

Lesson 4

Nutrition– Nourishing Your Body



Key Terms

amino acids
complex carbohydrates
fat soluble vitamins
monounsaturated fats
polyunsaturated fats
Referenced Daily Intake (RDI)
saturated fats
simple carbohydrates
water soluble vitamins

What You Will Learn to Do

- Analyze how well you meet nutrient guidelines

Linked Core Abilities

- Take responsibility for your actions and choices

Skills and Knowledge You Will Gain Along the Way

- Explain the six nutrients your body requires
- Explain the difference between simple and complex carbohydrates
- Describe the role fat and cholesterol play in body functioning
- Compare saturated and unsaturated fats
- Describe ways to reduce cholesterol levels
- Compare the functions of vitamins, carbohydrates, fats, and proteins
- Identify food sources of vitamins and minerals
- Define the key words contained in this lesson

Chapter 1

Introduction

Nutrition is the science of nourishing the body properly to reach the higher levels of dynamic living. This lesson introduces you to the six nutrients and shows you how to best provide them in a diet that is well rounded yet diversified. You will learn the newest methods available in how to choose your foods and how to read labels. Finally, you will better understand how to maintain a lean body, free from the damaging effects of carrying too much personal fat.

Our diets have radically changed during the past 35 years. With the advent of fast-food outlets, an increase in dual-career parents, and sky-rocketing numbers of single-parent households, most Americans now have a hurry-up lifestyle where proper eating habits take a back seat to convenience and lack of time.

Knowing that our lifestyles are busy and sometimes hurried, it is very important that young adults have at least a basic understanding of nutrients, how to obtain them, and how to control fat. This knowledge will lead to a more dynamic life and a higher quality lifestyle. The six types of nutrients are carbohydrates, fats, proteins, vitamins, minerals, and water.

We also refer to the first three nutrients, carbohydrates, fats, and proteins, as foodstuffs. They give us the energy for all of the bodily processes. When our body uses the foodstuffs, it releases energy. We measure this energy in calories.

Note

To learn more about calories, see Unit 4, Chapter 1, Lesson 3, “You Are What You Eat.”

Carbohydrates

Carbohydrates are the starches and sugars found in fruits, grains, and vegetables. They have a caloric value of four calories per gram and supply us with short- and long-term energy to accomplish everything from thinking and breathing to running a race.

The short-term carbohydrates are the sugars, or **simple carbohydrates**, which are quickly digested and absorbed into the blood. The most important simple sugar is glucose, or blood sugar. Before the body’s cells can use other simple sugars (such as fructose, sucrose, and lactose) for energy, a change must occur converting them into glucose. Many sugary foods are sources of simple carbohydrates; however, those such as soda and candy have few other nutrients, while fruit is an excellent source of simple carbohydrates and contains many other vitamins and minerals as well.

The long-term carbohydrates are starches, or **complex carbohydrates**, which are made up of combinations of simple sugars. They take longer to digest because the body must break them into simple sugars (glucose) before they can enter the bloodstream. When your body has extra glucose that it does not need immediately for energy, it converts it into the complex carbohydrate glycogen and stores it in

Key Note Terms

simple carbohydrate – a sugar that is found in the body in its simple state; it supplies the body with short-term energy

complex carbohydrates – a carbohydrate that is formed by the body after the conversion of extra glucose; it supplies the body with long-term energy

the muscles and liver to be released later when energy is needed, usually for short periods of strenuous activity. After your muscles and liver store as much glycogen as they can hold, your body changes the rest to body fat for long-term energy. Long distance runners use carbohydrate loading (eating large quantities of carbohydrates) to have the long-term energy they need to complete the race.

Good sources of complex carbohydrates are grains (such as bread, cereal, pasta, and rice) and starchy vegetables (such as peas, corn, beans, and potatoes), as shown in Figure 1.4.1. These starchy foods are also important sources of vitamins, minerals, and fiber. Fiber provides no calories but is roughage that aids in the movement of food through the digestive system.

Nourishing Your Body's Fuel with Fats

Fats, or lipids, perform the vital roles of maintaining body temperature, insulating body organs, providing the body with stored energy, and carrying the **fat soluble vitamins** A, D, E, and K to the cells. One gram of fat is the equivalent of nine calories of energy, more than twice the amount of carbohydrates; therefore, a minimum consumption of fats is the most sensible approach to maintaining a lean body fat content.

Triglycerides are the primary fats in the foods we eat, as well as the fats stored in body tissue. They include saturated fat, which mainly comes from animal sources and does not melt at room temperature, and **monounsaturated** and **polyunsaturated fats**, which are usually liquid oils of vegetable origin. When you eat too many calories, your liver changes them into triglycerides and stores them as fat. When you eat too many **saturated fats**, your liver makes more cholesterol than your body needs, which is unhealthy. Which of the foods in Figure 1.4.2 is low in saturated fats?

Cardiovascular Disease Is the Main Killer of Americans

Your liver already produces about 1,000 milligrams (mg) of cholesterol daily and diet adds another 400 to 500 mg. Cholesterol, a waxy, sticky substance found in animal and human tissue, insulates nerves and forms hormones, cell membranes, vitamin D, and bile to aid in food digestion.

Your blood carries cholesterol by way of lipoproteins, with low density lipoproteins (LDL) carrying cholesterol from the liver to the cells to accomplish the functions mentioned. Unfortunately, the LDLs deposit any cholesterol that is not needed by the cells in the arteries, giving them the nickname of the “bad guys.” Cholesterol accumulated on the inside walls of the arteries is a factor in the development of atherosclerosis. Eventually, cardiovascular disease, in the form of a heart attack or stroke, may result.

The high density lipoproteins (HDL) carry the extra cholesterol in your blood to the liver to dispose of it, thus preventing cholesterol from building up in the arteries. For this reason, HDLs are known as the “good guys.” To keep cholesterol at a normal level in the body, you must lower LDL levels and raise HDL levels. Steps you can take to accomplish this are to eat less fat, especially saturated fat, maintain appropriate body weight, and participate in a regular exercise program. Eating more fiber will also help because it binds with cholesterol and carries it out of the body; and consuming monounsaturated fats, such as olive, canola, and peanut oils, raises HDLs.

Key Note Terms

fat soluble vitamin – a vitamin that is absorbed through the intestinal tract with the help of fats and is stored in the body

monounsaturated fats – oils or fats that are liquid at room temperature, is low in hydrogen, which can lower the level of blood cholesterol

polyunsaturated fats – oils of fatty acids containing more than one double or triple bond and are, therefore, cholesterol defensive

saturated fats – fats that do not melt at room temperature and can raise the blood cholesterol level

Figure 1.4.1: Your body needs energy from the carbohydrates found in these foods.

Courtesy of Steven Mays.



Nourishing Your Body with Proteins

The body contains substances called proteins in every cell. They aid in the development and maintenance of muscle, bone, skin, and blood. Proteins are also the key behind keeping the immune system strong. They control the chemical activities in the body that transport oxygen, iron, and nutrients to the body cells. The body can also use protein for energy if it is low on carbohydrates and fats; but in most cases, its role as an energy source is minor. Proteins, like carbohydrates, contain four calories per gram.

The building blocks of protein are the **amino acids**. These chains of carbon, hydrogen, oxygen, and nitrogen linked together in different ways control all of the body's

Key Note Term

amino acids – the basic units of proteins, produced by living cells or obtained as an essential component of a diet

Figure 1.4.2: Of the fatty foods shown, only the olive oil is low in saturated fats.

Courtesy of Steven Mays.



chemical activities. There are 22 amino acids found in the human tissue, but the body cannot manufacture all of them. Eight (nine for children) amino acids, known as the essential amino acids, must come from the food we eat because the body cannot produce them. We refer to the food products that contain all eight essential amino acids as having complete proteins. The best sources of complete proteins are meat, fish, poultry, and dairy products. Plant foods generally contain incomplete proteins since they are either low on or lack an essential amino acid. However, plant foods can be combined easily, such as rice and beans or peanut butter and bread, to include all essential amino acids in high enough amounts to form a complete protein.

The remaining 14 amino acids are known as the nonessential amino acids. They are still necessary for bodily functioning, but are called *nonessential* because they do not have to be supplied in the diet. Instead, the body manufactures nonessential amino acids itself.

Keep in mind that although animal and dairy products are sources of complete proteins, many are often high in fat as well. As you will read later in this text, Americans get most of their protein from animal sources instead of from combinations of complex carbohydrates. You will have a healthier diet and still meet your protein needs if you consume less fatty foods and more carbohydrates in the forms of grains and vegetables.

Regulating Your Body with Vitamins, Minerals, and Water

Three important components that your body needs to be healthy are vitamins, minerals, and water. Vitamins and minerals are found in the foods you eat, and water is essential for proper hydration.

Vitamins

Vitamins are promoters of health and wellness. Unlike the carbohydrates, fats, and proteins, the body does not digest vitamins; instead, food products release them and your body tissues absorb them. Vitamins are classified as either fat soluble or water soluble. With the help of fats, the intestinal tract absorbs fat soluble vitamins (A, D, E, and K) and stores them in the body. The water in the tissues dissolves the **water soluble vitamins** (B complex and C).

Many countries have standards for vitamin and mineral requirements to recommend daily amounts needed for good health. For example, the standards for the United States are the **Referenced Daily Intakes (RDI)**. From time to time, the federal government reviews these standards and proposes new ones as research continues and more complete information about vitamins and minerals is discovered. Table 1.4.1 shows the current U.S. RDI for vitamins.

Key Note Terms

water soluble vitamin – a vitamin that is dissolved in the water of tissues

Referenced Daily Intake (RDI) – standards developed by the U.S. government for the regulation of vitamin and mineral requirements

Table 1.4.1: Vitamins

Vitamin	U.S. RDI	Functions	Sources
A	5000 International Units (IU)	Helps maintain eyes, skin, and linings of the nose, mouth, digestive, and urinary tracts	Liver, dairy products, fortified margarine, orange fruits and vegetables, and dark-green vegetables
B-1 (Thiamin)	1.5 mg	Helps convert carbohydrates into energy	Yeast, rice, whole-grain and enriched breads/cereals, liver, pork, meat, poultry, eggs, fish, fruits, and vegetables
B-2 (Riboflavin)	1.7 mg	Helps convert nutrients into energy; helps maintain skin, mucous membranes, and nervous structures	Dairy products, liver, yeast, fruits, whole-grain and enriched breads/cereals, vegetables, meat, and poultry
B-3 (Niacin)	20 mg	Helps convert nutrients into energy; essential for growth; aids in synthesis of hormones	Liver, poultry, fish, milk, eggs, whole-grain and enriched breads/cereals; fruit, and vegetables
B-5 (Pantothenic Acid)	10 mg	Helps convert nutrients into energy	Liver, yeast, whole grains, eggs, beans, and milk
B-6 (Pyridoxine)	2.0 mg	Aids in more than 60 enzyme reactions	Milk, liver, meat, green, leafy vegetables, and whole-grain and enriched breads/cereals
B-7 (Biotin)	0.3 mg	Helps convert nutrients to energy	Liver, yeast, milk, oatmeal, beans, nuts, and egg yolks
B-9 (Folic Acid)	0.4 mg	Aids in blood cell production; helps maintain nervous system	Liver, green, leafy vegetables, and beans
B-12 (Cobalmin)	6 micrograms (mcg)	Helps form new cells	Meat, seafood, poultry, dairy products, and eggs

(continued)

Table 1.4.1: Vitamins (continued)

Vitamin	U.S. RDI	Functions	Sources
C	60 mg	Helps maintain and repair connective tissue, bones, teeth, and cartilage; promotes wound-healing	Broccoli, brussel sprouts, citrus fruit, tomatoes, potatoes, peppers, cabbage, and other fruits and vegetables
D	400 IU	Helps regulate calcium and phosphorus metabolism; promotes calcium absorption; essential for development/maintenance of bones and teeth	Fortified milk, eggs, fish-liver oils, and sunlight on skin
E	30 IU	An antioxidant (prevents oxygen from interacting destructively with other substances) that helps protect cell membranes, maintain fats and vitamin A, and increase blood flow	Green, leafy vegetables, whole grains, seeds, nuts, vegetable oil/shortening, liver, and egg yolks
K	60–80 mcg*	Helps in blood clotting	Green, leafy vegetables, liver, tomatoes, egg yolks, and milk

*No U.S. RDI established. Amount is an estimated recommendation for dietary intake.

Points of Interest: Vitamins

According to a 10-year study of 11,348 U.S. adults, vitamin C was effective at cutting death rates from heart disease and stroke. Sources of vitamin C are illustrated in Figure 1.4.3. The study tested three groups getting

- **50 mg or more a day in food, plus an average supplement of 500 mg**
- **50 or more mg and no supplement**
- **less than 50 mg with no supplement**

Men in Group 1 had a 35 percent lower mortality rate and 42 percent lower death rate from heart disease and stroke. Women in Group 1 were 25 percent less likely to die of heart disease or stroke and had a 10 percent lower mortality rate.

Taking supplements of 2,000 mg of vitamin C daily might be helpful to allergy sufferers.

A new study also found vitamin E cuts the risk of certain cancers. Plus, two other studies with more than 130,000 people reported vitamin E helps prevent coronary heart diseases.



Figure 1.4.3: Citrus fruits, melons, papayas, tomatoes, and peppers are all high in vitamin C.
Courtesy of Steven Mays.

Minerals

Minerals are elements found in the environment that help regulate the bodily processes. Without minerals, the body cannot absorb vitamins. Macrominerals, shown in Table 1.4.2, are minerals that the body needs in large amounts. These minerals are calcium, phosphorus, magnesium, potassium, sulfur, sodium, and chloride.

Although sodium is a macromineral, many Americans consume too much of it, which can contribute to high blood pressure. High blood pressure, in turn, can contribute to cardiovascular disease. On the other hand, many Americans do not consume enough calcium, and a calcium deficiency can lead to osteoporosis later in life.

Although the body only needs trace minerals (such as selenium, manganese, molybdenum, iron, copper, zinc, iodine, and chromium, shown in Table 1.4.3) in very small amounts, they are also essential for proper functioning of the body. For example, an iron deficiency can reduce the number and size of red blood cells, causing weakness, sleepiness, and headaches. Iron is contained in many foods as shown in Figure 1.4.4.

Point of Interest: Minerals

A study has found that heart-disease patients who received 150 mcg of chromium per day had a dramatic jump in the HDL cholesterol, the good stuff that helps keep arteries clear.

Water

About 60 to 70 percent of your body is water, with most of your blood, brain, and muscles being water and even 20 percent of your bones. Water carries the other nutrients, when dissolved, to all parts of the body where and when needed. It also aids in digestion, regulation of temperature, removal of wastes, joint lubrication, and bio-

Table 1.4.2: Macrominerals

Mineral	U.S. RDI	Functions	Sources
Calcium	1000 mg	Structure of bones and teeth; muscle contraction; maintenance of cell membranes; blood clotting; nerve impulse transmission; heart activity; Helps convert carbohydrates into energy	Dairy products, small fish (such as sardines) with bones, dark-green vegetables, dried beans and peas
Phosphorus	1000 mg	Structure of bones and teeth; muscle contraction; maintenance of cell membranes; blood clotting; nerve impulse transmission; heart activity; Helps convert carbohydrates into energy	Dairy products, small fish (such as sardines) with bones, dark-green vegetables, and dried beans and peas
Magnesium	400 mg	Structure of bones and teeth; release of energy from nutrients; formation of enzymes	Meat, poultry, fish, eggs, dried beans and peas, and dairy products
Potassium	3500 mg*	Building bones; release of energy from muscle glycogen; conduction of nerve impulse to muscle	Green, leafy vegetables, nuts, soybeans, seeds, and whole grains
Sulfur	140 mg*	Muscle contraction; maintenance of fluid and electrolyte balance; transmission of nerve impulse; release of energy from nutrients	Orange juice, bananas, dried fruit, meat, bran, peanut butter, potatoes, coffee, tea, and cocoa
Chloride and Sodium	No more than 2400 mg*	Part of sulfur-containing amino acids; firm proteins of hair, nails, and skin	Meat, wheat germ, dried beans and peas, peanuts
Table salt (sodium chloride)		Regulate blood and fluids; nerve impulse transmission; heart activity; metabolic controls	many canned soups and processed foods, pickles, soy sauce, sauerkraut, and celery

*No U.S. RDI established. Amount is an estimated recommendation for dietary intake.

Table 1.4.3: Trace Minerals

Mineral	U.S. RDI	Functions	Sources
Selenium	50–75 mcg*	Prevents breakdown of fats	Seafood, whole-grain cereals, meat, egg yolks, milk, and garlic
Manganese	5 mg*	Central nervous system; normal bone structure; reproduction	Nuts, whole grains, vegetables, fruits, tea, and cocoa powder
Fluoride	1.5–4 mg*	Tooth and bone formation	Drinking water in some places, seafood, and tea
Molybdenum	75–250 mcg*	Part of enzymes	Legumes, cereals, liver, kidneys, and dark-green vegetables
Iron	18 mg	Formation of hemoglobin; part of enzymes and proteins	Liver, kidneys, meat, egg yolks, green, leafy vegetables, dried fruit, dried beans and peas, and whole-grain and enriched cereals
Copper	2 mg	Formation of red blood cells; part of respiratory enzymes	Oysters, nuts, cocoa powder, liver, kidneys, beans, corn oil, and margarine
Iodine	150 mcg	Functioning of the thyroid gland and production of thyroid hormones	Iodized salt and seafood
Chromium	50–200 mcg*	Helps the body use carbohydrates and fats; aids in digestion of protein	Liver, nuts, whole grains, Brewer's yeast, meat, mushrooms, potatoes, apples with skin, and oysters
Zinc	15 mg	Part of many enzymes; essential to synthesis of DNA and RNA; metabolizes carbohydrates, fats, and proteins; dispose of carbon dioxide; strengthen immune system; helps wounds heal; helps body use vitamin A	Meat, liver, eggs, poultry, and seafood

* No U.S. RDI established. Amount is an estimated recommendation for dietary intake.



Figure 1.4.4 These foods are rich in iron. Why is iron such an important mineral?

Courtesy of Steven Mays.

chemical processes taking place in the body all the time. Without water you would die in a few days. To maintain all the bodily functions water helps carry out, you need to consume the equivalent of six to eight glasses of water a day. If you exercise regularly, you may need as many as ten glasses, especially on the days you exercise.

Hunger and Malnutrition

As long as people can easily obtain an abundant and varied diet, it is not difficult for them to meet their nutritional needs. When such fortunate people become hungry, they can usually satisfy their need for food. However, many people in the world cannot obtain enough of the right foods, and in some cases cannot get much food at all. For them, hunger is a way of life—an ongoing, painful condition over which they have little control, as depicted in Figure 1.4.5. Poor nutrition is a serious, worldwide problem.

Malnutrition

Technically, malnutrition is any condition in which a person's nutrient consumption is inadequate or unbalanced. Most cases, however, are the result of consuming too little of one or more nutrients. Malnutrition harms every system of the body and also damages emotional well-being.

When people are malnourished, they do not have the energy to perform well in school or at work. Malnourished people are also more susceptible to disease than those who eat a healthy diet. Malnourished children usually grow much more slowly than children whose diet is adequate. If malnutrition occurs during pregnancy, the baby may weigh less than normal and have serious health problems.

Figure 1.4.5: Famine victims, such as this Somali woman, search in vain to try to find food.

Courtesy of Jean-Claude Coutausse/Contact Press Images.



There are various types of malnutrition, including the vitamin and mineral deficiencies discussed earlier in this lesson. In one especially serious condition known as protein-energy malnutrition, the diet does not contain adequate protein, nor does it supply enough calories to meet the body's energy needs. The effects of this condition are especially severe on children because their bodies need protein and calories for growth. Severe cases can cause death, either directly through starvation or indirectly through the diseases to which its victims become susceptible. Protein-energy malnutrition is the most serious nutrition problem affecting people in developing countries today.

Malnutrition has various causes. In some cases, people may be undernourished because they are unaware of the foods that they need for good health. Also, diseases and other conditions may prevent the digestive system from absorbing nutrients. But, indirectly, poverty is by far the most common cause of malnutrition. Victims of severe poverty cannot afford to buy or grow the food they need.

A World Problem

Hunger and malnutrition are an especially severe problem in many of the world's poorer nations. Severe famines, for example, have devastated countries such as Somalia and Bangladesh. However, hunger is also a problem in more prosperous countries, including the United States. Although few people starve in the United States, many are not receiving adequate nutrition. Hungry people in the United States are those who have little or no income, such as homeless people, teenage runaways, families dealing with unemployment, and some elderly people.

Various programs and organizations are trying to solve the problem of malnutrition and provide food for those who need it. For example, the Food and Agriculture Organization of the United Nations combats hunger by helping people improve methods of agriculture and food distribution. The U.S. government sponsors the Food Stamp Program that enables low-income people to purchase the food that they need. Volunteers also work hard to help those who are hungry. For example, soup kitchens, which are often staffed by volunteers, provide meals for those in need.

Conclusion

Understanding what nutrition your body needs is essential to maintaining both physical and emotional health. Without the proper balance of carbohydrates, fats, proteins, vitamins, and minerals, you open the door to all kinds of health problems—some possibly fatal. Even with a fast-paced lifestyle, it's still possible to eat correctly and give your body the fuel it needs.

Next, you will learn about dietary guidelines. You will examine the National Academy of Sciences' 1989 report on how we should eat, as well as some alternative choices that many nutritionists advocate.

Lesson Review

1. How do carbohydrates help the body?
2. Compare and contrast monounsaturated fats and polyunsaturated fats.
3. What roles do proteins play in nutrition?
4. What are the effects of malnutrition?