

Nutrients: Carbohydrates, Proteins, and Fats

In order to survive, the human body needs the nutrients found in food. These nutrients, which perform a number of life-sustaining functions in the body, are divided into six main categories: carbohydrates, proteins, fats, vitamins, minerals, and water. Each has a unique function in the normal growth and functioning of your body.

HEALTH TERMS

carbohydrates

glucose

glycogen

proteins

amino acids

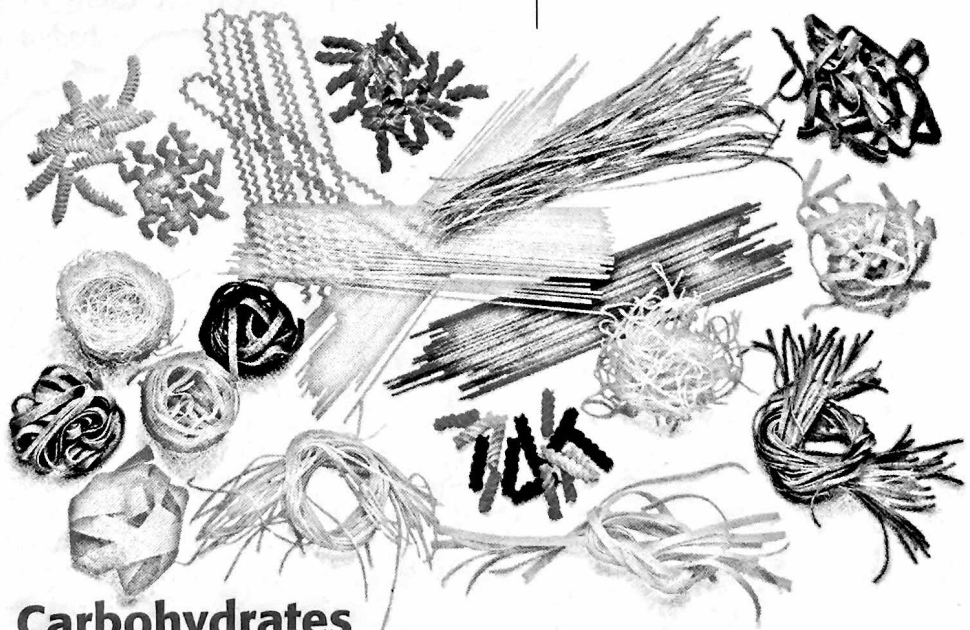
lipid

linoleic acid

cholesterol

HEALTH CONCEPTS

- The nutrients found in food are essential to life.
- Carbohydrates are the body's chief fuel.
- A healthful eating plan includes appropriate amounts of protein to build and repair body tissue.
- Limiting fat and dietary cholesterol is a guideline for health.



Carbohydrates

Do you enjoy eating potatoes, pasta, and bread? These foods are rich in carbohydrates. Made up of carbon, oxygen, and hydrogen, **carbohydrates** are *the starches and sugars found in foods*. Carbohydrates are the body's preferred source of energy, providing four calories per gram.

Depending on their chemical makeup, carbohydrates are classified into one of two types—simple or complex. Health experts recommend that 55 to 65 percent of your daily calories come from carbohydrates, mainly complex carbohydrates.

Simple Carbohydrates

Simple carbohydrates, or sugars, are present naturally in fruits, some vegetables, and milk. These sugars are called fructose in fruit, lactose in milk, maltose in grain, and sucrose in table sugar. Sugars are also added to many manufactured food products, such as candy, cookies, soft drinks, and other concentrated sweets. In recent decades, food manufacturers have also begun adding corn syrup and other forms of sugar to soups, salad dressings, breads, and other foods you may not characterize as being sweet.

Complex Carbohydrates

Complex carbohydrates, or starches, are found in great supply in rice and other grains, seeds, nuts, legumes (dried peas and beans), and tubers (potatoes, cassava, yams, taro). Starches are called complex carbohydrates because they are chemically more complex than simple carbohydrates. They are made of many sugars linked together.

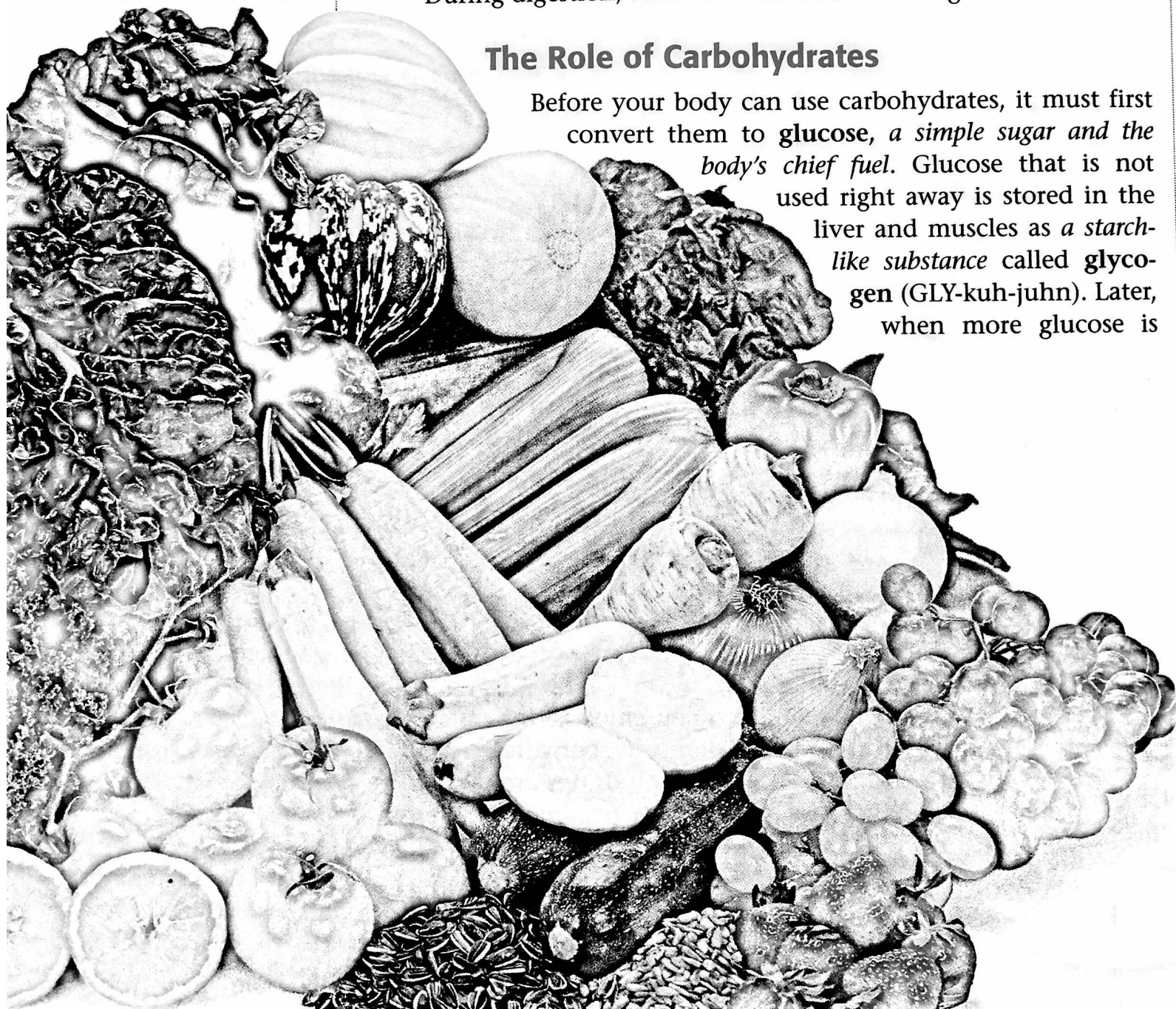
During digestion, starches break down into sugars.

The Role of Carbohydrates

Before your body can use carbohydrates, it must first convert them to **glucose**, a simple sugar and the body's chief fuel. Glucose that is not used right away is stored in the liver and muscles as a starch-like substance called **glycogen** (GLY-kuh-juhn). Later, when more glucose is

Which of these foods do you eat regularly? What other foods do you enjoy eating?

ACTIVITY List the foods in the picture that are high in complex carbohydrates.



needed, the glycogen is converted back to glucose. When people consume more carbohydrates than their body needs for energy or can store as glycogen, this excess is stored as adipose tissue, or body fat.

Fiber

Found in the tough, stringy part of vegetables, fruits, and grains, fiber is a special form of complex carbohydrate. Although it cannot be digested and used as energy, fiber serves other vital functions. It helps move waste through your **digestive system** and helps prevent constipation, appendicitis, and other intestinal problems. Eating enough fiber throughout your life may reduce your risk of some cancers and heart disease. It is also instrumental in controlling diabetes. Some types of fiber seem to help lower blood cholesterol and control blood sugar, though this connection is only partially understood.

For people watching their weight, fiber offers other benefits. Fiber-rich foods are bulky, so they offer a feeling of fullness. They tend to be lower in fat and calories, and they may take longer to chew, thereby slowing the pace of your meal.

You can increase your fiber intake by eating an abundance of vegetables and fruits, especially those with edible skins and seeds. Other good sources include whole-grain products, such as bran cereals, whole-wheat breads and pasta, whole rye bread, brown rice, oatmeal, corn tortillas, and popcorn. It is recommended that you eat 25 grams of fiber a day.

Proteins

A vital part of every body cell, **proteins** are *nutrients that help build and maintain body tissues*. Muscle, bone, connective tissue, teeth, skin, blood, and vital organs all contain protein. Like carbohydrates, proteins provide four calories per gram. Like both carbohydrates and fats, excess protein calories are converted to fat for storage.

Just as letters of the alphabet are arranged to make different words, proteins are made of chains of building blocks called amino acids. These **amino** (a-MEE-noh) **acids**, *substances that make up body proteins*, can be arranged in numerous ways. Your body can make all but nine of the 20 different amino acids. These nine are called *essential amino acids*, because they must come from foods you eat.

Complete and Incomplete Proteins

Protein-rich foods are categorized into *complete protein* or *incomplete protein* sources depending on the amino acids these foods contain.

- **Complete proteins** are foods that contain all the essential amino acids that the body needs and in the proper amounts. These sources include animal products, such as fish, meat, poultry, eggs, milk, cheese, yogurt, and many soybean products.



hot link

digestive system For more information on the digestive system and its functions, see Chapter 18, page 412.



Did You Know?

- Americans eat their own weight in sugar every year.
- The term *protein* comes from a Greek word meaning "of prime importance." The name is fitting because without protein, life could not exist.

- **Incomplete proteins** are foods that lack some of the essential amino acids. Such sources are foods derived from the seeds of plants: legumes, nuts, whole grains, and the seeds themselves. Eating various incomplete protein sources—legumes with grains, for example—yields the equivalent of a complete protein. They need not be eaten at the same meal as long as the day's meals supply both of them. The illustration below shows some examples of complete proteins from incomplete sources.

▼ **By combining incomplete protein sources over the course of a day, you can be sure your body is getting complete sources of protein.**

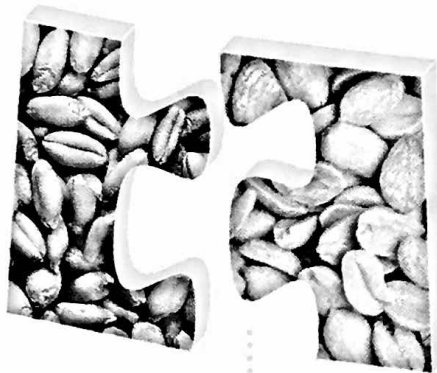
ACTIVITY *Look at the puzzle pieces and identify as many of the seeds pictured as you can. They represent foods you can combine to get complete proteins.*

The Role of Proteins

During each of the normal periods of marked growth—infancy, childhood, adolescence, and pregnancy—amino acids build new body tissues. Throughout life, new proteins form constantly to replace damaged or worn-out body cells.

Proteins in enzymes, hormones, and antibodies also help regulate many body processes. Enzymes are substances that control the rate of thousands of biochemical reactions in your body cells. Hormones regulate reactions. Antibodies help identify and destroy bacteria and viruses that cause disease in the body.

PROTEIN COMBINATIONS



1 slice of bread
+ 2 oz. of peanut butter



2 oz. of tofu
+ 1 cup of rice



1 tortilla
+ 1 cup of beans

Incomplete Proteins

Fats

You have no doubt seen the following words printed on food packages: "Now with less fat." "Reduced fat." "Low fat." "No fat." With all the media attention that fat has received in recent years, you might wonder why it is considered a nutrient at all. Although consuming too much fat is unhealthy, as these labels may indicate, the fact is your body needs some fat. Fats represent the most concentrated form of energy available. Gram for gram, fats deliver more than twice the energy of either carbohydrates or proteins.

Chemically, fats are a type of **lipid** (LIP-uhd), a *fatty substance that does not dissolve in water*. Like carbohydrates, fats are composed of carbon, hydrogen, and oxygen atoms. Fats are made of fatty acids. Fats are generally classified as either saturated or unsaturated, depending on their chemical composition. Fats are a combination of both types.

Saturated Fats

A fatty acid is said to be saturated when the fatty acid holds all the hydrogen atoms it can. Animal fats and tropical oils, such as palm oil, palm kernel oil, and coconut oil, have a high proportion of saturated fats. Fats in beef, pork, egg yolks, and dairy foods are higher in saturated fatty acids than fats in chicken and fish. Foods high in saturated fats are usually solid or semi-solid at room temperature. High intake of saturated fats is associated with an increased risk of heart disease.

Unsaturated Fats

A fatty acid is described as unsaturated when it is missing one or more pairs of hydrogen atoms. Most vegetable fats, including olive, canola, soybean, corn, and cottonseed oils, contain a higher proportion of unsaturated fatty acids. Such fats become liquids, or oils, at room temperature. Unsaturated fats have been associated with a reduced risk of heart disease. Be careful, however, when selecting products made with vegetable oils since processing can change a fat's characteristics. Hydrogenation—the adding of missing hydrogen atoms—makes them more saturated and firmer in texture. Margarine, for example, is vegetable oil but in hydrogenated form.

The Role of Fats

Besides providing nine calories per gram of energy, fats are integral to other important health functions as well. They carry vitamins A, D, E, and K into your blood and serve as sources of **linoleic** (lih-noh-LAY-ik) **acid**. This is *an essential fatty acid not made in the body but which is essential for growth and healthy skin*. Fats in food add flavor, and they help satisfy hunger since they take longer to digest than



Olive oil

Canola oil

Vegetable oil

▲ **More and more, Americans are switching to less saturated forms of fat in their diets.**

ACTIVITY *Can you think of other trends that show Americans are becoming more health-conscious?*

HEALTH Online



Using a research tool at health.glencoe.com, become familiar with good sources of each nutrient. Record what you have eaten in the last three meals and check which nutrients the foods contain. Are you lacking important nutrients?

carbohydrates and proteins. Body fat plays a different role than dietary fat does. Body fat surrounds and cushions your vital organs, protecting them from injury, and it insulates your body against excessive heat and cold.

Your body needs only a moderate amount of dietary fat each day. The average teenage girl, who needs about 2,200 calories daily, should have no more than 66 grams of fat daily. Teenage boys, who use an average of 2,800 calories daily, should have no more than 84 grams of fat daily. Too much fat is linked to obesity, heart attacks, and other health problems. The *Dietary Guidelines for Americans* and other reports from advisory groups recommend that most Americans cut their fat intake to no more than 30 percent of calories. These groups further suggest replacing some saturated fats with unsaturated fats.

Cholesterol

Cholesterol is a fatlike substance produced in the liver of all animals and, therefore, found only in foods of animal origin—meats, poultry, fish, eggs, and dairy products. Your body needs some cholesterol, like fat, but it can make what it needs. Cholesterol is instrumental, for example, in the production of the sex hormones, of vitamin D (in the presence of sunlight), and of the protective sheath around nerve fibers. At the same time, like fat, elevated blood cholesterol levels in the blood constitute a major risk factor for heart and other circulatory diseases. Consumption of dietary fat, especially saturated fat, tends to raise blood cholesterol levels. Limiting these fats may reduce the risk.