# UNIT 19: EFFECTS OF PROCESSING ON THE NUTRITIVE VALUES OF FOOD

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## 1.0 Introduction

This course is concerned with foods and nutrition. Hence, the nutritive value of foods is very important to us in this course.

Some raw food stuffs can be eaten raw. Most raw food stuffs must be processed to preserve, to improve the keeping quality and to remove all food hazards in the foods.

In all food processing, care must be taken that all the original nutrients in the raw food stuffs are retained as much as possible in the finished goods and that all the sources of either chemical, biological hazards in the raw food stuffs are removed.

In achieving all these objectives mentioned above, the nutritive value of food is affected either positively or negatively.

This unit therefore, discusses the effects of processing on the nutritive value of foods.

## 2.0 Objectives

At the end of this unit, you should be able to:

- List some processing procedures
- Discuss the effects of these processing methods on the nutritive values of foods.
- Discuss how to control changes in the nutritive value of food during processing.

## 3.0 Main Content

## 3.1 Preparation Operations

These operations include peeling, coring, washing, dry cleaning, winnowing, slicing, etc.

The effects of these operations on the nutritive values of foods depend on the type of food being processed. In some foods, preparation operation may have effects on the nutritive value of the food being processed. In some others, the preparation operations may not have any effect on the nutritive value of the food.

Nutrients are not distributed uniformly throughout the food. In some cases, he nutrients are highly concentrated just below the skin. In this case, you need to take a lot of care so as not to lose a significant amount of the nutrients during the preliminary operations. For instance, ascorbic acid is higher in the peel of fruits and vegetables than in the cortex. This brings about the loss of ascorbic acid when we are peeling oranges and pineapples.

In processing rice, thiamin is lost into the bran and this loss of thiamin for some years causes beriberi in rice consuming population until rice was later fortified with thiamin.

In peeling carrots, niacin and carotene are lost. In peeling of some fruits and vegetables, loss of riboflavin is experienced.

In washing of some food items, some nutrients are lost. Some leafy vegetables lose some of their vitamins during washing.

Washing of meat before processing can result into loss of some nutrients.

## 3.2 Heat Treatment

The heat treatments include blanching, pasteurization, sterilization, cooking, roasting, smoking and baking.

### 3.2.1 Blanching

There are water blanch and steam blanch.

In water blanch; water soluble nutrients are lost in the water. There is loss of minerals and vitamin C during the blanching of fruits and vegetables. There is destruction of some heat liable vitamins especially riboflavin. Loss of nutrients during blanching is generally due to leaching of nutrients from the leaf.

Generally. in heat treatment operations, spoilage micro organisms and pathogenic micro organisms are destroyed.

### 3.1.1 Pasteurization

We have low temperature long time method and high temperature short time method. There is loss of vitamin C during pasteurization especially when high temperature short time method is employed.

Pasteurization in milk also results into loss of some amino acids such as cystine.

### 3.2.3 Sterilization

In sterilization, the heat employed is very high (up to 121°C) so as to be able to destroy all forms of pathogenic and non-pathogenic micro organisms, spore forming micro organisms. In view of this, all nutrients that are liable to heat are destroyed. It should be noted that heat treatment denatures protein thereby decreasing or totally destroying the catalytic and the enzymatic activities of the protein. This decrease in catalytic and enzymatic activities of the protein is also a loss in the nutritive value of protein. The heat treatment during sterilization destroys essential amino acids such as niacin and histidine. Some vitamins and minerals are also leached from the canned foods into the liquid to which it is canned. This occurs when green pea is canned in brine.

### 3.2.4 Cooking

In cooking, such as in stewing and deep frying, there is loss of vitamin Bp and vitamin C. During boiling of potato some thiamin is lost. • Excessive cooking has been found to have effects on amino acids. In cooking of meat, water soluble nutrients and some fat soluble nutrients are lost into the stock. Also cooking causes the Denaturation of protein with the attendant loss of the catalytic and the enzymatic activities of the protein.

Many heat unstable vitamins such as vitamin A, D and fl. are generally affected during cooking.

### 3.2.5 Roasting, Smoking and Baking

In roasting, smoking and baking, heat treatment is also employed. The temperature is so high in these processes that many heat liable nutrients especially at the outer part of the food are lost or diminished. Protein is denatured; some essential amino acids are destroyed.

However, in smoking, some phenolic compounds that are implicated in the flavours of the smoked foods are added.

*Students' Assessment Exercise 19.1*

*Discuss losses in nutrients during heat treatments*

## 3.3 Cold Treatment

Cold treatment involves keeping of food in an environment of low temperature. It could be chilling, refrigerating or freezing.

There is the loss of about 40% vitamin during freezing of vegetables and animal tissue. Cold storage of sweet corn for about 4 days leads to about 20% loss of its sweetness. There is a loss of 53% of asparagus stored for 7 days. In potato, there is loss of vitamin C when it is stored in cold environment. When frozen food stuffs such as meat, fruits and some leafy vegetables are thawed, some nutrients are lost.

## 3.4 Irradiation

This is a method of food preservation in which radiation emitted by radio active elements is passed through the food. This is to effect a complete sterilization of the food. However, this method has a number of effects on the nutritive value of the food. The effects are:

a. It reduces the available calcium in egg and meat.
b. Production of peroxide and hydroxide radicals from the water molecules in the food. The peroxide constitute biological hazard in the food. A hydroxide radical reacts with some organic materials in the food and grossly alters the molecular structure of the organic compounds.

Apart from the loss of nutrients that occurs in irradiated foods, loss of colours can also occur. For instance, there is the bleaching of butter, loss of red colour in of salmon and darkening of meat.

In fruits containing high content of proteins there can be burnt-off flavour occurring when the foods are irradiated.

## 3.5 Uses of Preservatives

Preservatives are chemical substances, intentionally added to food to increase the keeping quality, to prevent deterioration, to inhibit the growth of micro organisms, to destroy and inactivate spoilage and deteriorative enzymes.

The safety levels of the additives must be clearly prescribes so as not to cause toxicity of the preservatives in the body. It should be noted that the excessive intake of the preservatives can cause physiological disorders in the body.

Sulphiting of fruits and vegetables has positive effect on the retention of ascorbic acid during freezing. Sulphur oxide is added to fruit juice, fruit pulp and jam to prevent microbial growth.

Proplonic acid is added to flour to prevent mould growth in bread. You also learn in Unit 18 under additive that iron is added to flour to prevent anaemia and garri is fortified with protein during processing. Vitamins are added to margarine to increase the nutritive value. With these, the actions of deliberate additives as you learn before can improve the nutritive values of foods during processing.

*Students' Assessment Exercise 19.2*

*Discuss the effects of irradiation and cold storage on tire nutritive value of pod.*

## 4.0 Conclusion

In this unit, the effects of processing such as preparation operations, heat treatment cold storage, irradiation and use of preservatives on The nutritive value of food are discussed.

Some students' assessment exercises are provided to test the students' understanding of the contents of the unit.

## 5.0 Summary

You learned that processing of food stuffs prevents deterioration of the food by eliminating or destroying the pathogenic or non-pathogenic organisms.

Processing also helps to improve the keeping quality of the foods. However, some processing methods leads to either the loss of nutrients or destruction of nutrients. Some other processing methods lead to improvement of the nutritive value of the food.

Some preparation operations of food lead to loss of nutrients during peeling and leaching of water soluble nutrients during washing. In fruits and vegetables some vitamin C and riboflavin are lost during peeling. Peeling of potatoes leads to loss of niacin. In milling of rice, thiamin is lost in the bran.

Generally, in heat treatment, protein is denatured leading to the loss of catalytic and enzymatic activities of the protein as a result of the change in the three-dimensional configuration of the protein. Some water soluble nutrients are lost during blanching through leaching.

Vitamin C and some heat liable nutrients are destroyed during heat treatment. In pasteurization and sterilization, some heat unstable vitamins such as vitamins A, D and E are destroyed.

Irradiation of the food also leads to destruction of nutrients. In irradiated eggs and milk there is reduction of calcium.

Some additions of chemical compounds can improve the nutritional quality of food as well as preventing the microbial deterioration of the food. Iron is added to flour to prevent anaemia. .

Rice is fortified with thiamin to prevent beriberi. Margarine is enriched with vitamins A and D.

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## 6.0 Tutor Marked Assignment

Discuss the effects of heat treatment on the nutritive values of food.

Answers to students' assessment exercises

19.1 See answers in Sections 3.2, 3.2.1 to 3.2.5
19.2 See answers in Sections 3.3 and 3.5

## 7.0 References and Other Sources

Davidson et al (1975) Human Nutrition and Dietictis 6[11]edition, Longman Group Ltd.

Lake B. and Waterworth M, Foods and Nutrition 13[th]edition, Mills and Boons Ltd., Brooks Mews, London

# APPENDICES

## APPEDIX A •

| | Age (years) | Weight | | Height | | Protein (9) | Fat-Soluble Vitamins | | |
|---|---|---|---|---|---|---|---|---|---|
| | | kg | lb | cm | in | | Vitamin A (¹9 RE)t | Vitamin D 610 | Vitamin E (mg a TE)§ |
| Infants | 0.0 - 0.5 | 6 | 13 | 60 | 24 | kg x 2.2 | 420 | 10 | 3 |
| | 0.5 - 1.0 | 9 | 20 | 71 | 28 | kg x 2.0 | 400 | 10 | 4 |
| Children | 1- 3 | 13 | 29 | 90 | 35 | 23 | 400 | 10 | 5 |
| | 4 - 6 | 20 | 44 | 112 | 44 | 30 | 500 | 10 | 6 |
| | 7 - 1 0 | 28 | 62 | 132 | 52 | 34 | 700 | 10 | 7 |
| Males | 11 - 14 | 45 | 99 | 157 | 62 | 45 | 1000 | 10 | 8 |
| | 15 -18 | 66 | 145 | 176 | 69 | 56 | 1000 | 10 | 10 |
| | 19 - 22 | 70 | 154 | 177 | 70 | 56 | 1000 | 7.5 | 10 |
| | 23- 50 | 70 | 154 | 178 | 70 | 56 | 1000 | 5 | 10 |
| | 51+ | 70 | 154 | 178 | 70 | 56 | 1000 | 5 | 10 |
| Females | 110- 14.0 | 46 | 101 | 157 | 62 | 46 | 800 | 10 | 8 |
| | 15 - 18 | 55 | 120 | 163 | 64 | 46 | 800 | 10 | 8 |
| | 19-22 | 55 | 120 | 163 | 64 | 44 | 800 | 7.5 | 8 |
| | 23-50 | 55 | 120 | 163 | 64 | 44 | 800 | 5 | 8 |
| | 51+ | 55 | 120 | 163 | 64 | 44 | 800 | 5 | e |
| Pregnant | | | | | | +30 | +200 | +5 | +2 |
| Lactating | | | | | | +20 | +400 | +5 | +3 |

*The allowances are intended to provide for individual variations among most normal persons as they live in the United States under usual environmental stresses. Diets should be based on a variety of common foods in order to provide other nutrients for which human requirements have been less well define. See text for detailed discussion of allowances and of nutrients tabulated. See Table (reverse page) for weights and heights by individual year of age...

tRetinol equivalent. 1 Retinol equivalent = 1 mg retinol or 6 1,tg Pcarotene. See text for calculation of Vitamin A activity of diets as retinol equivalent.

cholecalciferol, 10 cholecalciferol = 400 NJ vitamin D

§ a tocopherol equivalents. 1 iru! d-a-tocopherol = I a TE. See text for variation in allowances and calculation of vitamin E activity of the diet as a tocopherol equivalent

91 NE (niacin equivalent) is equal to I mg of niacin or 60 mg of dietary tryptophan

| Water Soluble Vitamins | | | | | | | Minerals | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Vitamin (mg) | Thiamin (mg) | Riboflavin (mg) | Niacin (mg NE) | Vitamin 136 (mg) | Folacinj (mg) | Vitamin B12 (mg) | Calcium (my) | Phosphorous (my) | Magnesium (mg) | Iron (my) | Zinc (mg) | Iodine (mg) |
| 35 | 0.3 | 0.4 | 6 | 0.3 | 30 | 0.5" | 360 | 240 | 50 | 10 | 3 | 40 |
| 35 | 0.5 | 0.6 | 8 | 0.6 | 45 | 1.5 | 540 | 360 | 70 | 15 | 5 | 50 |
| 45 | 0.7 | 0.8 | 9 | 0.9 | 100 | 2.0 | 800 | 800 | 150 | 15 | 10 | 70 |
| 45 | 0.9 | 1 | 11 | 1.3 | 200 | 2.5 | 800 | 800 | 200 | 10 | 10 | 90 |
| 45 | 12 | 1.4 | 16 | 1.6 | 300 | 3.0 | 800 | 800 | 250 | 10 | 10 | 120 |
| 50 | 1.4 | 1.6 | 18 | 1.8 | 400 | 3.0 | 1200 | 1200 | 350 | 18 | 15 | 150 |
| 60 | 1.4 | 1.7 | 18 | 2.0 | . 400 | 3.0 | 1200 | 1200 | 400 | 18 | 15 | 150 |
| 60 | 1.5 | 1.7 | 19 | 2.2 | 400 | 3.0 | 800 | 800 | 350 | 10 | 15 | 150 |
| 60 | 1.4 | 1.6 | 18 | 22 | 400 | 3.0 | 800 | 800 | 350 | 10 | 15 | 150 |
| 60 | 12 | 1.4 | 16 | 22 | 400 | 3.0 | 800 | 800 | 350 | 10 | 15 | 150 |
| 50 | 1.1 | 1.3 | 15 | 1.8 | 400 | 3.0 | 1200 | 1200 | 300 | 18 | 15 | 150 |
| 60 | 1.1 | 1.3 | 14 | 2.0 | 400 | 3.0 | 1200 | 1200 | 300 | 18 | 15 | 150 |
| 60 | 1.1 | 1.3 | 14 | 2.0 | 400 | 3.0 | 800 | 800 | 300 | 18 | 15 | 150 |
| 60 | 1.0 | 1.2 | 13 | 2.0 | 400 | 3.0 | 800 | 800 | 300 | 18 | 15 | 150 |
| 60 | 1.0 | 12 | 13 | 2.0 | 400 | 3.0 | 800 | 800 | 300 | 10 | 15 | 150 |
| 20 | +0.4 | +0.3 | +2 | +0.6 | +400 | +1.0 | +400 | +400 | +150 | ++ | +5 | +25 |
| 40 | +0.5 | +0.5 | +5 | +0.5 | +100 | +1.0 | +400 | +400 | +150 | | +10 | +50 |

folacin allowances refer to dietary sources as determined by *Lactobacillus cash'* assay after with enzymes ("conjugases") to make polyglutamyl forms of the vitamin available to the test organism
**The RDA for vitamin B1, in infants s basd on average concentration of the vitamin in human milk. The allowances after weaning are based on energy intake (as recommended by the American Academy of Pediatrics) and consideration of other factors such as intestinal absorption; see text.
÷÷ The increased requirement during pregnancy cannot be met by the iron content of habitual American diets nor by the existing iron stores of many women; therefore the use of 30-60mg of supplemental iron is recommended. Iron needs during lactation are not substantially different from those of non pregnant women, but continued supplementation of the mother for 2-3 months after parturition is advisable in order to replenish stores depleted by pregnancy.

Source: Guthrie. H. A (1979) Introductory Nutrition, 4th edition,
The C.V. Mosby Company, St. Louis, London

# APPENDIX B

Mean heights and weights and recommended energy intake'

| Catergory | Age • (years) | Weight | | Height | | Energy needs (with range) | | |
|---|---|---|---|---|---|---|---|---|
| | | kg | lb | | in | kcal | | MJ |
| Infants | 0.0 - 0.5 | 6 | 13 | 60 | 24 | kg x 115 | (95- 145) | kg x48 |
| | 0.5- 1.0 | 9 | 20 | 71 | 28 | kg x 105 | (80- 135) | kg x44 |
| Children | 1 -3 | 13 | 29 | 90 | 35 | 1300 | (900 - 1800) | 5.5 |
| | 4—6 | 20 | 44 | 112 | 44 | 1700 | (1300 - 2300) | 7.1 |
| | 7- 10 | 28 | 62 | 132 | 52 | 2400 | (1650 - 3300) | 10.1 |
| Males | 11 - 14 | 45 | 99 | 157 | 62 | 2700 | (2000 - 3700) | 11.3 |
| | 15 - 18 | 66 | 145 | 176 | 69 | 2800 | (2100 - 3900) | 11.8 |
| | 19 - 22 | 70 | 154 | 177 | 70 | 2900 | (2500 - 3300) | 12.2 |
| | 23 - 50 | 70 | 154 | 178 | 70 | 2700 | (2300 - 3100) | 11.3 |
| | 51 -75 | 70 | 154 | 178 | 70 | 2400 | (2000- 2800) | 10.1 |
| | 76+ | 70 | 154 | 178 | 70 | 2050 | (1650 - 2450) | 8.6 |
| Females | 11—14 | 46 | 101 | 157 | 62 | 2200 | (1500- 3000) | 9.2 |
| | 15 - 18 | 55 | 120 | 163 | 64 | 2100 | (1200 - 3000) | 8.8 |
| | 19 - 22 | 55 | 120 | 163 | 64 | 2100 | (1700 - 2500) | 8.8 |
| | 23 - 50 | 55 | 120 | 163 | 64 | 2000 | (1600 - 2400) | 84 |
| | 51 - 75 | 55 | 120 | 136 | 64.0 | 1800 | (1400 - 2200) | 7.6 |
| | 76+ | 55 | 120 | 163 | 64 | 1600 | (1200 - 2000) | 6.7 |
| Pregnant | | | | | | +300 | | |
| Lactating | | | | | | +500 | | |

*From: Recommended Dietary Allowances. Revised 1979. Food and Nutrition Board National Academy of Sciences National Research Council. Washington. D.0

The data in this table have been assembled from the observed median heights and weights of children shown in Table I. together with desirable weights for adults given in Table 2 for the mean heights of men (70 inches) and women (64 inches) between the ages of 18 and 34 years as surveyed in the US population (HEW/NCHS data°

The energy allowances for young adults are for men and women doing light work. The allowances for the two older age groups represent mean energy needs over these age spans allowing for a 2% decrease in basal (resting) metabolic rate per decade and a reduction in activity of 200 kcal/day for men and women between 51 and 75 years. 500 kcal for men over 75 years and 4(X) kcal for women over 75 The customary range of daily energy output is shown for adults in parentheses and is based on a variation in energy needs of ±-400 kcal at any one age.. emphasizing the wide range of energy intakes appropriate for any group of people.

Energy allowances for children through age IS are based on median energy intakes of children these ages followed in longitudinal growth studies. The values in parentheses are $10^{th}$ and $90^{th}$ percentiles of energy intake, to indicated the range of energy consumption among children of theses ages/

Sources of Appendices: Guthrie 11. A (1979) Introductory Nutrition $4^{th}$ edition. The C.V Mosby Company. St. Louise London

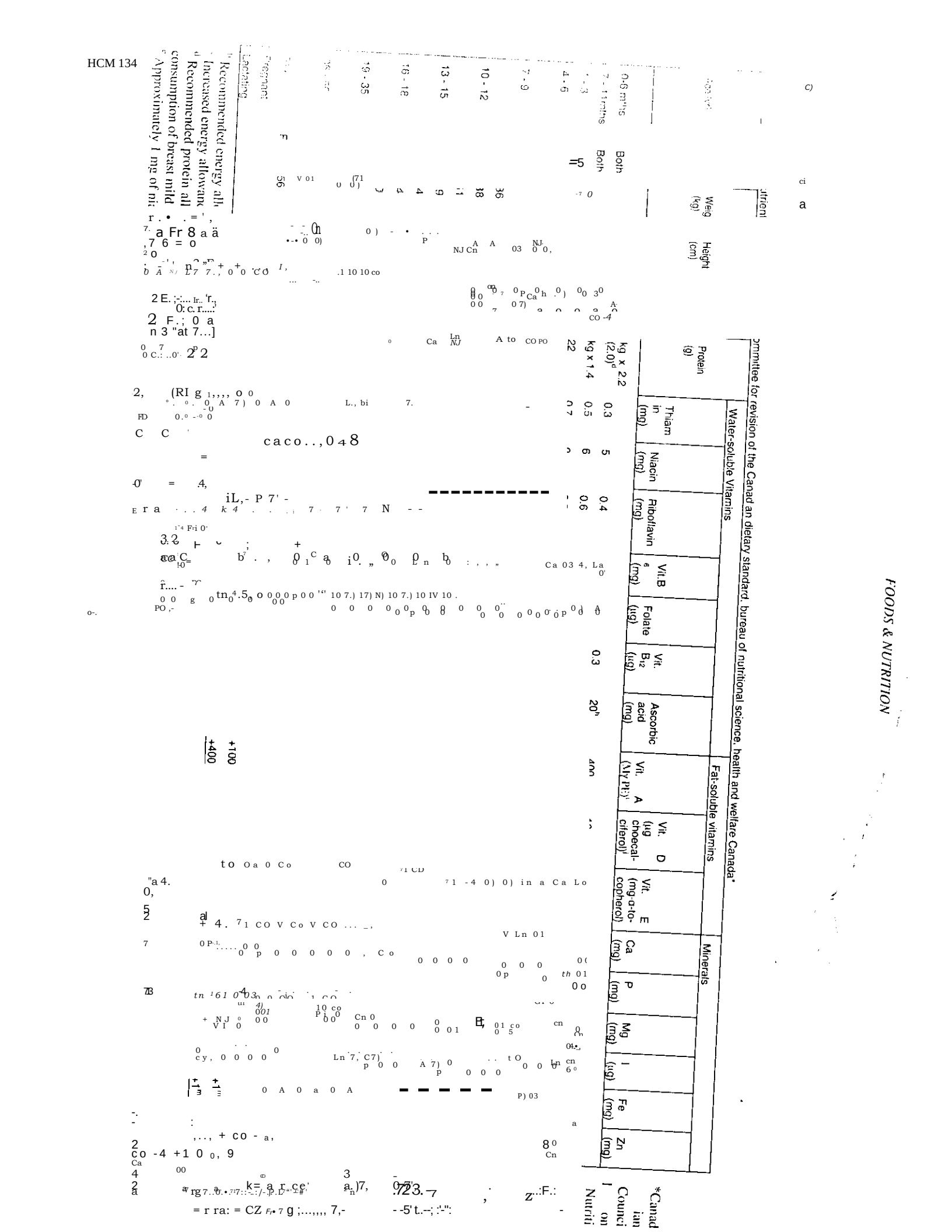
APPENDIX C

# United States Recommended Daily Allowances (U.S. RDA)*

| | Adults and children 4 or more years of age (For use in labeling conventional foods and also for 'special dietary foods") | Infants | Children under 4 years of age (For use only with 'special dietary foods" | Pregnant Or lactating women |
|---|---|---|---|---|
| *Nutrients which must be declared on the label (in the order below)* | | | | |
| Protein+ | | 45g "high quality protein<br>65g 'proteins in general' | | |
| Vitamin A | 5000 IU | 1500 IU | 2500 IU | 8000 IU |
| Vitamin C (or ascorbic acid) | 60 mg | 35 mg | 40 mg | 60 mg |
| Thiamin (or vitamin BO | 1.5 mg | 0.5 mg | 0.7 mg | 1.7 mg |
| Riboflavin (or vitamin B2) | 1.7 mg | 0.6 mg | 0.8 mg | 2.0 mg |
| Niacin | 20 mg | 8mg | 9 mg | 20 mg |
| Calcium | 1.0 mg | 0.6 g | 0.8 g | 1.3 g |
| Iron | 18 mg | 15 mg | 10 mg | 18 mg |
| *Nutrients which may be declared on the label an the order below)* | | | | |
| Vitamin D | 400 IU | 400 IU | 400 Ill | 400 IU |
| Vitamin E | 30I1) | 5 IU | 10 IU | 301U |
| Vitamin B6 | 2.0 mg | 0.4 mg | 0.7 mg | 2.5 mg |
| Folic acid (or folacin) | 0.4 mg | 0.1 mg | 0.2 mg | 0.8 mg |
| Vitamin B12 | 6117 | 2 pg | 3 Mg | 8 pg |
| Phosphorous | 1.0 g | 0.5 g ' | 0.8 g | 1.3 g |
| Iodine | 150 py | 45 jig | 70 jig | 150 jig |
| Magnesium | 400 mg | 70 mg | 20 mg | 450 mg |
| Zinc f | 15 mg | 5 mg | 8 mg | 15 mg |
| Copper t | 2 mg | 0.5 mg | 1 mg | 2 mg |
| Biotin t | 0.3 mg | 0.15 mg | 0.15 mg | 0.3 mg |
| Pantothenic acid t | 10 mg | 3 mg | 5 mg | 10 mg |

*U.S. RDA- is a new term replacing "MI111111011[1] daily requirement" (MDR). RDA value chosen are derived from the highest value for each nutrient given in the NAS-NRC tables except for calcium and phosphorous. flligh quality protein" is defined as having a protein efficiency ratio (PER) equal to or greater than that of casein; "proteins in general' are those with a PER less than that of casein. Total protein with a PER less than 20% that of casein are considered "not a significant source of protein- and would not be expressed on the label in tams of the U.S. RDA but only as amount per serving.

There are no NAS-NRC RDAs for biotin, pantothenic acid, zinc and copper.



Committee for revision of the Canadian dietary standard, bureau of nutritional science, health and welfare Canada*

| Nutrient | Weight (kg) | Height (cm) | Protein (g) | Water-soluble Vitamins | | | | | | Fat-soluble vitamins | | | Minerals | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Thiamin (mg) | Niacin (mg) | Riboflavin (mg) | Vit.B6 (mg) | Folate (µg) | Vit. B12 (µg) | Ascorbic acid (mg) | Vit. A (µg Ret Eq) | Vit. D (µg cholecalciferol) | Vit. E (mg-a-tocopherol) | Ca (mg) | P (mg) | Mg (mg) | I (µg) | Fe (mg) | Zn (mg) |
| 0-6 mths | 6 | 60 | 2.0 kg x 2.2 | 0.3 | 5 | 0.4 | 0.3 | 30 | 0.3 | 20 | 400 | 10 | 3 | 400 | 300 | 40 | 50 | 6 | 5 |
| 7 - 11 mths | 9 | 72 | 1.4 kg x 2.2 | 0.5 | 6 | 0.6 | 0.4 | 45 | 0.5 | 20 | 400 | 10 | 4 | 600 | 400 | 60 | 70 | 10 | 5 |
| 1 - 3 | 13 | 90 | 22 | 0.7 | 9 | 0.8 | 0.5 | 70 | 0.7 | 25 | 400 | 10 | 5 | 600 | 400 | 80 | 90 | 7 | 5 |
| 4 - 6 | 20 | 112 | 30 | 0.9 | 12 | 1.1 | 0.7 | 100 | 1.0 | 30 | 500 | 10 | 6 | 800 | 600 | 120 | 90 | 10 | 7 |
| 7 - 9 | 28 | 132 | 36 | 1.1 | 16 | 1.3 | 1.0 | 150 | 1.5 | 35 | 700 | 10 | 7 | 800 | 600 | 170 | 120 | 8 | 7 |
| 10 - 12 | 36 | 147 | 43 | 1.3 | 18 | 1.5 | 1.2 | 200 | 2.0 | 40 | 800 | 10 | 8 | 1000 | 800 | 220 | 120 | 8 | 8 |
| 13 - 15 | 49 | 162 | 46 | 1.5 | 20 | 1.7 | 1.4 | 250 | 2.0 | 45 | 1000 | 10 | 9 | 1200 | 1000 | 270 | 150 | 8 | 9 |
| 16 - 18 | 54 | 165 | 46 | 1.5 | 20 | 1.7 | 1.4 | 250 | 2.0 | 45 | 1000 | 10 | 9 | 1200 | 1000 | 280 | 150 | 8 | 9 |
| 19 - 35 | 54 | 165 | 44 | 1.4 | 19 | 1.6 | 1.4 | 250 | 2.0 | 45 | 1000 | 10 | 9 | 1000 | 800 | 280 | 150 | 8 | 7 |
| 36 - 55 | 54 | 165 | 44 | 1.4 | 19 | 1.6 | 1.4 | 250 | 2.0 | 45 | 1000 | 10 | 9 | 1000 | 800 | 280 | 150 | 8 | 7 |
| 56 - 75 | 54 | 165 | 44 | 1.4 | 19 | 1.6 | 1.4 | 250 | 2.0 | 45 | 1000 | 10 | 9 | 1000 | 800 | 280 | 150 | 8 | 7 |
| 76 + | 54 | 165 | 44 | 1.4 | 19 | 1.6 | 1.4 | 250 | 2.0 | 45 | 1000 | 10 | 9 | 1000 | 800 | 280 | 150 | 8 | 7 |
| Pregnant | | | +10 | +0.1 | +2 | +0.2 | +0.2 | +100 | +0.3 | +20 | +200 | +5 | +2 | +400 | +400 | +40 | +25 | [illegible] | +2 |
| Lactating | | | +20 | +0.2 | +3 | +0.3 | +0.2 | +100 | +0.3 | +40 | +400 | +5 | +3 | +400 | +400 | +80 | +50 | [illegible] | +3 |

[illegible] Recommended energy allowance

[illegible] Increased energy allowance

Recommended protein allowance

consumption of breast milk

Approximately 1 mg of nic

*Canadian Council on Nutrition

Recommendations are based on the estimated average daily protein intake of Canadians g Recommendations given in terms of free folate

Considerably higher levels may be prudent for infants during the first week of life to guard against neonatal tyrosinemia

'One pg retinol equivalent (I ph RE) corresponds to a biological activity in humans equal to I pg of retinol (3.33 IU) and 6 pg of 11-carotene (10 U)

One mg cholecalci feral is equivalent to 40 IU vitamin D

"Most older children and adults receive enough vitamin D from irradiation but 2.5 pe daily is recommended. This recommended allowance increases to 5.0 pg daily for pregnant and lactating women and for those who are confined indoors or otherwise deprived of sunlight for extended periods.

' The intake of breast-fed infants may be less than the recommendation but is considered to be adequate

"A recommended total intake of IS mg eaily during pregnancy and lactation assumes the presence of adequate stores of iron. If stores are suspected of being inadequate, additional iron as a supplement is recommended.

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cup, not pressed down | 1 cup | 2 | 18 | | | 0 | 19.1 | 7.7 | 0.3 | 4 | 1376 | 807 | | | 7 | | |
| Tablespoon | | | 18 | | | | | | Trace | Trace | 69 | 40 | | | | | |
| 0 a) | | | 18 | | | 9 | | | 0.1 | 1 | 390 | 229 | | | | | |
| Provolone | | | 41 | | | | | | 0.1 | 1 | 214 | 141 | d | | | | |
| Ricotta, made with | | | | | | | | | | | | | | | | | |
| Whole milk | | | | | | | | | 0.7 | 7 | 509 | 389 | 0.9 | | 1 | | |
| Part skim milk | 1 | | 74 | | | | | | 0.5 | 13 | 669 | 449 | 1.1 | | 1 | | |
| Romano | 1 | | 31 | | | | - | - | - | 1 | 302 | 215 | - | - | | - | |

From Nutritive value of foods, House and Gardens Bulletin No. 72 Washington D.C, 1977, U.S. Department of Agriculture.pp. 4 to 30
Oshes denote lack of reliable data for a constituent believed to be present in measurable amount.