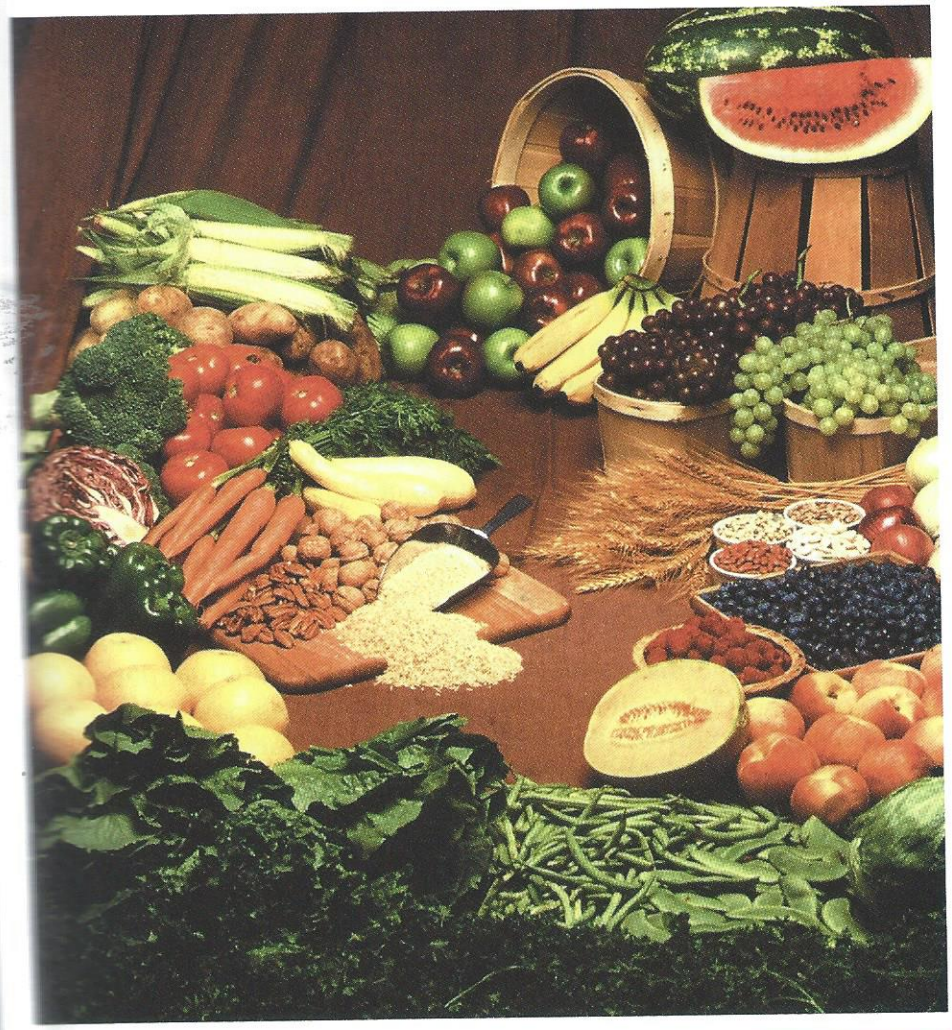


Figure 8-3 Fruits, vegetables, grains, and some dairy products are good sources of carbohydrates. (Courtesy of the Agricultural Research Service, USDA)

than the type consumed. Eating sugary foods, however, is an easy way to overload the carbohydrate allotment.

In planning a diet, nutritionists recommend that 45% to 50% of daily calories come from carbohydrate sources, with the bulk of these calories supplied by complex carbohydrates. As stated earlier, 1 gram of carbohydrate equals 4 calories. This means a daily diet should contain at least:

- 6 servings of grains such as bread, pasta, cereal, or rice
- 3 servings of vegetables
- 2 servings of fruit

It is estimated that American adults get about 20% of their daily calories from sugar. In a 2,000-calorie diet, that equals about 400 calories

(100 grams), or the equivalent of 25 teaspoons of sugar each day. That amounts to about 130 pounds of sugar being consumed by the typical American adult each year. Instead, the ideal is about half that: approximately 10% of total calories, or 200 calories (50 grams) on a 2,000-calorie-a-day diet.

The obvious way to cut back on refined sugar is to limit the amount of candy, cake, cookies, pies, ice cream, and other sweets eaten and to avoid adding table sugar to foods and beverages. But eliminating sugar is not always so easy, because sugar comes in many forms.

monosaccharide *The simplest form of carbohydrate, consisting of sugars that cannot be further reduced by the body, such as glucose, fructose, and galactose.*

- **Monosaccharides** include glucose (sometimes called dextrose), fructose, and galactose; all have the same number and types of atoms, but each has a different arrangement. The different arrangements of atoms account for the differences in sweetness. Glucose (one of the two sugars in every disaccharide) is mildly sweet; fructose (found in fruits and honey) is intensely sweet; galactose (a component of milk sugar) is hardly sweet at all.

disaccharide *A form of carbohydrate consisting of double sugars, such as sucrose, maltose, and lactose; these forms of sugars must be reduced to monosaccharides before they can be absorbed by the body.*

- **Disaccharides** include sucrose (table sugar), lactose (milk sugar), and maltose (produced in plants and in the human body when starch breaks down). They are all pairs of two monosaccharides: sucrose is glucose and fructose; lactose is glucose and galactose; and maltose is two molecules of glucose.

polysaccharide *A form of complex carbohydrate containing combinations of monosaccharides, such as starch, cellulose, and glycogen.*

- **Polysaccharides** (starches, glycogen, and cellulose) do not taste sweet. They are composed of hundreds, even thousands, of glucose molecules linked together. They are found in foods such as potatoes, rice, and dried beans.

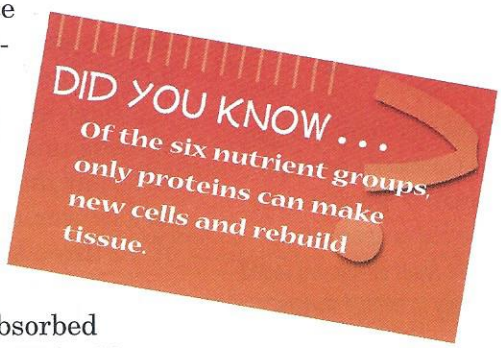
For purposes of overall health, all sugars are created equal. Honey, fructose, sucrose, corn syrup, maple syrup, and molasses are no better (or worse) than refined white sugar. They are absorbed differently, but all sugars eventually break down in the body and end up as glucose. Although refined white sugar has been blamed for an endless array of health problems (including hypoglycemia or low blood sugar, depression, yeast infections, and hyperactivity), there is no hard evidence to back up these claims. Sugar, however, does play a role in tooth decay; bacteria in the mouth break down sugar and produce an acid that erodes tooth enamel. However, the sugar that contributes to tooth decay can just as easily come from the breakdown of starchy foods, such as bread and potatoes, as it can from candy bars. Sugary foods that stay in the mouth (soft drinks and fruit drinks sipped throughout the day, for example) are worse than sugar added to the morning coffee. Regular brushing and flossing to remove sugar before any damage occurs is essential to a healthy mouth.

Sugar can contribute to obesity, which is linked to many diseases and disorders. These include heart disease, high blood pressure, diabetes, gallbladder problems, joint stress, and some cancers. Although dietary fat is often singled out as the main culprit in weight gain, eating too many calories from any source will cause weight gain.

Protein

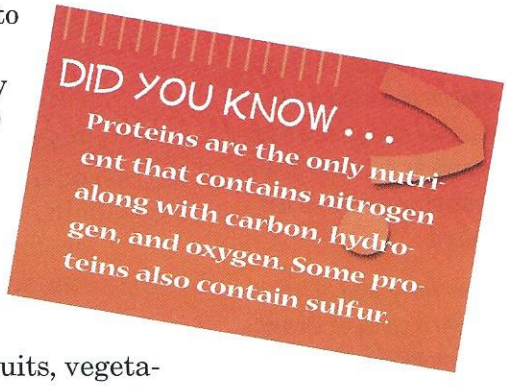
Proteins form the body's main structural elements, and are found in every cell and tissue. The body uses proteins for growth and to build and repair bone, muscles, connective tissue, skin, internal organs, and blood. Hormones, antibodies, and the enzymes that regulate the body's chemical reactions are all made of protein. Without the right proteins, blood will not clot properly and cuts will not heal. If available carbohydrates and fat cannot meet an individual's energy needs, proteins will be broken down and used as a source of emergency energy. Each gram of protein equals 4 calories of energy.

protein *An essential nutrient that contains nitrogen and helps the body grow, build, and repair tissue.*



Each protein is a large, complex molecule made up of a string of building blocks called *amino acids*. The 20 amino acids the body needs can be linked in thousands of different ways to form thousands of different proteins, each with a unique function in the body. Both the amino acids manufactured in the liver and those derived from the breakdown of the proteins we eat are absorbed into the bloodstream and taken up by the cells and tissues to build new proteins as needed.

The body cannot use food protein directly, even though the amino acids in food and in the body are the same. After protein is ingested, digestive enzymes break down the protein into shorter amino acid chains (polypeptides and then peptides) and finally into individual amino acids. The amino acids then enter the bloodstream and travel to the cells, where they are incorporated into proteins the body needs.



The quality of a food protein is measured in part by its amino acid content. There are two types: 9 of the 20 amino acids required by human beings are considered *essential* because they come only from the diet; the other 11 are considered *nonessential* because the body can make them. A *complete protein* contains all the essential amino acids in amounts the body needs. Animal proteins from eggs, meat, fish, poultry, cheese, and milk are generally complete. Plant proteins from fruits, vegetables, grains, and beans are usually low in one or more essential amino acids and are considered incomplete. A well-balanced vegetarian diet, however, can provide the body with all the needed amino acids.

The National Research Council of the National Academy of Sciences considers the average adult's daily requirements to be 0.8 grams (g) of protein for each kilogram (kg) of body weight. To determine this requirement, divide body weight by 2.2 (the number of pounds per kilogram), and then multiply the answer obtained by 0.8 (g of protein for each kg of body weight).

Fat

dietary fat *A nutrient that is a source of energy, insulates boyd tissues, and transports fat-soluble vitamins.*

fatty acid *A metabolic byproduct from the breakdown of fat.*

saturated fatty acid *Fats that contain the maximum number of hydrogen atoms attached to carbon atoms; these types of fats are found mainly in animal sources.*

monounsaturated fatty acid *Fats that do not contain high levels of hydrogen in combination with carbon atoms; these types of fats are found mainly in vegetable, olive, and peanut oils.*

polyunsaturated fatty acid *Fats that contain only limited amounts of hydrogen attached to carbon atoms; these types of fats are found mainly in some forms of vegetable oils and seafood.*

trans fatty acid *A type of fat that is produced through the process of hydrogenation; this type of fat is found mainly in processed foods such as margarine and snack foods.*

Dietary fat is required to carry out a number of functions. It is a carrier of fat-soluble vitamins and provides certain essential fatty acids. Fat is also an important source of energy, and is used interchangeably with protein and carbohydrates. Each gram of fat contains a little more than twice the calories (9) of carbohydrates and protein. Fats occur naturally in food and play an important role in nutrition. Fats and oils provide a concentrated source of energy for the body. Fats are used to store energy in the body, insulate body tissues, and transport fat-soluble vitamins through the blood.

Not all fats and oils are created equal. Fats and oils are made up of basic units called **fatty acids**. Each type of fat or oil is a mixture of different fatty acids. Because overall fat intake is associated with obesity, cancer, and heart disease risk, it is a good idea to limit your intake of all three kinds of fats.

- **Saturated fatty acids** are found chiefly in animal sources, such as meat, poultry, whole or reduced-fat milk, and butter. Some vegetable oils, like coconut, palm kernel oil, and palm oil, are saturated. Saturated fats are usually solid at room temperature. A diet high in saturated fats has been associated with increased risk of cancer and heart disease.
- **Monounsaturated fatty acids** are found mainly in vegetable oils, such as canola, olive, and peanut oils. They are liquid at room temperature. Monounsaturated fats and polyunsaturated (found in vegetable oil, corn oil, and safflower oil) are less closely linked to disease unless they are altered during processing by hydrogenation to trans fatty acids.
- **Polyunsaturated fatty acids** are found mainly in vegetable oils, such as safflower, sunflower, corn, flaxseed, and canola oils. Polyunsaturated fats are also the main fats found in seafood. They are liquid or soft at room temperature. Specific polyunsaturated fatty acids, such as linoleic acid and alpha-linoleic acid, are called *essential fatty acids*. They are necessary for cell structure and making hormones. Essential fatty acids must be obtained from the foods eaten.
- **Trans fatty acids** are formed when vegetable oils are processed into margarine or shortening. Sources of trans fats