

# Nutrition



## LOOKING AHEAD...

After reading this chapter, you should be able to:

- List the essential nutrients and describe the functions they perform in the body
- Describe the guidelines that have been developed to help people choose a healthy diet, avoid nutritional deficiencies, and reduce their risk of diet-related chronic diseases
- Describe nutritional guidelines for vegetarians and for special population groups
- Explain how to use food labels and other consumer tools to make informed choices about foods
- Put together a personal nutrition plan based on affordable foods that you enjoy and that will promote wellness, today and in the future

## TEST YOUR KNOWLEDGE

1. It is recommended that all adults consume 1–2 servings each of fruits and vegetables every day. True or false?
2. Candy is the leading source of added sugars in the American diet. True or false?
3. Which of the following is not a whole grain?
  - a. brown rice
  - b. wheat flour
  - c. popcorn

### Answers

1. **False.** For someone consuming 2000 calories per day, a minimum of 9 servings per day—4 of fruits and 5 of vegetables—is recommended. This is the equivalent of 4 1/2 cups per day.
2. **False.** Regular (nondiet) sodas are the leading source of added sugars. Together with energy drinks and sports drinks, they account for 36% of the added sugars in the American diet, and added sugars contribute an average of 16% of the total calories in American diets. Each 12-ounce soda supplies about 10 teaspoons of sugar, or nearly 10% of the calories in a 2000-calorie diet.
3. **b.** Unless labeled “whole wheat,” wheat flour is processed to remove the bran and germ and is not a whole grain.



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GET A BETTER GRADE. TRY LEARNSMART.

In your lifetime, you will spend about 6 years eating—about 70,000 meals and 60 tons of food. What you eat affects your energy level, well-being, and overall health. Your nutritional habits help determine your risk of major chronic diseases, including heart disease, cancer, stroke, and diabetes. Choosing foods that provide the nutrients you need while limiting the substances linked to disease should be an important part of your daily life.

Choosing a healthy diet is a two-part process. First, you have to know which nutrients you need and in what amounts. Second, you have to translate those requirements into a diet consisting of foods you like that are both available and affordable. Once you know what constitutes a healthy diet for you, you can adjust your current diet to bring it into line with your goals.

This chapter explains the basic principles of **nutrition**. It introduces the six classes of essential nutrients, explaining their role in the functioning of the body. It also provides guidelines that you can use to design a healthy eating plan. Finally, it offers practical tools and advice to help you apply the guidelines to your life.

## NUTRITIONAL REQUIREMENTS: COMPONENTS OF A HEALTHY DIET

You probably think about your diet in terms of the foods you like to eat. More important for your health, though, are the nutrients contained in those foods. Your body requires proteins, fats, carbohydrates, vitamins, minerals, and water—about 45 **essential nutrients**. In this context, the word *essential* means that you must get these substances from food because your body is unable to manufacture them, or at least not fast enough to meet your physiological needs. The six classes of nutrients, along with their functions and major sources, are listed in Table 8.1

The body needs some essential nutrients in relatively large amounts; these **macronutrients** include protein, fat, carbohydrate, and water. **Micronutrients**, such as vitamins and minerals, are required in much smaller amounts. Your body obtains nutrients through the process of **digestion**, which breaks down food into compounds that the gastrointestinal tract can absorb and the body can use (Figure 8.1, p. 226). A diet that provides enough essential nutrients is vital because they provide energy, help build and maintain body tissues, and help regulate body functions.

## Calories

The energy in foods is expressed as **kilocalories**. One kilocalorie represents the amount of heat it takes to raise the temperature of one liter of water 1°C. A person needs about 2000 kilocalories a day to meet his or her energy needs. In common usage, people refer to kilocalories as *calories*, which is a much smaller energy unit: 1 kilocalorie contains 1000 calories. This text uses the familiar word *calorie* to stand for the larger energy unit; you'll also find *calorie* used on food labels.

Of the six classes of essential nutrients, three supply energy:

- Fat = 9 calories per gram
- Protein = 4 calories per gram
- Carbohydrate = 4 calories per gram

Alcohol, though not an essential nutrient, also supplies energy, providing 7 calories per gram. (One gram equals a little less than 0.04 ounce.) The high caloric content of fat is one reason experts often advise against high fat consumption; most of us do not need the extra calories to meet energy needs. Regardless of their source, calories consumed in excess of energy needs can be converted to fat and stored in the body.

**Table 8.1** The Six Classes of Essential Nutrients

NUTRIENT	FUNCTION	MAJOR SOURCES
Proteins products, (4 calories/gram)	Form important parts of muscles, bone, blood, enzymes, some hormones, and cell membranes; repair tissue; regulate water and acid-base balance; help in growth; supply energy	Meat, fish, poultry, eggs, milk legumes, nuts
Carbohydrates (4 calories/gram)	Supply energy to cells in brain, nervous system, and blood; supply energy to muscles during exercise	Grains (breads and cereals), fruits, vegetables, milk
Fats (9 calories/gram)	Supply energy; insulate, support, and cushion organs; provide medium for absorption of fat-soluble vitamins	Animal foods, grains, nuts, seeds, fish, vegetables
Vitamins	Promote (initiate or speed up) specific chemical reactions within cells	Abundant in fruits, vegetables, and grains; also found in meat and dairy products
Minerals	Help regulate body functions; aid in growth and maintenance of body tissues; act as catalysts for release of energy	Found in most food groups
Water	Makes up 50–60% of body weight; provides medium for chemical reactions; transports chemicals; regulates temperature; removes waste products	Fruits, vegetables, liquids



## Tracking Your Junk Food Intake

How much junk food do you eat on any given day? Let's find out. Write down all the different kinds of junk food you eat during the day today:

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Now, write down your reason for eating each of those items:

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Whether you eat junk for pleasure or to help cope with stress, it pays to be mindful of your eating habits. Consider your reasons for eating junk food, and try to catch yourself the next time you're tempted to reach for some. If you're able to stop yourself, you can make healthier choices.



### Fitness Tip

A pound of body fat is equal to 3500 calories. If you eat 100 calories more than you expend every day, you will gain more than 10 pounds in a year.

Just meeting energy needs is not enough. Our bodies need enough of the essential nutrients to grow and function properly. Practically all foods contain combinations of nutrients, although foods are commonly classified according to their predominant nutrients. For example, spaghetti is considered a carbohydrate food, although it contains small amounts of other nutrients. The following sections discuss the functions and sources of each class of nutrients.

## Proteins—The Basis of Body Structure

**Proteins** form important parts of the body's main structural components: muscles and bones. Proteins also form

**nutrition** The science of food and how the body uses it in health and disease.

**essential nutrients** Substances the body must get from foods because it cannot manufacture them at all or fast enough to meet its needs. These nutrients include proteins, fats, carbohydrates, vitamins, minerals, and water.

**macronutrient** An essential nutrient required by the body in relatively large amounts.

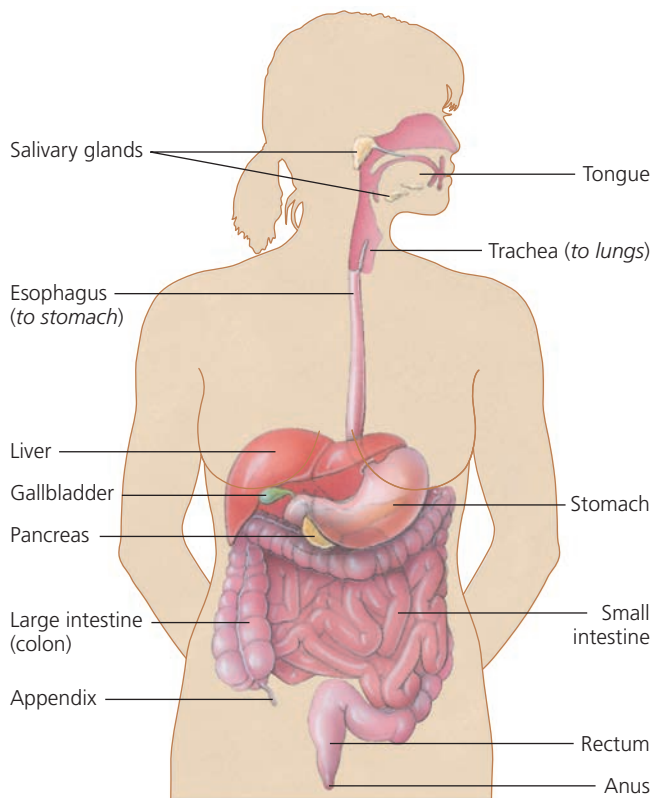
**micronutrient** An essential nutrient required by the body in minute amounts.

**digestion** The process of breaking down foods into compounds the gastrointestinal tract can absorb and the body can use.

**kilocalorie** A measure of energy content in food; 1 kilocalorie represents the amount of heat needed to raise the temperature of 1 liter of water 1°C; commonly referred to as *calorie*.

**protein** An essential nutrient that forms important parts of the body's main structures (muscles and bones) as well as blood, enzymes, hormones, and cell membranes; also provides energy.

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**FIGURE 8.1** The digestive system.

Food is partially broken down by being chewed and mixed with saliva in the mouth. After traveling to the stomach via the esophagus, food is broken down further by stomach acids and other secretions. As food moves through the digestive tract, it is mixed by muscular contractions and broken down by chemicals. Most absorption of nutrients occurs in the small intestine, aided by secretions from the pancreas, gallbladder, and intestinal lining. The large intestine reabsorbs excess water; the remaining solid wastes are collected in the rectum and excreted through the anus.

important parts of blood, enzymes, cell membranes, and some hormones. As mentioned earlier, proteins also provide energy (4 calories per gram) for the body.

**Amino Acids** The building blocks of proteins are called **amino acids**. Twenty common amino acids are found in food. Nine of these are essential (or indispensable). The other 11 amino acids can be produced by the body as long as the necessary components are supplied by foods.

**Complete and Incomplete Proteins** Individual protein sources are considered “complete” if they supply all the essential amino acids in adequate amounts and “incomplete” if they do not. Meat, fish, poultry, eggs, milk, cheese, and soy provide complete proteins. Incomplete proteins, which come from plant sources such as nuts and **legumes** (dried beans and peas), are good sources of most essential amino acids but are usually low in one or two.

Certain combinations of vegetable proteins, such as wheat and peanuts in a peanut butter sandwich, allow

**Table 8.2**

**Protein Content of Common Food Items**

ITEM	PROTEIN (GRAMS)
3 ounces lean meat, poultry, or fish	20–25
½ cup tofu	20–25
1 cup dried beans	15–20
1 cup milk, yogurt	8–12
1½ ounces cheese	8–12
1 serving of cereals, grains, nuts, vegetables	2–4

each vegetable protein to make up for the amino acids missing in the other protein. The combination yields a complete protein. It was once believed that vegetarians had to “complement” their proteins at each meal in order to receive the benefit of a complete protein. It is now known, however, that proteins consumed throughout the course of the day can complement each other to form a pool of amino acids the body can draw from to produce proteins. Vegetarians should include a variety of vegetable protein sources in their diets to make sure they get all the essential amino acids in adequate amounts. (Healthy vegetarian diets are discussed later in the chapter.)

**Recommended Protein Intake** Adequate daily intake of protein for adults is 0.8 gram per kilogram (0.36 gram per pound) of body weight, corresponding to 50 grams of protein per day for someone who weighs 140 pounds and 65 grams of protein for someone who weighs 180 pounds. Table 8.2 lists some popular food items and the amount of protein each provides.

Most Americans meet or exceed the protein intake needed for adequate nutrition. If you consume more protein than your body needs, the extra protein is synthesized into fat for energy storage or burned for energy requirements. A little extra protein is not harmful, but it can contribute fat to the diet because protein-rich foods are often fat-rich, as well.

A fairly broad range of protein intakes is associated with good health, and the Food and Nutrition Board of the Institute of Medicine recommends that the amount of protein adults eat should fall within the range of 10–35% of total daily calories, depending on the individual’s age. The average American diet includes about 15–16% of total daily calories as protein.

### Wellness Tip

Research shows that some protein-rich foods can give you a quick mental boost, which can be helpful before an exam.



## Fats—Essential in Small Amounts

Fats, also known as *lipids*, are the most concentrated source of energy, at 9 calories per gram. The fats stored in your body represent usable energy, help insulate your body, and support and cushion your organs. Fats in the diet help your body absorb fat-soluble vitamins, and they add flavor and texture to foods. Fats are the major fuel for the body during rest and light activity.

Two fats—linoleic acid and alpha-linolenic acid—are essential components of the diet. They are used to make compounds that are key regulators of such body functions as the maintenance of blood pressure and the progress of a healthy pregnancy.

**Types and Sources of Fats** Most of the fats in foods are fairly similar in composition, generally including a molecule of glycerol (an alcohol) with three fatty acid chains attached to it. The resulting structure is called a *triglyceride*. Animal fat, for example, is primarily made of triglycerides. Within a triglyceride, differences in the fatty acid structure result in different types of fats. Depending on this structure, a fat may be unsaturated, monounsaturated, polyunsaturated, or saturated. (The essential fatty acids—linoleic and alpha-linolenic acids—are both polyunsaturated.) The different types of fatty acids have different characteristics and different effects on your health.



Food fats are often composed of both saturated and unsaturated fatty acids; the dominant type of fatty acid determines the fat's characteristics. Food fats containing large amounts of saturated fatty acids are usually solid at room temperature; they are generally found naturally in animal products. The leading sources of saturated fat in the American diet are red meats (hamburger, steak, roasts), whole milk, cheese, hot dogs, and lunch meats. Food fats containing large amounts of monounsaturated and polyunsaturated fatty acids usually come from plant sources and are liquid at room temperature. Olive, canola, safflower, and peanut oils contain mostly monounsaturated fatty acids. Corn, soybean, and cottonseed oils contain mostly polyunsaturated fatty acids.

**Hydrogenation** There are notable exceptions to these generalizations. When unsaturated vegetable oils undergo the process of **hydrogenation**, a mixture of saturated and unsaturated fatty acids is produced, creating a more solid fat from a liquid oil. Hydrogenation also changes some unsaturated fatty acids into **trans fatty acids (trans fats)**, unsaturated fatty acids with an atypical shape that affects their behavior in the body. Food manufacturers use hydrogenation to increase the stability of an oil so it can be reused for deep frying, to improve the texture of certain foods (to make pastries and pie crusts flakier, for example), and to extend the shelf life of foods made with oil. Hydrogenation is also used to transform liquid vegetable oils into margarine or shortening.

Many baked and fried foods are prepared with hydrogenated vegetable oils, which means they can be relatively high in saturated and trans fatty acids. Leading sources of trans fats in the American diet are deep-fried fast foods such as french fries and fried chicken (typically fried in vegetable shortening rather than oil), baked and snack foods, and stick margarine.

In general, the more solid a hydrogenated oil is, the more saturated and trans fats it contains. For example, stick margarines typically contain more saturated and trans fats than do tub or squeeze margarines. Small amounts of trans fatty acids are also found naturally in meat and milk.

Hydrogenated vegetable oils are not the only plant fats that contain saturated fats. Palm and coconut oils,

**amino acids** The building blocks of proteins.

**legumes** Vegetables such as dried beans and peas that are high in fiber and are also important sources of protein.

**hydrogenation** A process by which hydrogens are added to unsaturated fats, increasing the degree of saturation and turning liquid oils into solid fats. Hydrogenation produces a mixture of saturated fatty acids and standard and trans forms of unsaturated fatty acids.

**trans fatty acid (trans fat)** A type of unsaturated fatty acid produced during the process of hydrogenation; trans fats have an atypical shape that affects their chemical activity.

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although derived from plants, are also highly saturated. Yet fish oils, derived from an animal source, are rich in polyunsaturated fats.

**Fats and Health** Different types of fats have very different effects on health. Many studies have examined the effects of dietary fat intake on blood **cholesterol** levels and the risk of heart disease. However, the results of a recent analysis concluded that dietary saturated fat is not associated with an increased risk of certain forms of heart disease, and that the benefits of diets low in saturated fat may come from the higher amounts of polyunsaturated fats that these diets provide.

Saturated and trans fatty acids raise blood levels of **low-density lipoprotein (LDL)**, or “bad” cholesterol, thereby increasing a person’s risk of heart disease. Unsaturated fatty acids lower LDL. Monounsaturated fatty acids, such as those found in olive and canola oils, may also increase levels of **high-density lipoprotein (HDL)**, or “good” cholesterol, providing even greater benefits for heart health. In large amounts, trans fatty acids may lower HDL. Saturated fats impair the ability of HDLs to prevent inflammation of the blood vessels, a key factor in vascular disease. Saturated fats also reduce the blood vessels’ ability to react normally to stress. Thus, to reduce the risk of heart disease, it is important to choose unsaturated fats instead of saturated and trans fats. (See Chapter 11 for more on cholesterol.)

Most Americans consume 4–5 times as much saturated fat as trans fat (8–10% versus 2% of total daily calories). However, health experts are particularly concerned about trans fats because of their double-negative effect on heart health—they not only raise LDL but also lower HDL—and because there is less public awareness of trans fats, although awareness is growing. Since 2006, federal law has required food labels to include trans fat content, and numerous states and cities have banned the use of trans fats in restaurant food. Consumers can also check for the presence of trans fats by examining a food’s ingredient list for partially hydrogenated oil or vegetable shortening.

For heart health, it’s important to limit your consumption of both saturated and trans fats. The best way to reduce saturated fat in your diet is to eat less meat and full-fat dairy products (whole milk, cream, butter, cheese, ice cream). To lower trans fats, eat fewer deep-fried foods and baked goods made with hydrogenated vegetable oils (such as many kinds of crackers and cookies), use liquid oils for cooking, and favor tub or squeeze margarines over stick margarines. Remember: The softer or more liquid a fat is, the less saturated and trans fat it is likely to contain.

Although saturated and trans fats pose health hazards, other fats can be beneficial. When used in place of saturated fats, monounsaturated fatty acids—as found in avocados, most nuts, and olive, canola, peanut, and safflower oils—improve cholesterol levels and may help protect against some cancers.

**Omega-3** fatty acids, a form of polyunsaturated fat found primarily in fish, may be even more healthful. Omega-3s and the compounds the body makes from them have a number of heart-healthy effects: They reduce the tendency of blood to clot, inhibit inflammation and abnormal heart rhythms, and reduce blood pressure and the risk of heart attack and stroke in some people. Because of these benefits, nutritionists recommend that Americans increase the proportion of omega-3s in their diet by eating fish two or more times a week. Salmon, tuna, trout, mackerel, herring, sardines, and anchovies are all good sources of omega-3s. Lesser amounts are found in plant foods, including dark green leafy vegetables; walnuts; flaxseeds; and canola, walnut, and flaxseed oils.

Most of the polyunsaturated fats currently consumed by Americans are **omega-6** fatty acids, primarily from corn oil and soybean oil. The American Heart Association (AHA) recommends consuming at least 5–10% of energy from omega-6 fatty acids as part of a low-saturated-fat and low-cholesterol diet to reduce the risk of coronary heart disease.

In addition to its effects on heart disease risk, dietary fat can affect health in other ways. Diets high in fatty red meat are associated with an increased risk of certain forms of cancer, especially colon cancer. A high-fat diet can also make weight management more difficult. Because fat is a concentrated source of calories, a high-fat diet is often a high-calorie diet that can lead to weight gain.

Although more research is needed on the precise effects of different types and amounts of fat on overall health, a great deal of evidence points to the fact that most people benefit from lowering their overall fat intake to recommended levels and choosing unsaturated fats instead of saturated and trans fats. The types of fatty acids and their effects on health are summarized in Table 8.3.

**Recommended Fat Intake** To meet the body’s need for essential fats, adult men need about 17 grams per day of linoleic acid and 1.6 grams per day of alpha-linolenic acid. Women need 12 grams of linoleic acid and 1.1 grams of alpha-linolenic acid. It takes only 3–4 teaspoons (15–20 grams) of vegetable oil per day incorporated into your diet to supply the essential fats. Most Americans get enough essential fats. Limiting unhealthy fats is a much greater health concern.

Limits for total fat, saturated fat, and trans fat intake have been set by a number of government and research organizations. The Institute of Medicine’s Food and Nutrition Board has released recommendations for the balance of energy sources in a healthful diet. These recommendations—called Acceptable Macronutrient Distribution Ranges (AMDRs)—are based on ensuring adequate intake of essential nutrients while reducing the risk of chronic diseases. As with protein, a range of levels of fat intake is associated with good health. The AMDR for total fat is 20–35% of total calories. Although more difficult for consumers to monitor, AMDRs have also been set for omega-6 fatty acids (5–10%) and omega-3 fatty acids (0.6–1.2%) as part of total fat intake.

**Table 8.3** Types of Fatty Acids and Their Possible Effects on Health

	TYPE OF FATTY ACID	FOUND IN <sup>a</sup>	POSSIBLE EFFECTS ON HEALTH
Keep Intake Low	SATURATED	<ul style="list-style-type: none"> <li>Animal fats (especially fatty meats and poultry fat and skin)</li> <li>Butter, cheese, and other high-fat dairy products</li> <li>Palm and coconut oils</li> </ul>	<ul style="list-style-type: none"> <li>Raises total cholesterol and LDL cholesterol</li> <li>May increase risk of heart disease</li> <li>May increase risk of colon and prostate cancers</li> </ul>
	TRANS	<ul style="list-style-type: none"> <li>Deep-fried fast foods</li> <li>Stick margarines, shortening</li> <li>Packaged cookies and crackers</li> <li>Processed snacks and sweets</li> </ul>	<ul style="list-style-type: none"> <li>Raises total cholesterol and LDL cholesterol</li> <li>Lowers HDL cholesterol</li> <li>May increase risk of heart disease and breast cancer</li> </ul>
	MONOUNSATURATED	<ul style="list-style-type: none"> <li>Olive, canola, and safflower oils</li> <li>Avocados, olives</li> <li>Peanut butter (without added fat)</li> <li>Many nuts, including almonds, cashews, pecans, and pistachios</li> </ul>	<ul style="list-style-type: none"> <li>Lowers total cholesterol and LDL cholesterol</li> <li>May reduce blood pressure and lower triglycerides (a risk factor for heart disease)</li> <li>May reduce risk of heart disease, stroke, and some cancers</li> </ul>
Choose Moderate Amounts	POLYUNSATURATED (two groups) <sup>b</sup>		
	Omega-3	<ul style="list-style-type: none"> <li>Fatty fish, including salmon, white albacore tuna, mackerel, anchovies, and sardines</li> <li>Lesser amounts in walnut, flaxseed, canola, and soybean oils; tofu, walnuts; flaxseeds; and dark green leafy vegetables</li> </ul>	<ul style="list-style-type: none"> <li>Reduces blood clotting and inflammation and inhibits abnormal heart rhythms</li> <li>Lowers triglycerides</li> <li>May lower blood pressure in some people</li> <li>May reduce the risk of fatal heart attack, stroke, and some cancers</li> </ul>
	Omega-6	<ul style="list-style-type: none"> <li>Corn, soybean, and cottonseed oils (often used in margarine, mayonnaise, and salad dressings)</li> </ul>	<ul style="list-style-type: none"> <li>Lowers total cholesterol and LDL cholesterol</li> <li>May lower HDL cholesterol</li> <li>May reduce risk of heart disease</li> <li>May slightly increase risk of cancer if omega-6 intake is high and omega-3 is low</li> </ul>

<sup>a</sup> Food fats contain a combination of types of fatty acids in various proportions. For example, canola oil is composed mainly of monounsaturated fatty acids (62%) but also contains polyunsaturated (32%) and saturated (6%) fatty acids. Food fats are categorized here according to their predominant fatty acid.

<sup>b</sup> The essential fatty acids are polyunsaturated: Linoleic acid is an omega-6 fatty acid and alpha-linolenic acid is an omega-3 fatty acid.

Because any amount of saturated and trans fat increases the risk of heart disease, the Food and Nutrition Board recommends that saturated and trans fat intake be kept as low as possible; most fat in a healthy diet should be unsaturated.

For advice on setting individual intake goals, see the box “Setting Intake Goals for Protein, Fat, and Carbohydrate.” To determine how close you are to meeting your personal intake goals for fat, keep a running total over the course of the day. For prepared foods, food labels list the number of grams of fat, protein, and carbohydrate. Nutrition information is also available in many grocery stores, in published nutrition guides, and online (see For Further Exploration at the end of the chapter). By checking these resources, you can keep track of the total grams of fat, protein, and carbohydrate you eat and assess your current diet.

In reducing fat intake to recommended levels, the emphasis should be on lowering saturated and trans fats (see Table 8.3). You can still eat high-fat foods, but it makes sense to limit the size of your portions and to balance your intake with low-fat foods. For example, peanut butter is high in fat, with 8 grams (72 calories) of fat in each 90-calorie tablespoon. Two tablespoons of peanut butter

eaten on whole-wheat bread and served with a banana, carrot sticks, and a glass of nonfat milk make a nutritious lunch—high in protein and carbohydrate, relatively low in total and saturated fat (500 calories, 18 grams of total fat, 4 grams of saturated fat). By comparison, four tablespoons of peanut butter on high-fat crackers with potato chips, cookies, and whole milk is a less healthy combination (1000 calories, 62 grams of total fat, 15 grams of saturated fat). So although it’s important to evaluate individual food items for their fat content, it is more important to look at them in the context of your overall diet.

**cholesterol** A waxy substance found in the blood and cells and needed for synthesis of cell membranes, vitamin D, and hormones.

**low-density lipoprotein (LDL)** Blood fat that transports cholesterol to organs and tissues; excess amounts result in the accumulation of fatty deposits on artery walls.

**high-density lipoprotein (HDL)** Blood fat that helps transport cholesterol out of the arteries, thereby protecting against heart disease.

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## Setting Intake Goals for Protein, Fat, and Carbohydrate

The Food and Nutrition Board has established goals to help ensure adequate intake of the essential amino acids, fatty acids, and carbohydrate. The daily goals for adequate intake for adults follow:

	MEN	WOMEN
Protein	56 grams	46 grams
Fat: Linoleic acid	17 grams	12 grams
Alpha-linoleic acid	1.6 grams	1.1 grams
Carbohydrate	130 grams	130 grams

Protein intake goals can be calculated more specifically by multiplying your body weight in kilograms by 0.8 or your body weight in pounds by 0.36. (Refer to the Nutrition Resources section at the end of the chapter for information for specific age groups and life stages.)

To meet your daily energy needs, you need to consume more than the minimally adequate amounts of the energy-providing nutrients listed above, which alone supply only about 800–900 calories.

The Food and Nutrition Board provides additional guidance in the form of Acceptable Macronutrient Distribution Ranges (AMDRs). These ranges can help you balance your intake of energy-providing nutrients in ways that ensure adequate intake and reduce the risk of chronic disease.

### Two Sample Macronutrient Distributions

NUTRIENT	AMDR	SAMPLE 1		SAMPLE 2	
		INDIVIDUAL GOALS	AMOUNTS FOR A 1600-CALORIE DIET	INDIVIDUAL GOALS	AMOUNTS FOR A 2800-CALORIE DIET
PROTEIN	10–35%	15%	240 calories = 60 grams	30%	840 calories = 210 grams
FAT	20–35%	30%	480 calories = 53 grams	25%	700 calories = 78 grams
CARBOHYDRATE	45–65%	55%	880 calories = 220 grams	45%	1260 calories = 315 grams

**SOURCE:** Food and Nutrition Board, Institute of Medicine, National Academies. 2002. *Dietary Reference Intakes: Applications in Dietary Planning*. Washington, D.C.: National Academies Press. © 2003 by the National Academy of Sciences. Reprinted with permission from the National Academies Press, Washington, D.C.

The AMDRs for protein, total fat, and carbohydrate are as follows:

Protein	10–35% of total daily calories
Total fat	20–35% of total daily calories
Carbohydrate	45–65% of total daily calories

To set individual goals, begin by estimating your total daily energy (calorie) needs. If your weight is stable, your current energy intake is the number of calories you need to maintain your weight at your current activity level. Next, select percentage goals for protein, fat, and carbohydrate. You can allocate your total daily calories among the three classes of macronutrients to suit your preferences; just make sure that the three percentages you select total 100% and that you meet the minimum intake goals listed. Two samples reflecting different total energy intake and nutrient intake goals are shown in the table below.

To translate your percentage goals into daily intake goals expressed in calories and grams, multiply the appropriate percentages by total calorie intake, and then divide the results by the corresponding calories per gram. For example, a fat limit of 35% applied to a 2200-calorie diet would be calculated as follows:  $0.35 \times 2200 = 770$  calories of total fat;  $770 \div 9$  calories per gram = 86 grams of total fat. (Remember that fat has 9 calories per gram and that protein and carbohydrate have 4 calories per gram.)

## Carbohydrates—An Ideal Source of Energy

**Carbohydrates** (“carbs”) are needed in the diet primarily to supply energy to body cells. Some cells, such as those in the brain and other parts of the nervous system and in the blood, use only carbohydrates for fuel. During high-intensity exercise, muscles also get most of their energy from carbohydrates.

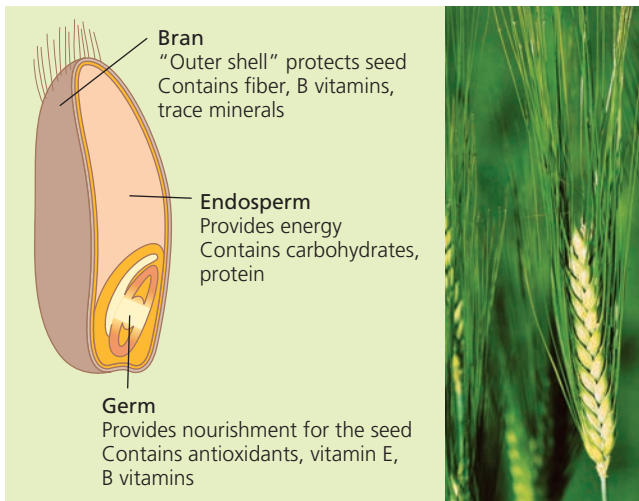
**Simple and Complex Carbohydrates** Carbohydrates are classified into two groups: simple and complex. *Simple carbohydrates* include sucrose (table sugar), fructose (fruit sugar, honey), maltose (malt sugar), and lactose (milk sugar). Simple carbohydrates provide much of

the sweetness in foods. They are found naturally in fruits and milk and are added to soft drinks, fruit drinks, candy, and sweet desserts. There is no evidence that any type of simple carbohydrate is more nutritious than others.

*Complex carbohydrates* include starches and most types of dietary fiber. Starches are found in a variety of plants, especially grains (wheat, rye, rice, oats, barley, and millet), legumes (dried beans, peas, and lentils), and tubers (potatoes and yams). Most other vegetables contain a mix of complex and simple carbohydrates. Fiber, which is discussed later in this chapter, is found in fruits, vegetables, and grains.

During digestion, your body breaks down carbohydrates into simple sugar molecules, such as **glucose**, for absorption. Once glucose is in the bloodstream, the





**FIGURE 8.2** The parts of a whole grain kernel.

pancreas releases the hormone insulin, which allows cells to take up glucose and use it for energy. The liver and muscles also take up glucose and store it in the form of a starch called **glycogen**. The muscles use glucose from glycogen as fuel during endurance events or long workouts.

**Refined Carbohydrates Versus Whole Grains** Complex carbohydrates can be further divided between refined, or processed, carbohydrates and unrefined carbohydrates, or whole grains. Before they are processed, all grains are **whole grains**, consisting of an inner layer of germ, a middle layer called the endosperm, and an outer layer of bran (Figure 8.2). During processing, the germ and bran are often removed, leaving just the starchy endosperm. The refinement of whole grains transforms whole-wheat flour into white flour, brown rice into white rice, and so on.

Refined carbohydrates usually retain all the calories of their unrefined counterparts, but they tend to be much lower in fiber, vitamins, minerals, and other beneficial compounds. Refined grain products are often enriched or fortified with vitamins and minerals, but many of the nutrients lost in processing are not replaced.

Unrefined carbohydrates tend to take longer to chew and digest than refined ones; they also enter the bloodstream more slowly. This slower digestive pace tends to make people feel full sooner and for a longer period. Also, a slower rise in blood glucose levels following consumption of complex carbohydrates may help in the

management of diabetes. Whole grains are also high in dietary fiber (discussed later).

Consumption of whole grains has been linked to a reduced risk of heart disease, diabetes, high blood pressure, stroke, and certain forms of cancer. For all these reasons, whole grains are recommended over those that have been refined. This does not mean you should never eat refined carbohydrates such as white bread or white rice; it simply means that whole-wheat bread, brown rice, and other whole grains are healthier choices. See the box “Choosing More Whole-Grain Foods” for tips on increasing your intake of whole grains.

**Glycemic Index and Glycemic Response** Insulin and glucose levels rise following a meal or snack containing any type of carbohydrate. Some foods cause a quick and dramatic rise in glucose and insulin levels, while others have a slower, more moderate effect. A food that has a rapid effect on blood glucose levels is said to have a high **glycemic index**. The glycemic index of a food indicates the type of carbohydrate in that food. High-glycemic-index foods do not, as some popular diets claim, directly cause weight gain beyond the calories they contain.

Attempting to base food choices on glycemic index is a difficult task. Unrefined complex carbohydrates and high-fiber foods generally tend to have a lower glycemic index, but patterns are less clear for other types of foods. The fat content of a food also affects its glycemic index; the higher in fat a food is, the lower its effect on glucose levels. Ripeness, storage time, processing, and food preparation are other factors that can affect a food’s glycemic index. The body’s response to carbohydrates also depends on other factors, such as what other foods are consumed at the same time, as well as the individual’s fitness status.

For people with particular health concerns, such as diabetes, glycemic index may be an important consideration in choosing foods. Still, it should not be the sole criterion for food choices. Carbohydrate choices (low versus high glycemic index) that replace dietary saturated fat may also be an important factor in determining the effects of diet on the risk of cardiovascular disease. Some unrefined grains, fruits, vegetables, and legumes are rich in nutrients, have a relatively low energy density, and have a

**carbohydrate** An essential nutrient; sugars, starches, and dietary fiber are all carbohydrates.

**glucose** A simple sugar that is the body’s basic fuel.

**glycogen** A starch stored in the liver and muscles.

**whole grain** The entire edible portion of a grain (such as wheat, rice, or oats), including the germ, endosperm, and bran; processing removes parts of the grain, often leaving just the endosperm.

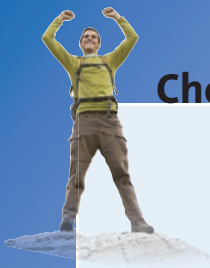
**glycemic index** A measure of how a particular food affects blood glucose levels.

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### Wellness Tip

Certain carbohydrate-rich foods, such as a bagel or a plain baked potato, can have a temporary calming effect on some people during stressful situations.



## Choosing More Whole-Grain Foods

### What Are Whole Grains?

The first step in increasing your intake of whole grains is to correctly identify them. The following are whole grains:

- whole wheat
- whole rye
- whole oats
- oatmeal
- whole-grain corn
- popcorn
- brown rice
- whole-grain barley

Other choices include bulgur (cracked wheat), millet, kasha (roasted buckwheat kernels), quinoa, wheat and rye berries, amaranth, wild rice, graham flour, whole-grain kamut, whole-grain spelt, and whole-grain triticale.

Wheat flour, unbleached flour, enriched flour, and degerminated corn meal are not whole grains. Wheat germ and wheat bran are also not whole grains, but they are the constituents of wheat typically left out when wheat is processed and so are healthier choices than regular wheat flour, which typically contains just the grain's endosperm.

### Checking Packages for Whole Grains

To find packaged foods—such as bread or pasta—that are rich in whole grains, read the list of ingredients and check for special health claims related to whole grains. The *first* item in the list of ingredients should be one of the whole grains in the preceding list. Product names and food color can be misleading. *When in doubt, always check the list of ingredients and make sure “whole” is the first word in the list.*

The U.S. Food and Drug Administration (FDA) allows manufacturers to include special health claims for foods that contain 51% or more whole-grain ingredients. Such products may contain a statement such as the following on their packaging:

- “Rich in whole grain”
- “Made with 100% whole grain”
- “Diets rich in whole-grain foods may help reduce the risk of heart disease and certain cancers.”

However, many whole-grain products will not carry such claims. This is one more reason to check the ingredient list to make sure you're buying a product made from one or more whole grains.

low to moderate glycemic index. Your best bet, therefore, is to choose a variety of vegetables daily and limit refined grains as well as foods that are high in added sugars but low in other nutrients.

**Recommended Carbohydrate Intake** On average, Americans consume 200–300 grams of carbohydrate per day, well above the 130 grams needed to meet the body's requirement for essential carbohydrate. A range of intakes is associated with good health, and experts recommend that adults consume 45–65% of total daily calories as carbohydrate. (That's about 225–325 grams of carbohydrate for someone who consumes 2000 calories per day.) The focus should be on consuming a variety of foods rich in complex carbohydrates, especially whole grains.

Athletes in training can especially benefit from high-carbohydrate diets (60–70% of total daily calories), which enhance the amount of carbohydrates stored in their muscles as glycogen and therefore provide more carbohydrate fuel for use during endurance events or long workouts. Carbohydrates consumed during prolonged athletic events (often in the form of sports beverages) can help fuel muscles and extend the availability of the glycogen stored in muscles. Caution is in order, however, because overconsumption of carbohydrates can lead to feelings of fatigue and underconsumption of other nutrients.

Although the Food and Nutrition Board set an AMDR for added sugars of 25% or less of total daily calories,

many health experts recommend an even lower intake. (Recall that sugars are a form of carbohydrate.) World Health Organization guidelines suggest a limit of 10% of total daily calories from added sugars. Limits set by the U.S. Department of Agriculture (USDA) are even lower, with a maximum of about 8 teaspoons (32 grams) suggested for someone consuming 2000 calories per day. Foods high in added sugar are generally high in calories and low in nutrients and fiber, thus providing “empty” calories.

To reduce your intake of added sugars, limit soft drinks, candy, desserts, and sweetened fruit drinks. The simple carbohydrates in your diet should come mainly from fruits, which are excellent sources of vitamins and minerals, and from low-fat or fat-free milk and other dairy products, which are high in protein and calcium.

### Fiber—A Closer Look

*Fiber* is the term given to nondigestible carbohydrates provided by plants. Instead of being digested, like starch, fiber moves through the intestinal tract and provides bulk for feces in the large intestine, which in turn facilitates elimination. In the large intestine, some types of fiber are broken down by bacteria into acids and gases, which explains why eating too much fiber-rich food can lead to intestinal gas. Even though humans don't digest fiber, it is necessary for good health.



Fruits, vegetables, and whole grains are excellent sources of carbohydrates and fiber.

**Types of Dietary Fiber** The Food and Nutrition Board has defined two types of fiber:

- **Dietary fiber** is the nondigestible carbohydrates (and the noncarbohydrate substance lignin) that are present naturally in plants such as grains, legumes, and vegetables.
- **Functional fiber** is any nondigestible carbohydrate that has been either isolated from natural sources or synthesized in a lab and then added to a food product or supplement.
- **Total fiber** is the sum of dietary and functional fiber in a person's diet.

Fibers have different properties that lead to different physiological effects in the body. **Soluble (viscous) fiber** such as that found in oat bran or legumes can delay stomach emptying, slow the movement of glucose into the blood after eating, and reduce absorption of cholesterol. **Insoluble fiber**, such as that found in wheat bran or psyllium seed, increases fecal bulk and helps prevent constipation, hemorrhoids, and other digestive disorders.

A high-fiber diet can help reduce the risk of type 2 diabetes, heart disease, and pulmonary disease, as well as improve gastrointestinal health and aid in weight management. Some studies have linked high-fiber diets with a reduced risk of colon and rectal cancer. Other studies have suggested that other characteristics of diets rich in fruits, vegetables, and whole grains may be responsible for this reduction in risk.

**Sources of Fiber** All plant foods contain some dietary fiber. Fruits, legumes, oats (especially oat bran), and barley all contain the viscous types of fiber that help lower blood glucose and cholesterol levels. Wheat (especially wheat bran), cereals, grains, and vegetables are all good sources of cellulose and other fibers that help prevent

## Wellness Tip

To avoid intestinal discomfort, add fiber to your diet slowly so you can build a tolerance to it.



constipation. Psyllium, which is often added to cereals or used in fiber supplements and laxatives, improves intestinal health and also helps control glucose and cholesterol levels. The processing of packaged foods can remove fiber, so it's important to depend on fresh fruits and vegetables and foods made from whole grains as your main sources of fiber.

**Recommended Fiber Intake** To reduce the risk of chronic disease and maintain intestinal health, the Food and Nutrition Board recommends a daily fiber intake of 38 grams for adult men and 25 grams for adult women. Americans currently consume about half this amount. Fiber should come from foods, not supplements, which should be used only under medical supervision.

## Vitamins—Organic Micronutrients

**Vitamins** are organic (carbon-containing) substances required in small amounts to regulate various processes within living cells (Table 8.4). Humans need 13 vitamins; of these, four are fat-soluble (A, D, E, and K), and nine are water-soluble (C and the B-complex vitamins thiamin, riboflavin, niacin, vitamin B-6, folate, vitamin B-12, biotin, and pantothenic acid).

Solubility affects how a vitamin is absorbed, transported, and stored in the body. The water-soluble vitamins are absorbed directly into the bloodstream, where they travel freely. Excess water-soluble vitamins are removed by the kidneys and excreted in urine. Fat-soluble vitamins require a more complex absorptive process. They are usually carried in the blood by special proteins and are stored in the liver and in fat tissues rather than excreted.

**dietary fiber** Nondigestible carbohydrates and lignin that are intact in plants.

**functional fiber** Nondigestible carbohydrates either isolated from natural sources or synthesized; these may be added to foods and dietary supplements.

**total fiber** The total amount of dietary fiber and functional fiber in the diet.

**soluble (viscous) fiber** Fiber that dissolves in water or is broken down by bacteria in the large intestine.

**insoluble fiber** Fiber that does not dissolve in water and is not broken down by bacteria in the large intestine.

**vitamins** Carbon-containing substances needed in small amounts to help promote and regulate chemical reactions and processes in the body.

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**Table 8.4 Facts About Vitamins**

VITAMIN	IMPORTANT DIETARY SOURCES	MAJOR FUNCTIONS	SIGNS OF PROLONGED DEFICIENCY	TOXIC EFFECTS OF MEGADOSES
<b>FAT-SOLUBLE</b>				
Vitamin A	Liver, milk, butter, cheese, fortified margarine; carrots, spinach, and other orange and deep green vegetables and fruits	Maintenance of vision, skin, linings of the nose, mouth, digestive and urinary tracts, immune function	Night blindness; dry, scaling skin; increased susceptibility to infection; loss of appetite; anemia; kidney stones	Liver damage, miscarriage and birth defects, headache, vomiting and diarrhea, vertigo, double vision, bone abnormalities
Vitamin D	Fortified milk and margarine, fish oils, butter, egg yolks (sunlight on skin also produces vitamin D)	Development and maintenance of bones and teeth; promotion of calcium absorption	Rickets (bone deformities) in children; bone softening, loss, fractures in adults	Kidney damage, calcium deposits in soft tissues, depression, death
Vitamin E	Vegetable oils, whole grains, nuts and seeds, green leafy vegetables, asparagus, peaches	Protection and maintenance of cellular membranes	Red blood cell breakage and anemia, weakness, neurological problems, muscle cramps	Relatively nontoxic, but may cause excess bleeding or formation of blood clots
Vitamin K	Green leafy vegetables; smaller amounts widespread in other foods	Production of factors essential for blood clotting and bone metabolism	Hemorrhaging	None reported
<b>WATER-SOLUBLE</b>				
Biotin	Cereals, yeast, egg yolks, soy flour, liver; widespread in foods	Synthesis of fat, glycogen, and amino acids	Rash, nausea, vomiting, weight loss, depression, fatigue, hair loss	None reported
Folate	Green leafy vegetables, yeast, oranges, whole grains, legumes, liver	Amino acid metabolism, synthesis of RNA and DNA, new cell synthesis	Anemia, weakness, fatigue, irritability, shortness of breath, swollen tongue	Masking of vitamin B-12 deficiency
Niacin	Eggs, poultry, fish, milk, whole grains, nuts, enriched breads and cereals, meats, legumes	Conversion of carbohydrates, fats, and proteins into usable forms of energy	Pellagra (symptoms include diarrhea, dermatitis, inflammation of mucous membranes, dementia)	Flushing of skin, nausea, vomiting, diarrhea, liver dysfunction, glucose intolerance
Pantothenic acid	Animal foods, whole grains, broccoli, potatoes; widespread in foods	Metabolism of fats, carbohydrates, and proteins	Fatigue, numbness and tingling of hands and feet, gastrointestinal disturbances	None reported
Riboflavin	Dairy products, enriched breads and cereals, lean meats, poultry, fish, green vegetables	Energy metabolism; maintenance of skin, mucous membranes, nervous system structures	Cracks at corners of mouth, sore throat, skin rash, hypersensitivity to light, purple tongue	None reported
Thiamin	Whole-grain and enriched breads and cereals, organ meats, lean pork, nuts, legumes	Conversion of carbohydrates into usable forms of energy; maintenance of appetite and nervous system function	Beriberi (symptoms include muscle wasting, mental confusion, anorexia, enlarged heart, nerve changes)	None reported
Vitamin B-6	Eggs, poultry, fish, whole grains, nuts, soybeans, liver, kidney, pork	Metabolism of amino acids and glycogen	Anemia, convulsions, cracks at corners of mouth, dermatitis, nausea, confusion	Neurological abnormalities and damage
Vitamin B-12	Meat, fish, poultry, fortified cereals	Synthesis of blood cells; other metabolic reactions	Anemia, fatigue, nervous system damage, sore tongue	None reported
Vitamin C	Peppers, broccoli, brussels sprouts, spinach, citrus fruits, strawberries, tomatoes, potatoes, cabbage, other fruits and vegetables	Maintenance and repair of connective tissue, bones, teeth, cartilage; promotion of healing; aid in iron absorption	Scurvy, anemia, reduced resistance to infection, loosened teeth, joint pain, poor wound healing, hair loss, poor iron absorption	Urinary stones in some people, acid stomach from ingesting supplements in pill form, nausea, diarrhea, headache, fatigue

**SOURCES:** Food and Nutrition Board, Institute of Medicine. 2006. *Dietary Reference Intakes: The Essential Guide to Nutrient Requirements*. Washington, D.C.: National Academies Press. The complete Dietary Reference Intake reports are available from the National Academies Press (<http://www.nap.edu>). Shils, M. E., et al., eds. 2005. *Modern Nutrition in Health and Disease*, 10th ed. Baltimore: Lippincott Williams and Wilkins.



Vitamin and mineral supplements are popular, but they are not usually necessary for healthy people who eat a balanced diet.

**Functions of Vitamins** Many vitamins help chemical reactions take place. They provide no energy to the body directly but help unleash the energy stored in carbohydrates, proteins, and fats. Other vitamins are critical in the production of red blood cells and the maintenance of the nervous, skeletal, and immune systems. Some vitamins act as **antioxidants**, which help preserve the health of cells. Key vitamin antioxidants include vitamin E, vitamin C, and the vitamin A precursor beta-carotene. (Antioxidants are described later in the chapter.)

**Sources of Vitamins** The human body does not manufacture most of the vitamins it requires and must obtain them from foods. Vitamins are abundant in fruits, vegetables, and grains. In addition, many processed foods, such as flour and breakfast cereals, contain added vitamins. A few vitamins are made in certain parts of the body: The skin makes vitamin D when it is exposed to sunlight, and intestinal bacteria make vitamin K. Nonetheless, you still need to get vitamin D and vitamin K from foods (see Table 8.4).

**Vitamin Deficiencies and Excesses** If your diet lacks a particular vitamin, characteristic symptoms of deficiency can develop (see Table 8.4). For example, vitamin A deficiency can cause blindness, and vitamin B-12 deficiency can cause anemia. Vitamin deficiency diseases are most often seen in developing countries; they are relatively rare in the United States because vitamins are readily available from our food supply. However, intakes below recommended levels can have adverse effects on health even if they are not low enough to cause a deficiency disease. For example, low intake of folate increases a woman's chance of giving birth to a baby with a neural tube defect (a congenital malformation of the central nervous system). Low intake of folate and vitamins B-6 and B-12 has been linked to increased heart disease risk. A great deal of recent research has focused on vitamin D, suggesting that vitamin D supplementation can reduce the

risk of cardiovascular disease and linking low vitamin D levels to an increased risk of several cancers. As important as vitamins are, however, many Americans consume less-than-recommended amounts of some vitamins.

Extra vitamins in the diet can be harmful, especially when taken as supplements. Megadoses of fat-soluble vitamins are particularly dangerous because the excess is stored in the body rather than excreted, increasing the risk of toxicity. Even when supplements are not taken in excess, relying on them for an adequate intake of vitamins can be problematic. There are many substances in foods other than vitamins and minerals, and some of these compounds may have important health effects. Later, this chapter discusses specific recommendations for vitamin intake and when a supplement is advisable. For now, keep in mind that it's best to get most of your vitamins from foods rather than supplements.

The vitamins and minerals in foods can be easily lost or destroyed during storage or cooking. To retain their value, eat or process vegetables immediately after buying them. If you can't do this, store them in a cool place, covered to retain moisture—either in the refrigerator (for a few days) or in the freezer (for a longer term). To reduce nutrient losses during food preparation, minimize the amount of water used and the total cooking time. Develop a taste for a crunchier texture in cooked vegetables. Baking, steaming, broiling, grilling, and microwaving are all good methods of preparing vegetables.

## Minerals—Inorganic Micronutrients

**Minerals** are inorganic (non-carbon-containing) elements you need in relatively small amounts to help regulate body functions, aid in the growth and maintenance of body tissues, and help release energy (Table 8.5). There are about 17 essential minerals. The major minerals, those that the body needs in amounts exceeding 100 milligrams per day, include calcium, phosphorus, magnesium, sodium, potassium, and chloride. The essential trace minerals, which you need in minute amounts, include copper, fluoride, iodine, iron, selenium, and zinc.

Characteristic symptoms develop if an essential mineral is consumed in a quantity too small or too large for good health. The minerals commonly lacking in the American diet are iron, calcium, magnesium, and potassium. Iron-deficiency **anemia** is a problem in some

**antioxidant** A substance that protects against the breakdown of food or body constituents by free radicals; antioxidants' actions include binding oxygen, donating electrons to free radicals, and repairing damage to molecules.

**minerals** Inorganic compounds needed in relatively small amounts for the regulation, growth, and maintenance of body tissues and functions.

**anemia** A deficiency in the oxygen-carrying material in the red blood cells.

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**Table 8.5** Facts About Selected Minerals

MINERAL	IMPORTANT DIETARY SOURCES	MAJOR FUNCTIONS	SIGNS OF PROLONGED DEFICIENCY	TOXIC EFFECTS OF MEGADOSES
Calcium	Milk and milk products, tofu, fortified orange juice and bread, green leafy vegetables, bones in fish	Formation of bones and teeth; control of nerve impulses, muscle contraction, blood clotting	Stunted growth in children, bone mineral loss in adults; urinary stones	Kidney stones, calcium deposits in soft tissues, inhibition of mineral absorption, constipation
Fluoride	Fluoridated water, tea, marine fish eaten with bones	Maintenance of tooth and bone structure	Higher frequency of tooth decay	Increased bone density, mottling of teeth, impaired kidney function
Iodine	Iodized salt, seafood, processed foods	Essential part of thyroid hormones, regulation of body metabolism	Goiter (enlarged thyroid), cretinism (birth defect)	Depression of thyroid activity, hyperthyroidism in susceptible people
Iron	Meat and poultry, fortified grain products, dark green vegetables, dried fruit	Component of hemoglobin, myoglobin, and enzymes	Iron-deficiency anemia, weakness, impaired immune function, gastrointestinal distress	Nausea, diarrhea, liver and kidney damage, joint pains, sterility, disruption of cardiac function, death
Magnesium	Widespread in foods and water (except soft water); especially found in grains, legumes, nuts, seeds, green vegetables, milk	Transmission of nerve impulses, energy transfer, activation of many enzymes	Neurological disturbances, cardiovascular problems, kidney disorders, nausea, growth failure in children	Nausea, vomiting, diarrhea, central nervous system depression, coma; death in people with impaired kidney function
Phosphorus	Present in nearly all foods, especially milk, cereal, peas, eggs, meat	Bone growth and maintenance, energy transfer in cells	Impaired growth, weakness, kidney disorders, cardiorespiratory and nervous system dysfunction	Drop in blood calcium levels, calcium deposits in soft tissues, bone loss
Potassium	Meats, milk, fruits, vegetables, grains, legumes	Nerve function and body water balance	Muscular weakness, nausea, drowsiness, paralysis, confusion, disruption of cardiac rhythm	Cardiac arrest
Selenium	Seafood, meat, eggs, whole grains	Defense against oxidative stress; regulation of thyroid hormone action	Muscle pain and weakness, heart disorders	Hair and nail loss, nausea and vomiting, weakness, irritability
Sodium	Salt, soy sauce, fast food, processed foods, especially lunch meats, canned soups and vegetables, salty snacks, processed cheese	Body water balance, acid-base balance, nerve function	Muscle weakness, loss of appetite, nausea, vomiting; deficiency rarely seen	Edema, hypertension in sensitive people
Zinc	Whole grains, meat, eggs, liver, seafood (especially oysters)	Synthesis of proteins, RNA, and DNA; wound healing; immune response; ability to taste	Growth failure, loss of appetite, impaired taste acuity, skin rash, impaired immune function, poor wound healing	Vomiting, impaired immune function, decline in blood HDL levels, impaired copper absorption

**SOURCES:** Food and Nutrition Board, Institute of Medicine. 2006. *Dietary Reference Intakes: The Essential Guide to Nutrient Requirements*. Washington, D.C.: National Academies Press. The complete Dietary Reference Intake reports are available from the National Academies Press (<http://www.nap.edu>). Shils, M. E., et al., eds. 2005. *Modern Nutrition in Health and Disease*, 10th ed. Baltimore: Lippincott Williams and Wilkins.

age groups, and researchers fear poor calcium intakes in childhood are sowing the seeds for future **osteoporosis**, especially in women. See the box “Eating for Healthy Bones” to learn more.

## Water—Vital but Often Ignored

Water is the major component in both foods and the human body: You are composed of about 50–60% water. Your need for other nutrients, in terms of weight, is much

less than your need for water. You can live up to 50 days without food but only a few days without water.

Water is distributed all over the body, among lean and other tissues and in blood and other body fluids. Water is used in the digestion and absorption of food and is the medium in which most chemical reactions take place within the body. Some water-based fluids, such as blood, transport substances around the body; other fluids serve as lubricants or cushions. Water also helps regulate body temperature.

## Eating for Healthy Bones

Osteoporosis is a condition in which the bones become dangerously thin and fragile over time. An estimated 10 million Americans over age 50 have osteoporosis, and another 34 million are at risk. Women account for about 80% of osteoporosis cases.

Most bone mass is built by age 18. After bone density peaks between ages 25 and 35, bone mass is lost over time. To prevent osteoporosis, the best strategy is to build as much bone as possible during your youth and do everything you can to maintain it as you age. Up to 50% of bone loss is determined by controllable lifestyle factors such as diet and exercise. Key nutrients for bone health include the following:

- **Calcium.** Getting enough calcium is important throughout life to build and maintain bone mass. Milk, yogurt, and calcium-fortified orange juice, bread, and cereals are all good sources.
- **Vitamin D.** Vitamin D is necessary for bones to absorb calcium; a daily intake of 600 IU is recommended for individuals age 1–70. Vitamin D can be obtained from foods and is manufactured by the skin when exposed to sunlight. Candidates for vitamin D supplements include people who don't eat many foods rich in vitamin D; those who don't expose their face, arms, and hands to the sun (without sunscreen) for 5–15 minutes a few times each week; and people who live north of an imaginary line drawn across the United States from Boston to the Oregon-California border (where the sun is weaker).

Water is contained in almost all foods, particularly in liquids, fruits, and vegetables. The foods and fluids you consume provide 80–90% of your daily water intake; the remainder is generated through metabolism. You lose water each day in urine, feces, and sweat and through evaporation from your lungs.

Most people can maintain a healthy water balance by consuming beverages at meals and drinking fluids in response to thirst. The Food and Nutrition Board has set levels of adequate water intake to maintain hydration. All fluids, including those containing caffeine, can count toward your total daily fluid intake. Under these guidelines, men need to consume about 3.7 total liters of water, with 3.0 liters (about 13 cups) coming from beverages; women need 2.7 total liters, with 2.2 liters (about 9 cups) coming from beverages. About 20% of daily water intake comes from food. (See Table 1 in the Nutrition Resources section



### Fitness Tip

Drink plenty of water before, during, and after workouts, especially when the weather is warm. Proper hydration helps you avoid cramps and heat-related problems such as heat stroke.

- **Vitamin K.** Vitamin K promotes the synthesis of proteins that help keep bones strong. Broccoli and leafy green vegetables are rich in vitamin K.

- **Other nutrients.** Other nutrients that may play an important role in bone health include vitamin C, magnesium, potassium, phosphorus, fluoride, manganese, zinc, copper, and boron.

Several dietary substances may have a *negative* effect on bone health, especially if consumed in excess. These include alcohol, sodium, caffeine, and retinol (a form of vitamin A). Drinking lots of soda, which often replaces milk in the diet, has been shown to increase the risk of bone fracture in teenage girls.

The effect of protein intake on bone mass depends on other nutrients: Protein helps build bone as long as calcium and vitamin D intake are adequate. But if intake of calcium and vitamin D is low, high protein intake can lead to bone loss.

Weight-bearing aerobic exercise helps maintain bone mass throughout life, and strength training improves bone density, muscle mass, strength, and balance. Drinking alcohol only in moderation, refraining from smoking, and managing depression and stress are also important for maintaining strong bones. For people who develop osteoporosis, a variety of medications are available to treat the condition.

at the end of the chapter for recommendations for specific age groups.) If you exercise vigorously or live in a hot climate, you need to consume additional fluids to maintain a balance between water consumed and water lost. Severe dehydration causes weakness and can lead to death.

## Other Substances in Food

Many substances in food are not essential nutrients but may influence health.

**Antioxidants** When the body uses oxygen or breaks down certain fats or proteins as a normal part of metabolism, it gives rise to substances called **free radicals**. Environmental factors such as cigarette smoke, exhaust fumes, radiation, excessive sunlight, certain drugs, and stress can increase free radical production. A free radical is a

**osteoporosis** A condition in which the bones become extremely thin and brittle and break easily; due largely to insufficient calcium intake.

**free radical** An electron-seeking compound that can react with fats, proteins, and DNA, damaging cell membranes and mutating genes in its search for electrons; produced through chemical reactions in the body and by exposure to environmental factors such as sunlight and tobacco smoke.

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## Ask yourself

### QUESTIONS FOR CRITICAL THINKING AND REFLECTION

Experts say that two of the most important factors in a healthy diet are eating the “right” kinds of carbohydrates and eating the “right” kinds of fats. Based on what you’ve read so far in this chapter, which are the “right” carbohydrates and the “right” fats? How would you say your own diet stacks up when it comes to carbs and fats?

chemically unstable molecule that reacts with fats, proteins, and DNA, damaging cell membranes and mutating genes. Free radicals have been implicated in aging, cancer, cardiovascular disease, and other degenerative diseases like arthritis.

Antioxidants found in foods can help protect the body by blocking the formation and action of free radicals and repairing the damage they cause. Some antioxidants, such as vitamin C, vitamin E, and selenium, are also essential nutrients. Others—such as carotenoids, found in yellow, orange, and dark green leafy vegetables—are not. Researchers recently identified the top antioxidant-containing foods and beverages as blackberries, walnuts, strawberries, artichokes, cranberries, brewed coffee, raspberries, pecans, blueberries, cloves, grape juice, unsweetened baking chocolate, sour cherries, and red wine. Also high in antioxidants are brussels sprouts, kale, cauliflower, and pomegranates.

**Phytochemicals** Antioxidants fall into the broader category of **phytochemicals**, substances found in plant foods that may help prevent chronic disease. In the past 30 years, researchers have identified and studied hundreds of different compounds found in foods, and many findings are promising. For example, certain substances found in soy foods may help lower cholesterol levels. Sulforaphane, a compound isolated from broccoli and other **cruciferous vegetables**, may render some carcinogenic compounds harmless. Allyl sulfides, a group of chemicals found in garlic and onions, appear to boost the activity of cancer-fighting immune cells. Carotenoids found in green vegetables may help preserve eyesight with age. Further research on phytochemicals may extend the role of nutrition to the prevention and treatment of many chronic diseases.

To increase your intake of phytochemicals, eat a variety of fruits, vegetables, and grains rather than relying on supplements. Like many vitamins and minerals, isolated phytochemicals may be harmful if taken in high doses. In many cases, their health benefits may be the result of chemical substances working in combination. The role of phytochemicals in disease prevention is discussed further in Chapters 11 and 12.

## NUTRITIONAL GUIDELINES: PLANNING YOUR DIET

Various tools have been created by scientific and government groups to help people design healthy diets:

- The **Dietary Reference Intakes (DRIs)** are standards for nutrient intake designed to prevent nutritional deficiencies and reduce the risk of chronic diseases.
- The **Dietary Guidelines for Americans** were established to promote health and reduce the risk of major chronic diseases through diet and physical activity.
- **MyPlate** (formerly MyPyramid) provides daily food intake patterns that meet the DRIs and are consistent with the Dietary Guidelines for Americans.

### Dietary Reference Intakes (DRIs)

The Food and Nutrition Board establishes dietary standards, or recommended intake levels, for Americans of all ages. The current set of standards, called Dietary Reference Intakes (DRIs), was introduced in 1997. The DRIs are frequently reviewed and are updated as substantial new nutrition-related information becomes available. The DRIs present different categories of nutrients in easy-to-read table format. The DRIs have a broad focus, being based on research that looks not just at the prevention of nutrient deficiencies but also at the role of nutrients in promoting health and preventing chronic diseases such as cancer, osteoporosis, and heart disease.

The DRIs include standards for both recommended intakes and maximum safe intakes. The recommended intake of each nutrient is expressed as either a *Recommended Dietary Allowance (RDA)* or as *Adequate Intake (AI)*. An AI is set when there is not enough information available to set an RDA value; regardless of the type of standard used, however, the DRI represents the best available estimate of intake for optimal health. The Estimated Average Requirement (EAR) is the average daily nutrient intake level estimated to meet the requirement of half the healthy individuals in a particular life stage and gender group. The *Tolerable Upper Intake Level (UL)* is the maximum daily intake that is unlikely to cause health problems in a healthy person. For example, the RDA for calcium for an 18-year-old female is 1300 milligrams (mg) per day; the UL is 3000 milligrams per day.

Because of a lack of data, ULs have not been set for all nutrients. This does not mean that people can tolerate long-term intakes of these vitamins and minerals above recommended levels. Like all chemical agents, nutrients can produce adverse effects if intakes are excessive. There is no established benefit from consuming nutrients at levels above the RDA or AI. The DRIs can be found in the Nutrition Resources section at the end of the chapter.

**Daily Values** Because the DRIs are too cumbersome to use as a basis for food labels, the FDA developed another



set of dietary standards, the **Daily Values**. The Daily Values are based on several different sets of guidelines and include standards for fat, cholesterol, carbohydrate, dietary fiber, and selected vitamins and minerals. The Daily Values represent appropriate intake levels for a 2000-calorie diet. The percent Daily Value shown on a food label shows how well that food contributes to your recommended daily intake. Food labels are described in detail later in the chapter.

**Should You Take Supplements?** The aim of the DRIs is to guide you in meeting your nutritional needs primarily with food, rather than with vitamin and mineral supplements. Supplements lack potentially beneficial phytochemicals and fiber that are found only in whole foods. Most Americans can get the vitamins and minerals they need by eating a varied, nutritionally balanced diet.

The question of whether to take supplements is a serious one. Some vitamins and minerals are dangerous when ingested in excess, as described previously in Tables 8.4 and 8.5. Large doses of particular nutrients can also cause health problems by affecting the absorption of other vitamins and minerals. For all these reasons, you should think carefully about whether to take high-dose supplements; consider consulting a physician or registered dietitian.

Over the past two decades, high-dose supplement use has been promoted as a way to prevent or delay the onset of many diseases, including heart disease and several forms of cancer. These claims remain controversial, however, and a growing body of research shows that vitamin or mineral supplements have no significant impact on the risk of developing such illnesses. For example, a 2008 study conducted as part of the Women's Health Initiative showed no differences in the levels of heart disease, cancer, or overall mortality between postmenopausal women who took multivitamin supplements and those who did not. A similar study of adult men indicated that taking vitamins C and E did not reduce the risk of heart disease or certain cancers. According to the experts behind these and other studies, the research provides further proof that a balanced diet of whole foods—not high-dose supplementation—is the best way to promote health and prevent disease.

In setting the DRIs, the Food and Nutrition Board recommended supplements of particular nutrients for the following groups:

- Women who are capable of becoming pregnant should take 400 micrograms ( $\mu\text{g}$ ) per day of folic

acid (the synthetic form of the vitamin folate) from fortified foods and/or supplements in addition to folate from a varied diet. Research indicates that this level of folate intake will reduce the risk of neural tube defects. Enriched breads, flours, corn meals, rice, noodles, and other grain products are fortified with folic acid. Folate is found naturally in green leafy vegetables, legumes, oranges, and strawberries.

- People over age 50 should eat foods fortified with vitamin B-12, take B-12 supplements, or both to meet the majority of the DRI of 2.4 micrograms of B-12 daily. Up to 30% of people over 50 may have problems absorbing protein-bound B-12 in foods.
- Because of the oxidative stress caused by smoking, smokers should get 35 milligrams *more* vitamin C per day than the RDA set for their age and sex. However, supplements are not usually needed because this extra vitamin C can easily be found in foods. For example, an 8-ounce glass of orange juice has about 100 mg of vitamin C.

Supplements may also be recommended in other cases. Women with heavy menstrual flows may need extra iron. Older people, people with dark skin, and people exposed to little sunlight may need extra vitamin D. Some vegetarians may need supplemental calcium, iron, zinc, and vitamin B-12, depending on their food choices. Other people may benefit from supplementation based on their lifestyle physical condition, medicines, or dietary habits.

Before deciding whether to take a vitamin or mineral supplement, consider whether you already eat a fortified breakfast cereal every day. Many breakfast cereals contain almost as many nutrients as a multivitamin pill. If you

**phytochemical** A naturally occurring substance found in plant foods that may help prevent and treat chronic diseases such as heart disease and cancer; *phyto* means “plant.”

**cruciferous vegetables** Vegetables of the cabbage family, including cabbage, broccoli, brussels sprouts, kale, and cauliflower; the flower petals of these plants form the shape of a cross, hence the name.

**Dietary Reference Intakes (DRIs)** An umbrella term for four types of nutrient standards: Adequate Intake (AI), Estimated Average Requirement (EAR), and Recommended Dietary Allowance (RDA) are levels of intake considered adequate to prevent nutrient deficiencies and reduce the risk of chronic disease; Tolerable Upper Intake Level (UL) is the maximum daily intake that is unlikely to cause health problems.

**Dietary Guidelines for Americans** General principles of good nutrition intended to help prevent certain diet-related diseases.

**MyPlate** A food-group plan that provides practical advice to ensure a balanced intake of the essential nutrients.

**Daily Values** A simplified version of the RDAs used on food labels; also included are values for nutrients with no established RDA.

KEY  
TERMS



### Wellness Tip

If you take a supplement, *never* take more than the recommended dosage unless your doctor tells you to.



Food choices and portion control are key factors in weight management.

elect to take a supplement, choose one that contains 50–100% of the Daily Value for vitamins and minerals. Avoid supplements containing large doses of nutrients that may be harmful.

## Dietary Guidelines for Americans

To provide general guidance for choosing a healthy diet, the USDA and the U.S. Department of Health and Human Services (DHHS) jointly issue the Dietary Guidelines for Americans, updating and revising the guidelines every 5 years. The guidelines are intended for all Americans aged 2 and older. Following these guidelines promotes health and reduces the risk of chronic diseases, including heart disease, cancer, diabetes, stroke, osteoporosis, and obesity. Each of the recommendations is supported by an extensive review of scientific and medical evidence.

The 2010 Dietary Guidelines highlight four areas. First, because the majority of Americans are overweight or obese, the guidelines focus on ways to balance calorie consumption and calorie expenditure to manage weight. Second, because Americans also tend to consume too many calories without getting enough of certain nutrients, the guidelines focus on foods to reduce in the diet (the second highlighted area) and foods to increase in the diet (the third highlighted area). Finally, the guidelines focus on ways to incorporate the recommendations into overall healthy eating patterns. Specific recommendations for putting the Dietary Guidelines into practice are provided in MyPlate (discussed in the next section).

**Balancing Calories to Manage Weight** Calorie balance—the balance between calories consumed and calories expended—is the key to weight management. Current high rates of overweight and obesity can be attributed at least in part to people consuming more calories in foods and beverages than they expend in physical activity.

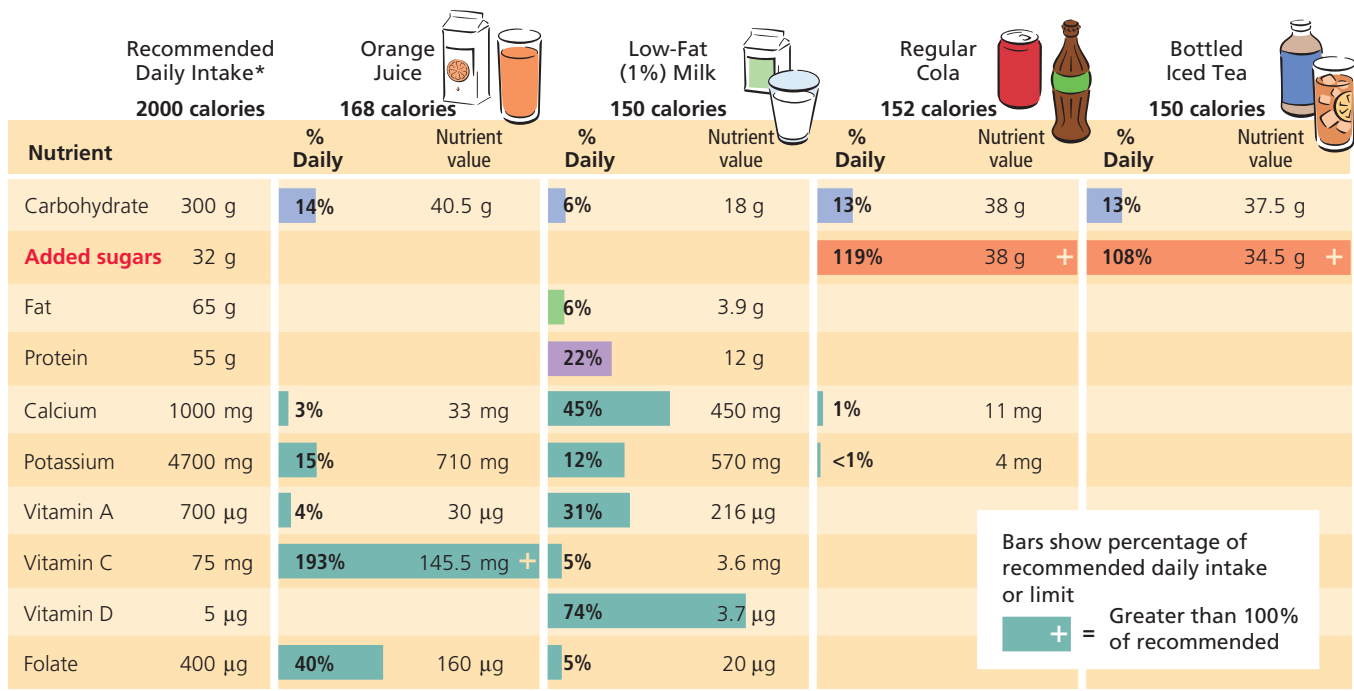
The guidelines recognize that many aspects of American life promote obesity, leading to an “obesogenic food environment.” Factors contributing to this environment include an increase in the number of fast-food restaurants in communities, an increase in meals eaten outside the home, increased portion sizes, sedentary work and home environments, limited availability of safe outdoor walking and recreational spaces, and increased dependence on transportation and technological advances that lead to lower calorie expenditure on everyday tasks.

Still, managing body weight means that individuals need to control total calorie intake, and for people who are overweight or obese, this means consuming fewer calories from foods and beverages. The guidelines encourage people to become more conscious of what, when, why, and how much they eat; to deliberately make better choices; and to seek ways to be more physically active. Several specific behaviors and practices can help people manage their calorie balance and maintain a healthy weight. Recommendations include:

- Know what calorie level is appropriate for you at your current level of activity, and be aware of how many calories you are consuming.
- Cook at home more and eat out less, and when you do eat out, eat smaller portions and lower-calorie options.
- Limit screen time, whether watching television, playing games, or using a computer, and don't eat when watching TV.

**Foods and Food Components to Reduce** In addition to overall calories, Americans tend to consume certain foods and food components in excess—in particular, sodium, solid fats, added sugars, and refined grains. These foods often replace needed nutrients in the diet. Key recommendations include:

- Reduce daily sodium intake to less than 2300 mg, and further reduce intake to 1500 mg if you are 51 or older, are African American, or have hypertension, diabetes, or chronic kidney disease. The 1500 mg recommendation applies to about half the U.S. population, including children, and the majority of adults. The average intake of sodium for all Americans is estimated at 3400 mg; for boys and men between the ages of 12 and 50, it is estimated at more than 4000 mg. High sodium intake is associated with high blood pressure. Most salt in the diet comes from salt added during food processing.
- Limit intake of saturated fat, trans fat, and dietary cholesterol. Consume less than 10% of calories from saturated fats by replacing them with monounsaturated and polyunsaturated fats. Keep trans fatty acid consumption as low as possible, especially by limiting foods that contain synthetic sources of trans fats, such as partially hydrogenated oils. (See the



\*Recommended intakes and limits appropriate for a 20-year-old woman consuming 2000 calories per day.

**FIGURE 8.3 Nutrient density of 12-ounce portions of selected beverages.**  
Color bars represent percentage of recommended daily intake or limit for each nutrient.

box “Reducing the Saturated and Trans Fats in Your Diet” for more information.) Consume less than 300 mg per day of dietary cholesterol.

- Reduce the intake of calories from solid fats and added sugars. Together, solid fats and added sugars contribute about 35% of the calories consumed by Americans, without contributing many nutrients. Most people should consume no more than 5–15% of daily calories from foods in these categories. Suggestions include limiting the amount of solid fats and added sugars when cooking and eating; consuming smaller and fewer portions of foods and beverages with these components, such as desserts and sodas; and eating the most nutrient-dense forms of foods in all food groups. Sodas, energy drinks, and sports drinks are the biggest source of added sugars in the American diet. The differences in nutrients between soda and other beverages are shown in Figure 8.3.
- Limit the consumption of foods that contain refined grains, especially refined grain foods that contain solid fats, added sugars, and sodium.

- If alcohol is consumed, it should be consumed in moderation.

**Foods and Nutrients to Increase** In general, Americans don’t eat a wide enough variety of nutrient-dense foods to obtain all the nutrients they need for optimal health. Recommendations include:

- Eat more fruits and vegetables, and eat a variety of vegetables, especially dark green, red, and orange vegetables and beans and peas. These foods are major sources of many nutrients that are underconsumed by many Americans, and they are relatively low in calories (unless prepared with added fats and sugars).
- Consume at least half of all grains as whole grains, which are a source of important nutrients such as iron, B vitamins, and dietary fiber.
- Increase intake of fat-free and low-fat milk and milk products, such as milk, yogurt, cheese, and fortified soy beverages. These foods are important sources of calcium, potassium, magnesium, vitamin D, and vitamin A. Milk and yogurt are preferable to cheese, which has more solid fat and more calories.
- Choose a variety of protein foods, including seafood, lean meat and poultry, eggs, beans and peas, soy products, and unsalted nuts and seeds. Increase the amount and variety of seafood, and reduce protein foods that are high in solid fats and calories. In addition to protein, these foods provide B vitamins,



### Wellness Tip

About a dozen major American cities, and the entire state of California, have enacted laws restricting the use of trans fats in commercially prepared foods.



## Reducing the Saturated and Trans Fats in Your Diet

Your overall goal is to limit total fat intake to no more than 35% of total calories. Favor unsaturated fats over saturated and trans fats. Here are some steps that can help reduce these types of fat in your diet:

- Be moderate in your consumption of foods high in fat, including fast foods, commercially prepared baked goods and desserts, deep-fried food, meat, poultry, nuts and seeds, and regular dairy products.
- When you eat high-fat foods, limit your portion sizes, and balance your intake with other foods that are low in fat.
- Choose lean cuts of meat, and trim any visible fat from meat before and after cooking. Remove skin from poultry before or after cooking.
- Drink fat-free or low-fat milk instead of whole milk, and use lower-fat milk when cooking or baking. Substitute plain low-fat yogurt, low-fat cottage cheese, or buttermilk for sour cream.
- Use vegetable oil instead of butter or margarine. Use tub or squeeze margarine instead of stick margarine. Look for

margarines that are free of trans fats. Minimize intake of coconut or palm oil.

- Season vegetables, seafood, and meats with herbs and spices rather than with creamy sauces, butter, or margarine.
- Use olive oil and lemon juice on salad, or use a yogurt-based salad dressing instead of mayonnaise or sour cream dressings.
- Steam, boil, bake, or microwave vegetables, or stir-fry them in a small amount of vegetable oil.
- Roast, bake, or broil meat, poultry, or fish so that fat drains away as the food cooks.
- Use a nonstick pan for cooking so that added fat will be unnecessary; use a vegetable spray for frying.
- Substitute egg whites for whole eggs when baking; limit the number of egg yolks when scrambling eggs.
- Choose fruits as desserts most often.
- Eat a low-fat vegetarian main dish at least once a week.

vitamin E, zinc, and magnesium. Seafood provides a range of nutrients, notably omega-3 fatty acids, which are associated with reduced risk of heart disease. (Seafood consumption is discussed in more detail later in the chapter.)

- Replace solid fats with oils where possible. Oils should not be added to the diet in addition to solid fats; instead, they should replace them.
- Because most Americans do not get enough potassium, dietary fiber, calcium, or vitamin D in their diet, they should consume more foods that contain these nutrients.
  - Potassium, which can help lower blood pressure, is found in many fruits, vegetables, and milk products. Recommended intake is 4700 mg per day.
  - Dietary fiber is found in beans and peas, other vegetables, fruits, nuts, and whole grains. Recommended daily intake for fiber is 25 g for women and 38 g for men; the current average daily intake is only about 15 g.
  - Calcium plays several important roles in health, including bone health. Low intake of calcium is a concern in children 9 and older, adolescent girls, adult women, and all adults age 51 and older. The chief sources of calcium in the diet are milk and milk products.
  - Vitamin D also has an important role in bone health. Chief sources are fortified foods, especially milk and yogurt.

- Other nutrients are a concern for certain special population groups, such as folic acid for women who may become pregnant.

**Building Healthy Eating Patterns** There are many different ways to incorporate the recommendations of the 2010 Dietary Guidelines into healthy eating patterns that (1) meet nutrient needs; (2) stay within calorie limits; (3) accommodate cultural, ethnic, traditional, and personal preferences; and (4) consider food cost and availability. In other words, people can eat healthfully in many different ways. Currently, however, there is a large discrepancy between the guidelines and the actual American diet.

Three eating plans that show how to put the Dietary Guidelines recommendations into action are the USDA Food Pattern (MyPlate), vegetarian adaptations of the USDA Food Pattern, and the DASH Eating Plan. (MyPlate and vegetarian diets are discussed later in the chapter, and the DASH Eating Plan is explained in the Nutrition Resources section at the end of this chapter.) A general principle in all these diets is that people should eat nutrient-dense foods—foods with little or no solid fats and added sugars. Another principle is that people should get their nutrients from foods rather than from supplements, although dietary supplements or fortification may be helpful in certain situations.

**Helping Americans Make Healthy Choices** A final area covered by the 2010 Dietary Guidelines for Americans is the environment in which people make their food choices.

To make healthy choices, individuals need *opportunities* to obtain healthy foods and engage in physical activity. Significant numbers of Americans—notably, members of racial and ethnic minorities, people with disabilities, and people with lower incomes—lack access to affordable, nutritious foods and/or opportunities for safe physical activity in their neighborhoods. The guidelines recognize the problem of *food security* in the United States—the ability to acquire adequate food to meet nutritional needs. Nearly 15% of the population is not able to obtain sufficient food to meet basic nutritional needs, and as noted above, many more Americans have diets that provide adequate calories but are deficient in essential nutrients.

The Dietary Guidelines propose the Social Ecological Model as a way to understand and address these complex problems. This model considers the interaction among individual factors (such as gender, income, and race/ethnicity), environmental settings (such as schools, workplaces, and restaurants), various sectors of influence (such as health care systems, agriculture, and media), and social and cultural norms and values (such as assumptions regarding body weight, types of foods consumed, and amount of physical activity incorporated into one's free time). All these factors play a role in a person's food and physical activity choices—and ultimately, in the person's health risks and outcomes.

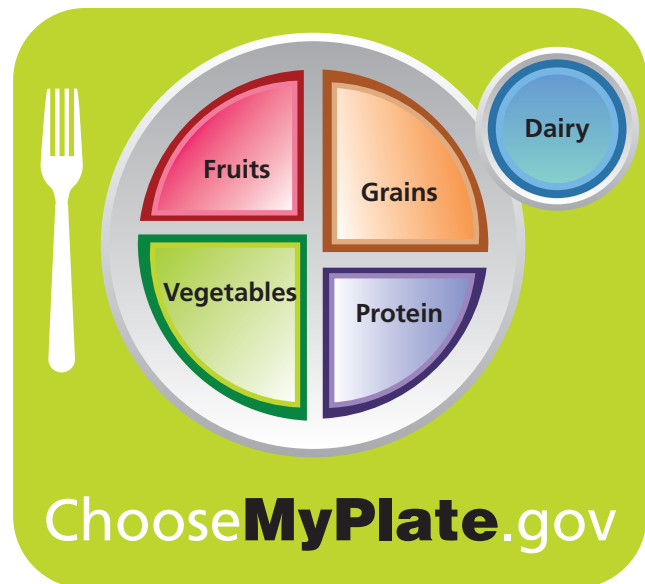
The guidelines call on all elements of society, ranging from educators to communities to government policy makers, to implement strategies aimed at improving the food and activity environment in the United States. Examples of such strategies are expanding access to grocery stores, farmers markets, and other sources of healthy food; ensuring that meals and snacks served in schools are consistent with the Dietary Guidelines; encouraging physical activity in schools; developing policies to limit food and beverage marketing to children; supporting sustainable agricultural practices; and providing nutrition assistance programs. Such measures have the potential to improve the health of current and future generations by making healthy physical activity and eating choices the norm.

## USDA's MyPlate

To help consumers put the Dietary Guidelines for Americans into practice, the USDA also issues the food guidance system known as MyPlate (called MyPyramid until 2011). MyPlate is designed for individuals to take advantage of the customization made possible by the Internet (Figure 8.4).

**Key Messages of MyPlate** MyPlate was developed to remind consumers to make healthy food choices and to be active every day. Key messages include the following:

- **Personalization** is an important element of the MyPlate program and the ChooseMyPlate.gov site, which includes individualized recommendations, interactive assessments of food intake and physical



**FIGURE 8.4** USDA's MyPlate.

The USDA food guidance system, called MyPlate, can be personalized based on an individual's sex, age, and activity level; visit [www.ChooseMyPlate.gov](http://www.ChooseMyPlate.gov) to obtain a food plan appropriate for you.

**SOURCE:** U.S. Department of Agriculture. 2011. *MyPlate* (<http://www.choosemyplate.gov>; retrieved August 6, 2011).

activity, weight-management tools, and tips for success.

- **Daily physical activity** is important for maintaining a healthy weight and reducing the risk of chronic disease.
- **Moderation** of food intake is represented by advice to use smaller plates and to carefully watch portion sizes.
- **Proportionality** is represented by the different sizes of the food groups on the plate. The serving sizes provide a general guide for how much food a person should choose from each group.
- **Variety** is represented by the five food groups. Foods from all groups are needed daily for good health.
- **Gradual improvement** is a good strategy; people can benefit from taking small steps to improve their diet and activity habits each day.

The MyPlate chart in Figure 8.5 shows the food intake patterns recommended for different levels of calorie intake. Table 8.6 provides guidance for determining an appropriate calorie intake for weight maintenance. Use the table to identify an energy intake that is about right for you, and then refer to the appropriate column in Figure 8.5. You can also get a personalized version of MyPlate recommendations by visiting [ChooseMyPlate.gov](http://ChooseMyPlate.gov). Each food group is described briefly in the following sections. Many Americans have trouble identifying serving sizes, so recommended daily intakes from each group are given in terms of cups and ounces; see the box "Judging Portion Sizes" for additional advice.



**Daily Amount of Food from Each Group**  
Food group amounts shown in cups (c) or ounce-equivalents (oz-eq)

Calorie level of pattern	1600	1800	2000	2200	2400	2600	2800	3000
<b>Fruits</b>	1.5 c	1.5 c	2 c	2 c	2 c	2 c	2.5 c	2.5 c
<b>Vegetables</b>	2 c	2.5 c	2.5 c	3 c	3 c	3.5 c	3.5 c	4 c
Dark-green	1.5 c/wk	1.5 c/wk	1.5 c/wk	2 c/wk	2 c/wk	2.5 c/wk	2.5 c/wk	2.5 c/wk
Red and orange	4 c/wk	5.5 c/wk	5.5 c/wk	6 c/wk	6 c/wk	7 c/wk	7 c/wk	7.5 c/wk
Beans and peas (legumes)	1 c/wk	1.5 c/wk	1.5 c/wk	2 c/wk	2 c/wk	2.5 c/wk	2.5 c/wk	3 c/wk
Starchy	4 c/wk	5 c/wk	5 c/wk	6 c/wk	6 c/wk	7 c/wk	7 c/wk	8 c/wk
Other	3.5 c/wk	4 c/wk	4 c/wk	5 c/wk	5 c/wk	5.5 c/wk	5.5 c/wk	7 c/wk
<b>Grains</b>	5 oz-eq	6 oz-eq	6 oz-eq	7 oz-eq	8 oz-eq	9 oz-eq	10 oz-eq	10 oz-eq
Whole grains	3 oz-eq	3 oz-eq	3 oz-eq	3.5 oz-eq	4 oz-eq	4.5 oz-eq	5 oz-eq	5 oz-eq
Enriched grains	2 oz-eq	3 oz-eq	3 oz-eq	3.5 oz-eq	4 oz-eq	4.5 oz-eq	5 oz-eq	5 oz-eq
<b>Protein foods</b>	5 oz-eq	5 oz-eq	5.5 oz-eq	6 oz-eq	6.5 oz-eq	6.5 oz-eq	7 oz-eq	7 oz-eq
Seafood	8 oz/wk	8 oz/wk	8 oz/wk	9 oz/wk	10 oz/wk	10 oz/wk	11 oz/wk	11 oz/wk
Meat poultry, eggs	24 oz/wk	24 oz/wk	26 oz/wk	29 oz/wk	31 oz/wk	31 oz/wk	34 oz/wk	34 oz/wk
Nuts, seeds, soy products	4 oz/wk	4 oz/wk	4 oz/wk	4 oz/wk	5 oz/wk	5 oz/wk	5 oz/wk	5 oz/wk
<b>Dairy</b>	3 c	3 c	3 c	3 c	3 c	3 c	3 c	3 c
<b>Oils</b>	22 g	24 g	27 g	29 g	31 g	34 g	36 g	44 g
<b>Maximum SoFAS limit, calories (% of calories)</b>	121 (8%)	161 (9%)	258 (13%)	266 (12%)	330 (14%)	362 (14%)	395 (14%)	459 (15%)

**FIGURE 8.5 MyPlate food intake patterns.**

To determine an appropriate amount of food from each group, find the column with your approximate daily energy intake. That column lists the daily recommended intake from each food group. Visit [ChooseMyPlate.gov](http://ChooseMyPlate.gov) for a personalized intake plan and for intakes for other calorie levels.

**SOURCE:** U.S. Department of Health and Human Services and U.S. Department of Agriculture. 2011. *Dietary Guidelines for Americans, 2010, Appendix 7. USDA Food Patterns* (<http://www.cnpp.usda.gov/Publications/DietaryGuidelines/2010/PolicyDoc/PolicyDoc.pdf>, retrieved August 7, 2011).

**Whole and Refined Grains** Foods from this group are usually low in fat and rich in complex carbohydrates, dietary fiber (if grains are unrefined), and many vitamins and minerals. A 2000-calorie diet should include 6 ounce-equivalents each day. The following count as 1 ounce-equivalent:

- 1 slice of bread
- 1 small (2½-inch diameter) muffin
- 1 cup ready-to-eat cereal flakes

- ½ cup cooked cereal, rice, grains, or pasta
- 1 6-inch tortilla

Choose foods that are typically made with little fat or added sugar (bread, rice, pasta) over those that are high in fat and added sugar (croissants, chips, cookies, doughnuts). The key message is to make at least half your grains whole grains.

**Vegetables** Vegetables contain carbohydrates, dietary fiber, and many other nutrients, and they are naturally low in fat. A 2000-calorie diet should include 2½ cups of

## Judging Portion Sizes

Studies have shown that most people underestimate the size of their food portions, in many cases by as much as 50%. If you need to retrain your eye, try using measuring cups and spoons and an inexpensive kitchen scale when you eat at home. With a little practice, you'll learn the difference between 3 and 8 ounces of chicken or meat, and what a half-cup of rice really looks like. For quick estimates, use the following equivalents:

- 1 teaspoon of margarine = one dice
- 1 ½ ounce of cheese = your thumb, four dice stacked together
- 3 ounces of chicken or meat = a deck of cards
- ½ cup of cooked rice, pasta, or potato = ½ baseball

- 1 cup of cereal flakes = a fist
- 2 tablespoons of peanut butter = a ping-pong ball
- 1 medium potato = a computer mouse
- 1–2-ounce muffin or roll = a plum or large egg
- 2-ounce bagel = a hockey puck or yo-yo
- 1 medium fruit (apple or orange) = a baseball
- ¼ cup nuts = a golf ball
- Small cookie or cracker = a poker chip



TAKE CHARGE

vegetables daily. Each of the following counts as 1/2 cup or equivalent of vegetables:

- ½ cup raw or cooked vegetables
- 1 cup raw leafy salad greens
- ½ cup vegetable juice

Because vegetables vary in the nutrients they provide, MyPlate recommends servings from five different subgroups within the vegetables group. Choose vegetables from several subgroups each day. (For clarity, Figure 8.5 shows servings from the subgroups in terms of weekly consumption.) The key message is to fill half your plate with fruits and vegetables.

**Fruits** Fruits are rich in carbohydrates, dietary fiber, and many vitamins, especially vitamin C. A 2000-calorie diet should include 2 cups of fruits daily. Each of the following counts as ½ cup or equivalent of fruit:

- ½ cup fresh, canned, or frozen fruit
- ½ cup fruit juice (100% juice)
- ½ large (3½" diameter) whole fruit
- ¼ cup dried fruit

Choose whole fruits often; they are higher in fiber and often lower in calories than fruit juices. Fruit *juices* typically contain more nutrients and less added sugar than fruit *drinks*. Choose canned fruits packed in 100% fruit juice or water rather than in syrup. Again, MyPlate's key message for consumers is to fill half your plate with fruits and vegetables.

**Dairy** This group includes all milk and milk products, as well as lactose-free and lactose-reduced products. Those consuming 2000 calories per day should include 3 cups

of milk or the equivalent daily. Each of the following counts as the equivalent of 1 cup:

- 1 cup milk or yogurt
- ½ cup ricotta cheese
- 1½ ounces natural cheese
- 2 ounces processed cheese

Cottage cheese is lower in calcium than most other cheeses; ½ cup is equivalent to ¼ cup milk. Ice cream is also lower in calcium and higher in sugar and fat than many other dairy products; one scoop counts as ⅓ cup milk. MyPlate's key message for consumers is to switch to fat-free or low-fat (1%) milk and dairy products.

**Protein Foods (Meat and Beans)** This group includes meat, poultry, fish, dried beans and peas, eggs, nuts, and seeds. A 2000-calorie diet should include 5½ ounce-equivalents daily. Each of the following counts as equivalent to 1 ounce:

- 1 ounce cooked lean meat, poultry, or fish
- ¼ cup cooked dry beans (legumes) or tofu
- 1 egg
- 1 tablespoon peanut butter
- ½ ounce nuts or seeds

Choose lean meats and skinless poultry, and watch your serving sizes carefully. Choose at least one serving of plant proteins, such as black beans, lentils, or tofu, every day.

**Oils** Oils and soft margarines include vegetable oils and soft vegetable oil table spreads that have no trans fats. These are major sources of vitamin E and unsaturated fatty

**Table 8.6** USDA Daily Calorie Intake Levels

AGE (YEARS)	SEDENTARY*	MODERATELY ACTIVE**	ACTIVE <sup>+</sup>
<b>FEMALE</b>			
2–3	1000	1000–1200	1000–1400
4–8	1200–1400	1400–1600	1400–1800
9–13	1400–1600	1600–2000	1800–2200
14–18	1800	2000	2400
19–25	2000	2200	2400
26–30	1800	2000	2400
31–50	1800	2000	2200
51 +	1600	1800	2000–2200
<b>MALE</b>			
2–3	1000–1200	1000–1400	1000–1400
4–8	1200–1400	1400–1600	1600–2000
9–13	1600–2000	1800–2200	2000–2600
14–18	2000–2400	2400–2800	2800–3200
19–20	2600	2800	3000
21–25	2400	2800	3000
26–30	2400	2600	3000
31–35	2400	2600	3000
36–40	2400	2600	2800
41–45	2200	2600	2800
46–50	2200	2400	2800
51–55	2200	2400	2800
56 +	2000–2200	2200–2400	2400–2600

\*A lifestyle that includes only the light physical activity associated with typical day-to-day life.

\*\*A lifestyle that includes physical activity equivalent to walking about 1.5–3 miles per day at 3–4 miles per hour (30–60 minutes a day of moderate physical activity), in addition to the light physical activity associated with typical day-to-day life.

<sup>+</sup>A lifestyle that includes physical activity equivalent to walking more than 3 miles per day at 3–4 miles per hour (60 or more minutes a day of moderate physical activity), in addition to the light physical activity associated with typical day-to-day life.

**SOURCE:** U.S. Department of Health and Human Services and U.S. Department of Agriculture. 2011. *Dietary Guidelines for Americans, 2010, Appendix 6. Estimated Calorie Needs per Day by Age, Gender, and Physical Activity Level* (<http://www.cnpp.usda.gov/Publications/DietaryGuidelines/2010/PolicyDoc/PolicyDoc.pdf>; retrieved August 7, 2011).

acids, including the essential fatty acids. A 2000-calorie diet should include 6 teaspoons of oils per day. One teaspoon is the equivalent of the following:

- 1 teaspoon vegetable oil or soft margarine
- 1 tablespoon salad dressing or light mayonnaise

Foods that are mostly oils include nuts, olives, avocados, and some fish. The following portions include about 1 teaspoon of oil: 4 large olives, ½ medium avocado, 2 tablespoons peanut butter, and 1 ounce roasted nuts.

Food labels can help you identify the type and amount of fat in various foods.

**Solid Fats and Added Sugars** If you consistently choose nutrient-dense foods that are fat-free or low-fat and that contain no added sugars, you can also have a small amount of additional calories in the form of solid fats and added sugars (SoFAS). Figure 8.5 shows the maximum number of SoFAS calories allowed at each calorie level in MyPlate.

People who are trying to lose weight may choose not to use SoFAS calories. For those wanting to maintain weight, these calories may be used to increase the amount of food from a food group; to consume foods that are not in the lowest-fat form or that contain added sugars; to add oil, fat, or sugars to foods; or to consume alcohol.

The current American diet includes higher levels of sugar intake and more calories per day from sugar than recommended. For teenagers age 14–18, sodas and energy and sports drinks are the top source of calories in the diet, accounting for 226 calories per beverage; teens typically drink more than one such beverage daily. In particular, experts advise consumers to be wary of products containing high-fructose corn syrup. Although this sweetener is not harmful in itself, it is high in calories and very low in nutritional value. High-fructose corn syrup is found in many products, especially soft drinks and processed foods. Research has linked high consumption of high-fructose corn syrup with obesity, diabetes, and other health problems.

**Physical Activity** Like the Dietary Guidelines and other plans, MyPlate encourages physical activity for improving health, preventing chronic diseases, and managing weight. The physical activity recommendations in MyPlate are very similar to those found in the Dietary Guidelines (described earlier in this chapter); if you meet the Department of Health and Human Services’ guidelines of 150 minutes per week of moderate physical activity, you will meet the recommendations found in MyPlate.

### Other Food-Group Plans

A variety of experts have proposed other food-group plans. Some of these address perceived shortcomings in the USDA plans, and some have adapted the old MyPyramid plans to special populations. Two alternative food plans appear in the Nutrition Resources section at the end

#### Fitness Tip



Consumption of red meats, sweets, eggs, and butter is greatly reduced or eliminated entirely in most forms of the Mediterranean diet.



of the chapter: the DASH eating plan and the Harvard Healthy Eating Pyramid. The USDA Center for Nutrition Policy and Promotion ([www.usda.gov/cnpp](http://www.usda.gov/cnpp)) has more on alternative food plans for special populations such as young children, older adults, and people choosing particular ethnic diets. MyPlate is available in Spanish, and there are special adaptations of MyPlate for children and for women who are pregnant or breastfeeding.

Another food plan that has received attention in recent years is the Mediterranean diet, which emphasizes vegetables, fruits, and whole grains; daily servings of beans, legumes, and nuts; moderate consumption of fish, poultry, and dairy products; and the use of olive oil over other types of fat, especially saturated fat. The Mediterranean diet has been associated with lower rates of heart disease and cancer, and recent studies have found a link between the diet and a greatly reduced risk of Parkinson's disease and Alzheimer's disease.

## The Vegetarian Alternative

**Vegetarians** choose a diet with one essential difference from the diets described previously—they eliminate or restrict foods of animal origin (meat, poultry, fish, eggs, milk). Many people choose such diets for health reasons; vegetarian diets tend to be lower in saturated fat, cholesterol, and animal protein and higher in complex carbohydrates, dietary fiber, folate, vitamins C and E, carotenoids, and phytochemicals. Some people adopt a vegetarian diet out of concern for the environment, for financial considerations, or for reasons related to ethics or religion.

**Types of Vegetarian Diets** There are various vegetarian styles. The wider the variety of the diet eaten, the easier it is to meet nutritional needs.

- **Vegans** eat only plant foods.
- **Lacto-vegetarians** eat plant foods and dairy products.
- **Lacto-ovo-vegetarians** eat plant foods, dairy products, and eggs.

Others can be categorized as partial vegetarians, semi-vegetarians, or pescovegetarians. These people eat plant foods, dairy products, eggs, and usually a small selection of poultry, fish, and other seafood. Many other people choose vegetarian meals frequently but are not strictly vegetarian. Including some animal protein (such as dairy products) in a mostly vegetarian diet makes meal planning easier, but it is not necessary.

**A Food Plan for Vegetarians** MyPlate can be adapted for use by vegetarians with only a few key modifications. For the meat and beans group, vegetarians can focus on the nonmeat choices of dry beans and peas, nuts, seeds, eggs, and soy foods like tofu. Vegans and other vegetarians who do not eat or drink any dairy products must

find other rich sources of calcium (see the following list). Fruits, vegetables, and whole grains are healthy choices for people following all types of vegetarian diets.

A healthy vegetarian diet emphasizes a wide variety of plant foods. Although plant proteins are generally of a lower quality than animal proteins, choosing a variety of plant foods will supply all of the essential amino acids. Choosing minimally processed and unrefined foods will maximize nutrient value and provide ample dietary fiber. Daily consumption of a variety of plant foods in amounts that meet total energy needs can provide all needed nutrients except vitamin B-12 and possibly vitamin D. Strategies for getting these and other nutrients include the following:

- **Vitamin B-12** is found naturally only in animal foods. If dairy products and eggs are limited or avoided, B-12



Variety is the key to maintaining a healthy, balanced vegetarian diet.

**vegetarian** Someone who follows a diet that restricts or eliminates foods of animal origin.

KEY  
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can be found in fortified foods such as ready-to-eat cereals, soy beverages, meat substitutes, special yeast products, and supplements.

- **Vitamin D** can be obtained by spending 5–15 minutes a day in the sun, by consuming vitamin D–fortified products like ready-to-eat cereals and soy or rice milk, or by taking a supplement.
- **Calcium** is found in legumes, tofu processed with calcium, dark-green leafy vegetables, nuts, tortillas made from lime-processed corn, fortified orange juice, soy milk, bread, and other foods.
- **Iron** is found in whole grains, fortified bread and breakfast cereals, dried fruits, leafy green vegetables, nuts and seeds, legumes, and soy foods. The iron in plant foods is more difficult for the body to absorb than the iron from animal sources. Eating or drinking a good source of vitamin C with most meals is helpful because vitamin C improves iron absorption.
- **Zinc** is found in whole grains, nuts, legumes, and soy foods.

If you are a vegetarian, remember that it's especially important to eat as wide a variety of foods as possible to ensure that all your nutritional needs are satisfied. Consulting with a registered dietitian will make your planning easier. Vegetarian diets for children, teens, and pregnant and lactating women warrant professional guidance.

## Dietary Challenges for Various Population Groups

MyPlate and the Dietary Guidelines for Americans provide a basis that nearly everyone can use to create a healthy diet. However, different population groups should be aware of special dietary challenges.

**Children and Teenagers** The best approach for parents with young children is to provide a variety of foods. For example, parents can add vegetables to casseroles and fruit to cereal, or they can offer fruit and vegetable juices or homemade yogurt or fruit shakes instead of sugary drinks. Allowing children to help prepare meals is another good way to encourage good eating habits.

**Women** Women tend to need fewer calories than men, so they may need to focus more on nutrient-dense foods to make sure they are getting enough of all the essential nutrients. Two nutrients of special concern to women are calcium and iron. Low calcium intake may be linked to the development of osteoporosis in later life. Nonfat and low-fat dairy products and fortified cereal, bread, and orange juice are good sources of calcium.

## Ask yourself

### QUESTIONS FOR CRITICAL THINKING AND REFLECTION

What factors influence your food choices—convenience, cost, availability, habit? Do you ever consider nutritional content or nutritional recommendations like those found in MyPlate? If not, how big a change would it be for you to think of nutritional content first when choosing food? Is it something you could do easily?

Menstruating women have higher iron requirements than other groups, and a lack of iron in the diet can lead to iron-deficiency anemia. Lean red meat, leafy green vegetables, and fortified breakfast cereals are good sources of iron. As discussed earlier, all women capable of becoming pregnant should also get enough folate or folic acid from fortified foods and/or supplements.

Good nutrition is essential to a healthy pregnancy. Nutritional counseling can help a woman create a plan for healthy eating before and during pregnancy. Diet is especially important for any woman with special nutritional needs or an eating disorder, or who is overweight or obese. Physicians commonly prescribe prenatal vitamin supplements to pregnant women. The U.S. Public Health Service recommends that all women of childbearing age get 400 µg of folic acid from fortified foods and/or supplements each day to reduce the risk of neural tube defects that can arise in the fetus.

**College Students** Foods that are convenient for college students are not always the healthiest choices. However, it is possible to make healthy eating both convenient and affordable. See the tips in the box “Eating Strategies for College Students.”

**Older Adults** As people age, they tend to become less active, so they require fewer calories to maintain their weight. At the same time, the absorption of nutrients tends to be lower in older adults because of age-related changes in the digestive tract. As discussed earlier, foods fortified with vitamin B-12 and/or B-12 supplements are recommended for people over age 50. Because constipation is a common problem, consuming foods high in dietary fiber and drinking enough fluids are important goals.

**Athletes** Key dietary concerns for athletes are meeting increased energy and fluid requirements for training and making healthy food choices throughout the day. For more on this topic, see the box “Do Athletes Need a Different Diet?”

**People with Special Health Concerns** Many Americans have special health concerns that affect their dietary needs. For example, women who are pregnant or breastfeeding





## In General

- Eat a colorful, varied diet. The more colorful your diet is, the more varied and rich in fruits and vegetables it will be. Fruits and vegetables are typically inexpensive, delicious, nutritious, and low in fat and calories.
- Eat breakfast. You'll have more energy in the morning and be less likely to grab an unhealthy snack later on.
- Choose healthy snacks—fruits, vegetables, whole grains, and cereals.
- Drink nonfat milk, water, mineral water, or 100% fruit juice more often than soft drinks or sweetened beverages.
- Pay attention to portion sizes.
- Combine physical activity with healthy eating.

## Eating in the Dining Hall

- Choose a meal plan that includes breakfast.
- Decide what you want to eat before you get in line, and stick to your choices.
- Build your meals around whole grains and vegetables. Ask for small servings of meat and high-fat main dishes.
- Choose leaner poultry, fish, or bean dishes rather than high-fat meats and fried entrees.
- Ask that gravies and sauces be served on the side; limit your intake.
- Choose broth-based or vegetable soups rather than cream soups.
- At the salad bar, load up on leafy greens, beans, and fresh vegetables. Avoid mayonnaise-coated salads, bacon, croutons, and high-fat dressings. Put dressing on the side; dip your fork into it rather than pouring it over the salad.
- Choose fruit for dessert rather than cookies or cakes.

## Eating in Fast-Food Restaurants

- Most fast-food chains can provide a brochure with the nutritional content of their menu items. Ask for it, or check the restaurant's Web site for nutritional information. Order small single burgers with no cheese instead of double burgers with many toppings. If possible, get them broiled instead of fried.
- Ask for items to be prepared without mayonnaise, tartar sauce, sour cream, or other high-fat sauces. Ketchup, mustard, and fat-free mayonnaise or sour cream are better choices and are available at many fast-food restaurants.

- Choose whole-grain buns or bread for sandwiches.
- Choose chicken items made from chicken breast, not processed chicken.
- Order vegetable pizzas without extra cheese.
- If you order french fries or onion rings, get the smallest size and/or share them with a friend. Better yet, get a salad or a fruit cup instead.

## Eating on the Run

- When you need to eat in a hurry, remember that you can carry healthy foods in your backpack or a small insulated lunch sack (with a frozen gel pack to keep fresh food from spoiling).
- Carry items that are small and convenient but nutritious, such as fresh fruits or vegetables, whole-wheat buns or muffins, snack-size cereal boxes, and water.





## Do Athletes Need a Different Diet?

If you exercise vigorously and frequently, or if you are an athlete in training, you likely have increased energy and fluid requirements.

Research supports the following recommendations for athletes:

- **Energy intake:** Someone engaged in a vigorous training program may have energy needs as high as 6000 calories per day—far greater than the energy needs of a moderately active person. For athletes, the Academy of Nutrition and Dietetics (formerly the American Dietetic Association) recommends a diet with 60–65% of calories coming from carbohydrates, 10–15% from protein, and no more than 30% from fat.

Athletes who need to maintain low body weight and fat (such as gymnasts, skaters, and wrestlers) need to get enough calories and nutrients while avoiding unhealthy eating patterns such as bulimia. The combination of low body fat, high physical activity, disordered eating habits—and, in women, amenorrhea—is associated with osteoporosis, stress fractures, and other injuries. If keeping your weight and body fat low for athletic reasons is important to you, seek dietary advice from a qualified dietician and make sure your physician is aware of your eating habits.

- **Carbohydrates:** Endurance athletes involved in competitive events lasting longer than 90 minutes may benefit from increasing carbohydrate intake to 65–70% of their total calories. Specifically, the American College of Sports Medicine (ACSM) recommends that athletes consume 2.7–4.5 grams per pound of body weight daily, depending on their weight, sport, and other nutritional needs. This increase should come in the form of complex carbohydrates.

High carbohydrate intake builds and maintains glycogen stores in the muscles, resulting in greater endurance and delayed fatigue during competitive events. The ACSM recommends that before exercise an active adult or athlete eat a meal or snack that is relatively high in carbohydrates, moderate in protein, and low in fat and fiber. Eating carbohydrates 30 minutes, 2 hours, and 4 hours after exercise can help replenish glycogen stores in the liver and muscles.

- **Fat:** The ACSM recommends that all athletes get 20–35% of calories from fat in their diets. This is in line with the daily intake suggested by the Food and Nutrition Board. Reducing fat intake to less than 20% of daily calories can negatively affect performance and be harmful to health.

- **Protein:** For endurance and strength-trained athletes, the ACSM recommends eating 0.5–0.8 gram of protein per pound of body weight each day, which is considerably higher than the standard DRI of 0.36 gram per pound. This level of protein is easily obtainable from foods; in fact, most Americans eat more protein than they need every day. A balanced, moderate-protein diet can provide the protein most athletes need.



There is no evidence that consuming supplements containing vitamins, minerals, protein, or specific amino acids builds muscle or improves sports performance. Strength and muscle are built with exercise, not extra protein, and carbohydrates provide the fuel needed for muscle-building exercise.

- **Fluids:** If you exercise heavily or live in a hot climate, you should drink extra fluids to maximize performance and prevent heat illness. For a strenuous endurance event, prepare yourself the day before by drinking plenty of fluids. The ACSM recommends drinking 2–3 milliliters of fluid per pound of body weight about 4 hours before the event. During the event, take in enough fluids to compensate for fluid loss due to sweating; the amount required depends on the individual and his or her sweat rate. Afterward, drink enough to replace lost fluids—about 16–24 ounces for every pound of weight lost.

Water is a good choice for fluid replacement for events lasting 60–90 minutes. For longer workouts or events, a sports drink can be a good choice. These contain water, electrolytes, and carbohydrates and can provide some extra energy as well as replace electrolytes like sodium lost in sweat.

**SOURCE:** American College of Sports Medicine. 2009. *American College of Sports Medicine Position Stand: Nutrition and Athletic Performance* (<http://www.acsm-msse.org/pt/pt-core/template-journal/msse/media/0309nutrition.pdf>; retrieved April 23, 2011).

require extra calories, vitamins, and minerals. People with diabetes benefit from a well-balanced diet that is low in simple sugars, high in complex carbohydrates, and relatively rich in monounsaturated fats. People with high

blood pressure need to limit their sodium consumption and control their weight. If you have a health problem or concern that may require a special diet, discuss your situation with a physician or registered dietitian.

# Using Food Labels



CRITICAL CONSUMER

The “Nutrition Facts” section of a food label designed to help consumers make food choices based on the nutrients that are most important to good health. In addition to listing nutrient content by weight, the label puts the information in the context of a daily diet of 2000 calories that includes no more than 65 grams of fat (approximately 30% of total calories). For example, if a serving of a particular product has 13 grams of fat, the label will show that the serving represents 20% of the daily fat allowance. If your daily diet contains fewer or more than 2000 calories, you need to adjust these calculations accordingly.

Food labels contain uniform serving sizes. This means that if you look at different brands of salad dressing, for example, you can compare calories and fat content based on the serving amount. (Food label serving sizes may be larger or smaller than USDA serving size equivalents, however.) Regulations also require that foods meet strict definitions if their packaging includes the terms *light*, *low-fat*, or *high-fiber* (see below). Health claims such as “good source of dietary fiber” or “low in saturated fat” on packages are signals that those products can wisely be included in your diet. Overall, the food label is an important tool to help you choose a diet that conforms to My-Plate and the Dietary Guidelines.

## Selected Nutrient Claims and What They Mean

- **Healthy** A food that is low in fat, is low in saturated fat, has no more than 360–480 mg of sodium and 60 mg of cholesterol, *and* provides 10% or more of the Daily Value for vitamin A, vitamin C, protein, calcium, iron, or dietary fiber.
- **Light or lite** 33% fewer calories or 50% less fat than a similar product.
- **Reduced or fewer** At least 25% less of a nutrient than a similar product; can be applied to fat (“reduced fat”), saturated fat, cholesterol, sodium, and calories.
- **Extra or added** 10% or more of the Daily Value per serving when compared to what a similar product has.
- **Good source** 10–19% of the Daily Value for a particular nutrient per serving.
- **High, rich in, or excellent source of** 20% or more of the Daily Value for a particular nutrient per serving.
- **Low calorie** 40 calories or less per serving.
- **High fiber** 5 g or more of fiber per serving.
- **Good source of fiber** 2.5–4.9 g of fiber per serving.
- **Fat-free** Less than 0.5 g of fat per serving.
- **Low-fat** 3 g of fat or less per serving.
- **Saturated fat-free** Less than 0.5 g of saturated fat and 0.5 g of trans fatty acids per serving.

- **Low saturated fat** 1 g or less of saturated fat per serving and no more than 15% of total calories.
- **Cholesterol-free** Less than 2 mg of cholesterol and 2 g or less of saturated fat per serving.
- **Low cholesterol** 20 mg or less of cholesterol and 2 g or less of saturated fat per serving.
- **Low sodium** 140 mg or less of sodium per serving.
- **Very low sodium** 35 mg or less of sodium per serving.
- **Lean** Cooked seafood, meat, or poultry with less than 10 g of fat, 4.5 g or less of saturated fat, and less than 95 mg of cholesterol per serving.
- **Extra lean** Cooked seafood, meat, or poultry with less than 5 g of fat, 2 g of saturated fat, and 95 mg of cholesterol per serving.

**NOTE:** The FDA has not yet defined nutrient claims relating to carbohydrates, so foods labeled low- or reduced-carbohydrate do not conform to any approved standard.

1. **Serving size:** Determine how many servings there are in the food package and compare it to how much you actually eat. You may need to adjust the rest of the nutrient values based on your typical serving size.

2. **Calories and calories from fat:** Note whether a serving is high in calories and fat. The sample food shown here is low in fat, with only 30 of its 235 calories from fat.

3. **Daily Values:** Based on a 2000-calorie diet, Daily Value percentages tell you whether the nutrients in a serving of food contribute a lot or a little to your total daily diet.  
5% or less is low  
20% or more is high

4. **Limit these nutrients:** Look for foods low in fat, saturated fat, trans fat, cholesterol, and sodium.

5. **Get enough of these nutrients:** Look for foods high in dietary fiber, vitamin A, vitamin C, calcium, and iron.



Nutrition Facts					
Serving Size 1 cup (265g)					
Servings per Container 2					
Amount per Serving					
<b>Calories</b> 235		Calories from Fat 30			
* % Daily Value*					
<b>Total Fat</b> 3g			5%		
Saturated Fat 1g			5%		
Trans Fat 0.5g					
<b>Cholesterol</b> 30mg			10%		
<b>Sodium</b> 775mg			32%		
<b>Total Carbohydrate</b> 34g			11%		
Dietary Fiber 9g			36%		
Sugars 5g					
<b>Protein</b> 18g					
Vitamin A 25%		Vitamin C 0%			
Calcium 12%		Iron 20%			
*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:					
		Calories	2,000	2,500	
Total Fat	Less than	65g	80g		
Sat Fat	Less than	20g	25g		
Cholesterol	Less than	300mg	300mg		
Sodium	Less than	2,400mg	2,400mg		
Total Carbohydrate		300g	375g		
Dietary Fiber		25g	30g		
Calories per gram:					
Fat	9	Carbohydrate	4	Protein	4

**Footnote:** This section shows recommended daily intake for two levels of calorie consumption and values for dietary calculations. It's the same on all labels.

## NUTRITIONAL PLANNING: MAKING INFORMED CHOICES ABOUT FOOD

Knowing about nutrition is a good start to making sound choices about food. It also helps if you can interpret food labels, understand food additives, and avoid foodborne illnesses.

### Food Labels

All processed foods regulated by either the FDA or the USDA include standardized nutrition information on their labels. Every food label shows serving sizes and the amount of fat, saturated fat, trans fat, cholesterol, protein, dietary fiber, sugars, total carbohydrate, and sodium in each serving. To make intelligent choices about food, learn to read and understand food labels (see the box “Using Food Labels”).

Food labels are not required on fresh meat, poultry, fish, fruits, and vegetables (many of these products are not packaged). You can get information on the nutrient content of these items from basic nutrition books, registered dietitians, nutrient analysis computer software, the Web, and the companies that produce or distribute these foods. Also, supermarkets often have posters or pamphlets listing the nutrient contents of these foods. In Lab 8.3, you compare foods using the information on their labels.

### Dietary Supplements

Dietary supplements include vitamins, minerals, amino acids, herbs, enzymes, and other compounds. Although dietary supplements are often thought of as safe and natural, they contain powerful bioactive chemicals that have the potential for harm. About one-quarter of all pharmaceutical drugs are derived from botanical sources, and even essential vitamins and minerals can have toxic effects if consumed in excess.

In the United States, supplements are not legally considered drugs and are not regulated the way drugs are. Before they are approved by the FDA and put on the market, drugs undergo clinical studies to determine safety, effectiveness, side effects and risks, possible interactions with other substances, and appropriate dosages. The FDA does not authorize or test dietary supplements, and manufacturers are not required to demonstrate either safety or effectiveness before they are marketed. Although dosage guidelines exist for some of the compounds in dietary supplements, dosages for many are not well established.

Many ingredients in dietary supplements are classified by the FDA as “generally recognized as safe,” but some have been found to be dangerous on their own or to interact with prescription or over-the-counter drugs in dangerous ways. Garlic supplements, for example, can cause bleeding if taken with anticoagulant (blood-thinning) medications. Some supplements can have side effects. St. John’s wort, for example, increases the skin’s sensitivity to sunlight and may decrease the effectiveness of oral contraceptives, drugs used to treat HIV infection, and many other medications.

There are also key differences in the way drugs and supplements are manufactured: FDA-approved medications are standardized for potency, and quality control and proof of purity are required. Dietary supplement manufacture is not as closely regulated, and there is no guarantee that a product contains a given ingredient at all, let alone in the appropriate amount. The potency of herbal supplements can vary widely due to differences in growing and harvesting conditions, preparation methods, and storage. Contamination and misidentification of plant compounds are also potential problems.

In an effort to provide consumers with more reliable and consistent information about supplements, the FDA has developed labeling regulations. Labels similar to those found on foods are now required for dietary supplements; for more information, see the box “Using Dietary Supplement Labels.”

### Food Additives

Today, some 2800 substances are intentionally added to foods to maintain or improve nutritional quality, to maintain freshness, to help in processing or preparation, or to alter taste or appearance. Additives make up less than 1% of our food. The most widely used are sugar, salt, and corn syrup; these three, plus citric acid, baking soda, vegetable colors, mustard, and pepper, account for 98% by weight of all food additives used in the United States.

Food additives pose no significant health hazard to most people because the levels used are well below any that could produce toxic effects. Two additives of potential concern for some people are sulfites, used to keep vegetables from turning brown, and monosodium glutamate (MSG), used as a flavor enhancer. Sulfites can cause severe reactions in some people, and the FDA strictly limits their use and requires clear labeling on any food containing sulfites. MSG may cause some people to experience episodes of sweating and increased blood pressure. If you have any sensitivity to an additive, check food labels when you shop and ask questions when you eat out.

### Foodborne Illness

Many people worry about additives or pesticide residues in their food, but a greater threat comes from microorganisms that cause foodborne illnesses. Raw or

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**pathogen** A microorganism that causes disease.

# Using Dietary Supplement Labels



CRITICAL CONSUMER

Since 1999, specific types of information have been required on the labels of dietary supplements. In addition to basic information about the product, labels include a “Supplement Facts” panel, modeled after the “Nutrition Facts” panel used on food labels (see the figure). Under the Dietary Supplement Health and Education Act (DSHEA) and food labeling laws, supplement labels can make three types of health-related claims:

- **Nutrient-content claims**, such as “high in calcium,” “excellent source of vitamin C,” or “high potency.” The claims “high in” and “excellent source of” mean the same as they do on food labels. A “high potency” single-ingredient supplement must contain 100% of its Daily Value; a “high potency” multi-ingredient product must contain 100% or more of the Daily Value of at least two-thirds of the nutrients present for which Daily Values have been established.
- **Health claims**, if they have been authorized by the FDA or another authoritative scientific body. The association between adequate calcium intake and lower risk of osteoporosis is an example of an approved health claim. The FDA also allows so-called *qualified health claims* for situations in which there is emerging but as yet inconclusive evidence for a particular claim. Such claims must include qualifying language such as “scientific evidence suggests but does not prove” the claim.
- **Structure-function claims**, such as “antioxidants maintain cellular integrity” or “this product enhances energy levels.” Because these claims are not reviewed by the FDA, they must carry a disclaimer (see the sample label).

## Tips for Choosing and Using Dietary Supplements

- Check with your physician before taking a supplement. Many are not meant for children, older people, women who are pregnant or breastfeeding, people with chronic illnesses or upcoming surgery, or people taking prescription or over-the-counter medications.
- Follow the cautions, instructions for use, and dosage given on the label.

- Look for the USP verification mark on the label, indicating that the product meets minimum safety and purity standards developed under the Dietary Supplement Verification Program by the United States Pharmacopeia (USP). The USP mark means that the product (1) contains the ingredients stated on the label, (2) has the declared amount and strength of ingredients, (3) will dissolve effectively, (4) has been screened for harmful contaminants, and (5) has been manufactured using safe, sanitary, and well-controlled procedures. The National Nutritional Foods Association has a self-regulatory testing program for its members; other, smaller associations and labs, including ConsumerLab.com, also test and rate dietary supplements.
- Choose brands made by nationally known food and drug manufacturers or “house brands” from large retail chains. Due to their size and visibility, such sources are likely to have high manufacturing standards.
- If you experience side effects, stop using the product and contact your physician. Report any serious reactions to the FDA’s MedWatch monitoring program (1-800-FDA-1088 or online at <http://www.fda.gov/Safety/MedWatch/default.htm>).

## For More Information About Dietary Supplements

ConsumerLab.Com: <http://www.consumerlab.com>

Food and Drug Administration: <http://www.fda.gov/Food/DietarySupplements/default.htm>

National Institutes of Health, Office of Dietary Supplements: <http://ods.od.nih.gov>

Natural Products Association: <http://www.npainfo.org>

U.S. Department of Agriculture: [http://fnic.nal.usda.gov/nal\\_display/index.php?info\\_center=4&tax\\_level=1&tax\\_subject=274](http://fnic.nal.usda.gov/nal_display/index.php?info_center=4&tax_level=1&tax_subject=274)

U.S. Pharmacopeia: <http://www.usp.org/USPVerified/DietarySupplements>

Statement of identity and net quantity

Structure-function claim

Directions for use and storage

Warnings may appear on some labels

Disclaimer accompanying structure-function claim

**MOOD ENHANCER  
DIETARY SUPPLEMENT**

60 capsules

***Specially formulated to enhance your mood, maintain healthy energy levels, and help you deal with daily stresses.\****

DIRECTIONS FOR USE: Take one capsule twice daily with a meal.

Keep out of reach of children. Store in a cool, dry place, tightly closed. Color variation is normal in this product.

WARNING: FOR ADULTS ONLY. Do not exceed the recommended dosage. Do not use if you are pregnant, lactating, or taking prescription antidepressant or anti-anxiety medication. Do not use with alcohol. Do not use if you have allergies to the ragweed family. Limit exposure to the sun as St. John’s wort may cause increased sensitivity to light. Discontinue use in the event of a rash.

PHENYLKETONURICS:  
CONTAINS PHENYLALANINE.

\*This statement has not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease.

**Supplement Facts**

Serving Size 1 capsule

Amount per capsule	% Daily Value*
Vitamin B <sub>6</sub> (as pyridoxine hydrochloride) 2.0 mg	100%
Folic acid 200 mcg	50%
Vitamin B <sub>12</sub> (as cyanocobalamin) 6 mcg	100%
St. John’s wort aerial parts extract 300 mg <i>(Hypericum perforatum)</i>	†
Kava root extract 250 mg <i>(Piper methysticum)</i>	†
Siberian ginseng root extract 200 mg <i>(Eleutherococcus senticosus)</i>	†
Phenylalanine (as L-phenylalanine hydrochloride) 100 mg	†

\*Percent Daily Values are based on a 2000 calorie diet.  
†Daily Value not established.

Other ingredients: Rice flour, gelatin, water.

Standardization levels: St. John’s wort: 0.3% hypericin; kava: 30% kavalactones; Siberian ginseng: 1% eleutherosides.

Made by JKS Herbal Supplements, P.O. Box 2000, San Francisco, CA 94444.

Serving size

Source and amount of ingredients with established Daily Values

Name, source, and amount of ingredients without established Daily Values

Standardization levels may appear on some labels

Address to write to for more product information



Careful food handling greatly reduces the risk of foodborne illness.

undercooked animal products, such as chicken, hamburger, and oysters, pose the greatest risk, although in recent years contaminated fruits and vegetables have been catching up.

The CDC estimates that 48 million illnesses, 128,000 hospitalizations, and 3000 deaths occur each year in the United States due to foodborne contaminants. Symptoms include diarrhea, vomiting, fever, pain, headache, and weakness. Although the effects of foodborne illness are usually not serious, some groups, such as children, pregnant women, and elderly people, are more at risk for severe complications such as rheumatic diseases, seizures, blood poisoning, and death.

**Causes of Foodborne Illnesses** Most cases of foodborne illness are caused by **pathogens**, disease-causing microorganisms that contaminate food, usually from improper handling. According to the CDC, about 90% of foodborne illnesses, hospitalizations, and deaths in 2010 were due to seven pathogens: *Salmonella* (most often found in eggs, on vegetables, and on poultry); norovirus (most often found in salad ingredients and shellfish); *Campylobacter jejuni* (most often found in meat and poultry); *Toxoplasma* (most often found in meat); *Escherichia coli* (*E. coli*) O157:H7 (most often found in meat and water); *Listeria monocytogenes* (most often found in lunch meats, sausages, and hot dogs); and *Clostridium perfringens* (most often found in meat and gravy). Salmonella was the leading cause of hospitalizations and deaths, accounting for 28% of deaths and 35% of hospitalizations. About 60% of illness, but a much smaller percentage of severe illness, was caused by norovirus.

## Wellness Tip

To get produce as clean as possible, rub it with a soft brush while holding it under running water.



Although pathogens are usually destroyed during cooking, the U.S. government is taking steps to bring down levels of contamination by improving national testing and surveillance. Raw meat and poultry products are now sold with safe-handling and -cooking instructions, and all packaged, unpasteurized fresh fruit and vegetable juices carry warnings about potential contamination. Although foodborne illness outbreaks associated with food-processing plants make headlines, most cases of illness trace back to poor food handling in the home or in restaurants. The 2010 Dietary Guidelines for Americans encourages people to follow four basic food safety principles:

- **Clean** hands, food contact surfaces, and vegetables and fruits.
- **Separate** raw, cooked, and read-to-eat foods while shopping, storing, and preparing foods.
- **Cook** foods to a safe temperature.
- **Chill** (refrigerate) perishable foods promptly.

The Dietary Guidelines also advise people to avoid certain high-risk foods, including raw (unpasteurized) milk, cheeses, and juices; raw or undercooked animal foods, such as seafood, meat, poultry, and eggs; and raw sprouts. These precautions are especially important for pregnant women, young children, older adults, and people with weakened immune systems or certain chronic diseases. For more information on food safety, see the box “Safe Food Handling.”

**Treating Foodborne Illness** If you think you may be having a bout of foodborne illness, drink plenty of clear fluids to prevent dehydration, and rest to speed recovery. To prevent further contamination, wash your hands often and always before handling food until you recover. A fever higher than 102°F, blood in the stool, or dehydration deserves a physician’s evaluation, especially if the symptoms persist for more than 2–3 days. In cases of suspected botulism—characterized by symptoms such as double vision, paralysis, dizziness, and vomiting—consult a physician immediately.

## Irradiated Foods

**Food irradiation** is the treatment of foods with gamma rays, X-rays, or high-voltage electrons to kill potentially harmful pathogens, including bacteria, parasites, insects, and fungi that cause foodborne illness. It also reduces spoilage and extends shelf life. Even though irradiation



# Safe Food Handling

## Shopping

- Don't buy food in containers that leak, bulge, or are severely dented. Refrigerated foods should be cold, and frozen foods should be solid.
- Check the food label for an expiration date and for safe-handling instructions.
- Place meat, poultry, and seafood in plastic bags, and separate foods in your grocery cart.
- Select cold and frozen food last to ensure that they stay refrigerated until just before checkout.

## Storing Food

- Store raw meat, poultry, fish, and shellfish in containers in the refrigerator so that the juices don't drip onto other foods. Keep these items away from other foods, surfaces, utensils, and serving dishes to prevent cross-contamination.
- Store eggs in the coldest part of the refrigerator, not in the door, and use them within 3–5 weeks.
- Keep hot foods hot (140°F or above) and cold foods cold (40°F or below); harmful bacteria can grow rapidly between these two temperatures. Refrigerate foods within 2 hours of purchase or preparation and within 1 hour if the air temperature is above 90°F. Freeze foods at or below 0°F. Use or freeze fresh meats within 3–5 days and fresh poultry, fish, and ground meat within 1–2 days. Use refrigerated leftovers within 3–4 days.

## Preparing Food

- Thoroughly wash your hands with warm soapy water for 20 seconds before and after handling food, especially raw meat, fish, shellfish, poultry, or eggs.
- Make sure counters, cutting boards, dishes, utensils, and other equipment are thoroughly cleaned with hot soapy water before and after use. Wash dishcloths and kitchen towels frequently.
- Use separate cutting boards for meat, poultry, and seafood and for foods that will be eaten raw, such as fruits and vegetables. Replace cutting boards once they become worn or develop hard-to-clean grooves.
- Thoroughly rinse and scrub fruits and vegetables with a brush (but not with soap or detergent), or peel off the skin.

- Don't eat raw animal products, including raw eggs in homemade hollandaise sauce, eggnog, or cookie dough.
- Thaw frozen food in the refrigerator, in cold water, or in the microwave, not on the kitchen counter. Cook foods immediately after thawing.

## Cooking

- Cook foods thoroughly, especially beef, poultry, fish, pork, and eggs; cooking kills most microorganisms. Use a food thermometer to ensure that foods are cooked to a safe temperature. Hamburgers should be cooked to 160°F. Turn or stir microwaved food to make sure it is heated evenly throughout.
- Cook stuffing separately from poultry; or wash poultry thoroughly, stuff immediately before cooking, and transfer the stuffing to a clean bowl immediately after cooking. The temperature of cooked stuffing should reach 165°F.



- Cook eggs until they're firm, and fully cook foods containing eggs.
- To protect against *Listeria*, reheat ready-to-eat foods like hot dogs and cold cuts until steaming hot.
- Because of possible contamination with *E. coli* 0157:H7 and *Salmonella*, avoid raw sprouts.

According to the USDA, "When in doubt, throw it out." Even if a food looks and smells fine, it may not be safe. If you aren't sure that a food has been prepared, served, and stored safely, don't eat it. For more information, see the USDA's *Kitchen Companion: Your Safe Food Handbook* at [http://www.fsis.usda.gov/PDF/Kitchen\\_Companion.pdf](http://www.fsis.usda.gov/PDF/Kitchen_Companion.pdf).

has been generally endorsed by agencies such as the World Health Organization, the CDC, and the American Medical Association, few irradiated foods are currently on the market due to consumer resistance and skepticism. Studies haven't conclusively identified any harmful effects of food irradiation, and newer methods of irradiation involving electricity and X-rays do not require the use of any radioactive materials. Studies indicate that

when consumers are given information about the process of irradiation and the benefits of irradiated foods, most want to purchase them.

**food irradiation** The treatment of foods with gamma rays, X-rays, or high-voltage electrons to kill potentially harmful pathogens and increase shelf life.

KEY  
TERM



TAKE CHARGE

All primary irradiated foods (meat, vegetables, and so on) are labeled with the flowerlike radura symbol and a brief information label; spices and foods that are merely ingredients do not have to be labeled. It is important to remember that although irradiation kills most pathogens, it does not completely sterilize foods. Proper handling of irradiated foods is still critical for preventing foodborne illness.



## Environmental Contaminants and Organic Foods

Contaminants are present in the food-growing environment. Environmental contaminants include various minerals, antibiotics, hormones, pesticides, and industrial chemicals. Safety regulations attempt to keep our exposure to contaminants at safe levels, but monitoring is difficult, and many substances (such as pesticides) persist in the environment long after being banned from use.

**Organic Foods** Some people who are concerned about pesticides and other environmental contaminants choose to buy foods that are **organic**. To be certified as organic,



foods must meet strict production, processing, handling, and labeling criteria. Organic crops must meet limits on pesticide residues. For meat, milk, eggs, and other animal products to be certified organic, animals must be given organic feed and access to the outdoors and may not be given antibiotics or growth hormones. The use of genetic engineering, ionizing radiation, and sewage sludge is prohibited. Products can be labeled “100% organic” if they contain all organic ingredients and “organic” if they contain at least 95% organic ingredients; all such products may carry the USDA organic seal. A product with at least 70% organic ingredients can be labeled “made with organic ingredients” but cannot use the USDA seal.

Organic foods, however, are not necessarily free of chemicals. They may be contaminated with pesticides used on neighboring lands or on foods transported in the same train or truck. However, they tend to have lower levels of pesticide residues than conventionally grown crops. Some experts recommend that consumers who want to buy organic fruits and vegetables spend their money on those that carry lower pesticide residues than their conventional counterparts (the “dirty dozen”): apples, bell peppers, celery, cherries, imported grapes, nectarines, peaches, pears, potatoes, red raspberries, spinach, and strawberries. Experts also recommend buying organic

KEY  
TERM

**organic** A designation applied to foods grown and produced according to strict guidelines limiting the use of pesticides, nonorganic ingredients, hormones, antibiotics, genetic engineering, irradiation, and other practices.

## Ask yourself

### QUESTIONS FOR CRITICAL THINKING AND REFLECTION



Have you ever taken a dietary supplement, such as St. John's wort for mild depression or echinacea or zinc for a cold? If so, who or what influenced your decision to use this product? Did you do any research before taking it? Did you read the label on the package? Do you think the product had the desired effect?

beef, poultry, eggs, dairy products, and baby food. Fruits and vegetables that carry little pesticide residue whether grown conventionally or organically include asparagus, avocados, bananas, broccoli, cauliflower, corn, kiwi, mangoes, onions, papaya, pineapples, and peas. All foods are subject to strict pesticide limits; the debate about the health effects of small amounts of residue is ongoing.

Whether organic foods are better for your health cannot be said for certain, but organic farming is better for the environment. It helps maintain biodiversity of crops and replenish the Earth's resources. It is less likely to degrade soil, contaminate water, or expose farm workers to toxic chemicals. As multinational food companies get into the organic food business, however, consumers who want to support environmentally friendly farming methods should look for foods that are not only organic but also locally grown.

**Guidelines for Fish Consumption** A specific area of concern has been possible mercury contamination in fish. Overall, fish and shellfish are healthy sources of protein, omega-3 fats, and other nutrients. Prudent choices can minimize the risk of any possible negative health effects. High mercury concentrations are most likely to be found in predator fish—large fish that eat smaller fish. Mercury can cause brain damage to fetuses and young children. According to FDA and Environmental Protection Agency (EPA) guidelines, women who are or who may become pregnant and nursing mothers should follow these guidelines to minimize their exposure to mercury:

- Do not eat shark, swordfish, king mackerel, or tilefish.
- Eat up to 12 ounces a week of a variety of fish and shellfish that are lower in mercury, such as shrimp, canned light tuna, salmon, pollock, and catfish. Limit consumption of albacore tuna to 6 ounces per week.
- Check advisories about the safety of recreationally caught fish from local lakes, rivers, and coastal areas. If no information is available, limit consumption to 6 ounces per week.

The same FDA/EPA guidelines apply to children, although they should consume smaller servings.

# Ethnic Foods



There is no one ethnic diet that clearly surpasses all others in providing people with healthful foods. Every diet has its advantages and disadvantages, and within each cuisine, some foods are better choices. The dietary guidelines described in this chapter can be applied to any ethnic cuisine. For additional guidance, refer to the table below.

## Choose More Often

## Choose Less Often

<b>CHINESE</b>	Dishes that are steamed, poached (jum), boiled (chu), roasted (kow), barbecued (shu), or lightly stir-fried Hoisin sauce, oyster sauce, wine sauce, plum sauce, velvet sauce, or hot mustard Fresh fish and seafood, skinless chicken, tofu Mixed vegetables, Chinese greens Steamed rice, steamed spring rolls, soft noodles	Fried wontons or egg rolls Crab rangoon Crispy (Peking) duck or chicken Sweet-and-sour dishes made with breaded and deep-fried meat, poultry, or fish Fried or crispy noodles Fried rice
<b>FRENCH</b>	Dishes prepared au vapeur (steamed), en brochette (skewered and broiled), or grillé (grilled) Fresh fish, shrimp, scallops, mussels, or skinless chicken, without sauces Clear soups	Dishes prepared à la crème (in cream sauce), au gratin or gratinée (baked with cream and cheese), or en croûte (in pastry crust) Drawn butter, hollandaise sauce, and remoulade (mayonnaise-based sauce)
<b>GREEK</b>	Dishes that are stewed, broiled, or grilled, including shish kabobs (souvlaki) Dolmas (grape leaves) stuffed with rice Tzatziki (yogurt, cucumbers, and garlic) Tabouli (bulgur-based salad) Pita bread, especially whole wheat	Moussaka, saganaki (fried cheese) Vegetable pies such as spanakopita and tyropita Baba ghanoush (eggplant and olive oil) Deep-fried falafel (chickpea patties) Gyros stuffed with ground meat Baklava
<b>INDIAN</b>	Dishes prepared masala (curry), tandoori (roasted in a clay oven), or tikke (pan roasted); kabobs Raita (yogurt and cucumber salad) and other yogurt-based dishes and sauces Dal (lentils), pullao or pilau (basmati rice) Chapati (baked bread)	Ghee (clarified butter) Korma (meat in cream sauce) Samosas, pakoras (fried dishes) Molee and other coconut milk-based dishes Poori, bhatura, or paratha (fried breads)
<b>ITALIAN</b>	Pasta primavera or pasta, polenta, risotto, or gnocchi with marinara, red or white wine, white or red clam, or light mushroom sauce Dishes that are grilled or prepared cacciatore (tomato-based sauce), marsala (broth and wine sauce), or piccata (lemon sauce) Cioppino (seafood stew) Vegetable soup, minestrone or fagioli (beans)	Antipasto (cheese, smoked meats) Dishes that are prepared alfredo, frito (fried), crema (creamed), alla panna (with cream), or carbonara Veal scaloppini Chicken, veal, or eggplant parmigiana Italian sausage, salami, and prosciutto Buttered garlic bread Cannoli
<b>JAPANESE</b>	Dishes prepared nabemono (boiled), shabu-shabu (in boiling broth), mushimono (steamed), nimono (simmered), yaki (broiled), or yakimono (grilled) Sushi or domburi (mixed rice dish) Steamed rice or soba (buckwheat), udon (wheat), or rice noodles	Tempura (battered and fried) Agemono (deep fried) Katsu (fried pork cutlet) Sukiyaki Fried tofu
<b>MEXICAN</b>	Soft corn or wheat tortillas Burritos, fajitas, enchiladas, soft tacos, and tamales filled with beans, vegetables, or lean meats Refried beans, nonfat or low-fat; rice and beans Ceviche (fish marinated in lime juice) Salsa, enchilada sauce, and picante sauce Gazpacho, menudo, or black bean soup Fruit or flan for dessert	Crispy, fried tortillas Dishes that are fried, such as chile rellenos, chimichangas, flautas, and tostadas Nachos and cheese, chili con queso, and other dishes made with cheese or cheese sauce Guacamole, sour cream, and extra cheese Refried beans made with lard Fried ice cream
<b>THAI</b>	Dishes that are barbecued, sauteed, broiled, boiled, steamed, braised, or marinated Sáte (skewered and grilled meats) Fish sauce, basil sauce, chili or hot sauces Bean thread noodles, Thai salad	Coconut milk soup Peanut sauce or dishes topped with nuts Mee-krob (crispy noodles) Red, green, and yellow curries, which typically contain coconut milk

Some experts have also expressed concern about the presence of toxins in farmed fish, especially farmed salmon. Although no federal guidelines have been set, some researchers suggest that consumers limit themselves to 8 ounces of farmed salmon per month. Fish should be labeled with its country of origin and whether it is wild or farmed; most canned salmon is wild.

## A PERSONAL PLAN: APPLYING NUTRITIONAL PRINCIPLES

Based on your particular nutrition and health status, there probably is an ideal diet for you, but no single type of diet provides optimal health for everyone. Many cultural dietary patterns can meet people's nutritional requirements (see the box "Ethnic Foods"). Customize your food plan based on your age, gender, weight, activity level, medical risk factors, and personal tastes.

### Assessing and Changing Your Diet

The first step in planning a healthy diet is to examine what you currently eat. Labs 8.1 and 8.2 help you analyze your current diet and compare it with optimal dietary goals. (This analysis can be completed using a nutritional analysis software program or one of several Web sites.)

To put your plan into action, use the behavioral self-management techniques and tips described in Chapter 1. If you identify several changes you want to make, focus on one at a time. You might start, for example, by substituting nonfat or low-fat milk for whole milk. When you become used to that, you can try substituting whole-wheat bread for white bread. The information on eating behavior in Lab 8.1 will help you identify and change unhealthy patterns of eating.

### Staying Committed to a Healthy Diet

Beyond knowledge and information, you also need support in difficult situations. Keeping to your plan is easiest when you choose and prepare your own food at home. Advance planning is the key: mapping out meals and shopping appropriately, cooking in advance when possible, and preparing enough food for leftovers. A tight budget does not necessarily make it more difficult to eat

## TIPS FOR TODAY AND THE FUTURE

Opportunities to improve your diet present themselves every day, and small changes add up.

### RIGHT NOW YOU CAN

- Substitute a healthy snack for an unhealthy one.
- Drink a glass of water and put a bottle of water in your backpack for tomorrow.
- Plan to make healthy selections when you eat out, such as steamed vegetables instead of french fries or salmon instead of steak.

### IN THE FUTURE YOU CAN

- Visit the MyPlate Web site at [www.choosemyplate.gov](http://www.choosemyplate.gov) and use the online tools to create a personalized nutrition plan and begin tracking your eating habits.
- Learn to cook healthier meals. There are hundreds of free Web sites and low-cost cookbooks that provide recipes for healthy dishes.

healthy meals. It makes good health sense and good budget sense to use only small amounts of meat and to have a few meatless meals each week.

In restaurants, sticking to food plan goals becomes somewhat more difficult. Portion sizes in restaurants tend to be larger than MyPlate serving size equivalents, but by remaining focused on your goals, you can eat only part of your meal and take the rest home for a meal later in the week. Don't hesitate to ask questions when you're eating in a restaurant. Most restaurant personnel are glad to explain how menu selections are prepared and to make small adjustments, such as serving salad dressings and sauces on the side so they can be avoided or used sparingly.

Strategies like these are helpful, but small changes cannot change a fundamentally high-fat, high-calorie meal into a moderate, healthful one. Often, the best advice is to bypass a large steak with potatoes au gratin for a flavorful but low-fat entree. Many of the selections offered in ethnic restaurants are healthy choices (refer to the box on ethnic foods for suggestions).

## SUMMARY

- The six classes of nutrients are carbohydrates, proteins, fats, vitamins, minerals, and water.
- The nutrients essential to humans are released into the body through digestion. Nutrients in foods provide energy, measured in kilocalories (commonly called calories), build and maintain body tissues, and regulate body functions.
- Protein, an important component of body tissue, is composed of amino acids; nine are essential to good health. Foods



## Ask Yourself

### QUESTIONS FOR CRITICAL THINKING AND REFLECTION

What is the least healthy food you eat every day (either during meals or as a snack)? Identify at least one substitute that would be healthier but just as satisfying.

from animal sources provide complete proteins. Plants provide incomplete proteins.

- Fats, a major source of energy, also insulate the body and cushion the organs. Just 3–4 teaspoons of vegetable oil per day supply the essential fats. For most people, dietary fat intake should be 20–35% of total calories, and unsaturated fats should be favored over saturated and trans fats.

- Carbohydrates provide energy to the brain, nervous system, and blood and to muscles during high-intensity exercise. Naturally occurring simple carbohydrates and unrefined complex carbohydrates should be favored over added sugars and refined carbohydrates.

- Fiber includes plant substances that are impossible for the human body to digest. It helps reduce cholesterol levels and promotes the passage of wastes through the intestines.

- The 13 essential vitamins are organic substances that promote specific chemical and cell processes and act as antioxidants. The 17 known essential minerals are inorganic substances that regulate body functions, aid in growth and tissue maintenance, and help in the release of energy from food. Deficiencies in vitamins and minerals can cause severe symptoms over time, but excess doses are also dangerous.

- Water aids in digestion and food absorption, allows chemical reactions to take place, serves as a lubricant or cushion, and helps regulate body temperature.

- Foods contain other substances, such as phytochemicals, that may not be essential nutrients but that may protect against chronic diseases.

- The Dietary Reference Intakes, Dietary Guidelines for Americans, and MyPlate food guidance system provide standards and recommendations for getting all essential nutrients from a varied, balanced diet and for eating in ways that protect against chronic disease.

- The Dietary Guidelines for Americans advise us to balance calorie intake and calorie expenditure to manage weight; reduce consumption of sodium, solid fats, added sugars, and refined grains; increase consumption of fruits, vegetables, and whole grains; and follow a healthy eating pattern.

- Choosing foods from each group in MyPlate every day helps ensure the appropriate amounts of necessary nutrients.

- A vegetarian diet requires special planning but can meet all human nutritional needs.

- Different population groups, such as college students and athletes, face special dietary challenges and should plan their diets to meet their particular needs.

- Consumers can get help applying nutritional principles by reading the standardized labels that appear on all packaged foods and on dietary supplements.

- Although nutritional basics are well established, no single diet provides wellness for everyone. Individuals should focus on their particular needs and adapt general dietary principles to meet them.

## FOR FURTHER EXPLORATION

### BOOKS

Byrd-Bredbenner, C., et al. 2009. *Wardlaw's Perspectives in Nutrition*, 8th ed. New York: McGraw-Hill. *An easy-to-understand review of major concepts in nutrition.*

Duyff, R. L. 2006. *ADA Complete Food and Nutrition Guide*, 3rd ed. Hoboken, N.J.: Wiley. *An excellent review of current nutrition information.*

Insel, P., D. Ross, K. McMahon, and M. Bernstein. 2011. *Nutrition*, 4th ed. Sudbury, Mass.: Jones & Bartlett. *An introductory nutrition textbook covering a variety of key topics.*

Nestle, M. 2007. *What to Eat*. New York: North Point Press. *A nutritionist examines the marketing of food and explains how to interpret food-related information while shopping.*

Selkowitz, A. 2005. *The College Student's Guide to Eating Well on Campus*, revised ed. Bethesda, Md.: Tulip Hill Press. *Provides practical advice for students, including how to make healthy choices when eating in a dorm or restaurant and how to stock a first pantry.*

Warshaw, H. 2008. *Eat Out Eat Right: The Guide to Healthier Restaurant Eating*, 3rd ed. Agate Surrey. *A registered dietitian provides realistic, informative guidelines for restaurant eating to enable diners to make healthy menu choices from a wide variety of foods and cuisines.*

### NEWSLETTERS

*Environmental Nutrition* (800-424-7887;

<http://www.environmentalnutrition.com>)

*Nutrition Action Health Letter* (202-332-9110;

<http://www.cspinet.org/nah/index.htm>)

*Tufts University Health & Nutrition Letter* (800-274-7581;

<http://www.tuftshealthletter.com>)

### ORGANIZATIONS, HOTLINES, AND WEB SITES

*Academy of Nutrition and Dietetics*. Provides a wide variety of educational materials on nutrition.

<http://www.eatright.org>

*American Heart Association: Delicious Decisions*. Provides basic information about nutrition, tips for shopping and eating out, and heart-healthy recipes.

<http://www.deliciousdecisions.org>

*FDA: Food*. Offers information and interactive tools about topics such as food labeling, food additives, dietary supplements, and foodborne illness.

<http://www.fda.gov/food/default.htm>

*Food Safety Hotlines*. Provide information on the safe purchase, handling, cooking, and storage of food.

800-535-4555 (USDA)

888-SAFEFOOD (FDA)

## Q Which should I eat—butter or margarine?

**A** Both butter and margarine are concentrated sources of fat, containing about 11 grams of fat and 100 calories per tablespoon. Butter is higher in saturated fat, which raises levels of artery-clogging LDL (“bad” cholesterol). Each tablespoon of butter has about 8 grams of saturated fat; margarine has about 2. Butter also contains cholesterol, which margarine does not.

Margarine, on the other hand, contains trans fat, which not only raises LDL but lowers HDL (“good” cholesterol). A tablespoon of stick margarine contains about 2 grams of trans fat. Butter contains a small amount of trans fat as well. Although butter has a combined total of saturated and trans fats that is twice that of stick margarine, the trans fat in stick margarine may be worse for you. Clearly, you should avoid both butter and stick margarine. To solve this dilemma, remember that softer is better. The softer or more liquid a margarine or spread is, the less hydrogenated it is and the less trans fat it contains. Tub and squeeze margarines contain less trans fat than stick margarines; some margarines are modified to be low-trans or trans-fat-free and are labeled as such. Vegetable oils are an even better choice for cooking and for table use (such as olive oil for dipping bread) because most are low in saturated fat and completely free of trans fats.

## Q MyPlate recommends such large amounts of vegetables and fruit.

## How can I possibly eat that many servings without gaining weight?

**A** First, consider your typical portion sizes; you may be closer to meeting the recommendations than you think. Many people consume large servings of foods and underestimate the size of their portions. For example, a large banana may contain the equivalent of a cup of fruit, or half the recommended daily total for someone consuming 2000–2600 calories per day. Likewise, a medium baked potato (3-inch diameter) or an ear of corn (8-inch length) counts as a cup of vegetables. Use a measuring cup or a food scale for a few days to train your eye to accurately estimate food portion sizes. The ChooseMyPlate.gov Web site includes charts of portion-size equivalents for each food group.

If an analysis of your diet indicates that you need to increase your overall intake of fruits and vegetables, look for healthy substitutions. If you are like most Americans, you are consuming more than the recommended number of calories from added sugars and solid fats; trim some of these calories to make room for additional servings of fruits and vegetables. Your beverage choices may be a good place to start. Do you routinely consume regular sodas, sweetened energy or fruit drinks, or whole milk? One regular 12-ounce soda contains the equivalent of about 150 calories of added sugars; an 8-ounce glass of whole milk provides about 75 calories as discretionary fats. Substituting water or low-fat milk would free up calories for additional servings of fruits and vegetables. A half-cup of carrots, tomatoes,

apples, or melon has only about 25 calories; you could consume 6 cups of these foods for the calories in one can of regular soda. Substituting lower-fat condiments for such full-fat items as butter, mayonnaise, and salad dressing is another good way to trim calories to make room for additional servings of nutrient-rich fruits and vegetables.

Also consider your portion sizes and/or the frequency with which you consume foods high in discretionary calories: You may not need to eliminate a favorite food—instead, just cut back. For example, cut your consumption of fast-food fries from four times a week to once a week, or reduce the size of your ice cream dessert from a cup to half a cup. Treats should be consumed infrequently, and in small amounts.

For additional help on improving food choices to meet dietary recommendations, visit the ChooseMyPlate.gov Web site and the family-friendly chart of “Go, Slow, and Whoa” foods at the site for the National Heart, Lung, and Blood Institute ([www.nhlbi.nih.gov/health/public/heart/obesity/wecan/downloads/gswtips.pdf](http://www.nhlbi.nih.gov/health/public/heart/obesity/wecan/downloads/gswtips.pdf)).

## Q What exactly are genetically modified foods? Are they safe? How can I recognize them on the shelf, and how can I know when I’m eating them?

**A** Genetic engineering involves altering the characteristics of a plant, animal, or microorganism by adding, rearranging, or replacing genes in its

*Fruits and Veggies Matter.* Hosted by a partnership of the CDC, DHHS, and National Cancer Institute; promotes the consumption of fruits and vegetables every day.

<http://www.fruitsandveggiesmatter.gov>

*Gateways to Government Nutrition Information.* Provides access to government resources relating to food safety, including consumer advice and information on specific pathogens.

<http://www.foodsafety.gov>

<http://www.nutrition.gov>

*Harvard School of Public Health: Nutrition Source.* Provides advice on interpreting news on nutrition; an overview of the Healthy Eating Pyramid, an alternative to the basic USDA pyramid; and suggestions for building a healthy diet.

<http://www.hsph.harvard.edu/nutritionsource>

*International Food Information Council.* Provides information on food safety and nutrition for consumers, journalists, and educators.

<http://www.ific.org>

DNA; the result is a genetically modified (GM) organism. New DNA may come from related species of organisms or from entirely different types of organisms. Many GM crops are already grown in the United States: About 75% of the current U.S. soybean crop has been genetically modified to be resistant to an herbicide used to kill weeds, and about a third of the U.S. corn crop carries genes for herbicide resistance or to produce a protein lethal to a destructive type of caterpillar. Products made with GM organisms include juice, soda, nuts, tuna, frozen pizza, spaghetti sauce, canola oil, chips, salad dressing, and soup.

The potential benefits of GM foods cited by supporters include improved yields overall and in difficult growing conditions, increased disease resistance, improved nutritional content, lower prices, and less use of pesticides. Critics of biotechnology argue that unexpected effects may occur: Gene manipulation could elevate levels of naturally occurring toxins or allergens, permanently change the gene pool and reduce biodiversity, and produce pesticide-resistant insects through the transfer of genes. In 2000, a form of GM corn approved for use only in animal feed was found to have commingled with other varieties of corn and to have been used in human foods; this mistake sparked fears of allergic reactions and led to recalls. Opposition to GM foods is particularly strong in Europe; in many developing nations that face food shortages, responses to GM crops have tended to be more positive.

In April 2000, the National Academy of Sciences released a report stating that there is no proof that GM food on the

market is unsafe but that changes are needed to better coordinate regulation of GM foods and to assess potential problems.

Labeling has been another major concern. Surveys indicate that the majority of Americans want to know if their foods contain GM organisms. However, under current rules, the FDA requires special labeling only when a food's composition is changed significantly or when a known allergen is introduced. For example, soybeans that contain a gene from a peanut would have to be labeled because peanuts are a common allergen. The only foods guaranteed not to contain GM ingredients are those certified as organic.

## Q How can I tell if I'm allergic to a food?

A A true food allergy is a reaction of the body's immune system to a food or food ingredient, usually a protein. This immune reaction can occur within minutes of ingesting the food, resulting in symptoms such as hives, diarrhea, difficulty breathing, or swelling of the lips or tongue. The most severe response is a systemic reaction called anaphylaxis, which involves a potentially life-threatening drop in blood pressure. Food allergies affect only about 1.5% of the adult population and 4% of children. Between 1997 and 2007, the food allergy rate among American children increased 18%. People with food allergies, especially children, are more likely to have asthma or other allergic conditions.

Just eight foods account for more than 90% of the food allergies in the United States: cow's milk, eggs, peanuts, tree nuts (walnuts, cashews, and so on), soy, wheat, fish, and shellfish. Food manufacturers are now required to state the presence of these eight allergens in plain language in the list of ingredients on food labels.

Many people who believe they have food allergies may actually suffer from a food intolerance, a much more common source of adverse food reactions that typically involves problems with metabolism rather than with the immune system. The body may not be able to adequately digest a food or the body may react to a particular food compound. Food intolerances have been attributed to lactose (milk sugar), gluten (a protein in some grains), tartrazine (yellow food coloring), sulfite (a food additive), MSG, and the sweetener aspartame. Although symptoms of a food intolerance may be similar to those of a food allergy, they are typically more localized and not life-threatening. Many people with food intolerance can safely and comfortably consume small amounts of the food that affects them.

If you suspect you have a food allergy or intolerance, a good first step is to keep a food diary. Note everything you eat or drink, any symptoms you develop, and how long after eating the symptoms appear. Then make an appointment with your physician to go over your diary and determine if any additional tests are needed. People at risk for severe allergic reactions must diligently avoid trigger foods and carry medications to treat anaphylaxis.

*For more Common Questions Answered about nutrition, visit the Online Learning Center at [www.mhhe.com/fahey](http://www.mhhe.com/fahey).*

**MedlinePlus: Nutrition.** Provides links to information from government agencies and major medical associations on a variety of nutrition topics.

<http://www.nlm.nih.gov/medlineplus/nutrition.html>

**MyPlate.** Provides personalized dietary plans and interactive food and activity tracking tools.

<http://www.choosemyplate.gov>

**National Academies' Food and Nutrition Board.** Provides information about the Dietary Reference Intakes and related guidelines.

<http://www.iom.edu/CMS/3788.aspx>

**National Institutes of Health: Osteoporosis and Related Bone Diseases' National Resource Center.** Provides information about osteoporosis prevention and treatment; includes a special section on men and osteoporosis.

<http://www.osteoporosis.org>

**National Osteoporosis Foundation.** Provides information on the causes, prevention, detection, and treatment of osteoporosis.

<http://www.nof.org>

**USDA Center for Nutrition Policy and Promotion.** Includes information on the Dietary Guidelines and the Food Guide Pyramid.

<http://www.cnpp.usda.gov>

**USDA Food and Nutrition Information Center.** Provides a variety of materials relating to the Dietary Guidelines, food labels, Food Guide Pyramid, MyPlate, and many other topics.

<http://www.nal.usda.gov/fnic>

**Vegetarian Resource Group.** Provides information and links for vegetarians and people interested in learning more about vegetarian diets.

<http://www.vrg.org>

You can find nutrient breakdowns of individual food items at the following sites:

**Nutrition Analysis Tool, University of Illinois, Urbana/Champaign**

<http://www.nat.uiuc.edu>

**USDA Nutrient Data Laboratory**

<http://www.ars.usda.gov/ba/bhnrc/ndl>

See also the resources listed in Chapters 9, 11, and 12.

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# Nutrition Resources

**Table 1** Dietary Reference Intakes (DRIs): Recommended Levels for Individual Intake

Life Stage	Group	BIOTIN ( $\mu\text{g/day}$ )	CHOLINE ( $\text{mg/day}$ ) <sup>a</sup>	FOLATE ( $\mu\text{g/day}$ ) <sup>b</sup>	NIACIN ( $\text{mg/day}$ ) <sup>c</sup>	PANTOTHENIC ACID ( $\text{mg/day}$ ) <sup>c</sup>	RIBOFLAVIN ( $\text{mg/day}$ )	THIAMIN ( $\text{mg/day}$ )	VITAMIN A ( $\mu\text{g/day}$ ) <sup>d</sup>	VITAMIN B-6 ( $\text{mg/day}$ )	VITAMIN B-12 ( $\mu\text{g/day}$ )	VITAMIN C ( $\text{mg/day}$ ) <sup>e</sup>	VITAMIN D (IU/day) <sup>f</sup>	VITAMIN E ( $\text{mg/day}$ ) <sup>g</sup>
Infants	0–6 months	5	125	65	2	1.7	0.3	0.2	400	0.1	0.4	40	400	4
Children	7–12 months	6	150	80	4	1.8	0.4	0.3	500	0.3	0.5	50	400	5
	1–3 years	8	200	150	6	2	0.5	0.5	300	0.5	0.9	15	600	6
	4–8 years	12	250	200	8	3	0.6	0.6	400	0.6	1.2	25	600	7
Males	9–13 years	20	375	300	12	4	0.9	0.9	600	1.0	1.8	45	600	11
	14–18 years	25	550	400	16	5	1.3	1.2	900	1.3	2.4	75	600	15
	19–30 years	30	550	400	16	5	1.3	1.2	900	1.3	2.4	90	600	15
	31–50 years	30	550	400	16	5	1.3	1.2	900	1.3	2.4	90	600	15
	51–70 years	30	550	400	16	5	1.3	1.2	900	1.7	2.4 <sup>h</sup>	90	600	15
Females	>70 years	30	550	400	16	5	1.3	1.2	900	1.7	2.4 <sup>h</sup>	90	600	15
	9–13 years	20	375	300	12	4	0.9	0.9	600	1.0	1.8	45	800	11
	14–18 years	25	400	400 <sup>i</sup>	14	5	1.0	1.0	700	1.2	2.4	65	600	15
	19–30 years	30	425	400 <sup>i</sup>	14	5	1.1	1.1	700	1.3	2.4	75	600	15
	31–50 years	30	425	400 <sup>i</sup>	14	5	1.1	1.1	700	1.3	2.4	75	600	15
Pregnancy	51–70 years	30	425	400 <sup>i</sup>	14	5	1.1	1.1	700	1.5	2.4 <sup>h</sup>	75	600	15
	>70 years	30	425	400	14	5	1.1	1.1	700	1.5	2.4 <sup>h</sup>	75	600	15
	≤18 years	30	450	600 <sup>i</sup>	18	6	1.4	1.4	750	1.9	2.6	80	800	15
	19–30 years	30	450	600 <sup>i</sup>	18	6	1.4	1.4	770	1.9	2.6	85	600	15
	31–50 years	30	450	600 <sup>i</sup>	18	6	1.4	1.4	770	1.9	2.6	85	600	15
Lactation	≤18 years	35	550	500	17	7	1.6	1.4	1200	2.0	2.8	115	600	19
	19–30 years	35	550	500	17	7	1.6	1.4	1300	2.0	2.8	120	600	19
	31–50 years	35	550	500	17	7	1.6	1.4	1300	2.0	2.8	120	600	19
<i>Tolerable Upper Intake Levels for Adults (19–70)</i>		3500	1000 <sup>k</sup>	35 <sup>l</sup>	3000	100	2000	4000 <sup>m</sup>	50	2000	50	4000 <sup>n</sup>		

**NOTE:** The table includes values for the type of DRI standard—Adequate Intake (AI) or Recommended Dietary Allowance (RDA)—that has been established for that particular nutrient and life stage; RDAs are shown in **bold type**. The final row of the table shows the Tolerable Upper Intake Levels (ULs) for adults; refer to the full DRI report for information on other ages and life stages. A UL is the maximum level of daily nutrient intake that is likely to pose no risk of adverse effects. There is insufficient data to set ULs for all nutrients, but this does not mean that there is no potential for adverse effects; source of intake should be from food only to prevent high levels of intake of nutrients without established ULs. In healthy individuals, there is no established benefit from nutrient intakes above the RDA or AI.

<sup>a</sup>Although AIs have been set for choline, there are few data to assess whether a dietary supply of choline is needed at all stages of the life cycle, and it may be that the choline requirement can be met by endogenous synthesis at some of these stages.

<sup>b</sup>As dietary folate equivalents (DFE); 1 DFE = 1  $\mu\text{g}$  food folate = 0.6  $\mu\text{g}$  folate from fortified food or as a supplement consumed with food = 0.5  $\mu\text{g}$  of a supplement taken on an empty stomach.

<sup>c</sup>As niacin equivalents (NE); 1 mg niacin = 60 mg tryptophan.

**Table 1** Dietary Reference Intakes (DRIs): Recommended Levels for Individual Intake (*continued*)

Life Stage	VITAMIN K ( $\mu\text{g/day}$ )	CALCIUM (mg/day)	CHROMIUM ( $\mu\text{g/day}$ )	COPPER ( $\mu\text{g/day}$ )	FLUORIDE (mg/day)	IODINE (mg/day)	IRON (mg/day) <sup>1</sup>	MAGNESIUM (mg/day)	MANGANESE (mg/day)	MOLYBDENUM ( $\mu\text{g/day}$ )	PHOSPHORUS (mg/day)	SELENIUM ( $\mu\text{g/day}$ )	ZINC (mg/day) <sup>m</sup>
Infants													
0–6 months	2.0	200	0.2	200	0.01	110	0.27	30	0.003	2	100	15	2
7–12 months	2.5	260	5.5	220	0.5	130	11	75	0.6	3	275	20	3
Children													
1–3 years	30	700	11	340	0.7	90	7	80	1.2	17	460	20	3
4–8 years	55	1000	15	440	1	90	10	130	1.5	22	500	30	5
Males													
9–13 years	60	1300	25	700	2	120	8	240	1.9	34	1250	40	8
14–18 years	75	1300	35	890	3	150	11	410	2.2	43	1250	55	11
19–30 years	120	1000	35	900	4	150	8	400	2.3	45	700	55	11
31–50 years	120	1000	35	900	4	150	8	420	2.3	45	700	55	11
51–70 years	120	1000	30	900	4	150	8	420	2.3	45	700	55	11
>70 years	120	1200	30	900	4	150	8	420	2.3	45	700	55	11
Females													
9–13 years	60	1300	21	700	2	120	8	240	1.6	34	1250	40	8
14–18 years	75	1300	24	890	3	150	15	360	1.6	43	1250	55	9
19–30 years	90	1000	25	900	3	150	18	310	1.8	45	700	55	8
31–50 years	90	1000	25	900	3	150	18	320	1.8	45	700	55	8
51–70 years	90	1200	20	900	3	150	8	320	1.8	45	700	55	8
>70 years	90	1200	20	900	3	150	8	320	1.8	45	700	55	8
Pregnancy													
≤18 years	75	3000	29	1000	3	220	27	400	2.0	50	1250	60	13
19–30 years	90	2500	30	1000	3	220	27	350	2.0	50	700	60	11
31–50 years	90	2500	30	1000	3	220	27	360	2.0	50	700	60	11
≥18 years	75	3000	44	1300	3	290	10	360	2.6	50	1250	70	14
Lactation													
19–30 years	90	2500	45	1300	3	290	9	310	2.6	50	700	70	12
31–50 years	90	2500	45	1300	3	290	9	320	2.6	50	700	70	12
<i>Tolerable Upper Intake Levels for Adults (19–70)</i>		2500		10,000	10	1100	45	350 <sup>b</sup>	11	2000	4000	400	40

<sup>a</sup>As retinol activity equivalents (RAEs); 1 RAE = 1  $\mu\text{g}$  retinol, 12  $\mu\text{g}$   $\beta$ -carotene, or 24  $\mu\text{g}$   $\alpha$ -carotene or  $\beta$ -cryptoxanthin. Preformed vitamin A (retinol) is abundant in animal-derived foods; provitamin A carotenoids are abundant in some dark yellow, orange, red, and deep-green fruits and vegetables. For preformed vitamin A and for provitamin A carotenoids in supplements, IRE = 1 RAE; for provitamin A carotenoids in foods, divide the REs by 2 to obtain RAEs. The UL applies only to preformed vitamin A.

<sup>b</sup>Individuals who smoke require an additional 35 mg/day of vitamin C over that needed by nonsmokers; nonsmokers regularly exposed to tobacco smoke should ensure they meet the RDA for vitamin C.

<sup>c</sup>UL = International Unit.

<sup>d</sup>As  $\alpha$ -tocopherol. Includes naturally occurring RRR- $\alpha$ -tocopherol and the 2R-stereoisomeric forms from supplements; does not include the 2S-stereoisomeric forms from supplements.

<sup>e</sup>Because 10–30% of older people may malabsorb food-bound B-12, those over age 50 should meet their RDA mainly with supplements or foods fortified with B-12.

<sup>f</sup>In view of evidence linking folate intake with neural tube defects in the fetus it is recommended that all women capable of becoming pregnant consume 400  $\mu\text{g}$  from supplements or fortified foods in addition to consuming folate from a varied diet.

<sup>g</sup>It is assumed that women will continue consuming 400  $\mu\text{g}$  from supplements or fortified food until their pregnancy is confirmed and they enter prenatal care, which ordinarily occurs after the end of the periconceptual period—the critical time for formation of the neural tube.

<sup>h</sup>The UL applies only to intake from supplements, fortified foods, and/or pharmacological agents and not to intake from foods.

<sup>i</sup>Because the absorption of iron from plant foods is low compared to that from animal foods, the RDA for strict vegetarians is approximately 1.8 times higher than the values established for omnivores (14 mg/day for adult male vegetarians; 33 mg/day for premenopausal female vegetarians). Oral contraceptives (OCs) reduce menstrual blood losses, so women taking them need less daily iron; the RDA for premenopausal women taking OCs is 10.9 mg/day. For more on iron requirements for other special situations, refer to *Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc* (visit <http://www.nap.edu> for the complete report).

<sup>m</sup>Zinc absorption is lower for those consuming vegetarian diets, so the zinc requirement for vegetarians is approximately twofold greater than for those consuming a nonvegetarian diet.

**Table 1** Dietary Reference Intakes (DRIs): Recommended Levels for Individual Intake (continued)

Life Stage	Group	POTASSIUM (g/day)	SODIUM (g/day)	CHLORIDE (g/day)	CARBOHYDRATE		TOTAL FIBER		TOTAL FAT		LINOLEIC ACID		ALPHA-LINOLENIC ACID		PROTEIN <sup>b</sup>	
					RDA/AI (g/day)	AMDR <sup>c</sup> (%)	RDA/AI (g/day)	AMDR <sup>c</sup> (%)	RDA/AI (g/day)	AMDR <sup>c</sup> (%)	RDA/AI (g/day)	AMDR <sup>c</sup> (%)	RDA/AI (g/day)	AMDR <sup>c</sup> (%)	RDA/AI (g/day)	AMDR <sup>c</sup> (%)
Infants	0–6 months	0.4	0.12	0.18	60	ND <sup>d</sup>	ND	ND	4.4	ND <sup>d</sup>	0.5	ND <sup>d</sup>	0.5	ND <sup>d</sup>	9.1	ND <sup>d</sup>
	7–12 months	0.7	0.37	0.57	95	ND <sup>d</sup>	ND	ND	4.6	ND <sup>d</sup>	0.5	ND <sup>d</sup>	0.5	ND <sup>d</sup>	13.5	ND <sup>d</sup>
Children	1–3 years	3.0	1.0	1.5	130	45–65	19	30–40	7	5–10	0.7	0.6–1.2	0.7	0.6–1.2	13	5–20
	4–8 years	3.8	1.2	1.9	130	45–65	25	25–35	10	5–10	0.9	0.6–1.2	0.9	0.6–1.2	19	10–30
Males	9–13 years	4.5	1.5	2.3	130	45–65	31	25–35	12	5–10	1.2	0.6–1.2	1.2	0.6–1.2	34	10–30
	14–18 years	4.7	1.5	2.3	130	45–65	38	25–35	16	5–10	1.6	0.6–1.2	1.6	0.6–1.2	52	10–30
	19–30 years	4.7	1.5	2.3	130	45–65	38	20–35	17	5–10	1.6	0.6–1.2	1.6	0.6–1.2	56	10–35
	31–50 years	4.7	1.5	2.3	130	45–65	38	20–35	17	5–10	1.6	0.6–1.2	1.6	0.6–1.2	56	10–35
	51–70 years	4.7	1.3	2.0	130	45–65	30	20–35	14	5–10	1.6	0.6–1.2	1.6	0.6–1.2	56	10–35
Females	>70 years	4.7	1.2	1.8	130	45–65	30	20–35	14	5–10	1.6	0.6–1.2	1.6	0.6–1.2	56	10–35
	9–13 years	4.5	1.5	2.3	130	45–65	26	25–35	10	5–10	1.0	0.6–1.2	1.0	0.6–1.2	34	10–30
	14–18 years	4.7	1.5	2.3	130	45–65	26	25–35	11	5–10	1.1	0.6–1.2	1.1	0.6–1.2	46	10–30
	19–30 years	4.7	1.5	2.3	130	45–65	25	20–35	12	5–10	1.1	0.6–1.2	1.1	0.6–1.2	46	10–35
	31–50 years	4.7	1.5	2.3	130	45–65	25	20–35	12	5–10	1.1	0.6–1.2	1.1	0.6–1.2	46	10–35
Pregnancy	31–50 years	4.7	1.3	2.0	130	45–65	25	20–35	12	5–10	1.1	0.6–1.2	1.1	0.6–1.2	46	10–35
	51–70 years	4.7	1.3	2.0	130	45–65	21	20–35	11	5–10	1.1	0.6–1.2	1.1	0.6–1.2	46	10–35
	>70 years	4.7	1.2	1.8	130	45–65	21	20–35	11	5–10	1.1	0.6–1.2	1.1	0.6–1.2	46	10–35
	≤18 years	4.7	1.5	2.3	175	45–65	28	20–35	13	5–10	1.4	0.6–1.2	1.4	0.6–1.2	71	10–35
	19–30 years	4.7	1.5	2.3	175	45–65	28	20–35	13	5–10	1.4	0.6–1.2	1.4	0.6–1.2	71	10–35
Lactation	31–50 years	4.7	1.5	2.3	175	45–65	28	20–35	13	5–10	1.4	0.6–1.2	1.4	0.6–1.2	71	10–35
	≤18 years	5.1	1.5	2.3	210	45–65	29	20–35	13	5–10	1.3	0.6–1.2	1.3	0.6–1.2	71	10–35
	19–30 years	5.1	1.5	2.3	210	45–65	29	20–35	13	5–10	1.3	0.6–1.2	1.3	0.6–1.2	71	10–35
Tolerable Upper Intake Level for Adults (19–70)		5.1	1.5	2.3	210	45–65	29	20–35	13	5–10	1.3	0.6–1.2	1.3	0.6–1.2	71	10–35
			2.3	3.6												

<sup>a</sup>Daily protein recommendations are based on body weight for reference body weights. To calculate for a specific body weight, use the following values: 1.5 g/kg for infants, 1.1 g/kg for 1–3 years, 0.95 g/kg for 4–13 years, 0.85 g/kg for 14–18 years, 0.8 g/kg for adults, and 1.1 g/kg for pregnant (using pregnancy weight) and lactating women.

<sup>b</sup>Acceptable Macronutrient Distribution Range (AMDR), expressed as a percent of total daily calories, is the range of intake for a particular energy source that is associated with reduced risk of chronic disease while providing intakes of essential nutrients. If an individual consumes in excess of the AMDR, there is a potential for increasing the risk of chronic diseases and/or insufficient intakes of essential nutrients.

<sup>c</sup>Total water intake from fluids and food.









<sup>d</sup>Not determinable due to lack of data of adverse effects in this age group and concern with regard to lack of ability to handle excess amounts. Source of intake should be from food only to prevent high levels of intake.

<sup>e</sup>For infants, Adequate Intake of total fat is 31 grams/day (0–6 months) and 30 grams per day (7–12 months) from breast milk and, for infants 7–12 months, complementary food and beverages.

**SOURCE:** Food and Nutrition Board, Institute of Medicine, National Academies. 2004. *Dietary Reference Intakes: Tables*. Washington, DC: National Academies Press. The complete Dietary Reference Intake reports are available from the National Academy Press (<http://www.nap.edu>).

<sup>\*</sup>Reprinted with permission from *Dietary Reference Intakes Applications in Dietary Planning*. Copyright © 2004 by the National Academy of Sciences. Reprinted with permission from the National Academies Press, Washington, D.C.

# Nutrition Resources

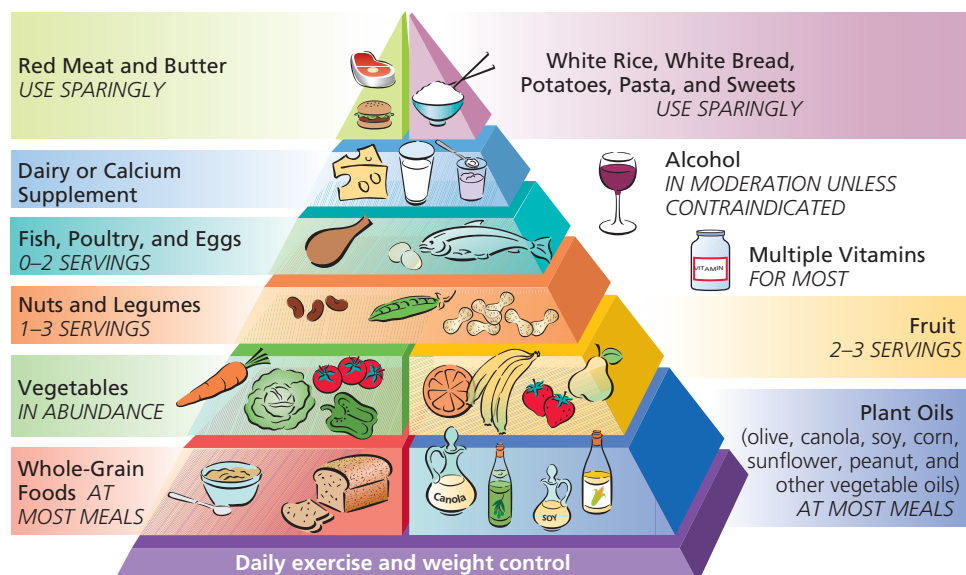
Food groups	Number of servings per day (or per week, as noted)				Serving sizes and notes
	1600 calories	2000 calories	2600 calories	3100 calories	
<b>Grains</b> 	6	6–8	10–11	12–13	1 slice bread, 1 oz dry cereal, 1/2 cup cooked rice, pasta, or cereal; choose whole grains
<b>Vegetables</b> 	3–4	4–5	5–6	6	1 cup raw leafy vegetables, 1/2 cup cooked vegetables, 1/2 cup vegetable juice
<b>Fruits</b> 	4	4–5	5–6	6	1/2 cup fruit juice, 1 medium fruit, 1/4 cup dried fruit, 1/2 cup fresh, frozen, or canned fruit
<b>Low-fat or fat-free dairy foods</b> 	2–3	2–3	3	3–4	1 cup milk; 1 cup yogurt, 1 1/2 oz cheese; choose fat-free or low-fat types
<b>Meat, poultry, fish</b> 	3–6	6 or less	6	6–9	1 oz cooked meats, poultry, or fish: select only lean; trim away visible fats; broil, roast, or boil instead of frying; remove skin from poultry
<b>Nuts, seeds, legumes</b> 	3 servings per week	4–5 servings per week	1	1	1/3 cup or 1 1/2 oz nuts, 2 Tbsp or 1/2 oz seeds, 1/2 cup cooked dry beans/peas, 2 Tbsp peanut butter
<b>Fats and oils</b> 	2	2–3	3	4	1 tsp soft margarine, 1 Tbsp low-fat mayonnaise, 2 Tbsp light salad dressing, 1 tsp vegetable oil; DASH has 27% of calories as fat (low in saturated fat)
<b>Sweets</b> 	0	5 servings/week or less	2	2	1 Tbsp sugar, 1 Tbsp jelly or jam, 1/2 cup sorbet, 1 cup lemonade; sweets should be low in fat

**FIGURE 1 The DASH Eating Plan.**

**SOURCE:** National Institutes of Health, National Heart, Lung, and Blood Institute. 2006. *Your Guide to Lowering Your Blood Pressure with DASH: How Do I Make the Dash?* ([http://www.nhlbi.nih.gov/health/public/heart/hbp/dash/how\\_make\\_dash.html](http://www.nhlbi.nih.gov/health/public/heart/hbp/dash/how_make_dash.html); retrieved April 30, 2009).

**FIGURE 2 Healthy Eating Pyramid.** The Healthy Eating Pyramid is an alternative food-group plan developed by researchers at the Harvard School of Public Health. This pyramid reflects many major research studies that have looked at the relationship between diet and long-term health. The Healthy Eating Pyramid differentiates between the various dietary sources of fat, protein, and carbohydrates, and it emphasizes whole grains, vegetable oils, fruits and vegetables, nuts, and dried peas and beans.

**SOURCE:** Reprinted by permission of Simon & Schuster Inc., from *Eat, Drink, and Be Healthy: The Harvard Medical School Guide to Healthy Eating* by Walter C. Willett, M.D. Copyright © 2001, 2005 by President and Fellows of Harvard College. All rights reserved.





Next, average your daily intake totals for the 3 days and enter them in the chart below. For example, if your three daily totals for the fruit group were 1 cup, 1½ cups, and 2 cups, your average daily intake would be 1½ cups. Fill in the recommended intake totals that apply to you from Figure 8.5 and Table 8.6.

MyPlate Food Group	Recommended Daily Amounts or Limits	Your Actual Average Daily Intake
<b>Grains (total)</b>	oz-eq	oz-eq
<b>Whole grains</b>	oz-eq	oz-eq
<b>Other grains</b>	oz-eq	oz-eq
<b>Vegetables (total)</b>	cups	cups
<b>Fruits</b>	cups	cups
<b>Milk</b>	cups	cups
<b>Meat and beans</b>	oz-eq	oz-eq
<b>Oils</b>	tsp	tsp
<b>Solid fats</b>	g	g
<b>Added sugars</b>	g/tsp	g/tsp

## Using Your Results

*How did you score?* How close is your diet to that recommended by MyPlate? Are you surprised by the amount of food you are consuming from each food group or from added sugars and solid fats?

*What should you do next?* If the results of the assessment indicate that you could boost your level of wellness by improving your diet, set realistic goals for change. Do you need to increase or decrease your consumption of any food groups? List any areas of concern below, along with a goal for change and strategies for achieving the goal you've set. If you see that you are falling short in one food group, such as fruits or vegetables, but have many foods that are rich in discretionary calories from solid fats and added sugars, you might try decreasing those items in favor of an apple, a bunch of grapes, or some baby carrots. Think carefully about the reasons behind your food choices. For example, if you eat doughnuts for breakfast every morning because you feel rushed, make a list of ways to save time to allow for a healthier breakfast.

Problem: \_\_\_\_\_

Goal: \_\_\_\_\_

Strategies for change: \_\_\_\_\_

\_\_\_\_\_

Problem: \_\_\_\_\_

Goal: \_\_\_\_\_

Strategies for change: \_\_\_\_\_

\_\_\_\_\_

Problem: \_\_\_\_\_

Goal: \_\_\_\_\_

Strategies for change: \_\_\_\_\_

\_\_\_\_\_

Enter the results of this lab in the Preprogram Assessment column in Appendix C. If you've set goals and identified strategies for change, begin putting your plan into action. After several weeks of your program, complete this lab again and enter the results in the Postprogram Assessment column of Appendix C. How do the results compare?







Name \_\_\_\_\_ Section \_\_\_\_\_ Date \_\_\_\_\_



## LAB 8.3 Informed Food Choices

### Part I Using Food Labels

Choose three food items to evaluate. You might want to select three similar items, such as regular, low-fat, and nonfat salad dressing, or three very different items. Record the information from their food labels in the table below.

Food Items			
Serving size			
Total calories	cal	cal	cal
Total fat—grams	g	g	g
—% Daily Value	%	%	%
Saturated fat—grams	g	g	g
—% Daily Value	%	%	%
Trans fat—grams	g	g	g
Cholesterol—milligrams	mg	mg	mg
—% Daily Value	%	%	%
Sodium—milligrams	mg	mg	mg
—% Daily Value	%	%	%
Carbohydrates (total)—gram	g	g	g
—% Daily Value	%	%	%
Dietary fiber—grams	g	g	g
—% Daily Value	%	%	%
Sugars—grams	g	g	g
Protein—grams	g	g	g
Vitamin A—% Daily Value	%	%	%
Vitamin C—% Daily Value	%	%	%
Calcium—% Daily Value	%	%	%
Iron—% Daily Value	%	%	%

How do the items you chose compare? You can do a quick nutrient check by totaling the Daily Value percentages for nutrients you should limit (total fat, cholesterol, sodium) and the nutrients you should favor (dietary fiber, vitamin A, vitamin C, calcium, iron) for each food. Which food has the largest percent Daily Value sum for nutrients to limit? For nutrients to favor?

Food Items			
Calories	cal	cal	cal
% Daily Value total for nutrients to limit (total fat, cholesterol, sodium)	%	%	%
% Daily Value total for nutrients to favor (fiber, vitamin A, vitamin C, calcium, iron)	%	%	%

## Part II Evaluating Fast Food

Use the nutritional information available from fast-food restaurants to complete the chart on this page for the last fast-food meal you ate. Add up your totals for the meal. Compare the values for fat, protein, carbohydrate, cholesterol, and sodium content for each food item and for the meal as a whole with the levels suggested by the Dietary Guidelines for Americans. Calculate the percent of total calories derived from fat, saturated fat, protein, and carbohydrate using the formulas given.

To get fast-food nutritional information, ask for a nutrition information brochure when you visit the restaurant, or visit restaurant Web sites: Arby's (<http://www.arbysrestaurant.com>), Burger King (<http://www.burgerking.com>), Domino's Pizza (<http://www.dominos.com>), Jack in the Box (<http://www.jackinthebox.com>), KFC (<http://www.kfc.com>), McDonald's (<http://www.mcdonalds.com>), Subway (<http://www.subway.com>), Taco Bell (<http://www.tacobell.com>), Wendy's (<http://www.wendys.com>).

If you haven't recently been to a fast-food restaurant, fill in the chart for any sample meal you might eat.

### FOOD ITEMS

	Dietary Guidelines							Total**
Serving size (g)		g	g	g	g	g	g	g
Calories		cal	cal	cal	cal	cal	cal	cal
Total fat—grams		g	g	g	g	g	g	g
—% calories*	20–35%	%	%	%	%	%	%	%
Saturated fat—grams		g	g	g	g	g	g	g
—% calories*	<10%	%	%	%	%	%	%	%
Protein—grams		g	g	g	g	g	g	g
—% calories*	10–35%	%	%	%	%	%	%	%
Carbohydrate—grams		g	g	g	g	g	g	g
—% calories*	45–65%	%	%	%	%	%	%	%
Cholesterol†	100 mg	mg	mg	mg	mg	mg	mg	mg
Sodium†	800 mg	mg	mg	mg	mg	mg	mg	mg

\*To calculate the percent of total calories from each food energy source (fat, carbohydrate, protein), use the following formula:

$$\frac{(\text{number of grams of energy source}) \times (\text{number of calories per gram of energy source})}{(\text{total calories in serving of food item})}$$

(Note: Fat and saturated fat provide 9 calories per gram; protein and carbohydrate provide 4 calories per gram.) For example, the percent of total calories from protein in a 150-calorie dish containing 10 grams of protein is

$$\frac{(10 \text{ grams of protein}) \times (4 \text{ calories per gram})}{(150 \text{ calories})} = \frac{40}{150} = 0.27, \text{ or } 27\% \text{ of total calories from protein}$$

\*\*For the Total column, add up the total grams of fat, carbohydrate, and protein contained in your sample meal and calculate the percentages based on the total calories in the meal. (Percentages may not total 100% due to rounding.) For cholesterol and sodium values, add up the total number of milligrams.

†Recommended daily limits of cholesterol and sodium are divided by 3 here to give an approximate recommended limit for a single meal.

**SOURCE:** Insel, P. M., and W. T. Roth. 2010. Wellness Worksheet 66. *Core Concepts in Health*, 11th ed. Copyright © 2010 The McGraw-Hill Companies, Inc. Reprinted with permission.