

# Food and Nutrients

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## CONCEPT

## 1

# Food and Nutrients

## Lesson Objectives

- Explain why the body needs food.
- Identify the roles of carbohydrates, proteins, and lipids.
- Give examples of vitamins and minerals, and state their functions.
- Explain why water is a nutrient.

## Check Your Understanding

- What are the four types of organic compounds?
- What do all cells need in order to function?
- What are muscles made of?

## Vocabulary

- calorie
- essential amino acid
- minerals
- nutrients
- starch
- trans fat
- vitamins

## Why We Need Food

Did you ever hear the old saying “An apple a day keeps the doctor away”? Do apples really prevent you from getting sick? Probably not, but eating apples and other fresh fruits can help keep you healthy. The girl shown in **Figure 1.1** is eating fresh vegetables as part of a healthy meal. Why do you need foods like these for good health? What role does food play in the body?

Your body needs food for three reasons:

1. Food gives your body energy. You need energy for everything you do.
2. Food provides building materials for your body. Your body needs building materials so it can grow and repair itself.
3. Food contains substances that help control body processes. Your body processes must be kept in balance for good health.

For all these reasons, you must have a regular supply of nutrients. **Nutrients** are chemicals in food that your body needs. There are six types of nutrients:

**FIGURE 1.1**

This girl is eating a salad of vegetables and leafy green vegetables. Fresh vegetables such as these are excellent food choices for good health.

1. Carbohydrates.
2. Proteins.
3. Lipids.
4. Vitamins.
5. Minerals.
6. Water.

Carbohydrates, proteins, and lipids give your body energy. Proteins provide building materials. Proteins, vitamins, and minerals help control body processes.

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## Nutrients that Provide Energy

Molecules of carbohydrates, proteins, and lipids contain energy. When your body digests food, it breaks down the molecules of these nutrients. This releases the energy so your body can use it. The energy in food is measured in units called **calories**.

### Carbohydrates

Carbohydrates are nutrients that include sugars, starches, and fiber. How many grams of carbohydrates you need each day are shown in **Figure 1.2**. It also shows some foods that are good sources of carbohydrates.

There are two types of carbohydrates: simple and complex.

### Simple Carbohydrates

Sugars are small, simple carbohydrates that are found in foods such as fruits and milk. The sugar found in fruits is called fructose. The sugar found in milk is called lactose. These sugars are broken down by the body to form glucose, the simplest sugar of all. Glucose is used by cells for energy.

Remember the discussion of cellular respiration in the *Cell Functions* chapter? Cellular respiration turns glucose into the usable form of chemical energy, ATP. One gram of sugar provides your body with four Calories of energy.



Fresh fruits are good sources of simple carbohydrates. An apple has about 20 grams of carbohydrates.



Whole grain breads are a good source complex carbohydrates. A slice of whole grain bread has about 15 grams of carbohydrates.



Vegetables are good sources of complex carbohydrates. A cup of cooked acorn squash has about 30 grams of carbohydrates.

### FIGURE 1.2

Up to the age of 13 years, you need about 130 grams of carbohydrates a day. Most of the carbohydrates should be complex. They are broken down by the body more slowly than simple carbohydrates. Therefore, they provide energy longer and more steadily. What other foods do you think are good sources of complex carbohydrates?

Some people cannot digest lactose, the sugar in milk. This condition is called lactose intolerance. If people with this condition drink milk, they may have cramping, bloating, and gas. To avoid these symptoms, they should not drink milk, or else they should drink special, lactose-free milk.

## Complex Carbohydrates

**Starch** is a large, complex carbohydrate. Starches are found in foods such as vegetables and grains. Starches are broken down by the body into sugars that provide energy. Like sugar, one gram of starch provides your body with four calories of energy.

Fiber is another type of large, complex carbohydrate. Unlike sugars and starches, fiber does not provide energy. However, it has other important roles in the body. There are two types of fiber found in food: soluble fiber and insoluble fiber. Each type has a different role. Soluble fiber dissolves in water. It helps keep sugar and fat at normal levels in the blood. Insoluble fiber does not dissolve in water. As it moves through the large intestine, it absorbs water. This helps keep food waste moist so it can pass easily out of the body.

Eating foods high in fiber helps fill you up without providing too many calories. Most fruits and vegetables are high in fiber. Some examples are shown in **Figure 1.3**.

## Proteins

Proteins are nutrients made up of smaller molecules called amino acids. As discussed in the *Introduction to Living Things* chapter, the amino acids are arranged like "beads on a string." These amino acid chains then fold up into a three-dimensional molecule. Proteins have several important roles in the body. For example, proteins:

## High-Fiber Foods

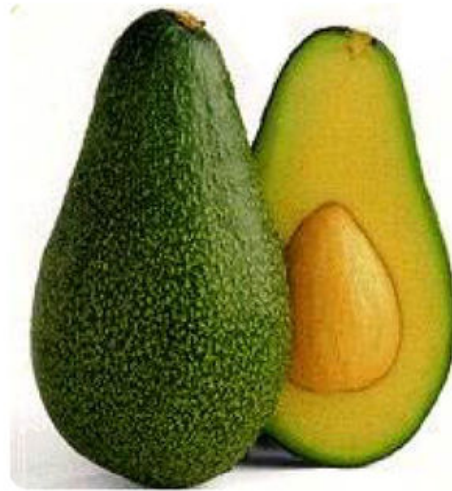
A cup of broccoli has about 11 grams of fiber



A cup of green peas has about 9 grams of fiber



A pear has about 5 grams of fiber.



An avocado has about 12 grams of fiber.

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**FIGURE 1.3**

Between the ages of 9 and 13 years, girls need about 26 grams of fiber a day, and boys need about 31 grams of fiber a day. Do you know other foods that are high in fiber?

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- Make up muscles.
- Help control body processes.
- Help the body fight off bacteria and other “foreign invaders.”
- Carry substances in the blood.

If you eat more proteins than you need for these purposes, the extra proteins are used for energy. One gram of protein provides four calories of energy. This is the same amount as one gram of sugar or starch. How many grams of proteins you need each day are shown in **Figure 1.4**. It also shows some foods that are good sources of proteins.



An 8 oz. glass of milk has about 8 grams of protein.



A 3 oz. serving of chicken has about 20 grams of protein.



A cup of kidney beans has about 16 grams of protein.

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#### FIGURE 1.4

Between the ages of 9 and 13 years, you need about 34 grams of proteins a day. What other foods do you think are good sources of proteins?

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There are many different amino acids, the building blocks of proteins, but your body needs only 20 of them. Your body can make ten of these amino acids from simpler substances. The other ten amino acids must come from the proteins in foods. These ten are called **essential amino acids**. Only animal foods, such as milk and meat, contain all ten essential amino acids in a single food. Plant foods are missing one or more essential amino acids. However, by eating a combination of plant foods, such as beans and rice, you can get all ten essential amino acids.

### Lipids

Lipids are nutrients such as fats that store energy. The heart and skeletal muscles rely mainly on lipids for energy. One gram of lipids provides nine calories of energy. This is more than twice the amount provided by carbohydrates or proteins. Lipids have several other roles in the body. For example, lipids:

- Protect nerves.
- Help control blood pressure.
- Help blood to clot.
- Make up the membranes that surround cells.

Fats are one type of lipid. Stored fat gives your body energy to use for later. It's like having money in a savings account. It's there in case you need it. Stored fat also cushions and protects internal organs. In addition, it insulates the body. It helps keep you warm in cold weather.

Fats and other lipids are necessary for life. However, they can be harmful if you eat too much of them, or the wrong type of fats. Fats can build up in the blood and damage blood vessels. This increases the risk of heart disease.

There are two types of lipids, saturated and unsaturated.

1. Saturated lipids can be unhealthy, even in very small amounts. They are found mainly in animal foods, such as meats, whole milk, and eggs. Saturated lipids increase cholesterol levels in the blood. Cholesterol is a fatty substance that is found naturally in the body. Too much cholesterol in the blood can lead to heart disease. It is best to limit the amount of saturated lipids in your diet.

1. Unsaturated lipids are found mainly in plant foods, such as vegetable oil, olive oil, and nuts. Unsaturated lipids are also found in fish, such as salmon. Unsaturated lipids are needed in small amounts for good health because your body cannot make them. Most lipids in your diet should be unsaturated.

Another type of lipid is called **trans fat**. Trans fats are manufactured and added to certain foods to keep them fresher for longer. Foods that contain trans fats include cakes, cookies, fried foods, and margarine. Eating foods that contain trans fats increases the risk of heart disease. You should do your best to eat fewer foods that contain it.

Beginning in 2010, California banned trans fats from restaurant products, and, beginning in 2011, from all retail baked goods.

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## Vitamins and Minerals

Vitamins and minerals are also nutrients. They do not provide energy, but they are needed for good health.

### Vitamins

**Vitamins** are substances that the body needs in small amounts to function properly. Humans need 13 different vitamins. Some of them are listed in **Table 1.1**. The table also shows how much of each vitamin you need each day. Vitamins have many roles in the body. For example, Vitamin A helps maintain good vision. Vitamin B<sub>9</sub> helps form red blood cells. Vitamin K is needed for blood to clot when you have a cut or other wound.

**TABLE 1.1: Vitamins Needed For Good Health**

Vitamin	One Reason You Need It	Some Foods that Have It	How Much of It You Need Each Day (at ages 9–13 years)
Vitamin A	Needed for good vision	Carrots, spinach, milk, eggs	600 $\mu\text{g}$ ( $1 \mu\text{g} = 1 \times 10^{-6} \text{ g}$ )
Vitamin B <sub>1</sub>	Needed for healthy nerves	Whole wheat, peas, meat, beans, fish, peanuts	0.9 mg ( $1 \text{ mg} = 1 \times 10^{-3} \text{ g}$ )
Vitamin B <sub>3</sub>	Needed for healthy skin and nerves	Beets, liver, pork, turkey, fish, peanuts	12 mg
Vitamin B <sub>9</sub>	Needed to make red blood cells	Liver, peas, dried beans, green leafy vegetables	300 $\mu\text{g}$
Vitamin B <sub>12</sub>	Needed for healthy nerves	Meat, liver, milk, shellfish, eggs	1.8 $\mu\text{g}$
Vitamin C	Needed for growth and repair of tissues	Oranges, grapefruits, red peppers, broccoli	45 mg
Vitamin D	Needed for healthy bones and teeth	Milk, salmon, tuna, eggs	5 $\mu\text{g}$
Vitamin K	Needed for blood to clot	Spinach, Brussels sprouts, milk, eggs	60 $\mu\text{g}$

Some vitamins are produced in the body. For example, vitamin D is made in the skin when it is exposed to sunlight. Vitamins B<sub>12</sub> and K are produced by bacteria that normally live inside the body. Most other vitamins must come from foods. Foods that are good sources of vitamins are listed in **Table 1.1**. They include whole grains, vegetables, fruits, and milk.

Not getting enough vitamins can cause health problems. For example, too little vitamin C causes a disease called



scurvy. People with scurvy have bleeding gums, nosebleeds, and other symptoms. Getting too much of some vitamins can also cause health problems. The vitamins to watch out for are vitamins A, D, E, and K. These vitamins are stored by the body, so they can build up to high levels. Very high levels of these vitamins can even cause death, although this is very rare.

## Minerals

**Minerals** are chemical elements that are needed for body processes. Minerals are different from vitamins because they do not contain the element carbon. Minerals that you need in relatively large amounts are listed in **Table 1.2**. Minerals that you need in smaller amounts include iodine, iron, and zinc.

Minerals have many important roles in the body. For example, calcium and phosphorus are needed for strong bones and teeth. Potassium and sodium are needed for muscles and nerves to work normally.

**TABLE 1.2: Minerals Needed For Good Health**

Mineral	One Reason You Need It	Some Foods that Have It	How Much of It You Need Each Day (at ages 9–13 years)
Calcium	Needed for strong bones and teeth	Milk, soy milk, green leafy vegetables	1,300 mg
Chloride	Needed for proper balance of water and salts in body	Table salt, most packaged foods	2.3 g
Magnesium	Needed for strong bones	Whole grains, green leafy vegetables, nuts	240 mg
Phosphorus	Needed for strong bones and teeth	Meat, poultry, whole grains	1,250 mg
Potassium	Needed for muscles and nerves to work normally	Meats, grains, bananas, orange juice	4.5 g
Sodium	Needed for muscles and nerves to work normally	Table salt, most packaged foods	1.5 g

Your body cannot produce any of the minerals that it needs. Instead, you must get minerals from the foods you eat. Good sources of minerals are listed in **Table 1.2**. They include milk, green leafy vegetables, and whole grains.

Not getting enough minerals can cause health problems. For example, too little calcium may cause osteoporosis. This is a disease in which bones become soft and break easily. Getting too much of some minerals can also cause health problems. Many people get too much sodium. Sodium is added to most packaged foods. People often add more sodium to their food by using table salt. Too much sodium causes high blood pressure in some people.

## Water

Did you know that water is also a nutrient? By weight, your cells are about two-thirds water, so you cannot live without it. In fact, you can survive for only a few days without water.

You lose water in each breath you exhale. You also lose water in sweat and urine. If you do not take in enough water to replace the water that you lose, you may develop dehydration. Symptoms of dehydration include dry mouth, headaches, and feeling dizzy. Dehydration can be very serious. Severe dehydration can even cause death.

When you exercise, especially on a hot day, you lose more water in sweat than you usually do. You need to drink extra water before, during, and after exercise. The children in **Figure 1.5** are drinking water while playing outside

on a warm day. They need to drink water to avoid dehydration.



**FIGURE 1.5**

When you are active outside on a warm day, it's important to drink plenty of water. You need to replace the water you lose in sweat.

Getting too much water can also be dangerous. Excessive water may cause a condition called hyponatremia. In this condition, water collects in the brain and causes it to swell. Hyponatremia can cause death. It requires emergency medical care.

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## Lesson Summary

- The body needs food for energy, building materials, and substances that help control body processes.
- Carbohydrates, proteins, and lipids provide energy and have other important roles in the body.
- Vitamins and minerals do not provide energy but are needed in small amounts for the body to function properly.
- The body must have water to survive.

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## Review Questions

### Recall

1. What are three reasons that your body needs food?
2. Which nutrients can be used for energy?
3. What are some foods that are good sources of vitamin C?
4. What are two minerals that are needed for strong bones and teeth?

### Apply Concepts

5. Name two types of fiber and state the role of each type of fiber in the body.
6. Your body needs 20 different amino acids. Why do you need to get only ten of these amino acids from food? Name foods you can eat to get these ten amino acids.
7. Compare and contrast saturated and unsaturated lipids.
8. Identify three vitamins that are produced in the body. How are they produced?

9. Why do you need to drink extra water when you exercise on a hot day? What might happen if you did not drink extra water?

### Critical Thinking

10. List some of the functions of proteins in the body. Based on your list, predict health problems people might have if they do not get enough proteins in foods.

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### Points to Consider

Think about how you can be sure you are getting enough nutrients.

- Do you think knowing the nutrients in the foods you eat are important?
- Do you have to keep track of all the nutrients you eat, or is there an easier way to choose foods that provide the nutrients you need?

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