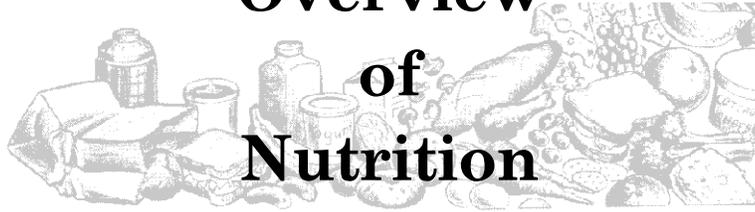


2

Overview of Nutrition



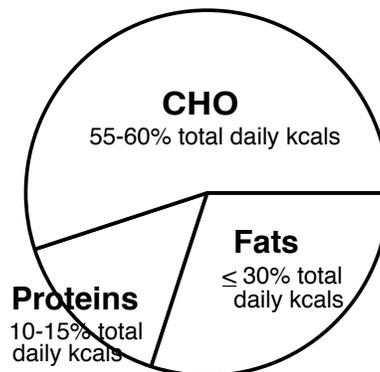
In this chapter you will learn about:

- ◆ The different nutrients and their functions in the body.
- ◆ The various food sources of all the nutrients.
- ◆ Importance and distribution of water in the body.

There are six classes of nutrients: **carbohydrates (CHO), proteins, fats, vitamins, minerals and water.** CHO, proteins, and fats are energy providing nutrients, while vitamins and minerals are needed for energy metabolism. Water is the most abundant nutrient in the body and is essential for the normal functioning of all the organs in the body. All six nutrients will be discussed in detail throughout the chapter.

Energy Providing Nutrients

The ideal percentage of daily kcals from CHO, proteins and fats for optimum health and performance are shown in the chart to the right.



Carbohydrates

CHO are found in grains, fruits, and vegetables and are the main source of energy in a healthy diet. CHO provide energy to the body in the form of glucose (stored as glycogen), act as building blocks for chemicals made by the body, and are used to repair tissue damage. Unfortunately, many people think CHO are unhealthy and lead to weight gain. That notion came about because many people add high-fat toppings and sauces to their starchy foods.

The two types of CHO are:

- ◆ **Simple CHO** - have one or two sugar molecules hooked together. Examples include: glucose, table sugar, sugars in fruits, honey, sugar in milk (lactose), maple syrup, and molasses. Simple sugars are added to some processed foods and provide extra kcals.
- ◆ **Complex CHO** - have three or more simple sugars hooked together and are digested into simple sugars by the body. Examples include: whole grains, fruits, vegetables, and legumes (peas, beans). Both **starch** (digestible) and **dietary fiber** (indigestible) are forms of complex CHO. Although, dietary fiber does not provide any kcals, for health reasons it is recommended that adults eat 20-35 grams of fiber a day. This is achieved by eating more fruits, vegetables, and whole grains (see [page 17](#) and [Appendix A](#)).



Energy From CHO



1 gram of CHO supplies 4 kcal.

CHO should supply 55-60% of your total daily kcals.



e.g., in a 2,000 kcal diet at least $2,000 \times 55 \div 100 = 1,100$ kcals should be from CHO. To convert kcals of CHO into grams of CHO, divide the number of kcals by 4; i.e., $1,100 \text{ kcals} \div 4 \text{ kcals per gram} = 275$ grams of CHO.

Worksheet 2-1. Calculate Your CHO Requirements

_____ x 0.55 = _____ kcal from CHO per day.
Your EER (from [Worksheet 1-2](#))

_____ ÷ 4 kcal per gram = _____ grams CHO per day.
kcal from CHO per day

Proteins

Proteins are found in meat, fish, poultry, dairy foods, beans and grains. Proteins are used by the body to form muscle, hair, nails, and skin, to provide energy, to repair injuries, to carry nutrients throughout the body, and to contract muscle.

Energy from Proteins



1 gram of protein supplies 4 kcal (the same as CHO).
 Proteins should supply 10-15% of your total daily kcals.



Your protein needs are determined by your age, body weight, and activity level. Most people eat 100 to 200 g of proteins each day, which is more protein than is actually needed by the body. Many people eat high-protein foods because they think that proteins make them grow “bigger and stronger”. Actually, these excess kcals from proteins can be converted to fat and stored. High-protein intakes also increase fluid needs and may be dehydrating if fluid needs are not met (see “[Water](#)” on page 14 and [Chapter 12](#)).

Table 2-1. Determining Your Protein Factor

Grams of Proteins Per Pound of Body Weight



Activity Level	Protein Factor
Low to Moderate	0.5 grams
Endurance Training	0.6 - 0.8 grams
Strength Training	0.6 - 0.8 grams



Your Protein Factor is _____.

Calculate your daily protein requirements in [Worksheet 2-2](#) using your protein factor from [Table 2-1](#).

Worksheet 2-2. Calculate Your Protein Requirements

$$\frac{\text{Body Weight (lbs.)}}{\text{Protein Factor}} \times \text{Protein Factor} = \text{_____ grams of proteins per day.}$$

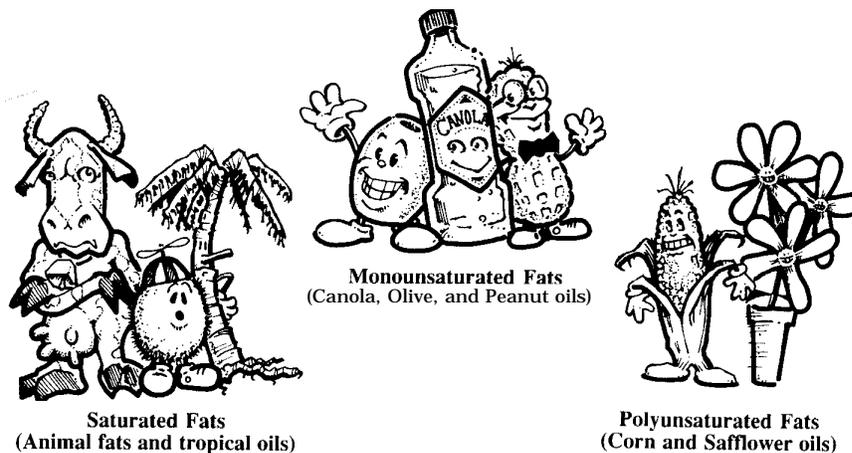
Fats

Fats are an essential part of your diet, regardless of their bad reputation. Fats provide a major form of stored energy, insulate the body and protect the

organs, carry nutrients throughout the body, satisfy hunger, and add taste to foods. However, not all fats are created equal. The three types of fats naturally present in foods are saturated, and mono- and polyunsaturated fats. A fourth type of fat, trans fat, is formed during food processing.

- ◆ **Saturated Fats** are solid at room temperature and are found primarily in animal foods (red meats, lard, butter, poultry with skin, and whole milk dairy products); tropical oils such as palm, palm kernel and coconut are also high in saturated fat.
- ◆ **Monounsaturated Fats** are liquid at room temperature and are found in olive oil, canola oil and peanuts.
- ◆ **Polyunsaturated Fats** are liquid at room temperature and are found in fish, corn, wheat, nuts, seeds, and vegetable oils.

Saturated, monounsaturated, and polyunsaturated fats should each be less than or equal to 10% of your total daily kcals. Therefore, total fat intake should be less than or equal to **30%** of your total daily kcal intake.



- ◆ **Trans Fats** are created when foods are manufactured. Currently, food labels do not list the trans fat content of a food but if “hydrogenated oils” are listed under ingredients it indicates the presence of trans fats. The more processed foods you eat, the greater your trans fat intake. Trans fats may increase blood cholesterol.

A high-fat diet is associated with many diseases, including heart disease, cancer, obesity, and diabetes. On average, people who eat high-fat diets have more body fat than people who eat high-CHO, low-fat diets. On the other hand, a fat-free diet is also very harmful since fat is an essential nutrient.

Energy From Fat



1 gram of fat supplies 9 kcal, more than twice the energy supplied by CHO.

Fats should supply no more than 30% of your total daily kcals.

e.g., in a 2,000 kcal diet no more than $2,000 \times 30 \div 100 = 600$ kcals should be from fats.
To convert kcals of fat into grams of fat, divide the number of kcals by 9;
i.e., $600 \text{ kcals} \div 9 \text{ kcals per gram} = 67$ grams of fat.

Worksheet 2-3. Determine Your Maximum Fat Limit

_____ x 0.30 = _____ kcal of fat per day.
Your EER(from [Worksheet 1-2](#))

_____ ÷ 9 kcal per gram = _____ grams of fat per day.
kcal of fat per day

Cholesterol

Cholesterol is made in the liver, is an essential part of body cells, serves as a building block for some hormones (e.g., testosterone and estrogen), and it is required to digest fats. Cholesterol is also consumed in the diet by eating animal products. High intakes of dietary cholesterol and saturated fats are associated with an increased risk for heart disease. The American Heart Association recommends that daily cholesterol intakes should not exceed 300 milligrams (mg.). Red meats and egg yolks are examples of cholesterol rich foods that should be consumed in moderation.

Vitamins and Minerals

Vitamins and minerals do not provide kcals but both facilitate release of energy from CHO, proteins, and fats. Specific functions of each are listed in [Table 2-2](#) and [Table 2-3](#).

Vitamins

Vitamins are classified as fat or water soluble.

- ◆ **Fat Soluble Vitamins** are absorbed with dietary fat and can be stored in the body. These include vitamins A, D, E and K.
- ◆ **Water Soluble Vitamins** are not stored in the body and excess is excreted in the urine. These include the B and C vitamins.

Minerals

Minerals are classified according to their concentrations and functions in the body.

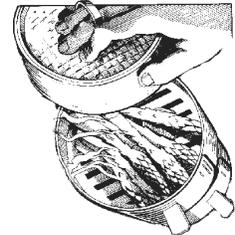
- ◆ **Minerals** - examples include: calcium and magnesium.
- ◆ **Trace Minerals** - are less abundant than minerals; examples include: zinc, copper and iron.
- ◆ **Electrolytes** - examples include sodium, potassium and chloride.

Recommended Dietary Allowances

The Recommended Dietary Allowances (RDA) and the Dietary Reference Intakes (DRI), shown in [Table 2-2](#) and [Table 2-3](#), are the amounts of the vitamins and minerals that a healthy person should eat to meet the daily requirements. Your vitamin and mineral needs can be met by eating a variety of foods. However, if you elect to take vitamin and mineral supplements, you are urged to take only the RDA/DRI amount for each micronutrient (see [Chapter 14, page 80](#)). Taking more than the RDA of a micronutrient could lead to toxicity and create deficiencies of other micronutrients.

Vitamins and Minerals in the Diet

No one food has all of the vitamins and minerals, so you need to eat a variety of foods. Food preparation, medications, caffeine, tobacco, alcohol, and stress can all affect the amount of nutrient available to the body. For example, drinking coffee or tea with meals can decrease iron absorption and taking antibiotics can increase your Vitamin B needs.



Some cooking tips to minimize vitamin and mineral losses include:

- ◆ Use just enough water to prevent burning.
- ◆ Cook vegetables only until they are crisp and tender.
- ◆ Steam or stir-fry foods to retain the most vitamins.
- ◆ Cut and cook vegetables shortly before serving or store them in an airtight container.

The nutrient content of many foods can be found on food labels. Also, you can look up information for most foods on the US Department of Agriculture's (USDA) web site (<http://www.nal.usda.gov/fnic/foodcomp/data>) or consult a dietitian or nutritionist.

Table 2-2. Requirements and Functions of Vitamins

Fat Soluble Vitamins	Some Important Functions	Food Sources
Vitamin A: Retinol, Retinoids, Carotene 800-1,000 μg . RE or 5,000 International Units (IU).	Growth and repair of body tissues, immune function, night vision. Carotene is the water soluble form with antioxidant properties.	Oatmeal, green and yellow fruits and vegetables, liver, milk.
Vitamin D: 5-10 μg . or 200 - 400 IU.	Regulates calcium metabolism and bone mineralization.	Fortified milk, egg yolk, salmon, sunlight.
Vitamin E: alpha-Tocopherol, 8-10 mg.	Antioxidant, protects cell membranes, and enhances immune function.	Fortified cereals, nuts, wheat germ, shrimp, green vegetables.
Vitamin K: 60 - 80 μg .	Assists in blood clotting and calcium metabolism.	Green and leafy vegetables.
Water Soluble Vitamins	Some Important Functions	Food Sources
Vitamin B₁: Thiamin, 1.0 -1.5 mg.	Needed in energy metabolism, and growth. Supports muscle, nerve, and cardiovascular function.	Fortified cereals, legumes, pork, nuts, organ meats, molasses, yeast.
Vitamin B₂: Riboflavin, 1.2 -1.7 mg.	Essential for energy metabolism; growth and tissue repair.	Cereals, liver, milk, green leafy vegetables, nuts, whole grains.
Vitamin B₃: Niacin, Niacinamide, Nicotinic acid 13 -19 mg.	Essential for energy metabolism and nerve function.	Lean meat, seafood, milk, yeast, enriched cereals, whole grains.
Vitamin B₅: Pantothenic acid, 4 - 7 mg.	Essential for energy metabolism and for nerve function.	Legumes, meat, fish, poultry, wheat germ, whole grains.
Vitamin B₆: Pyridoxine HCl, 2 mg.	Essential for CHO and protein metabolism, immune function, red blood cell production, nerve function.	Oatmeal and cereals, banana, plantain, poultry, liver.
Folate: Folic acid, Folacin, 400 μg .	Vital for red blood cell synthesis. Essential for the proper division of cells. Maternal folate deficiency may result in an infant with birth defects.	Fortified cereals, green leafy vegetables, liver, lentils, black-eyed peas, orange juice.
Vitamin B₁₂: Cobalamin, 2 μg .	Required for red blood cell production, energy metabolism, and nerve function.	Ground beef, liver, seafood, milk, cheese.
Biotin: 30 - 100 μg .	Participates in energy metabolism, fatty acid formation, and utilization of the B vitamins.	Legumes, whole grains, eggs, organ meats.
Vitamin C: Ascorbic acid, Ascorbate 60 mg.	Antioxidant, role in growth and repair of tissues, increases resistance to infection, and supports optimal immune function.	Cantaloupe, citrus fruit, strawberries, asparagus, cabbage, tomatoes, broccoli.

From the 1989 RDA and 1998 DRIs for healthy adults 19 to 50 years. CHO = carbohydrates. mg= milligrams, μg = micrograms.

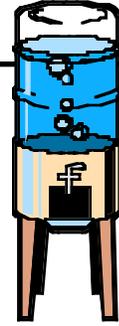
Table 2-3. Requirements and Functions of Minerals

Mineral	Some Important Functions	Food Sources
Boron Unknown	Important in bone retention.	Fruits, leafy vegetables, nuts, legumes, beans.
Calcium 1,000 - 1,300 mg.	Essential for growth and structural integrity of bones and teeth; nerve conduction; muscle contraction and relaxation.	Yogurt, milk, cheese, tofu, fortified juices, green leafy vegetables.
Chromium¹ 50 - 200 µg.	Participates in CHO and fat metabolism; muscle function; increases effectiveness of insulin.	Whole grains, cheese, yeast.
Copper¹ 1.5 - 3 mg.	Essential for red blood cell production, pigmentation, and bone health.	Nuts, liver, lobster, cereals, legumes, dried fruit.
Iron² 10 - 15 mg.	Essential for the production of hemoglobin in red blood cells and myoglobin in skeletal muscle, and enzymes that participate in metabolism.	Liver, clams, oatmeal, farina, fortified cereals, soybeans, apricot, green leafy vegetables.
Magnesium 280 - 350 mg.	Essential for nerve impulse conduction; muscle contraction and relaxation; enzyme activation.	Whole grains, artichoke, beans, green leafy vegetables, fish, nuts, fruit.
Manganese¹ 2 - 5 mg.	Essential for formation and integrity of connective tissue and bone, sex hormone production, and cell function.	Nuts, legumes, whole grains.
Phosphorous 800 - 1,200 mg.	Essential for metabolism and bone development. Involved in most biochemical reactions in the body.	Fish, milk, meats, poultry, legumes, nuts.
Potassium³ 2,000 mg.	Essential for nerve impulse conduction, fluid balance, and for normal heart function.	Squash, potatoes, beans, fresh fruits (bananas, oranges) and vegetables (tomatoes).
Selenium 55 - 70 µg.	Antioxidant, works with vitamin E to reduce oxidation damage to tissues.	Meats, seafood, cereals.
Sodium⁴ 500 - 2,400 mg.	Essential for nerve impulse conduction, muscle contraction, fluid balance, and acid-base balance.	Table salt, canned and processed foods.
Zinc 12 - 15 mg.	Involved in metabolism, immune function, wound healing, and taste and smell sensitivity.	Seafood, beef, lamb, liver, eggs, whole grains, legumes, peanuts.

From the 1989 RDA and 1998 DRIs for healthy adults 19 to 50 years. CHO = carbohydrates. ¹Estimated safe and adequate daily intake range - meets requirements of individuals and avoids the danger of toxicity (Food and Nutrition Board, 1989). ²Men should consult a physician before taking iron supplements. ³The minimum daily requirement for potassium is 2,000 mg. ⁴The minimum daily requirement for sodium is 500 mg. or 1,250 mg. of salt. Salt is 40% sodium and 60% chloride. One teaspoon of salt (5g sodium chloride) has 2g (2,000 mg) of sodium. mg= milligrams, µg= micrograms.

Water

Approximately 60% of total body weight is water. Thus, adequate amounts of water must be consumed daily to ensure the normal functioning of the body and to replenish lost fluids. Water is needed to help digest and absorb nutrients, excrete wastes, maintain blood circulation, and maintain body temperature.



Worksheet 2-4. Calculate Your Daily Water Requirement

Your Body Weight = _____ lbs.

$0.5 \times \text{_____ (body weight)} \div 8 \text{ oz. per cup} = \text{_____ cups per day.}$

Note: Exercise, heat, cold, and altitude can increase fluid requirements. See [Chapters 11](#) and [12](#).

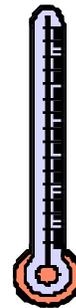
Maintaining Fluid Balance

Fluid balance, like energy balance, is determined by the ratio of fluid losses to fluid intakes. With dehydration, water loss exceeds intake and fluid balance becomes negative. Water is lost in the urine, in stools, in sweat, and through breathing. When activity levels are low, most fluids are lost through the urine. When activity levels are high or the temperature is high, most of the fluid is lost through sweat. To maintain fluid balance you must consume enough fluids each day.

Dehydration

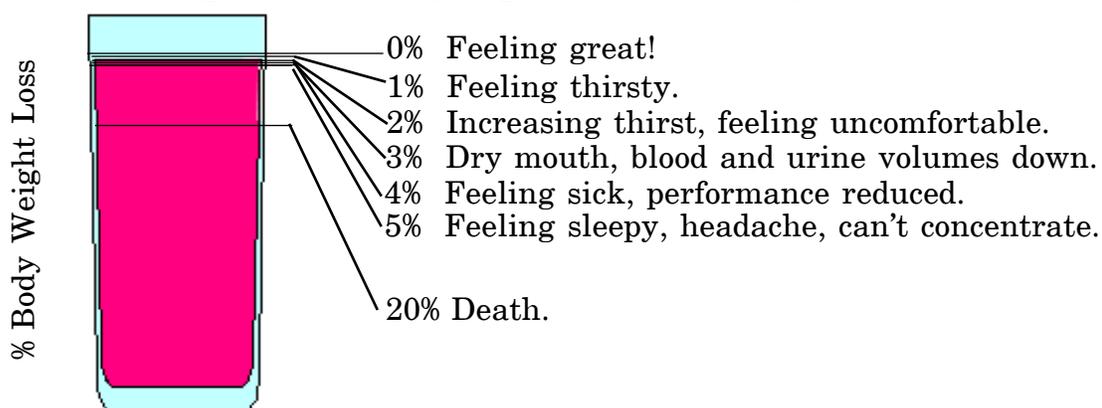
Dehydration results when fluid losses exceed fluid intake. Conditions that can lead to dehydration include:

- ◆ Not drinking enough fluids daily.
- ◆ Working or exercising in a hot environment (wet or dry).
- ◆ Working or exercising in a cold environment (wet or dry).
- ◆ Going to high altitudes.
- ◆ Drinking too much alcohol or exercising with a hangover.



If 4% of your body weight is lost through fluid losses, decision-making, concentration, and physical work are impaired. A loss of 20% of body water can result in death (see [Figure 2-1](#)).

Figure 2-1. Symptoms of Dehydration



Worksheet 2-5. Calculate Your Water Loss Limit

A 2% loss in body weight due to fluid loss equals:

$$\frac{\text{_____}}{\text{(Your body weight)}} \times 0.98 = \text{_____ lbs.}$$

Goal: Rehydrate to stay above this weight!

[Chapter 3](#) outlines the dietary guidelines which apply the information discussed throughout this chapter to everyday dietary practices and food choices.