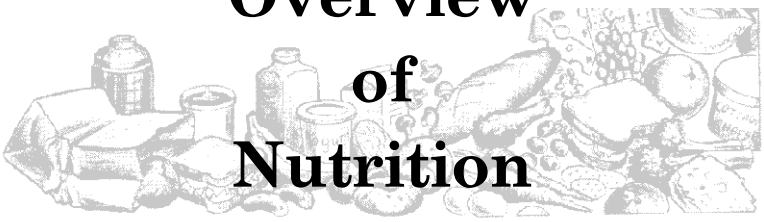
2 Overview of Nutrition



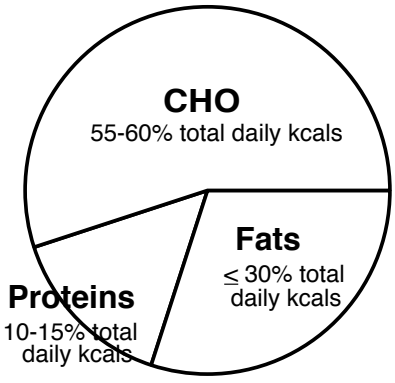
In this chapter you will learn about:

- 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 fat, also called macronutrients, are the energy providing nutrients. Vitamins and minerals, also called micronutrients, are needed in small amounts to help in 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

CHO, proteins, and fats provide energy. The ideal percentage of daily kcals from these macronutrients 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. Unfortunately, many people think CHO are unhealthy and lead to weight gain. That notion came about because most people add high-fat toppings and sauces to their starchy foods. The two types of CHO are:

- **Simple CHO** - have one (mono-) or two (disaccharides) sugar molecules hooked together. Examples include: glucose, table sugar (sucrose), sugars in fruit (fructose), honey (fructose and glucose), sugar in milk (lactose), maple syrup, and molasses. Some are added in processing. Added sugars provide kcals and no nutrients.

- **Complex CHO** - have three or more simple sugar molecules hooked together and are digested into simple sugars by our bodies. 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 22 and Appendix A).

CHO are used in the body to:

- Provide energy in the form of glucose (stored as glycogen).
- Provide fuel for the brain.
- Act as building blocks for chemicals needed by the body.
- Repair tissue damage in the body.

Energy From CHO

1 gram of CHO supplies 4 kcal.

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

Example1:

One fig newton has 10 grams of CHO and provides a total of 60 kcals. The kcals from CHO and the percent of total kcals from CHO are:

4 kcal X 10 grams = 40 kcal from CHO.

40 ÷ 60 = 0.67 = 67% of energy from CHO.

Example 2:

A woman eats 2,000 kcals per day. How many kcals should be from CHO? How many grams of CHO should she eat per day?

2,000 kcal x 55%=1,100 kcal from CHO.

1,100 kcal ÷ 4 kcal per gram = 275 grams CHO.

Based on your estimated energy requirement (EER) calculated in Chapter 1, how many of your kcals should come from CHO? How many grams of CHO should you eat each day?

Worksheet 2-1. Calculate Your CHO Requirements

_____ x 0.55 = _____ kcal from CHO per day.
Your EER

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

Proteins

Proteins are found in meat, fish, poultry and dairy foods. Beans and grains also provide proteins but in smaller amounts than animal foods. All proteins are made of various **amino acids** that are joined together. There are 20 different amino acids. Nine of these are called **essential amino acids** because the body cannot make them, so they must be obtained from the diet.

Proteins are used in the body to:

- Form muscle, hair, nails, skin, and other tissues.
- Provide energy.
- Repair injuries.
- Carry fats, vitamins and minerals to different parts of the body.
- Contract muscle.
- Serve a structural role for every part of the body.

Energy from Proteins

1 gram of protein supplies 4 kcal (the same as CHO).

Proteins should supply 10-15% of your total daily kcals.

Example:
One large hard boiled egg provides 78 kcal and contains 6 grams of proteins. Therefore, kcal from proteins are 4 kcal/gram x 6 grams = 24 kcal of energy from proteins.

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. Although proteins provide energy, they should not be the main dietary source of energy. High-protein intakes also increase fluid needs and may be dehydrating if fluid needs are not met (see "Water" on page 17 and Chapter 12). In addition, high-protein intakes put the kidneys under great strain in order to get rid of all the breakdown products.

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

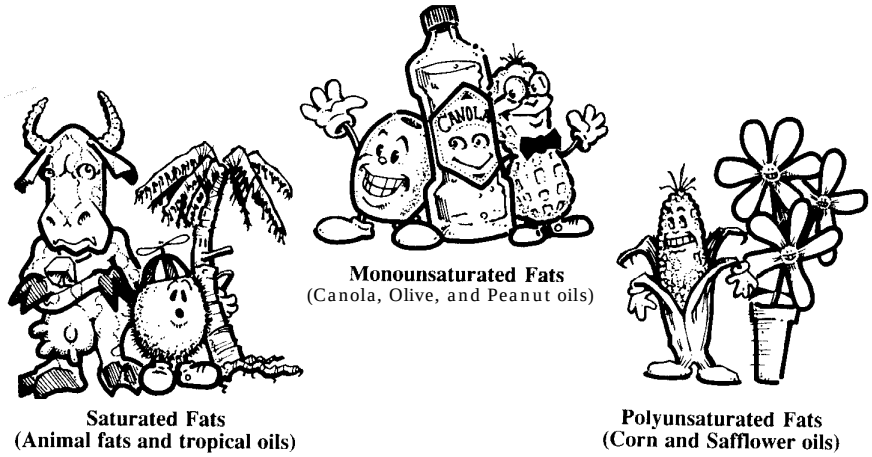
_____x_____=_____ grams of proteins per day.
Body Weight (lbs.) Protein Factor

Fats

Fats are an essential part of your diet, regardless of their bad reputation. However, not all fats are created equal. By knowing about the different types of dietary fats and using the guidelines for daily fat consumption, you can eat the right amount of fat. The three types of fats naturally present in foods are saturated, and mono- and polyunsaturated fats. A fourth type of fat is trans fat and is created during the processing of some foods.

- **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 during manufacturing by a process known as hydrogenation. This process converts unsaturated fats to saturated fats. Manufacturers hydrogenate foods to improve the shelf-life of their products. 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 required by the body (see a list of its functions below).

Fats are used in the body to:

- Provide a major form of stored energy.
- Insulate the body and protect the organs.
- Carry other nutrients throughout the body.

- Serve a structural role in cells.
- Satisfy hunger and add taste to foods.

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.

Example:

A 1-ounce bag of potato chips that provides 152 kcals contains 10 grams of fat. The kcals from fat are:

10 grams x 9 kcals = 90 kcals from fats.

Worksheet 2-3. Determine Your Maximum Fat Limit

_____ x 0.30 = _____kcal of fat per day.
Your EER

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

Cholesterol

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

Micronutrients

Micronutrients include all vitamins and minerals. Neither provides any kcals but both facilitate metabolism (the chemical breakdown) of the macronutrients. Specific functions of micronutrients 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, can be stored in the body, and are not excreted in the urine. These include vitamins A, D, E and K.
- **Water Soluble Vitamins,** including the B vitamins and Vitamin C, are not stored in the body in appreciable amounts and excess amounts are excreted in the urine each day.

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

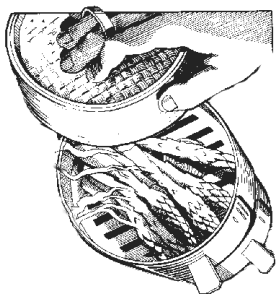
The Recommended Dietary Allowances (RDA) shown in Table 2-2 and Table 2-3 are the amounts of the vitamins and minerals, respectively, that a healthy person should eat to meet daily requirements. The RDAs are designed to meet the daily requirements for most healthy people. The RDAs are undergoing revisions and new standards are gradually becoming available. These new standards are called the Dietary Reference Intakes (DRI). The military has also developed a set of allowances known as the Military DRIs (MDRIs) to be used for designing military rations.

In most cases your micronutrient needs will be met by eating a variety of foods. Taking multivitamin and mineral supplements is another way to meet the RDAs for the micronutrients (see Chapter 14, page 105). However, if you elect to take micronutrient supplements, you are urged to take only the RDA amount for each micronutrient. Taking more than the RDA of a micronutrient could lead to toxicity and create deficiencies of other micronutrients.

Micronutrients in the Diet

No one food can provide all of the micronutrients, so you are encouraged to eat a variety of foods. Also, food preparation can affect the amount of nutrients that remain in the food, especially when cooking vegetables. To

increase the retention of vitamins while preparing a meal:



- Cook food in just enough water to prevent burning, do not soak.
- Cook vegetables only until they are crisp and tender.
- Steam or stir-fry foods to retain the most vitamins.
- Use leftover cooking water for preparing soups and sauces to use the water soluble vitamins that were leached out.
- Cut and cook vegetables shortly before serving or store them in an airtight container.

The amount of minerals that will be absorbed from foods depends upon a number of factors, such as:

- The presence of other dietary constituents, such as dietary fiber and other minerals.
- Medications.
- The body's need for the mineral and the mineral's chemical form.
- The integrity of the intestinal tract.

Many things can affect your body's ability to properly absorb vitamins and minerals. These include caffeine, tobacco, antibiotics, aspirin, alcohol and stress. For example, drinking coffee or tea with meals can decrease iron absorption and taking antibiotics can increase your Vitamin B needs.

The nutrient content of many foods can be found on food labels. For most foods, including fresh produce, processed foods, and fast foods, you can look up specific information on the USDA web site (http://www.nal.usda.gov/fnic) 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 B_1: Thiamin, 1.0 -1.5 mg.	Needed in energy production, CHO metabolism, and growth. Supports muscle, nerve, and cardiovascular function.	Fortified cereals, legumes, pork, nuts, organ meats, molasses, yeast.
Vitamin B_2: Riboflavin, 1.2 -1.7 mg.	Essential for energy metabolism; growth and tissue repair.	Cereals, liver, milk, yogurt, green leafy vegetables, nuts, whole grain.
Vitamin B_3: Niacin, Niacinamide, Nicotinic acid 13 -19 mg.	Essential for energy metabolism, blood circulation, nerve function, and appetite.	Lean meat, seafood, milk, yeast, fortified cereals, whole grain.
Vitamin B_5: Pantothenic acid, 4 - 7 mg.	Essential for energy metabolism and nerve function.	Legumes, meat, fish, poultry, wheat germ, whole grain.
Vitamin B_6: 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 B_{12}: 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 grain, 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.

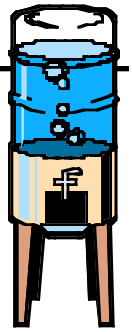
From the 1989 RDA and 1998 DRIs for healthy adults 19 to 50 years. CHO = carbohydrates. mg= milligrams, μg= micrograms.

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.
Chromium[1] 50 - 200 μg.	Participates in CHO and fat metabolism; muscle function; increases effectiveness of insulin.	Whole grains, cheese, yeast.
Copper[1] 1.5 - 3 mg.	Essential for red blood cell production, pigmentation, and bone health.	Nuts, liver, lobster, cereals, legumes, dried fruit.
Iron[2] 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.
Manganese[1] 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.
Potassium[3] 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.
Sodium[4] 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.
[1]Estimated safe and adequate daily intake range - meets requirements of individuals and avoids the danger of toxicity (Food and Nutrition Board, 1989). [2]Men should consult a physician before taking iron supplements. [3]The minimum daily requirement for potassium is 2,000 mg. [4]The 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 found both inside and outside the cells of the body, but most water is inside cells, especially muscle cells. The lowest concentration of water is in bone and fat. Since muscle mass contains more water than fat, the leaner you are, the more body water you have! Water in the body serves many important roles, including:

- Digesting and absorbing nutrients.
- Excreting wastes.
- Maintaining blood circulation throughout the body.
- Maintaining body temperature.

Worksheet 2-4. Calculate Your Daily Water Requirement

Your Body Weight = _____lbs.

0.5 x _____(body weight) ÷ 8 oz. per cup = _____ cups per day.

Note: Exercise, heat, cold, and altitude can increase fluid requirements. See Chapters 11 and 12.

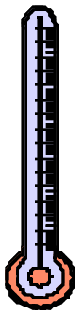
Maintaining Fluid Balance

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. The average person loses 1,000 ml to 2,300 ml (1.0 to 2.4 quarts) of water per day. This 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. In fact, up to 2,000 ml (2.1 quarts) per hour can be lost through sweating, depending on the temperature. To maintain fluid balance you must consume enough fluids each day from:

- Water in beverages (water, fruit juices, milk, sport drinks).
- Water in food (fruits, vegetables, soups, meats, grains).

Dehydration

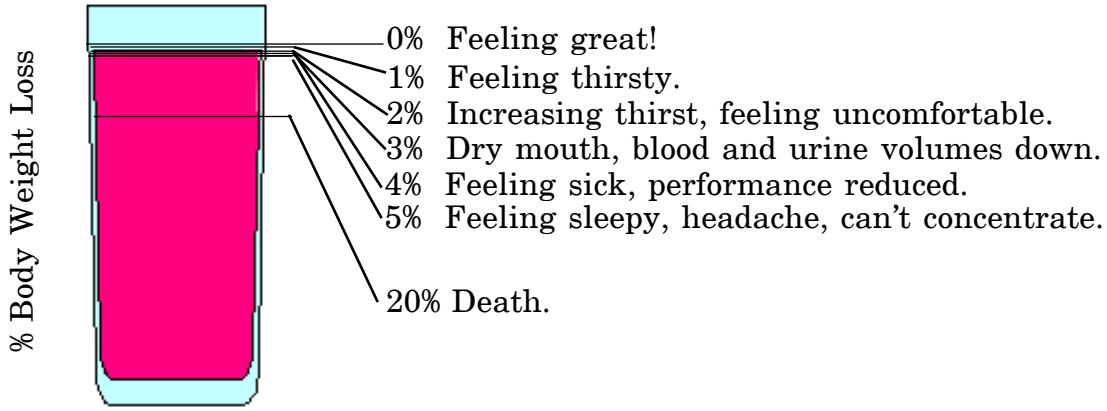
Dehydration results when fluid losses exceed fluid intake. Conditions that can lead to dehydration include:



- 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:

_____ x 0.98 = _____ lbs.
(Your body weight)

Goal: Always stay above this weight!

Chapter 3 outlines the dietary guidelines which apply the information discussed throughout this chapter to every day dietary practices and food choices.