underway to assess whether school gardening interventions can improve the intake of fruits and vegetables in children (<http://www.ncbi.nlm.nih.gov/pubmed/22537179>).

It is also important to note that growing fruits and vegetables can be part of the Farm to School program (discussed below). However, it can also be a separate strategy for increasing fruit and vegetable intake, without having the Farm to School program.

Based on the existing research and CDC recommendations, growing fruits and vegetables in schools may be a potential strategy to increase fruit and vegetable consumption in school students.

##### 11. Farm To School/Preschool Programs

According to the National Farm to School Act of 2015, Farm to School programs contribute a wide array of benefits to students, parents, schools, communities, and food producers, most notable of which is increasing the consumption of fruits and vegetables in children (<http://www.farmtoschool.org/Resources/2015_CNR_F2S.pdf>). In addition, Farm to School programs strengthen students’ knowledge and attitude towards food, nutrition, agriculture, and the environment. The National Farm to School Network reports that 26 states in the U.S. now have supportive Farm to School policies, with 44% of U.S. schools already participating in the program, with a total of 23.5 million students (<http://www.farmtoschool.org>).

##### 12. Promotion and Advertising in Grocery Stores

A review of strategies, examples, and available research on ways to increase fruit and vegetable intake by Glanz and Yaroch suggests promoting and advertising fruits and vegetables in grocery stores and communities, stating that there is “strong support for the feasibility of these approaches and modest evidence of their efficacy in influencing eating behavior.” The authors of the review note that promotion and advertisement strategies, such as “advertising, posters, games, and targeted or multimedia sources to announce and encourage purchases of fruits and vegetables and fruit and vegetable-rich items” can be either an independent strategy for increasing fruit and vegetable consumption in the community, or can be combined with other strategies implemented in grocery stores (<http://www.ncbi.nlm.nih.gov/pubmed/15313075>).

Another review by Glanz et al. reports that studies show that grocery store marketing strategies for promoting healthful eating include increased “availability, affordability, prominence, and promotion of healthful foods and/or restricting or de-marketing unhealthy foods.” (<http://www.ncbi.nlm.nih.gov/pubmed/22516491>).

Based on the findings of these reviews, fruit and vegetable promotion strategies could be implemented in grocery stores in order to increase the intake of fruits and vegetables in communities.

### II. Sugar-Sweetened Beverages

As defined in *The CDC Guide to Strategies for Reducing the Consumption of Sugar-Sweetened Beverages*, “sugar-sweetened beverages (SSBs) include soft drinks (soda or pop), fruit drinks, sports drinks, tea and coffee drinks, energy drinks, sweetened milk or milk alternatives, and any other beverages to which sugar, typically high fructose corn syrup or sucrose (table sugar), has been added” (<http://www.cdph.ca.gov/SiteCollectionDocuments/StratstoReduce_Sugar_Sweetened_Bevs.pdf>).

SSBs are the single largest source of added sugars, have few to no nutrients, and are “the top source of energy intake in the U.S. diet.” (<http://www.ncbi.nlm.nih.gov/pubmed/23763695>) In 1965, the average adult consumed about 50 calories per day from SSBs (excluding sweetened milks) (http://www.kickthecan.info/files/documents/DuffeyPopkin2007\_ShiftBevConsump1965-2002.pdf). Currently, it is estimated that youth consume 224 calories per day (http://www.ncbi.nlm.nih.gov/pubmed/18519465) and adults consume 203 calories per day from SSBs (http://ajcn.nutrition.org/content/89/1/372.full). In addition, NHANES data from 2005-2008 show that half of the U.S. population consumes SSBs on any given day, and a quarter obtain 200 calories or more from SSBs every day (Ogden CL, Kit BK, Carroll MD, Park S. Consumption of sugar drinks in the United States, 2005–2008. NCHS Data Brief 2011; 11: 1–8). The intake of SSBs has been linked to weight gain, obesity, metabolic syndrome, and other health issues in both children and adults. Because liquid calories are less satiating and are thus easier to over-consume, and because there is now sufficient evidence that decreasing SSB intake will decrease the risk of obesity and diabetes (<http://www.ncbi.nlm.nih.gov/pubmed/23763695>), effective strategies need to be implemented to reduce SSB consumption.

An expert report by the World Cancer Research Fun and the American Institute for Cancer Research, Food, Nutrition, Physical Activity, and the Prevention of Cancer: a Global Perspective recommends to avoid sugary drinks (drinks with added sugars). The report notes that there is “impressive” evidence that the consumption of sugary drinks with added sugars “’fools’ the human satiety mechanism”, promoting weight gain. Numerous other major organizations and associations support reducing or avoiding the intake of SSBs, including the AHA, the American Academy of Pediatrics (AAP), the American Diabetes Association (ADA), the American Medical Association (AMA), the CDC, the Institute of Medicine of the National Academies (IOM), the USDA Dietary Guidelines Advisory Committee, and the WHO.

#### Health Effects

##### Endocrine System

**Type 2 diabetes**. Excessive carbohydrate consumption, particularly from refined carbohydrates (high-fructose corn syrup), and insufficient fiber intake has been associated with type 2 diabetes (Gross, Li, Ford, & Liu, 2004). A meta-analysis of 11 studies including nearly 311,000 individuals and over 15,000 cases of type 2 diabetes found that those in the highest levels of SSB intake (1-2 servings per day) has a 26% higher risk of type 2 diabetes compared to the individuals in the lowest levels of SSB consumption (none to less than one serving per month) (Vasanti S. Malik, 2010). In addition, a case-cohort study including 11,684 adults with type 2 diabetes and a stratified sub-cohort of 15,374 participants found that drinking one 12-ounce sugar-sweetened soft drink per day was associated with an 18% higher risk for type 2 diabetes (Consortium, 2013). In a review of three prospective longitudinal cohort studies including 66,105 women from the Nurses’ Health Study, 85,104 women from the Nurses’ Health Study II, and 36,173 men from the Health Professionals Follow-up Study, three servings of fruit juice per week were associated with an 8% higher risk of developing diabetes (hazard ratio 1.08), while consumption of three servings of whole fruits per week were associated with a 2% lower risk (Muraki, Imamura, Manson, Hu, Willett, & van Dam, 2013).

**Excess calories and obesity**. A 2013 study in New York City conducted a dietary survey in a representative sample of the population and found that people who consume SSBs have a 572 kcal greater daily caloric intake compared to those who do not consume SSBs, which is due to both SSB calorie and food calorie intake. In addition, for those who consumed SSBs, each 10-oz increase in SSB consumption was associated with a 62% greater odds for obesity (OR=1.62), a 223% greater odds of overweight-obesity (OR=2.23), and each 10-calorie increase in SSB was also related to obesity and overweight-obesity (<http://www.ncbi.nlm.nih.gov/pubmed/24671367>).

A recent meta-analysis of 30 trials and 38 cohort studies commissioned by the WHO found that decreased intake of dietary sugars led to a significant reduction in body weight (0.8 kg) in adults, whereas increased sugar intake resulted in a comparable weight gain (0.75 kg) (Te Morenga L, Mallard S, Mann J. Dietary sugars and body weight: systematic review and meta-analyses of randomised controlled trials and cohort studies. *BMJ* 2012; 346: e7492.). A recent review of prospective cohort studies and RCTs has found similar effects in terms of weight and adiposity reduction with reduced SSB use, and increased risk of weight gain, obesity, and diabetes with higher SSB consumption, stating that “the cumulative evidence from observational studies and experimental trials is sufficient to conclude that regular consumption of SSBs causes excess weight gain and these beverages are unique dietary contributors to obesity and type 2 diabetes.” (<http://onlinelibrary.wiley.com/doi/10.1111/obr.12040/full>)

**Metabolic Syndrome**. A meta-analysis of three studies with nearly 19,500 participants and 5,803 cases of metabolic syndrome, higher consumption of SSBs was associated with the development of metabolic syndrome. Individuals in the highest quintile of SSB intake had a 20% greater risk of developing metabolic syndrome compared to those in the lowest quintile (<http://www.ncbi.nlm.nih.gov/pubmed/20693348>).

##### Cardiovascular System

**Hypertension**. In the SUN project study with nearly 14,000 participants (university graduates), SSB consumption was associated with an increased risk for hypertension. The participants consuming seven or more SSBs per week (i.e., one or more SSBs per day) had 33% higher risk (hazard ratio 1.33) of developing hypertension, compared to those who did not drink SSBs. The association was stronger in women than in men (<http://www.ncbi.nlm.nih.gov/pubmed/25481680>).

**Stroke and cerebral infarction**. In a prospective cohort study with over 69,000 adult and elderly participants, consumption of sweetened beverages (including sugar-sweetened and artificially-sweetened soft and juice drinks) was associated with a higher risk of having a stroke and cerebral infarction. Participants consuming two or more servings of sweetened beverages per day had a 19% higher risk (risk ratio 1.19) for stroke and a 22% higher risk (risk ratio 1.22) for cerebral infarction compared to participants consuming 0.1-0.5 servings of sweetened-beverages per day (<http://www.ncbi.nlm.nih.gov/pubmed/24717367>).

##### Nervous System

**Depression**. In a prospective cohort study among nearly 264,000 elderly individuals consuming four or more cans/cups of soft drinks or fruit drinks per day had a 30% and 38% higher risk (odds ratio 1.3 and 1.38), respectively, of self-reported depression compared to those drinking no soft or fruit drinks. Interestingly, the risk for depression was even greater among individuals drinking artificially-sweetened beverages compared to those drinking sugar-sweetened beverages (<http://www.ncbi.nlm.nih.gov/pubmed/24743309>).

##### Digestive and Endocrine Systems

**Colon cancer**. In a study of over 1,000 patients with stage III colon cancer, those consuming two or more servings of sugar-sweetened beverages per day had a 67% higher risk (hazard ratio 1.67) for colon cancer recurrence or mortality compared to those consuming less than two servings of sugar-sweetened beverages per month. In addition, the association between SSB consumption and cancer recurrence or mortality was greater in patients who were both overweight and had lower levels of physical activity (<http://www.ncbi.nlm.nih.gov/pubmed/24937507>).

##### Digestive System

**Dental caries**. In a study with 939 adults, those drinking 1-2 and three or more SSBs per day had 31% and 33% greater net DMFT (decayed/missing/filled teeth) increments, respectively, compared to individuals who did not drink any SSBs. The authors of the study concluded that daily consumption of SSBs is related to greater dental caries risk in adults, noting that there is a dose-response relationship between the frequency with which SSBs are consumed and the increment of caries. Interestingly, age and use of fluoride were not significantly associated with net DMFT increment (<http://www.ncbi.nlm.nih.gov/pubmed/24813370>).

**Dental erosion**. The WHO report *Diet, Nutrition and the Prevention of Chronic Diseases* notes that studies have shown that the consumption of soft drinks (including sports drinks) is associated with dental erosion. It recommends limiting the amount and frequency of soft drink consumption in order to reduce the risk of dental erosion (<http://whqlibdoc.who.int/trs/who_trs_916.pdf>).

### Solutions

##### 1. Ready Access to Potable Drinking Water

*The CDC Guide to Strategies for Reducing the Consumption of Sugar-Sweetened Beverages* recommends ensuring access to drinking water as one of the strategies to reduce the consumption of SSBs: “To promote water consumption, potable drinking water should be easily accessible to children and adults in homes and public facilities, including parks, playgrounds, schools, public buildings, worksites, and clinics.” (<http://www.cdph.ca.gov/SiteCollectionDocuments/StratstoReduce_Sugar_Sweetened_Bevs.pdf>) The guide reports three successful interventions of increasing the consumption of water in schools, two of which are summarized below.

A randomized cluster trial was conducted 32 elementary schools in Germany with nearly 3,000 children, in which water fountains were installed in schools, and plastic water bottles were given to each student. The study found that provision of drinking water in schools, along with health education, lead to 1.1 glasses per day greater consumption of water after the intervention compared to baseline. In addition, compared to the control group, the risk for overweight was reduced by 31%. However, the authors noted that decreased SSB consumption was not statistically significant, likely because the intervention “did not actively discourage drinking of those beverages but only promoted water consumption.” (<http://www.ncbi.nlm.nih.gov/pubmed/19336356>).

Another randomized controlled trial was conducted in 22 elementary schools in Brazil, where fourth graders were educated about and encouraged to consume water, and were given water bottles with the campaign logo that encouraged water consumption. After seven months, children in the intervention schools consumed about 2 ounces less of carbonated beverages per day compared to children in the control schools (<http://www.ncbi.nlm.nih.gov/pubmed/?term=chool+randomized+trial+on+prevention+of+excessive+weight+gain+by+discour+aging+students+from+drinking+sodas>).

#### Well Features

Suggested Feature: Water Access

##### 2. Restricted Sales of SSBs

*The CDC Guide to Strategies for Reducing the Consumption of Sugar-Sweetened Beverages* recommends limiting the availability and accessibility of SSBs in order to reduce their intake: “Limiting availability and accessibility of SSBs can decrease SSB consumption and increase the consumption of more healthful beverages.” (<http://www.cdph.ca.gov/SiteCollectionDocuments/StratstoReduce_Sugar_Sweetened_Bevs.pdf>). The Guide reports that students participating in the National School Lunch Program, which restricts the sale of carbonated soft drinks in the same place where the lunch is served, consume less added sugar (17% of daily calories coming from added sugars) compared to students who do not participate in the program (20% of daily calories from added sugars) (<http://www.cdph.ca.gov/SiteCollectionDocuments/StratstoReduce_Sugar_Sweetened_Bevs.pdf>); (Gleason PM, Suitor CW. Eating at school: how the National School Lunch Program affects children's diets. Am J Agric Econ. 2003;85(4):1047-1061).

The Institute of Medicine (IOM) recommends that schools limit the availability of foods and beverages obtained outside the USDA school meals program. In addition, the IOM recommends that carbonated, fortified, and flavored water be excluded during the school day, based on evidence that “these beverages are unnecessary for hydration and are associated with displacement of beverages that are more healthful than SSBs” (<http://www.cdph.ca.gov/SiteCollectionDocuments/StratstoReduce_Sugar_Sweetened_Bevs.pdf>).

Based on these findings and recommendations, SSBs should not be sold in schools, and their sales should be limited in food and eating establishments that serve other populations, such as adults and the elderly. In addition, SSBs should not be provided in offices. Instead, healthy alternatives to SSBs should be provided, such as water, unsweetened tea, and other drinks that do not contain added sugars or artificial sweeteners.

#### Well Features

Processed Foods

##### 3. Provision of Caloric Information

Providing easily understandable caloric information (especially in the form of a physical activity equivalent) may reduce calorie intake from SSBs. In an intervention study with four corner stores in low-income neighborhoods in Baltimore, MD, one of three signs was randomly posted with information on the absolute caloric count, percentage of total recommended daily intake, or physical activity equivalent. The study collected data for 1,600 beverage sales by Black adolescents, and found that provision of any caloric information lead to a significant reduction in the odds of an SSB purchase compared to baseline purchase levels. However, the study did not measure the actual consumption of SSBs (a purchased beverage may not have been finished), and the authors note that some of the adolescents may have been sampled more than once (<http://www.ncbi.nlm.nih.gov/pubmed/22390447>).

Based on the findings of the study, caloric information for SSBs could be provided in places of purchase as a potential strategy to reduce the intake of SSBs. The caloric information could include the total amount of calories and the amount of sugar, the percentage of total recommended intake, or be expressed as a physical activity equivalent, listing the activity and the amount of time that would have to be spent to burn the amount of calories consumed from the beverage.

#### Well Features

Nutritional Information

Food Advertising

##### 4. Limited Marketing and Advertising

*The CDC Guide to Strategies for Reducing the Consumption of Sugar-Sweetened Beverages* recommends to “Limit marketing of sugar-sweetened beverages and minimize marketing’s impact on children”. (<http://www.cdph.ca.gov/SiteCollectionDocuments/StratstoReduce_Sugar_Sweetened_Bevs.pdf>); (Institute of Medicine. Food marketing to children and youth: threat or opportunity? Washington, D.C., The National Academies Press. 2006).

Based on the CDC’s recommendations, there should be limited marketing of SSBs on the building premises as well as in the surrounding areas in order to reduce the consumption of SSBs.

#### Well Features

Food Advertising

##### 5. Visualization of Sugar Content In SSBs

A study by Adams et al. found that individuals “view SSBs more negatively and show less preference for SSBs when they are able to concretely visualize the quantity of sugar in SSBs”. In a series of small, similar experiments on college students, the researchers found that when the sugar content of an SSB is visually presented in the form of a pyramid of sugar cubes, in addition to providing the number of grams of sugar in the beverage, individuals are less likely to choose to consume it. Based on the results of the study, the authors suggest displaying the amount of sugar in an SSB in the form of sugar cubes in a pyramid, as individuals find SSBs less attractive and are less likely to select them when they can visually see the amount of sugar in the beverage as opposed to merely seeing a numerical display of sugar content (<http://www.ncbi.nlm.nih.gov/pubmed/?term=sugar+sweetened+beverage+sugar+cubes>).

Based on the findings of the study, the sugar content of SSBs could be visualized in places of purchase in the form of pictures showing the total sugar content of the beverage in the shape of a pyramid of sugar cubes.

#### Well Features

Processed Foods (Suggested sub-feature: Sugar Display)

### III. 100% Fruit Juice

Fruit juice is a liquid made from squeezing or cold-pressing the pulp of fresh fruits and eliminating the fiber. Fruit juice that is 100% natural does not contain any other additives (e.g., added sugar) besides the fruit itself. While natural and high in certain vitamins and minerals, 100% fruit juice does not have the same nutritional properties as whole fruit and can be very high in sugar. Without the fiber to slow down sugar absorption into the bloodstream, juice consumption can lead to similar spikes in blood glucose as those seen with sugar-sweetened beverages. In addition, the absence of fiber inhibits the satiety response, which is why beverages are easy to over-consume and can lead to increased overall caloric intake. Consumption of large amounts of fruit juice can lead to detrimental health effects, similar to those seem with high intakes of SSBs.

An expert report by the World Cancer Research Fund and the American Institute for Cancer Research, *Food, Nutrition, Physical Activity, and the Prevention of Cancer: a Global Perspective* recommends to avoid sugary drinks (drinks with added sugars), and limit fruit juices. The report notes that there is “impressive” evidence that the consumption of sugary drinks with added sugars “’fools’ the human satiety mechanism”, promoting weight gain. It also notes that fruit juices (without added sugar) “are likely to have the same effect and may promote weight gain, and so they should not be drunk in large quantities” (<http://www.aicr.org/assets/docs/pdf/reports/Second_Expert_Report.pdf>).

#### Health Effects

##### Endocrine System

**Excess adiposity and obesity**. In a survey of 2,801 parents and guardians of 1-4 year old children (attendees of the SNAP/WIC program), increased fruit juice consumption by children at risk for overweight or currently overweight was linked to excess adiposity gain, and “each additional daily serving of fruit juice intake was associated with an additional BMI z-score (“change in age- and gender-standardized BMI per month) gain of 0.009 SD per month”, with greater adiposity gain noted in boys than in girls. The authors concluded that in children who are overweight or at risk for being overweight, consumption of fruit juice “may promote adiposity gain through passive overconsumption of total energy intake” (<http://pediatrics.aappublications.org/content/118/5/2066.short>).

In addition, the WHO classifies high intake of fruit juices as a “probable” factor that may promote weight gain and obesity (<http://whqlibdoc.who.int/trs/who_trs_916.pdf>). The Dietary Guidelines for Americans 2010 recommend limiting the intake of 100% fruit juices in children and adolescents who are overweight or obese, as it has been linked to higher body weight.

##### Digestive System

**Dental erosion**. The WHO report *Diet, Nutrition and the Prevention of Chronic Diseases* notes that studies have shown that the consumption of fruit juices is associated with dental erosion. The WHO recommends limiting the amount and frequency of fruit juice consumption in order to reduce the risk of dental erosion (<http://whqlibdoc.who.int/trs/who_trs_916.pdf>).

##### Cardiovascular System

**Blood pressure**. In a study with 160 adults, those who reported drinking fruit juice daily (using a 12-month dietary recall questionnaire) had a higher central systolic blood pressure (3-4 mmHg higher) and a higher central pulse pressure compared to individuals who reported rare or occasional consumption of fruit juice. The authors concluded that daily consumption of fruit juice is associated with higher central blood pressure, and that further studies are needed to confirm these preliminary findings ([http://www.sciencedirect.com/science/article/pii/S0195666314004620#](http://www.sciencedirect.com/science/article/pii/S0195666314004620)).

#### Solutions

##### 1. Limited Marketing and Availability

Based on the recommendations to limit fruit juice consumption by the World Cancer Research Fund and the American Institute for Cancer Research, as well as the WHO and the USDA/HHS, the marketing and availability of fruit juices should be limited in schools, workplaces, food establishments and other places were beverages are sold or served. The availability of healthier alternatives, such as water, tea and coffee (unsweetened), and low-sugar or artificially-sweetened non-caloric beverages should be increased.

### IV. Fried Foods

Fried foods are foods cooked in fat at high temperatures (generally at or above 320**°**F, depending on the food and oil used) by immersing the food into oil for a short amount of time. Frying is considered a dry cooking method, as water is not used in the process. Examples of commonly eaten fried foods include fried chicken, French fries, potato chips, doughnuts, and onion rings.

Several changes occur in the foods when they are deep-fried, including diminished nutrient content (due to oxidation; e.g., vitamin E content decreases), increased fat and calorie content, and the formation of by-products that may pose risk to human health. Various chemical processes, such as oxidation, polymerization, and hydrogenation occur, modifying the fried foods as well as their frying mediums; these processes are especially likely to occur when oil is overheated or re-used many times. Different oils have different smoke points, at which the oil breaks down turning into a darker color, acquiring a rancid smell or taste. Oils that have the highest smoke points include refined oils such as canola, grapeseed, peanut, safflower, and soybean; their smoke points range from about 435 to 450F (<http://www.fsis.usda.gov/wps/wcm/connect/65f762d0-e4d0-4278-b5cb-2836854a3eda/Deep_Fat_Frying.pdf?MOD=AJPERES>). However, some of these oils are also high in omega-6 fatty acids, which are essential for the human body in moderate amounts, but have been found to be harmful and inflammatory when consumed in excess. Finally, if foods are fried in oils that contain trans fats, which despite their known health detriments are still used in many commercial kitchens and fast food restaurants, they will have trans fats, leading to increased trans fat consumption and higher risk of detrimental health outcomes.

One by-product that forms in the process of deep-frying is acrylamide. The FDA reports that research shows that acrylamide is particularly likely to form in carbohydrate-rich, protein-poor foods, such as potatoes and cereals, due to a chemical reaction that occurs between asparagine (amino acid) and certain sugars; both components are found naturally in these foods (Figure 1) (<http://www.fda.gov/Food/FoodborneIllnessContaminants/ChemicalContaminants/ucm053519.htm>). Acrylamide has been identified as a carcinogen in laboratory animals, is considered a potential human carcinogen, and is a known human neurotoxicant (<http://www.fda.gov/Food/FoodborneIllnessContaminants/ChemicalContaminants/ucm053519.htm>). The National Toxicology Program in the U.S. has classified acrylamide as “reasonably anticipated to be a human carcinogen”, and the U.S. EPA classifies acrylamide as “likely to be a carcinogen to humans” (<http://www.fda.gov/Food/FoodborneIllnessContaminants/ChemicalContaminants/ucm053519.htm>). In June 2002, the WHO and FAO expert consultation on acrylamide concluded that “the presence of acrylamide in food is a major concern”, and recommended that more research be done regarding the mechanisms of acrylamide formation and toxicity (<http://www.fda.gov/Food/FoodborneIllnessContaminants/ChemicalContaminants/ucm053519.htm>). The main foods contributing to acrylamide exposure are potato chips, fries, coffee, and cereal-based products, such as breads, rolls, cookies and crackers (<http://www.who.int/mediacentre/news/notes/2005/np06/en/>).

The FDA reports that it is unclear whether acrylamide causes cancer in humans at the levels of acrylamide found in foods. The agency states that epidemiological studies have not found an increased risk of cancer with exposure to acrylamide in humans; however, the type of studies looking into the associations between acrylamide intake and cancer may not be able to detect this effect (<http://www.fda.gov/Food/FoodborneIllnessContaminants/ChemicalContaminants/ucm053519.htm>).

There are currently no guidelines regarding the presence of acrylamide in food, one of the reasons being the high variation of acrylamide levels in the same foods, depending on cooking time and temperature. Until more research is done on the effects of acrylamide on human health, and until guidelines regulating acrylamide content in foods are established, strategies on reducing the intake of acrylamide, and thus on reducing the foods that are high in acrylamide, most notably deep-fried foods, should be considered and implemented. The FDA reports that “The WHO/FAO consultation advised that food should not be cooked excessively, i.e., for too long a time or at too high a temperature, but also advised that it is important to cook all food thoroughly – particularly meat and meat products – to destroy foodborne pathogens (bacterial, viruses, etc.) that might be present.” (<http://www.fda.gov/Food/FoodborneIllnessContaminants/ChemicalContaminants/ucm053519.htm>)

Many studies show associations between the consumption of fried foods and negative health outcomes. However, it is not clear yet which compounds or properties of the fried foods may be causing those effects. Numerous agencies and organizations, including the American Heart Association (http://www.heart.org/HEARTORG/GettingHealthy/NutritionCenter/HealthyEating/Trans-Fats\_UCM\_301120\_Article.jsp), the CDC (http://www.cdc.gov/healthyweight/healthy\_eating/energy\_density.html), and the WHO recommend to reduce the consumption of fried foods, primarily due to the presence of saturated and trans fats, as well as due to the large number of calories that fried foods deliver.

|  |  |  |
| --- | --- | --- |
| Food | Acrylamide range (ppb) | Average (ppb) |
| French fries and other potato foods (restaurant and take out) | 109-1250 | 544 |
| Potato chips | 462-1970 | 798 |
| Cereals | 25-534 | 139 |
| Coffee | 27-609 | 191 |
| Cookies | 34-955 | 125 |
| Crackers | 39-1540 | 271 |

Figure 1. Acrylamide content in selected foods (data collected in 2003-2004).

(<http://www.fda.gov/food/foodborneillnesscontaminants/chemicalcontaminants/ucm053549.htm#u1004>)

Besides acrylamide, other by-products form in high-temperature frying, such as polycyclic aromatic hydrocarbons (PAHs), heterocyclic amines, formaldehyde, acetaldehyde, acrylamide, acrolein, and dietary advanced glycation end products (dAGEs) (<http://monographs.iarc.fr/ENG/Monographs/vol95/mono95.pdf>). In addition, significant amounts of airborne particulate matter can form during high-temperature frying, such as ultrafine particles and fine particulate matter, as well as aerosol oil droplets, combustion products, organic gaseous pollutants, and steam (<http://monographs.iarc.fr/ENG/Monographs/vol95/mono95.pdf>); for more detailed information about the airborne products and ways to reduce their concentrations in the indoor environment, refer to the Air Wellography.

Based on the current research findings on acrylamide and other compounds formed in frying, the classifications by government organizations of acrylamide as a potential human carcinogen, the fact that frying foods adds many extra calories and can add trans fats to the diet, and the government and other agency recommendations to limit the consumption of fried foods, strategies to limit the intake of fried foods should be implemented to reduce the overall consumption of fried foods and the health outcomes that their use may be associated with.

#### Health Effects

##### Cardiovascular System

**Hypertension**. In a prospective cohort study of nearly 13,700 adults, individuals consuming fried foods 2-4 times per week were 18% more likely to develop hypertension, whereas those consuming fried foods more than 4 times per week were 21% more likely to develop hypertension, compared to those consuming foods less than twice per week. The association between fried food intake and the age, sex, and type of oil used for frying were not statistically significant (<http://www.ncbi.nlm.nih.gov/pubmed/25201306>).

**Coronary artery disease**. In a prospective cohort study of nearly 71,000 women from the Nurses’ Health Study and nearly 41,000 men from the Health Professionals Follow-Up Study, frequent consumption of fried foods was moderately associated with coronary artery disease. Consumption of fried foods 1-3 times, 4-6 times, or seven or more times per week was associated with 6%, 23%, and 21% higher risk (RR 1.06, 1.23, 1.21), respectively, of coronary artery disease compared to those consuming fried foods less than once per week. However, the association between fried food consumption and coronary artery disease was attenuated after controlling for body weight, hypercholesterolemia, and comorbid hypertension (<http://www.ncbi.nlm.nih.gov/pubmed/24944061>).

##### Endocrine and Urinary Systems

**Prostate cancer**. In a case-control study on deep-fried food intake and cancer with over 2,000 men, those consuming French fries, fried chicken, fried fish, and doughnuts one or more times per week were 37%, 30%, 32%, and 35% more likely, respectively, to have prostate cancer (OR 1.37, 1.30, 1.32, and 1.35, respectively). The authors concluded that regular consumption of certain deep-fried foods is associated with increased risk of prostate cancer, even though it is still unclear if this risk is specific to deep-fried foods or if it is associated with the consumption of foods exposed to high heat and/or other components of the Western diet (<http://www.ncbi.nlm.nih.gov/pubmed/23335051>).

##### Endocrine System

**Gestational diabetes**. In a study of the Nurses’ Health Study II cohort, frequent fried food consumption (especially away from home) prior to becoming pregnant was associated with a greater risk of gestational diabetes. The researchers looked at over 21,000 singleton (singe-baby) pregnancies in 15,027 women, and documented 847 incident cases of gestational diabetes. Women consuming fried foods 1-3, 4-6, and 7 or more times per week were 13%, 31%, and 218% more likely (RR 1.13, 1.31, and 2.18), respectively, to develop gestational diabetes compared to women who consumed fried foods less than once per week. When the results were analyzed separately, consumption of fried foods away form home, but not at home, was associated with a higher risk of gestational diabetes. Women consuming fried foods four or more times per week away from home had a 63% higher risk of gestational diabetes (RR 1.63) (<http://www.ncbi.nlm.nih.gov/pubmed/25303998>).

#### Solutions

##### 1. Limited Marketing and Availability

The Dietary Guidelines for Americans 2010 recommend that when eating out, individuals should avoid choosing foods that are fried (<http://www.cnpp.usda.gov/sites/default/files/dietary_guidelines_for_americans/PolicyDoc.pdf>). In addition, the Dietary Guidelines for Americans 2010, the CDC, and the U.S. Surgeon General all recommend reducing the general intake of fried foods, and increasing the intake of whole foods, such as fresh fruits and vegetables; two reasons behind the recommendation are reduction of excess calories and trans fats. In addition, the Report of a Joint FAO/WHO Consultation, *Health Implications of Acrylamide in Food* recommends that even though the knowledge on acrylamide is not yet complete, one of the principles that individuals can apply in order to minimize any risks that may exist in relation to acrylamide intake is to “eat a balanced and varied diet, which includes plenty of fruit and vegetables” and “moderate their consumption of fried and fatty foods” (<http://www.fda.gov/ohrms/dockets/dailys/02/Oct02/100402/02n-0393-rpt0001-vol1.pdf>).

Limiting the marketing and availability of fried foods in food establishments, restaurants, schools and workplaces will lead to a lower consumption of fried foods, as they would simply not be available as a food option.

#### Well Features

Food Advertising

### IV. Red and Processed Meat

The consumption rate of meat in the U.S. is high. The USDA reports that in 2000, the total consumption of meat (fish, poultry and red meat) was 195 pounds per person, which is 57 pounds higher than the average consumption of total meat in 1950s (<http://www.usda.gov/factbook/chapter2.pdf>).

Red meat includes beef, lamb, pork, and other meats such as hamburgers, pork chops, roast beef and lamb, or steak. Processed meat includes any meat that has been smoked, cured, salted, or otherwise preserved, including bacon, cold cuts, hot dogs, pastrami, salami, sausages and others (<http://preventcancer.aicr.org/site/DocServer/Guidelines_Brochure.pdf?docID=1550>). Processed and unprocessed meats differ slightly nutritionally, with about four times more salt in processed compared to unprocessed meat. High intake of both processed and unprocessed meat has been associated with several negative health outcomes as well as increased all-cause mortality (<http://www.ncbi.nlm.nih.gov/pubmed/24148709>) (<http://www.ncbi.nlm.nih.gov/pubmed/24932617>).

Numerous institutions, including the CDC, the AHA, the WHO, the FAO, the American Institute of Cancer Research (AICR), and the World Cancer Research Fund (WCRF) recommend limiting the consumption of red meat, and avoiding the consumption of processed meat. Specifically, the AICR recommends eating no more than 18 ounces (cooked weight) of red meat per week, and avoiding processed meat. They recommend that red meat should be replaced with fish, low-fat poultry and plant sources of protein when possible (<http://preventcancer.aicr.org/site/DocServer/Guidelines_Brochure.pdf?docID=1550>).

In addition, when muscle meat (e.g., beef, fish, pork, poultry) is cooked at high-temperatures, using methods such as pan frying or grilling, it leads to the formation of heterocyclic amines (HCAs) and polycyclic aromatic hydrocarbons (PAHs). High levels of exposure to HCAs and PAHs have been associated with cancer in animals, and numerous studies are investigating whether the same outcomes may occur in humans. No Federal guidelines currently address the intake of HCAs and PAHs in meat (<http://www.cancer.gov/cancertopics/factsheet/Risk/cooked-meats>).

#### Health Effects

##### Cardiovascular System

**Heart failure**. In a prospective cohort study of over 35,000 adult and elderly men, consumption of processed meat was associated with heart failure. Men consuming 75 or more grams of processed meat per day were 28% more likely to have heart failure and had a 243% higher risk of dying from heart failure compared to men who consumed less than 25 grams of processed meat. The intake of unprocessed meat was not associated with an increased risk of heart failure or heart failure mortality (<http://www.ncbi.nlm.nih.gov/pubmed/24926039>).

**Hypertension**. In a prospective cohort study of 44,616 French women, those consuming five or more servings of processed red meat per week had a 17% higher rate of hypertension compared to women who consumed less than one serving of processed meat per week. There was no association between the consumption of unprocessed red meat and hypertension (<http://www.ncbi.nlm.nih.gov/pubmed/25080454>).

**CVD mortality**. In a meta-analysis of 13 cohort studies with nearly 1.7 million individuals, participants in the highest category of processed meat intake had an 18% higher risk, and those in the highest category of red meat intake had a 16% higher risk for cardiovascular disease mortality compared to those in the lowest category of consumption. The meta-analysis did not find any association between total and white meat intake and CVD mortality (<http://www.ncbi.nlm.nih.gov/pubmed/24932617>).

**Coronary heart disease**. A systematic review and meta-analysis of 17 prospective cohort studies and three case-control studies (including over 1.2 million individuals) on the consumption of red (unprocessed) and processed meat found that red meat intake was not associated with coronary heart disease, whereas processed meat consumption was associated with a higher risk for CHD. For every 50-gram serving of processed meat per day, there was a 42% increase in coronary heart disease (RR=1.42). The associations for total meat consumption were intermediate (<http://circ.ahajournals.org/content/121/21/2271.long>).

##### Digestive and Endocrine Systems

**Colorectal cancer**. A meta-analysis of prospective studies examining the association between meat consumption and colorectal cancer found that the intake of red and processed meats was associated with an increased risk of colorectal cancer. Participants with the highest intakes of red and processed meat had a 22% higher risk (RR=1.22) of colorectal cancer, compared to those with the lowest intakes. The increase in relative risk for colorectal cancer with every 100 gram/day increase in red and processed meat intake was 14%. In addition, the analysis found that the risk of colorectal cancer increases “approximately linearly with increasing intake of red and processed meats up to approximately 140 g/day, where the curve approaches its plateau” (<http://www.ncbi.nlm.nih.gov/pubmed/21674008>).

##### Endocrine System

**Type 2 diabetes**. In a meta-analysis of three cohorts (26,357 men in the Health Professionals Follow-up Study, 48,709 women in the Nurses’ Health Study, and 74,077 women in the Nurses’ Health Study II), participants’ red meat consumption and the incidence of type 2 diabetes were assessed. The study found that increasing red meat intake over time was associated with an increased risk of type 2 diabetes. Specifically, increased red meat intake of more than 0.5 servings per day over a 4-year period was associated with a 48% higher risk for type 2 diabetes during the subsequent 4-year period, compared to the reference group that did not have a change in red meat intake. Reduced red meat intake, on the other hand, by more than 0.5 servings per day (compared to baseline intake) over a 4-year period was associated with a 14% lower risk of type 2 diabetes during the subsequent 4-year follow-up period (<http://www.ncbi.nlm.nih.gov/pubmed/23779232>).

Another systematic review and meta-analysis of 17 prospective cohort studies and three case-control studies (including over 1.2 million individuals) on the consumption of red (unprocessed) and processed meat consumption found that red meat intake was not associated with diabetes, whereas processed meat consumption was associated with a 19% higher risk for diabetes. The associations for total meat consumption were intermediate (<http://circ.ahajournals.org/content/121/21/2271.long>).

##### Respiratory and Endocrine Systems

**Lung cancer**. A systematic review and meta-analysis of 23 case-control and 11 cohort studies showed a 35% higher risk (RR=1.35) for lung cancer for the highest compared to lowest categories of total meat intake. A high intake of poultry, on the other hand, was associated with a 9% lower risk (RR=0.91) of lung cancer (<http://www.ncbi.nlm.nih.gov/pubmed/22855553>).

##### Reproductive and Endocrine Systems

**Breast cancer**. In a case-control study with nearly 7,000 women, highest quintiles or tertiles of total meat intake were associated with a 2.18 times higher risk of breast cancer (adjusted OR: 2.18) compared to the lowest quartiles or tertiles of intake. In addition, highest intakes of red meat were associated with a 1.45 times higher risk of breast cancer (adjusted OR: 1.45) compared to the lowest levels of intake (<http://www.ncbi.nlm.nih.gov/pubmed/22860889>).

#### Solutions

##### Limited Marketing and Availability

The American Cancer Society recommends to limit the intake of red meat and avoid processed meat in order to lower the risk of colorectal cancer (<http://www.aicr.org/assets/docs/pdf/reports/Second_Expert_Report.pdf>). The American Institute for Cancer Research recommends that people who eat red meat limit their intake to 500 g (18 oz.) per week, and further recommends that “the population average consumption of red meat to be no more than 300 g (11 oz.) a week, very little if any of which to be processed” (<http://onlinelibrary.wiley.com/doi/10.3322/caac.20140/full>).

The Dietary Guidelines for Americans 2010 recommend increasing the amount and variety of seafood intake by choosing seafood instead of some meat and poultry. However, they “did not evaluate the components of processed meats that are associated with increased risk of colorectal cancer and cardiovascular disease.” (<http://www.health.gov/dietaryguidelines/dga2010/dietaryguidelines2010.pdf>)

Based on the dietary recommendations to limit red and processed meat consumption by the USDA/HHS, the WHO, the FAO, the AICR, the AHA, and the WCRF, and based on the links between red and processed meat consumption and increased risk of disease and mortality, and also based on the fact that there is little evidence to suggest that red meat consumption is beneficial for chronic disease prevention, the marketing and availability of red and especially processed meat in food and eating establishments, schools and workplaces should be limited. For example, one or two unprocessed meat options could be provided in an on-site cafeteria, with 5-10 options of fish and seafood, beans, tofu, and legumes. In addition, no processed meats should be marketed, served or sold on the premises, because according to the AICR, there is no safe amount of processed meat that can be consumed before the risk of cancer increases (<http://preventcancer.aicr.org/site/DocServer/Guidelines_Brochure.pdf?docID=1550>).

Research also shows that consumers may be receptive to the potential reduction in meat consumption. In a nationwide sample of 1,083 Dutch consumers, 64% of the respondents said that they were familiar with the concept of “meatless meals”. In addition, 15% said that they are “certainly”, 41% “maybe”, 21% “were doing so already”, and 23% said they did not want to change in response to their willingness to adopt “meatless meals” in order to decrease their meat consumption (<http://www.sciencedirect.com/science/article/pii/S0195666314000907>).

Limiting the marketing and availability of red and processed meats in food establishments, restaurants, schools and workplaces will lead to a lower consumption of these foods, as they would simply not be available as a food option.

#### Well Features

Food Advertising

##### 2. “Meatless Mondays”

Meatless Mondays is a public health initiative aimed at encouraging the consumption of healthy, plant-based foods. The program was recommended for implementation in NYC public schools by the borough president of Manhattan, Scott Stringer (<http://web.archive.org/web/20130906194745/http://urbanomnibus.net/redux/wp-content/uploads/2010/02/foodnyc.pdf>). It has also been approved for implementation in San Francisco in 2010, whereby the grocery stores, restaurants and schools have been encouraged to offer a wider variety of plant-based foods on Mondays (<http://abc7news.com/archive/7370993/>). In addition, Sodexo has implemented Meatless Mondays in nearly 3,000 hospitals, corporate and government client locations in order to promote health, wellness and sustainability in places where the company operates (<http://sodexousa.com/usen/media/press-releases/2011/meatlessmondayexpands041811.aspx>).

Based on the dietary recommendations to reduce the intake of meat, and based on the already existing wide-scale implementation of Meatless Mondays, the program should be implemented on Mondays in schools, workplaces, and other places where food is served or sold in order to reduce the intake of meat and promote the consumption of plant-based foods and an overall healthy diet.

### V. Energy-Dense Foods

Dietary energy density (DED) is defined as the amount of energy theoretically able to be metabolized per unit weight of food (<http://www.ncbi.nlm.nih.gov/pubmed/11518179>).

Energy-dense foods are primarily processed foods that have fat and sugar added to improve their taste, leading to more calories per ounce. For example, a 3.5-ounce chocolate (520 calories) contains 10 times more calories compared to 3.5 ounces of apple (52 calories) (<http://preventcancer.aicr.org/site/DocServer/Guidelines_Brochure.pdf?docID=1550>).

NHANES data show that many foods and food groupings that U.S. children consume are energy-dense, nutrient-poor foods (<http://www.ncbi.nlm.nih.gov/pubmed/23340318>).

Foods that are rich in fats and sugars (also called highly-palatable foods) and are consequently high in calories, taste good. It is now established that highly palatable foods activate the mesocorticolimbic reward circuits of the brain via dopamine release, as well as neurotransmitters and hormones. And while most foods will activate reward pathways to some extent, especially after a period of food deprivation, highly palatable foods stimulate the reward pathways much more potently and reliably relative to foods that are not as delicious (http://www.hindawi.com/journals/isrn/2013/435027/). However, consumption of processed, energy-dense foods that are high in fat and sugar has been linked to a number of negative health outcomes. For instance, excessive sugar intake – fructose in particular – has physiologically addictive and metabolically destructive qualities (Avena, Rada, & Hoebel, 2008). Evidence stemming from limited human studies suggests that insulin, leptin and ghrelin resistance create conditions of hormonal dysregulation brought about by eating “junk food” (foods high in fat and/or sugars and empty calories), and these hormone imbalances are suspected to play a major role in metabolic dysregulation, hunger and overeating (Elliott, Keim, Stern, Teff, & Havel, 2002).

### Health Effects

##### 1. Endocrine and Reproductive Systems

In a case-control study with nearly 3,200 African-American and European-American women, consumption of energy-dense foods was associated with an increased risk of post-menopausal breast cancer in European-American women, and with estrogen receptor-positive tumors in African-American women (<http://www.ncbi.nlm.nih.gov/pubmed/25265504>).

##### Endocrine System

The European Prospective Investigation of Cancer (EPIC)-Norfolk Cohort Study of nearly 22,000 adult participants found that dietary energy density may be associated with a higher risk of type 2 diabetes. Individuals in the highest quintile of energy-dense food intake had a 60% higher risk of diabetes compared to those in the lowest quintile, independent of baseline obesity (<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2571060/>).

A study looking at the intake of energy-dense, nutrient-poor snacks in 1466 adults found that consuming more than 361 calories per day from energy-dense snacks increased the occurrence of metabolic syndrome in those who were in the highest quartile of energy-dense snack consumption compared to those in the lowest quartile (<http://www.ncbi.nlm.nih.gov/pubmed/24508464>).

##### 3. Cardiovascular System

In a cross-sectional study of 486 adult women, consumption of energy-dense diets was associated with higher levels of total and LDL cholesterol, triglycerides, and lower levels of HDL cholesterol. In addition, women in the highest quartile of dietary energy density were 61% more likely to have dyslipidemia and at least one (68%) or two (29%) cardiometabolic risk factors compared to women in the lowest quartile of dietary energy density (<http://www.ncbi.nlm.nih.gov/pubmed/22008550>).

##### 4. Endocrine and Digestive System

In a case-control study of 908 adult patients with pancreatic cancer and 1067 normal controls, regular consumption of energy-dense foods was positively associated with pancreatic cancer risk. Patients in the highest quintile of energy density had a 72% greater risk of pancreatic cancer compared to those in the lowest quintile (<http://www.ncbi.nlm.nih.gov/pubmed/23902959>).

#### Solutions

##### 1. Menu Labeling

A between-subjects experimental design study with nearly 1,300 adults examined the effects of providing energy information alone or accompanied by other nutritional information had an effect on selecting less energy-dense fast food meals. The information provided on the menu included energy information alone (kJ), energy information and percent daily intake, energy information and traffic light picture, and energy information and traffic light picture and percent daily intake. The researchers found that participants who were provided with energy information along with the traffic light picture selected meals that had a significantly lower mean energy content (a 120 kcal reduction) compared to those who were not provided any energy content or nutritional information. In addition, the participants most commonly reported that they used the traffic light labels in making their selections (http://www.ncbi.nlm.nih.gov/pubmed/23523666).

Based on the findings of this study, energy (caloric) information should be provided for all foods and food items, regardless of whether they are packaged or not, and regardless of whether they are served in a chain restaurant or a single food establishment. The caloric information should also be accompanied by additional nutritional information, such as a graphic showing the percentage that a particular food contributes towards the daily caloric intake, or a traffic light graphic indicating/suggesting which foods are less energy-dense compared to others.

#### Well Features

Nutritional Information (Suggested sub-feature: Menu Labeling)

##### 2. Limited Marketing

In a study of 281 children (6-13 years old), those with lower advertising exposure to food promotion messages were less responsive to food promotion messages than children with greater previous exposure to food promotion messages. Children in both groups chose more fat- and carbohydrate-rich food items after viewing food commercials compared to viewing toy commercials (<http://www.ncbi.nlm.nih.gov/pubmed/21708808>). The study concluded that food commercials increase children’s preference for energy-dense foods, especially in those children who watch more television and are therefore exposed to more food commercials.

In addition, research on the effects of food marketing, and especially food marketing to children, strongly advocates to change the current marketing environment, which “almost exclusively promotes calorie-dense, nutrient-poor foods and takes advantage of children’s vulnerability to persuasive messages”, and has a detrimental effect on children’s health (<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3181192/>). The WHO states that heavy marketing of energy-dense foods is associated with an increased risk of weight gain and obesity, and recommends limiting heavy marketing of energy-dense, micronutrient-poor foods to children, providing them with the information and skills needed to make healthy food choices <http://whqlibdoc.who.int/trs/who_trs_916.pdf>

Based on the findings of these studies and recommendations, the marketing and advertising of energy-dense foods (especially aimed at children) should be limited in eating establishments, grocery stores, and other places that sell food.

#### Well Features

Food Advertising

### VI. Trans Fatty Acids

Trans fatty acids, or trans fats are formed by adding hydrogen to unsaturated fatty acids during partial hydrogenation of oils in commercial food processing to make oils become solid at room temperature, increase the shelf-life of the product, and make it more stable at higher temperatures (increase the smoking point). Trans fats also occur naturally in very small amounts in beef and dairy products, but the main sources are commercially fried foods, chips, crackers, baked goods, breads, margarine, vegetable shortening, and many other processed foods.

Trans fats are the most dangerous type of fat and have now been determined to confer no health benefits, raise the levels of LDL cholesterol, lower HDL cholesterol, increase the risk of heart disease, stroke, and type 2 diabetes (<http://www.heart.org/HEARTORG/GettingHealthy/NutritionCenter/HealthyEating/Trans-Fats_UCM_301120_Article.jsp>). In November 2013, the FDA issued a preliminary determination that trans fats are no longer Generally Recognized as Safe (GRAS) in human food. Some cities, such as New York City, have laws that are already in effect, banning the storage, usage, or serving any food products that contain more than 0.5 grams of trans fat per serving (<http://www.nyc.gov/html/doh/downloads/pdf/cardio/cardio-transfat-bro.pdf>).

#### Health Effects (INCOMPLETE)

#### Solutions (INCOMPLETE)

This section will be expanded to include health effects associated with trans fatty acids, and solutions of how to avoid or reduce the consumption of trans fatty acids.

Here’s what we’re planning:

Currently, the FDA allows food companies to label their food products as “fat free” if they contain less than 0.5 grams of trans fatty acids per serving. While this might seem like a small amount, for people who regularly consume foods with up to 0.5 grams of trans fats per serving, this can quickly add up to several grams. The AHA, the CDC, the FDA, and many other health organizations recommend not only looking for foods that are labeled “trans fat free”, but also looking at the ingredients list to make sure it does not contain any partially hydrogenated fats or oils, aiming for as little trans fatty acid consumption as possible. In addition, they explain the less than 0.5 grams per serving labeling rule. Processed foods that may contain trans fats include cakes, cookies, crackers, frozen pies and other baked goods, coffee creamer, fast food, frozen pizza, snack foods (e.g., microwave popcorn), ready-to-use frostings, refrigerated dough products (e.g., biscuits, cinnamon rolls), stick margarine, vegetable shortening, and other foods (<http://www.fda.gov/Food/ResourcesForYou/Consumers/ucm079609.htm>). In addition, if the ingredients list contains the words “hydrogenated vegetable oil”, “partially hydrogenated vegetable oil”, or “shortening”, the food contains trans fat (note: fully hydrogenated oils do not contain trans fats; however, if the ingredient is listed as “hydrogenated vegetable oil” with the word “partially” omitted, it can still contain trans fats). Based on the fact that there is no safe level of trans fatty acid consumption and on the recommendations to reduce trans fat consumption to a minimum due by the leading health authorities, and the labeling “loophole”, the only way to ensure elimination of trans fatty acids from the diet is to exclude foods listing “hydrogenated vegetable oil”, “partially hydrogenated vegetable oil”, or “shortening” as an ingredient, and avoiding foods in food establishments that are prepared by using partially hydrogenated oil for frying or baking (or salad dressings), which requires asking the food service staff about it.

We intend to advocate for the elimination of foods that are not only labeled “Trans fat-free”, but also those containing “partially hydrogenated oils”, “hydrogenated oils”, or “shortening” in the ingredients list. The Solutions will likely be similar to those intended to reduce SSB consumption (i.e. labeling, providing alternatives, and outright bans).