Chapter 1

Food Choices: Nutrients and Nourishment

Revised by Kimberley McMahon

THINK About It

1. What, if anything, might persuade or influence you to change your food preferences?
2. Are there some foods you definitely avoid? If so, do you know why?
3. What do you think is driving the popularity of vitamins and other supplements?
4. Where do you get the majority of your information about nutrition?

CHAPTER Menu

LEARNING Objectives

- Define *nutrition*.
- Identify factors that influence food choice.
- Describe the typical American diet.
- Identify the six classes of nutrients essential for health.
- Describe the basic steps in the nutrition research process.
- Recognize credible scientific research and reliable sources of nutrition information.

A group of friends goes out for pizza every Thursday night. A young man greets his girlfriend with a box of chocolates. A 5-year-old imitates her parents after they salt their food. A firefighter who is asked to explain why hot dogs are his favorite food says it has something to do with going to baseball games with his father. A parent punishes a misbehaving child by withholding dessert. What do all of these people have in common? They are using food for something other than its nutrient value. Can you think of a holiday that is not celebrated with food? For most of us, food is more than a collection of nutrients. Many factors affect what we choose to eat. Many of the foods people choose are nourishing and contribute to good health. The same, of course, may be true of the foods we reject.

The science of **nutrition** helps us improve our food choices by identifying the amounts of nutrients we need, the best food sources of those nutrients, and the other components in foods that are helpful or harmful. The U.S. National Library of Medicine defines *nutrition* as the science of food; the nutrients and other substances therein; their action, interaction, and balance in relation to health and disease; and the processes by which we ingest, absorb, transport, utilize, and excrete food substances.[1] Learning about nutrition helps us to be informed and more likely to make healthy nutrition choices, which in turn may not only improve our health, but also reduce our risk of some diseases and even increase our longevity. Keep in mind, though, that no matter how much you know about nutrition, you are still likely to choose some foods regardless of the nutrients they provide, simply for their taste or just because it makes you feel good to eat them.

▶ **nutrition** The science of foods and their components (nutrients and other substances), including the relationships to health and disease (actions, interactions, and balances); processes within the body (ingestion, digestion, absorption, transport, functions, and disposal of end products); and the social, economic, cultural, and psychological implications of eating.

Why Do We Eat the Way We Do?

Do you "eat to live" or "live to eat"? For most of us, the first is certainly true—you must eat to live. But there can be times when our enjoyment of food is more important to us than the nourishment we get from it. Factors such as age, gender, genetic makeup, occupation, lifestyle, family, and cultural background affect our daily food choices. We use food to project a desired image, forge relationships, express friendship, show creativity, and disclose our feelings. We cope with anxiety or stress by eating or not eating; we reward ourselves with food for a good grade or a job well done; or, in extreme cases, we punish failures by denying ourselves the benefit and comfort of eating.

Quick Bite

Try It Again, You Just Might Like It

Studies have found that children between the ages of 2 and 6 years commonly dislike things that are new or unfamiliar. This is also the time when kids are most likely to reject vegetables. Kids have a better chance to overcome this tendency if they are repeatedly exposed to the food they initially reject—somewhere between 5 and 15 exposures should do it.

FIGURE 1.1 Adventures in eating. Babies and toddlers are willing to try new things, generally after repeated exposure.

Personal Preferences

What we eat reveals much about who we are. Food preferences begin early in life, and then change as we interact with parents, friends, and peers. Further experiences with different people, places, and situations often cause us to expand or change our preferences. Taste and other sensory factors such as texture are the most important things that influence our food choices; next are cost and convenience.[2]

THINK About It 1

Age is also a factor in food preferences. Consider taste preferences and how they might be influenced even before birth. Science shows that, when compared to adults, children naturally prefer higher levels of sweet and salty tastes and reject bitter tastes.[3] This might help explain why children are drawn to more unhealthy food choices within our current food environment—an environment composed of high-salt, high-refined-sugar foods. In support of this idea, studies have found that sensory experiences, beginning early in life, can shape preferences in both a positive and a negative way.[4] For example, expecting mothers who consume diets rich in healthy foods can help develop their child's taste preferences in a positive way because flavors from foods that the mother eats are transmitted to amniotic fluid and to mother's milk, creating an environment in which breastfed infants are more accepting of these flavors. In contrast, infants fed formula learn to prefer its unique flavor profile and may have more difficulty initially accepting flavors not found in formula, such as those of fruit and vegetables.[5] Having healthy food experiences early in life may go a long way toward promoting healthy eating throughout a person's life span.

Although young children prefer sweet or familiar foods, babies and toddlers are generally willing to try new things (see **FIGURE 1.1**). Experimental evidence suggests children repeatedly exposed to a variety of foods, particularly when the caregiver focuses on the child's willingness to eat a food, are more likely to accept these foods; as a result, the child will add more variety to their diet and, therefore, eat more healthfully.[6]

▶ **neophobia** A dislike for anything new or unfamiliar.

Preschoolers typically go through a period of food **neophobia**, a dislike for anything new or unfamiliar. School-age children tend to accept a wider array of foods, and teenagers are strongly influenced by the preferences and habits of their peers. If you track the kinds of foods you have eaten in the past year, you might be surprised to discover how few basic foods your diet includes. By the time we reach adulthood, we have formed a core group of foods we prefer. Of this group, only about 100 basic items account for 75 percent of our food intake.

Like many aspects of human behavior, food choices are influenced by many interrelated factors. Generally, hunger and satiety dictate when we eat, but what we choose to eat is not always determined by physiological or nutritional needs. When we consider that our food preferences are also dictated by factors such as sensory properties of foods (taste, smell, and texture), emotional and cognitive factors (habits, comfort/discomfort foods, food advertising and promotion, eating away from home, etc.), and environmental factors (economics, lifestyle, food availability, culture, religion, and socioeconomics), we can better understand why we choose to eat the foods that we do (see **FIGURE 1.2**).

Environmental Factors

Economic
Lifestyle
Availability
Cultural influences
Religion
Socio-ecological model

Personal Preference

Sensory influences (taste, smell, texture) Habit
Comfort/discomfort foods
Food advertising and promotion
Eating away from home
Food and diet trends
Social factors
Nutrition and health belief

FIGURE 1.2 Factors that affect food choices. We often select a food to eat automatically without thought. But, in fact, our choices are complex events involving the interactions of a multitude of factors.

Sensory Influences: Taste, Smell, and Texture

In making food choices, what appeals to our senses contributes to our personal preferences. People often refer to **flavor** as a collective experience that describes both taste and smell. Texture also plays a part. You may prefer foods that have a crisp, chewy, or smooth texture. You may reject foods that feel grainy, slimy, or rubbery. Other sensory characteristics that affect food choice are color, moisture, and temperature.

We are familiar with the classic four tastes—sweet, sour, bitter, and salty—but studies show that there are more. One of these additional taste sensations is **umami**, which is a Japanese term for the taste produced by glutamate.[7] It is the brothy, meaty, savory flavor in foods such as meat, seafood, and vegetables. Monosodium glutamate (MSG) enhances this flavor when it is added to such foods.

▶ **flavor** The collective experience that describes both taste and smell.

▶ **umami [ooh-MA-mee]** A Japanese term that describes a delicious meaty or savory sensation. Chemically, this taste detects the presence of glutamate.

Emotional and Cognitive Influences

Habits

Your eating and cooking habits likely reflect what you learned from your parents. We typically learn to eat three meals a day, at about the same times each day. Quite often we eat the same foods, particularly for breakfast (e.g., cereal and milk) and lunch (e.g., sandwiches). This routine makes life convenient, and we don't have to think much about when or what to eat. But we don't have to follow this routine! How would you feel about eating mashed potatoes for breakfast and cereal for dinner? Some people might get a stomach ache just thinking about it, whereas others may enjoy the prospect of doing things differently. Look at your eating habits and see how often you make the same choices every single day.

Comfort/Discomfort Foods

Our desire for particular foods often is based on behavioral motives, even though we may not be aware of them. For some people, food becomes an emotional security blanket. Consuming our favorite foods can make us feel better, relieve stress, and allay anxiety (see **FIGURE 1.3**). Starting in the first days of life, food and affection are intertwined. Breastfed infants, for example, experience physical, emotional, and psychological satisfaction when nursing. As we grow older, this experience is continually reinforced. For example, chicken soup and hot tea with honey may be favorites when we feel under the weather because someone had prepared these foods for us when we were not feeling well. If we were rewarded for good behavior with a particular food (e.g., ice cream, candy, cookies), our positive feelings about that food can persist for a lifetime. In contrast, at some point, you may have gotten sick soon after eating a certain food and you still avoid that food.

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FIGURE 1.3 Comfort foods. Depending on your childhood food experiences, a bowl of traditional soup, a remembered sweet, or a mug of hot chocolate can provide comfort in times of stress.

Food Advertising and Promotion

Aggressive and sometimes deceptive advertising programs can influence a person's food-buying decision; therefore, it may not surprise you that some of the most popular food purchases are high-fat and high-sugar baked goods and alcoholic beverages. We are, however, seeing more innovative and aggressive advertising that promotes milk, meat, cranberries, and other more nutrient-dense products.

According to the Federal Trade Commission (FTC), businesses spend $9.6 billion annually marketing food and beverages. More than $1.79 billion specifically targets children and adolescents, promoting items such as sugared

Quick Bite

Sweetness and Salt

Salt can do more than just make your food taste salty. Researchers at the Monell Chemical Senses Center demonstrated that salt also suppresses the bitter flavors in foods. When combined with chocolate, for example, in a chocolate-covered pretzel, salt blocks some of the bitter flavor, making the chocolate taste sweeter. This may explain why people in many cultures salt their fruit.

FIGURE 1.4 Healthy advertising. Got milk? Is an example of a successful healthy advertising campaign.

▶ **calorie** The general term for energy in food; used synonymously with the term *energy*. Often used instead of *kilocalorie* on food labels, in diet books, and in other sources of nutrition information.

breakfast cereals, fast food, and soft drinks.[8] It is easy to see that from television to online marketing, a lot of money is being spent to promote certain products. Children and teens see about 12–16 TV advertisements per day for products generally high in saturated fat, sugar, or sodium.[9] Some researchers have linked the high prevalence of obesity among American children to their exposure to TV food advertisements. When compared to other countries, the contribution of TV food ads for children ages 6 to 11 years old to the occurrence of childhood obesity was greatest among the American population.[10]

Some advertising is positive. Ads like the one shown in **FIGURE 1.4**, for example, can be helpful, especially to consumers whose diets need improvement.

Eating Away from Home

Americans spend almost half of their food budget on foods prepared away from home.[11] Many people, however, underestimate the amount of **calories**, the general term for the amount of energy in food, and the amount of fat in foods prepared away from home, which is likely contributing to increasing weight and obesity.[12] This trend has promoted an increase in the interest for information on calories, fat, and sodium, as well as other nutrients on restaurant menus. When calories are present on menus, people order foods with fewer calories compared to menus without calories identified,[13] and parents order fewer calories for their children.[14] The Food and Drug Administration (FDA) has implemented guidelines in which nutrition labeling in chain restaurants and similar retail food establishments will provide consumers with clear and consistent nutrition information in a direct and accessible manner for the foods they eat and buy.

Food and Diet Trends

The popularity of different diets can influence changes in food product consumption. Beginning in the late 1980s, low-fat diets became popular and were accompanied by an explosion of reduced-fat, low-fat, and fat-free products. When the "low-carb" diet became popular, so did the rise in low-carb or no-carb products. Diet and health-related products also compete for consumer dollars. For example, sales of gluten-free products in the United States continue to rise due to the increased diagnosis of celiac disease and the belief that eliminating gluten, a protein found in wheat and related grains such as barley and rye, from the diet will treat other conditions as well.[15]

Social Factors

Social factors exert a powerful influence on food choice. Food is often at the center of family reunions, social gatherings, and office holiday parties. Perhaps even more influential, though, are the messages from peers about what to eat or how to eat.

FIGURE 1.5 Social facilitation. Interactions with others can affect your eating behaviors.

As **FIGURE 1.5** illustrates, eating is a social event that brings together people for a variety of purposes (e.g., religious or cultural celebrations, business meetings, family dinners). Social pressures, however, can restrict our food intake and selection. We might, for example, order nonmeat dishes when dining with a group of vegetarian friends.

Knowledge of Health and Nutrition

Many people select and emphasize certain foods they think are "good for them" (see **FIGURE 1.6**). Consumer health beliefs, perceptions of disease susceptibility, and desires to take action to prevent or delay disease onset can have powerful influences on diet and food choices. For example, people who feel vulnerable to disease and believe that dietary change might lead to positive results are more likely to pay attention to information

about links among dietary choices, dietary fat, and health risks. A desire to lose weight or alter one's physical appearance also can be a powerful force shaping decisions to accept or reject particular foods. How nutrition information is delivered to consumers may also play a role in food choices. One study that compared the type of nutrition information provided, education levels, and obesity predominance in three different countries (France, Canada, and the United States) supported the idea that a "science" or nutrient approach to food might not result in appropriate food choices, indicating that in these instances consumers lose sight of the big picture and that a more practical approach to nutrition education may lead to better overall food choices.[16] Furthermore, consumers are placing higher priority on foods for health and seeking foods with more protein, less sugars, and minimal processing.[17]

FIGURE 1.6 Where do you get your nutrition information? We are constantly bombarded by food messages. Which sources do you find most influential? Are they the most reliable?

Key Concepts Many factors influence our decisions about what to eat and when to eat. Some of the main factors include personal preferences such as taste, texture, and smell; our habits with eating; the emotional connections of comfort or discomfort that are linked to certain foods; advertisements and promotions; and whether we choose to eat our meals at home or away from home. The cultural environment in which people live also has a major influence on what foods they choose to eat.

Environment

Your environment—where you live, how you live, who you live with—has a lot to do with what you choose to eat. People around us influence our food choices, and we generally prefer the foods we grew up eating. Environmental factors that influence our food choices include economics, lifestyle, culture, and religion. Where you live and the surrounding climate also influence which foods are most accessible to you. Environmental factors such as location and climate affect food costs, a major determinant of food choice. In the United States, our environment and the choices we make play a large role in the current obesity epidemic. The **obesogenic environment** is used to describe how many Americans live: in an environment that promotes overconsumption of calories while at the same time discouraging physical activity. Other environmental factors that influence our food choices include economics, lifestyle, availability, cultural influences, religion, and the social-ecological model.

▶ **obesogenic environment** Circumstances in which a person lives, works, and plays that promote the overconsumption of calories and discourage physical activity and calorie expenditure.

Economics

Where you live and the surrounding climate not only influence which foods are most accessible to you, but also affect food costs, which are a major determinant of food choice. You may have "lobster taste" but a "hot dog budget." The types of foods purchased and the percentage of income used for food are affected by total income. Households spend more money on food when incomes rise. In 2012, middle-income families spent an average of $5,798 on food, representing about 12 percent of income. In contrast, the lowest-income households spent an average of $3,502 on food, representing 35 percent of income.[18] How much does it cost to follow dietary recommendations? For adults on a 2,000-calorie per day diet, the cost of meeting the *Dietary Guidelines for Americans* recommendations for fruit and vegetable consumption is $2.00 to $2.50 per day, according to an analysis by the U.S. Department of Agriculture (USDA).[19]

Lifestyle

Another influential factor is lifestyle. Our fast-paced society has little time or patience for food preparation. Convenience foods, from frozen entrées to

Going Green

Are you taking part in the green revolution? What are your environmental concerns?

Are you familiar with the terms *eco-friendly, carbon footprint, greenhouse gases, global climate,* and *global warming*? These phrases reflect new perspectives on our interrelated world, signaling our recent awareness of an environment in trouble. Our continuing abuse of our environment has resulted in a global climatic backlash: widespread disruptions threaten irreversible damage to our planet. The result could be a far less livable planet, inhospitable to a way of life we have taken for granted. Some green protesters are taking action. For example, to stop Brazilian rainforest destruction, some soya traders refuse to sell soy from deforested areas of the Amazon.

It is important to focus on our nutrition environment. Here are several examples of the new green technology. Only three kinds of plants supply 65 percent of the global food supply. You might be surprised to learn that they are rice, wheat, and corn. With amazing efficiency, farmers can turn plant products into animal protein with aquaculture, a fancy word for fish farming, which has realized the fastest growth of global food production and now accounts for more than 30 percent of fish consumption in the world. Again, although modern agricultural methods depend heavily on fertilizers, pesticides, and herbicides, we can also turn to newer, ecologically friendly farming technologies that increasingly lower costs and preserve the quality of soils. And although surrounded by controversy, genetically modified crops and foods are used to resist pests and increase yields and are finding a niche in our nutrition environment.

Quick Bite

Dietary Guidelines for Americans, 2015

"Positive changes in individual diet and physical activity behaviors, and in the environmental contexts and systems that affect them, could substantially improve health outcomes."

Reproduced from U.S. Department of Agriculture and U.S. Department of Health and Human Services. *Dietary Guidelines for Americans, 2015.* 8th ed. Washington, DC: U.S. Government Printing Office; February 2015.

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FIGURE 1.7 Cultural influences. If you were visiting China, would you sample the local delicacy—deep-fried scorpion?

complete meals "in a box," saturate supermarket shelves. Rising incomes and busier lifestyles have led consumers to spend less time cooking and more time taking advantage of the convenience of food prepared away from home.

Availability

Poor access to healthy, nutritious foods can negatively affect health and well-being. Approximately 23.5 million Americans, including 6.5 million children, live in nutritional wastelands commonly referred to as "food deserts." Food deserts are low-income areas where residents lack access to a supermarket or large grocery store to buy affordable fruits, vegetables, whole grains, low-fat milk, and other foods that make up the full range of a healthy diet.[20]

Not only do many people who live in food deserts lack the ability to get fresh, healthy, and affordable foods easily, but they often rely on "quick markets" that offer mostly highly processed, high-sugar, and high-fat foods. Their communities often lack healthy food providers, such as grocery stores and farmers' markets. In these neighborhoods, food needs typically are served by inexpensive restaurants and convenience stores, which offer few fresh foods. As part of its Let's Move! initiative, the Healthy Food Financing Initiative (HFFI) plans to help revitalize neighborhoods by eliminating food deserts that exist across urban and rural America.[21]

Cultural Influences

One of the strongest influences on food preferences is tradition or cultural background. In all societies, no matter how simple or complex, eating is the primary way of initiating and maintaining human relationships.

To a large extent, culture defines our attitudes. "One man's food is another man's poison." Look at **FIGURE 1.7**. How does the photo make you feel? Insects, maggots, and entrails are delicacies to some, whereas just the thought of ingesting them is enough to make others cringe. Cultural forces are so powerful that if you were permitted only a single question to establish someone's

Food and Culture

Do you ever wonder why people choose prickly pears over apples or pomegranates over blueberries? For the most part, food choices are a result of what people are accustomed to or what they have learned. Dietary habits are as diverse as individuals, and culture plays a key role in the food choices people make. Cultural influences often determine what roles various foods play in dietary habits, health beliefs, and everyday behaviors. As cultural diversity becomes more common among populations, regional food favorites become less foreign. Although beliefs and traditions can be modified through geography, economics, or experiences, core values and customs typically remain similar within a specific group.[a–c]

Food plays a major role in most religions and religious customs. Religious beliefs usually are learned early and can define certain dietary habits. For example, Jewish dietary laws specify that foods must be *kosher*. To be kosher, meat must come from animals that chew their cud, have split hooves, and are free from blemishes to their internal organs. Fish must have fins and scales. Pork, crustaceans and shellfish, and birds of prey are not kosher. Kosher laws prohibit eating meat and milk at the same meal or even preparing or serving them with the same plates and utensils. Islam identifies acceptable foods as Halal and has rules similar to those of Judaism for the slaughtering of animals. Islam prohibits the consumption of pork, the flesh of clawed animals, alcohol, and other intoxicating drugs. The Church of Jesus Christ of Latter Day Saints disapproves of coffee, tea, and alcoholic beverages. Most Hindus are vegetarians and do not eat eggs, and some avoid onions and garlic. The Orthodox Jain religion in India forbids eating meat or animal products (e.g., milk, eggs) and any root vegetables (e.g., potatoes, carrots, garlic). In Buddhism, mind-altering substances or intoxicating beverages are prohibited, but dietary habits vary considerably based on the sect and geographic location.[d] Some Buddhists follow strict forms of vegetarianism whereas others do not. In Christianity and many other religions, food plays a key role in religious ceremonies and various religious holidays, from what foods may or may not be eaten (e.g., no meat on Fridays during Lent) to when foods can be consumed (e.g., only from sundown to sunrise during Islam's Ramadan). Food plays an important role not only in physical survival, but also in many people's spiritualism.

Many cultures have traditional medical practices based on the belief that nature is composed of two opposing forces. In traditional Chinese medicine, for example, these forces, called *yin* and *yang*, must be in proper balance for good health.[e] It is believed that excesses in either direction cause illness. The illness must then be treated by giving foods of the opposite force. This idea of balance or harmony, accompanied by terms describing illness and foods as either cold (e.g., banana, fish, juices) or hot (e.g., beef, nuts, ginger) or yin or yang, also is found in other Asian cultures, including India and the Philippines, and in Latin American cultures and ethnicities.

Numerous cultures view a variety of foods as having medicinal properties. Treatments commonly use assorted herbs, herbal teas, and special foods. From generation to generation, knowledge of such remedies is passed on. Remarkably, various cultures all over the world use remedies based on similar common substances, such as chamomile, garlic, and honey. These familiar substances often are more trusted and are considered safer than modern medicines. In addition to traditions and culture, the complete array of herbs and foods used daily and also as medicines is based on the geographic region, growing conditions, and climate.

The interplay of diet and culture helps to define a person's values, preferences, and practices. As a result, even in the face of changing world events and populations, neither is abandoned easily or quickly. Just as there is diversity in individuals and families, there is also diversity within cultures. One must be alert to avoid the assumption that all people of a specific culture eat, believe, or follow traditions in the exact same manner. Even so, the question arises: What impact will our increasing mobility and globalization have on food choice? Undoubtedly, cultural interactions and exposure to various cuisines will increase. Will this expand our appreciation and preservation of cultural culinary practices and result in the formation of new hybrid cuisines?

[a]Welcome to food, culture and tradition. http://www.food-links.com. Accessed December 18, 2015.

[b]EthnoMed. Cultures. http://ethnomed.org/culture. Accessed December 18, 2015.

[c]PBS. The meaning of food: food and culture. http://www.pbs.org/opb/meaningoffood/ Accessed April 10, 2015.

[d]HerbMed. Top 20 herbs. http://www.herbmed.org/#param.wapp?sw_page=top20. Accessed December 18, 2015.

[e]China Highlights. Chinese medicinal cuisine/food therapy. http://www.chinahighlights.com/travelguide/chinese-food/medicinal-cuisine.htm. Accessed December 18, 2015.

food preferences, a good choice would be "What is your ethnic background?" (See the FYI feature "Food and Culture.")

Knowledge, beliefs, customs, and habits all are defining elements of human culture. Although genetic characteristics tie people of ethnic groups together, culture is a learned behavior and, consequently, can be modified through education, experience, and social and political trends.[22]

In many cultures, food has symbolic meanings related to family traditions, social status, and health. In fact, many folk remedies rely on food. Some of these have gained wide acceptance, such as the use of spices and herbal teas

Quick Bite

Nerve Poison for Dinner?

The puffer fish is a delicacy in Japan. Danger is part of its appeal; eating a puffer fish can be life threatening! The puffer fish contains a poison called tetrodotoxin (TTX), which blocks the transmission of nerve signals and can be fatal. Chefs who prepare the puffer fish must have special training and licenses to prepare the fish properly so that diners feel nothing more than a slight numbing feeling.

for purposes ranging from allaying anxiety to preventing cancer and heart disease. Just as cultural distinctions eventually blur when ethnic groups take part in the larger American culture, so do many of the unique expectations about the ability of certain foods to prevent disease, restore health among those with various afflictions, or enhance longevity. Food habits are among the last practices to change when an immigrant adapts to a new culture.[23]

Religion

Food is an important part of religious rites, symbols, and customs. Some religious rules apply to everyday eating whereas others are concerned with special celebrations. Christianity, Judaism, Hinduism, Buddhism, and Islam, for example, all have distinct dietary laws, but within each religion, different interpretations of these laws give rise to variations in dietary practices.

Social-Ecological Model

The social-ecological model included in the *Dietary Guidelines for Americans* (**FIGURE 1.8**) is designed to illustrate how individual factors, environmental settings, various sectors of influence, and social and cultural elements of society overlap to form the food and physical activity choices of an individual.[24] You can use the social-ecological model to think about how your current food and physical activity choices affect your calorie balance and risk for chronic diseases.

Quick Bite

Does Being Overweight Spread from Person to Person?

The spread of obesity in social networks appears to be a factor in the obesity epidemic. Likewise, this also suggests that it may be possible for peers to have the same effect in the opposite direction, slowing the spread of obesity.

Key Concepts The cultural environments in which people grow up have a major influence on what foods they prefer, what foods they consider edible, and what foods they eat in combination and at what time of day. Many factors work to define a group's culture: environment, economics, access to food, lifestyle, traditions, and religious beliefs. As people from other cultures immigrate to new lands, they adopt new behaviors consistent with their new homes. However, food habits are among the last to change. The social-ecological model of food and physical activity behavior shows how individual factors, environmental settings, sectors of influence, and cultural social values influence our food and physical activity behavior.

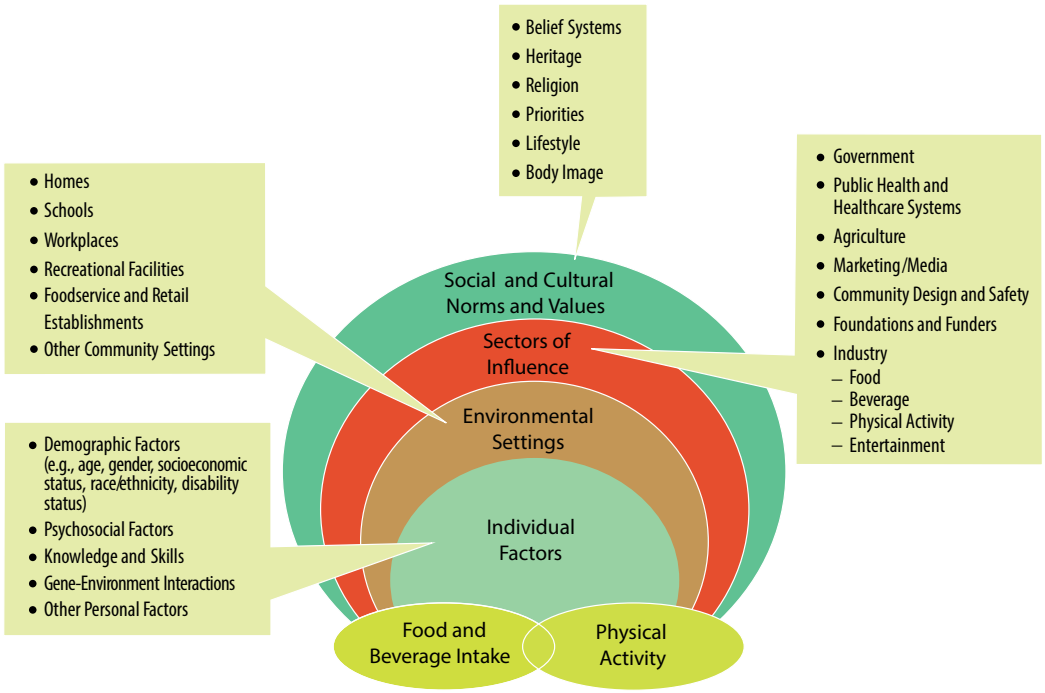


FIGURE 1.8 A social-ecological framework for nutrition and physical activity decisions.

Modifed from Centers for Disease Control and Prevention. Division of Nutrition, Physical Activity, and Obesity. State Nutrition, Physical Activity and Obesity (NPAO) Program: Technical Assistance Manual. January 2008, page 36. Accessed April 21, 2010. http://www.cdc.gov/obesity/ downloads/TA_Manual_1_31_08.pdf; Institute of Medicine. Preventing Childhood Obesity: Health in the Balance, Washington (DC): The National Academies Press; 2005, page 85; Story M, Kaphingst KM, Robinson-O'Brien R, Glanz K. Creating healthy food and eating environments: Policy and environmental approaches. Annu Rev Public Health 2008;29:253–272.

The American Diet

Surveys involving large amounts of people are conducted in the United States to determine what foods are consistently being eaten. The U.S. government uses data collected by the U.S. Department of Health and Human Services called the National Health and Nutrition Examination Survey (NHANES), which combines interviews and physical examinations for data collection. What, then, is a "typical American diet"? As a country influenced by the practices of so many cultures, religions, backgrounds, and lifestyles, there is no easy or single answer to this question. The U.S. diet is as diverse as Americans themselves, even though many people around the world imagine that the American diet consists mainly of hamburgers, french fries, and cola drinks. Our fondness for fast food and the marketability of such restaurants overseas make them seem like icons of American culture—and many of the stereotypes are true.

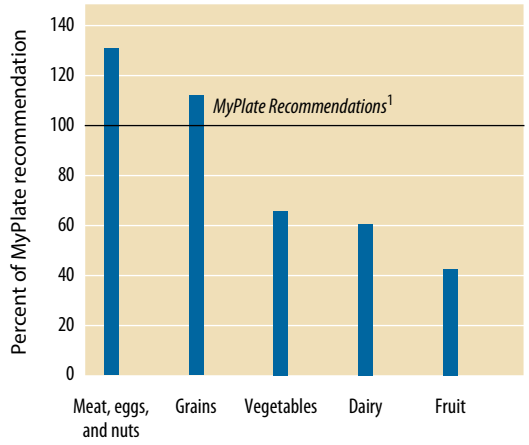
So, how healthful is the "American" diet? The average American falls short of the USDA's MyPlate recommendations for vegetables, dairy, and fruit. **TABLE 1.1** shows average U.S. consumption compared to the MyPlate recommendations (see **Table 1.1**).[25]

For individuals age 2 years and older, the estimated average total intakes of the following foods all fall well below the Dietary Guidelines: fruit intake is 1.03 cups, with 33% consumed as fruit juice; vegetable intake is 1.47 cups, of which 22% was potatoes and 20% was tomatoes; whole grains consumption is less than 1 ounce, average dairy intake is 1.8 cups, of which 44% is cheese and 51% was fluid milk; average solid fat intake is 37 grams, oil is 25 grams, and sugar intake is estimated to be 18.4 teaspoon equivalents.[26] (See **TABLE 1.2**.)

Americans are not eating enough nutrient-dense foods and eating too much of the foods known to be harmful. Together, solid fats and added sugars alone contribute many empty calories. Soda, sugar-sweetened beverages, and grain-based desserts are the major sources of added sugars for many Americans. Regular cheese, grain-based desserts, and pizza are the top contributors of solid and saturated fat in the American diet. In addition, Americans of all age groups are eating more than the recommended amounts of sodium, mainly in the form of processed foods.[27]

Although good health and nutrition information can be found in multiple publications and at a variety of venues, this doesn't necessarily translate into better food choices. People are not natural nutritionists, and they generally don't know which foods to choose for good health. So, it is not surprising when national surveys indicate that although Americans know that nutrition

TABLE 1.1
Average U.S. Consumption Compared to Recommendations, 2013



Note: Rice data were discontinued and thus are not included in the grains group.
[1]Based on a 2,000-calorie diet.
Reproduced from USDA, Economic Research Service, Loss-adjusted Food Availability Data.

Quick Bite

High Fructose Corn Syrup (HFCS)

High fructose corn syrup (HFCS) is a desired ingredient for food manufacturers because it provides the sweet taste we get from table sugar, it works well in a number of different products helping maintain longer shelf life, and is inexpensive compared to other sweeteners. HFCS is a likely ingredient in foods such as soft drinks and other canned beverages, ice cream, cereal, baked goods, and snack foods. But, did you know that HFCS can also be found in products that do not taste sweet, such as sliced bread, processed meats, and condiments? Reading food labels is the easiest way to determine if a food has HFCS added.

TABLE 1.2
Estimated Average Intake Compared to the *Dietary Guidelines or Americans*, 2015–2020

	Estimated Average Intake	Recommended Intake
Fruit	1.03 cups	2 cups per day
Vegetables	1.47 cups	2 ½ cups per day
Whole grains	< 1 ounce per day	> 3 ounces per day
Dairy	1.8 cups	3 cups per day
Solid fat intake	37 grams	Limit solid fat intake
Sugar	18.4 teaspoon equivalents	<10% of calories per day

Data from Bowman, S. Clemens J, Friday J, Moshfegh, A. Food Patterns Equivalents Intakes from Food: Mean Amounts Consumer per Individual, What We Eat In America, NHANES 2011-12; Tables 1-4. http://www.ars.usda.gov/research/publications/publications.htm?seq_no_115=312662

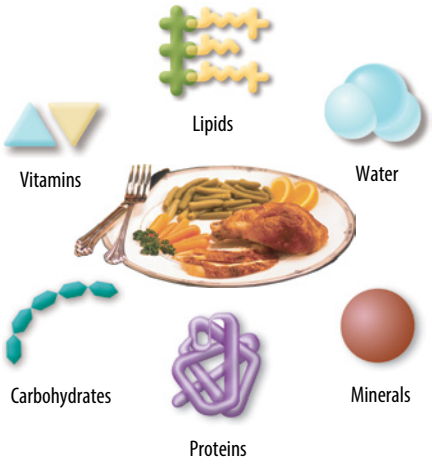


FIGURE 1.9 The six classes of nutrients. Water is the most important nutrient, and we cannot survive long without it. Because our bodies need large quantities of carbohydrate, protein, and fat, they are called macronutrients. Our bodies need comparatively small amounts of vitamins and minerals, so they are called micronutrients.

and food choices are important factors in health, few have made recommended changes such as eating less fat, sugar, and salt, and eating more fruits and vegetables.

You are in a position to gather more information than the average consumer. By using this book to expand your study of nutrition, you will be getting the full story: the nutrients we need for good health, the science behind the health messages, and the food choices it will take to implement them. Whether you use this information is up to you, but at least you will be a well-informed consumer!

Key Concepts "American" cuisine is truly a melting pot of cultural contributions to foods and tastes. Although Americans receive and believe many messages about the role of diet in good health, these beliefs do not always translate into better food choices. The typical American diet contains too much sodium, solid fat, saturated fat, and sugar and not enough fruits, vegetables, low-fat dairy, and whole-grain foods.

Introducing the Nutrients

Although we give food meaning through our culture and experience and make dietary decisions based on many factors, ultimately the reason for eating is to obtain nourishment—nutrition.

Just like your body, food is a mixture of chemicals, some of which are essential for normal body function. These essential chemicals are called **nutrients**. You need nutrients for normal growth and development, for maintaining cells and tissues, for fuel to do physical and metabolic work, and for regulating the hundreds of thousands of body processes that go on inside you every second of every day. Further, food must provide these nutrients; the body either cannot make these **essential nutrients** or cannot make enough of them. There are six classes of nutrients in food: carbohydrates, lipids (fats and oils), proteins, vitamins, minerals, and water (see **FIGURE 1.9**). For normal human growth, development, and maintenance, the diet must supply about 45 essential nutrients.

▶ **nutrients** Any substances in food that the body can use to obtain energy, synthesize tissues, or regulate functions.

▶ **essential nutrients** Substances that must be obtained in the diet because the body either cannot make them or cannot make adequate amounts of them.

Definition of Nutrients

In studying nutrition, we focus on the functions of nutrients in the body so that we can see why they are important in the diet. However, to define a nutrient in technical terms, we focus on what happens in its absence. A nutrient is a chemical the absence of which from the diet for a long enough time results in a specific change in health; we say that a person has a deficiency of that nutrient. A lack of vitamin C, for example, can eventually lead to scurvy. A diet with too little iron can result in iron-deficiency anemia. To complete the definition of a nutrient, it also must be true that putting the essential chemical back in the diet reverses the change in health, if done before permanent damage occurs. For example, if taken early enough, supplements of vitamin A can reverse the effects of deficiency on the eyes. If not, prolonged vitamin A deficiency can cause permanent blindness.

Nutrients are not the only chemicals in food. Other substances add flavor and color, some contribute to texture, and others such as caffeine have physiological effects on the body. **Phytochemicals** are compounds in plants that are believed to provide health benefits beyond the traditional nutrients. **Zoochemicals** are the animal equivalent of phytochemicals in plants. Although not nutrients, nor considered essential in the diet, these chemicals have important health benefits. For instance, research suggests that phytochemicals in fruits and vegetables provide **antioxidant** activity, which can reduce risk for heart disease or cancer.[28]

▶ **phytochemicals** Substances in plants that possess health-protective effects, even though they are not essential for life.

▶ **zoochemicals** The animal equivalent of phytochemicals in plants that are believed to provide health benefits beyond the traditional nutrients that foods contain.

▶ **antioxidant** A substance that combines with or otherwise neutralizes a free radical, thus preventing oxidative damage to cells and tissues.

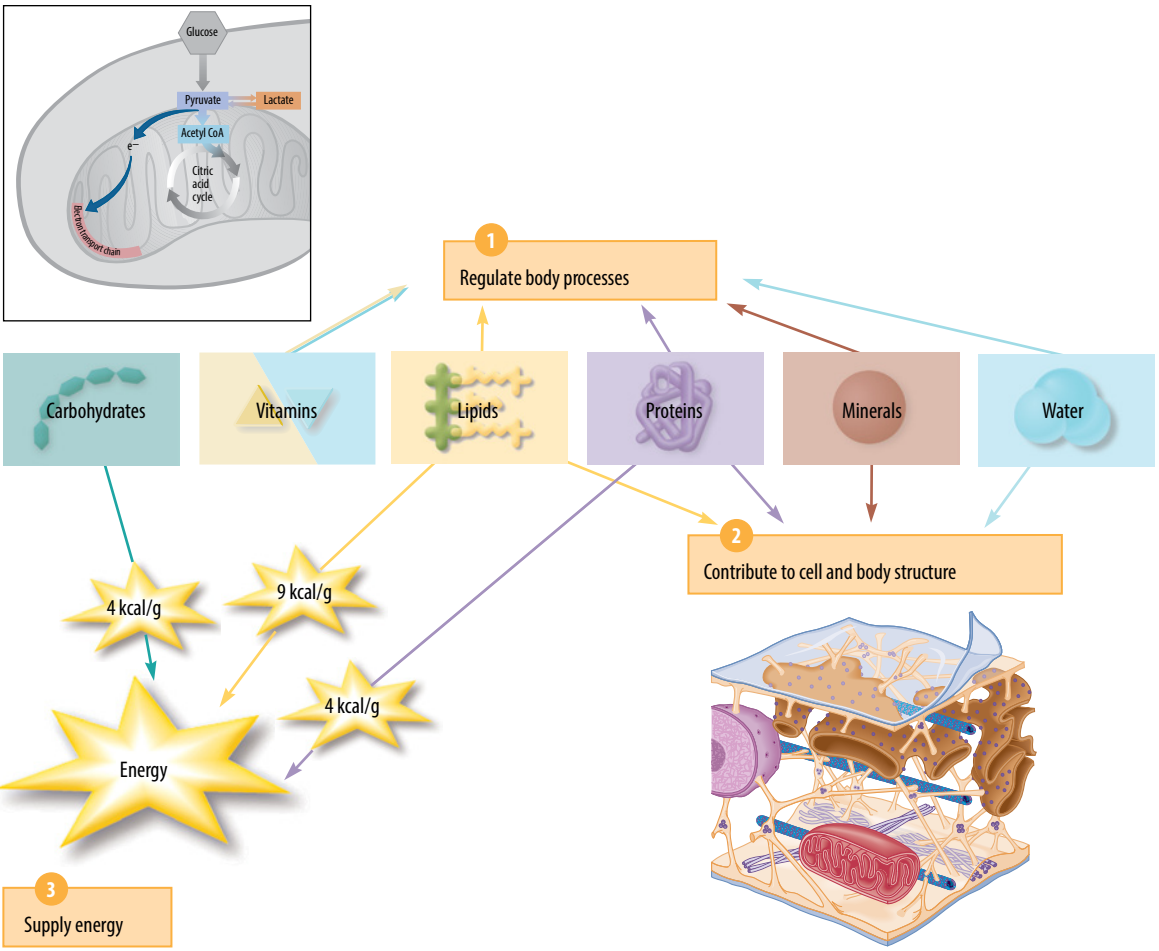


FIGURE 1.10 Nutrients have three general functions in your body. (1) Micronutrients, some lipids and proteins, and water help regulate body processes such as blood pressure, energy production, and temperature. (2) Lipids, proteins, minerals, and water help provide structure to bone, muscle, and other cells. (3) Macronutrients supply energy to power muscle contractions and cellular functions.

The six classes of nutrients serve three general functions: They provide energy, regulate body processes, and contribute to body structures (see **FIGURE 1.10**). Although virtually all nutrients can be said to influence body processes, and many contribute to body structures, only proteins, carbohydrates, and fats are sources of energy.

Because the body needs large quantities of carbohydrates, proteins, and fats, they are called **macronutrients**; vitamins and minerals are called **micronutrients** because the body needs comparatively small amounts of these nutrients.

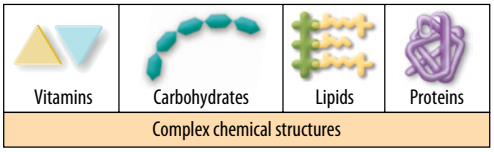
In addition to their functions, there are several other key differences among the classes of nutrients. First, the chemical composition of nutrients varies widely. One way to divide the nutrient groups is based on whether the compounds contain the element carbon. Most substances that contain carbon are **organic** substances; most of those that do not are **inorganic**. Carbohydrates, lipids, proteins, and vitamins are all organic; minerals and water are not. Structurally, nutrients can be very simple—minerals such as sodium are single elements, although we often consume them as larger compounds (e.g., sodium chloride, which is table salt). Water also is very simple in structure. The organic nutrients have more complex structures—the carbohydrates, lipids, and proteins we eat are made of smaller building blocks, whereas the vitamins are elaborately structured compounds.

▶ **macronutrients** Nutrients, such as carbohydrate, fat, or protein, that are needed in relatively large amounts in the diet.

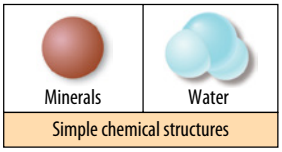
▶ **micronutrients** Nutrients, such as vitamins and minerals, that are needed in relatively small amounts in the diet.

▶ **organic** In chemistry, any compound that contains carbon, except carbon oxides (e.g., carbon dioxide) and sulfides and metal carbonates (e.g., potassium carbonate). The term *organic* also is used to denote crops that are grown without synthetic fertilizers or chemicals.

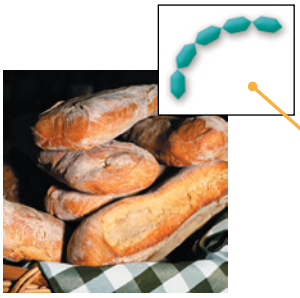
▶ **inorganic** Any substance that does not contain carbon, excepting certain simple carbon compounds such as carbon dioxide and carbon monoxide. Common examples include table salt (sodium chloride) and baking soda (sodium bicarbonate).



Organic – contains carbon



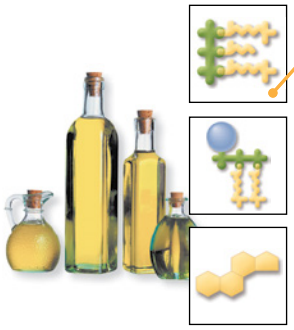
Inorganic – no carbon



© Photodisc

Whenever you see this icon, we'll be talking about **carbohydrates**.

Provide:
Energy (4 kcal/g)



© Photodisc

Whenever you see one of these three icons, we'll be talking about **lipids**.

Provide:
Energy (9 kcal/g)
Structure
Regulation (hormones)

- **carbohydrates** Compounds, including sugars, starches, and dietary fibers, that usually have the general chemical formula $(CH_2O)n$, where n represents the number of CH_2O units in the molecule. Carbohydrates are a major source of energy for body functions.
- **circulation** Movement of substances through the vessels of the cardiovascular or lymphatic system.
- **lipids** A group of fat-soluble compounds that includes triglycerides, sterols, and phospholipids.
- **triglycerides** Fats composed of three fatty acid chains linked to a glycerol molecule.
- **hormones** Chemical messengers that are secreted into the blood by one tissue and act on cells in another part of the body.
- **proteins** Large, complex compounds consisting of many amino acids connected in varying sequences and forming unique shapes.
- **amino acids** Organic compounds that function as the building blocks of protein.
- **legumes** A family of plants with edible seed pods, such as peas, beans, lentils, and soybeans; also called pulses.

It is rare for a food to contain just one nutrient. Meat is not just protein and bread is not solely carbohydrate. Foods contain mixtures of nutrients, although in many cases protein, fat, or carbohydrate dominates. So, although bread is certainly rich in carbohydrates, it also contains some protein, a little fat, and many vitamins and minerals. If you're eating whole-grain bread, you also get fiber, which is not technically a nutrient, but an important compound for good health nonetheless.

Key Concepts Nutrients are the essential chemicals in food that the body needs for normal functioning and good health and that must come from the diet because they either cannot be made in the body or cannot be made in sufficient quantities. Six classes of nutrients—carbohydrates, proteins, lipids, vitamins, minerals, and water—can be described by their composition or by their function in the body.

Carbohydrates

If you think of water when you hear the word *hydrate*, then the word *carbohydrate*—or literally "hydrate of carbon"—tells you exactly what this nutrient is made of. **Carbohydrates** are made of carbon, hydrogen, and oxygen and are a major source of fuel for the body. Dietary carbohydrates are the starches and sugars found in grains, vegetables, legumes (dry beans and peas), and fruits. We also get carbohydrates from dairy products and from fiber, a type of carbohydrate that exists in plants. Your body converts most dietary carbohydrates to glucose, a simple sugar compound that is found in the body's circulation and provides a source of energy for cells and tissues. The monosaccharide units that make up fiber molecules are not broken down by human digestive enzymes. Fiber passes through the small intestine into the large intestine, where bacteria metabolize some and some short-chain fatty acids and gas are also formed. It is glucose that we find in **circulation**, or the movement of substances through the vessels of the cardiovascular or lymphatic system, providing a source of energy for cells and tissues.

Lipids

The term **lipids** refers to substances we know as fats and oils but also to fatlike substances in foods, such as cholesterol and phospholipids. Lipids are organic compounds and, like carbohydrates, contain carbon, hydrogen, and oxygen. Fats and oils—or, more correctly, **triglycerides**—are another major fuel source for the body. In addition, triglycerides, cholesterol, and phospholipids have other important functions: providing structure for body cells, carrying the fat-soluble vitamins (A, D, E, and K), and providing the starting material (cholesterol) for making many **hormones**. Dietary sources of lipids include the fats and oils we cook with or add to foods, the naturally occurring fats in meats and dairy products, and some less obvious plant sources, such as coconut, olives, and avocado.

Proteins

Proteins are organic compounds made of smaller building blocks called **amino acids**. Unlike carbohydrates and lipids, amino acids contain nitrogen as well as carbon, hydrogen, and oxygen. Proteins are found in a variety of foods, but meats and dairy products are among the most concentrated sources. Grains, **legumes**, and vegetables all contribute protein to the diet, whereas fruits contribute negligible amounts. The amino acids that we get from dietary protein combine with the amino acids made in the body to make hundreds of different body proteins. Proteins are the main structural material in the body. They are also important components in blood, cell membranes, enzymes, and immune factors.[29] Proteins regulate body processes and can also be used for energy.

Vitamins

THINK About It 3

Vitamins are organic compounds that contain carbon and hydrogen and perhaps nitrogen, oxygen, phosphorus, sulfur, or other elements. The main function of vitamins is to help regulate many body processes such as energy production, blood clotting, and calcium balance. Vitamins help to keep organs and tissues functioning and healthy. Because vitamins have such diverse functions, a lack of a particular vitamin can have widespread effects. Although the body does not break down vitamins to yield energy, vitamins have vital roles in the extraction of energy from carbohydrate, fat, and protein.

Each of the 13 vitamins belongs in one of two groups: fat-soluble or water-soluble. The four fat-soluble vitamins—A, D, E, and K—have very diverse roles. What they have in common is the way they are absorbed and transported in the body and the fact that they are more likely to be stored in larger quantities than the water-soluble vitamins are. The water-soluble vitamins include vitamin C and eight B vitamins: thiamin (B_1), riboflavin (B_2), niacin (B_3), pyridoxine (B_6), cobalamin (B_{12}), folate, pantothenic acid, and biotin. Most of the B vitamins are involved in some way with the pathways for energy metabolism. Vitamins are found in a wide variety of foods, not just fruits and vegetables—although these are important sources—but also meats, grains, legumes, dairy products, and even fats. Choosing a well-balanced diet usually makes vitamin supplements unnecessary. In fact, when taken in large doses, vitamin supplements (especially those containing vitamins A, D, B_6, or niacin) can be harmful.

Whenever you see this icon, we'll be talking about **proteins**.

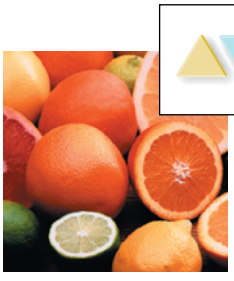
Provide:
Energy (4 kcal/g)
Structure
Regulation

- **vitamins** Organic compounds necessary for reproduction, growth, and maintenance of the body. Vitamins are required in miniscule amounts.
- **minerals** Inorganic compounds needed for growth and for regulation of body processes.
- **macrominerals** Major minerals required in the diet and present in the body in large amounts compared with trace minerals.
- **microminerals** See *trace minerals*.
- **trace minerals** Minerals present in the body and required in the diet in relatively small amounts compared with major minerals; also known as *microminerals*.

Minerals

Structurally, **minerals** are simple, inorganic substances. Minerals are important for keeping your body healthy because they are used for many different functions. There are two kinds of minerals: macrominerals and trace minerals. **Macrominerals** are minerals your body needs in relatively large amounts compared to other minerals and include calcium, phosphorus, magnesium, sodium, potassium, chloride, and sulfur.[30] The body needs the remaining minerals in only very small amounts. These **microminerals**, or **trace minerals**, include iron, zinc, copper, manganese, molybdenum, selenium, iodine, and fluoride. As with vitamins, the functions of minerals are diverse. Minerals can be found in structural roles (e.g., calcium, phosphorus, and fluoride in bones and teeth) as well as regulatory roles (e.g., control of fluid balance, regulation of muscle contraction).

Food sources of minerals are just as diverse. Although we often associate minerals with animal foods, such as meats and milk, plant foods are important sources as well. Deficiencies of minerals, except iron, calcium, iodine (in patients with cystic fibrosis and people who are pregnant), and selenium, are generally uncommon. A balanced diet provides enough minerals for most people. However, individuals with iron-deficiency anemia may need iron supplements, and others may need calcium supplements if they cannot or will not drink milk or eat dairy products. As is true for vitamins, excessive intake of some minerals as supplements can be toxic.



Whenever you see these icons, we'll be talking about **vitamins**.

Provide:
Regulation

Whenever you see this icon, we'll be talking about **minerals**.

Provide:
Regulation
Structure

Water

Water is the most essential nutrient. We can survive far longer without any of the other nutrients in the diet, indeed without food at all, than we can without water. Like minerals, water is inorganic. Water has many roles in the body, including temperature control, lubrication of joints, and transportation of nutrients and wastes.

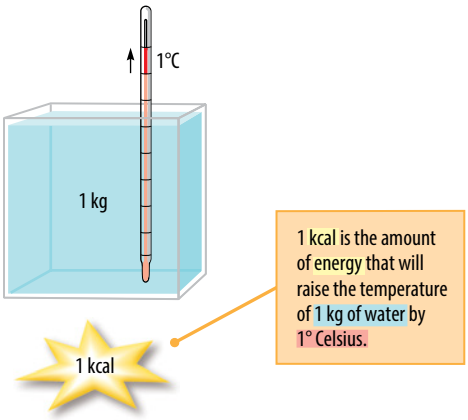
Because your body is nearly 60 percent water, regular fluid intake to maintain adequate hydration is important. Water is found not only in beverages,

Whenever you see this icon, we'll be talking about **water**.

Provides:
Regulation
Structure

but also in most food products. Fruits and vegetables in particular are high in water content. Through many chemical reactions, the body makes some of its own water, but this is only a fraction of the amount needed for normal function.

Key Concepts The body needs larger amounts of carbohydrates, lipids, and proteins (macronutrients) than vitamins and minerals (micronutrients). Carbohydrates, lipids, and proteins provide energy; proteins, vitamins, minerals, water, and some fatty acids regulate body processes; and proteins, lipids, minerals, and water contribute to body structure.



▶ **energy** The capacity to do work. The energy in food is chemical energy, which the body converts to mechanical, electrical, or heat energy.

▶ **kilocalories (kcal)** [KILL-oh-kal-oh-rees] Units used to measure food energy (1,000 calories = 1 kilocalorie).

Nutrients and Energy

One major reason we eat food, and the nutrients it contains, is for **energy**. Every cellular reaction, every muscle movement, and every nerve impulse requires energy. Three of the nutrient classes—carbohydrates, lipids (triglycerides only), and proteins—are energy sources. Although not considered a nutrient, another energy source is alcohol. When we speak of the energy in foods, we are really talking about the *potential* energy that foods contain.

Different scientific disciplines use different measures of energy. In nutrition, we discuss the potential energy in food, or the body's use of energy, in units of heat called **kilocalories** (1,000 calories). One kilocalorie (or kcal) is the amount of energy (heat) it would take to raise the temperature of 1 kilogram (kg) of water by 1 degree Celsius. For now, this may be an abstract concept, but, as you learn more about nutrition, you will discover how much energy you likely need to fuel your daily activities. You also will learn about the amounts of potential energy in various foods. You'll find that food labels, diet books, and other sources of nutrition information generally use the term *calorie* rather than *kilocalorie*. Technically, the potential energy in foods is best measured in kilocalories; however, the term *calorie* has become familiar and commonplace. Throughout the text, we will use the terms *calorie* and *kilocalorie (kcal)* to mean generally the same thing.

Energy in Foods

Energy is available from foods because foods contain carbohydrate, fat, and protein. These nutrients can be broken down completely (metabolized) to yield energy in a form that cells can use. When completely metabolized in the body, carbohydrate and protein yield 4 kilocalories of energy for every gram (g) consumed; fat yields 9 kilocalories per gram; and alcohol contributes 7 kilocalories per gram (see **FIGURE 1.11**). Therefore, the energy available from a given food or from a total diet is reflected by the amount of each of these substances consumed. Because fat is a concentrated source of energy, adding or removing fat from the diet can have a big effect on available energy.

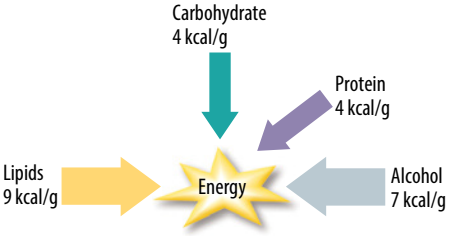


FIGURE 1.11 Energy sources. Carbohydrate, fat, protein, and alcohol provide different amounts of energy per gram.

How Can We Calculate the Energy Available from Foods?

To calculate the energy available from food, multiply the number of grams of fat, carbohydrate, and protein by 9, 4, and 4, respectively; then, add the results.

Here is an example:

One bagel with ½ ounce of cream cheese contains 39 grams of carbohydrate, 10 grams of protein, and 16 grams of fat, so:

Carbohydrate	39 grams × 4 calories per gram = 156 kcal
Protein	10 grams × 4 calories per gram = 40 kcal
Fat	16 grams × 9 calories per gram = 144 kcal
Total	**340 kcal**

Be Food Smart: Calculate the Percentages of Calories in Food

To calculate the *percentage* of calories that carbohydrate, protein, and fat each contribute to the total, divide the amount of kcal from each nutrient (carbohydrate, protein, fat) by the total amount of kcal and then multiply by 100.

For example, to determine the percentage of calories from fat in a bagel with cream cheese:

% of energy as carbohydrates = 156 kcal/340 kcal
= 0.459 × 100 = 46% kcal from carbohydrate

% of energy from protein = 40 kcal/340 kcal
= 0.118 × 100 = 12% kcal from protein

% of energy from fat = 144 kcal/340 kcal
= 0.423 × 100 = 42% kcal from fat

Current health recommendations suggest limiting fat intake to about 20 to 35 percent of *total* energy intake. You can monitor this for yourself in two ways. If you like counting fat grams, you can first determine your suggested maximum fat intake. For example, if you need to eat 2,000 kilocalories each day to maintain your current weight, at most 35 percent of those calories can come from fat:

2,000 kcal × 0.35 = 700 kcal from fat

700 kcal from fat ÷ 9 kcal/g = 77.8 g of fat

Therefore, your maximum fat intake should be about 78 grams/day. You can check food labels to see how many fat grams you typically eat.

Another way to monitor your fat intake is to know the percentage of calories that come from fat in various foods. If the proportion of fat in each food choice throughout the day exceeds 35 percent of calories, then the day's total of fat will be too high as well. Some foods contain virtually no fat calories (e.g., fruits, vegetables) whereas others are nearly 100 percent fat calories (e.g., margarine, salad dressing). Being aware that a snack like the bagel with cream cheese provides 42 percent of its calories from fat can help you select lower-fat foods at other times of the day.

Diet and Health

What does it mean to be healthy? The World Health Organization (WHO) defines health as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity."[31] Although we often focus on the last part of that definition, "the absence of disease or infirmity," the first part is equally important. As you have learned, nutrition is an important part of physical, mental, and social well-being. It also is important for preventing disease.

Disease can be defined as "an impairment of the normal state of the living animal or plant body or one of its parts that interrupts or modifies the performance of the vital functions" and can arise from environmental factors or specific infectious agents, such as bacteria or viruses.[32] Diseases can be *acute* (short-lived illnesses that arise and resolve quickly) or *chronic* (diseases with a slow onset and long duration). Although nutrition can affect our susceptibility to acute diseases—and contaminated food is certainly a source of acute disease—our food choices are more likely to affect our risk for developing chronic diseases such as heart disease or cancer. Other lifestyle factors, such as smoking and exercise, in addition to genetic factors, also determine who gets sick and who remains healthy. The 10 leading causes of death are listed in **TABLE 1.3**. Nutrition plays a role in the prevention or treatment of

Calculating the Energy Available from Foods and Percentage of Macronutrients in Your Diet

Example: If you know the amount of carbohydrates, protein, and fat that you eat each day, you can calculate the total amount of calories as well as the percentage of calories from each nutrient. In this example if you eat 275 g of carbohydrate, 75 g of protein and 67 g of fat you have eaten 2,000 kcal because:

275 g carbohydrate × 4 kcal/g = 1,100 kcal

75 g protein × 4 kcal/g = 300 kcal

67 g fat × 9 kcal/g = 600 kcal (rounded from 603 kcal)

Total = 2,000 kcal

Calculating the Percentage of Kilocalories from Carbohydrate, Protein, and Fat

Example:

275 g carbohydrate × 4 kcal/m = 1,100 kcal

1,100 kcal ÷ 2,000 kcal × 100 = 55% carbohydrate kcal

75 g protein × 4 kcal/g = 300 kcal

300 kcal ÷ 2,000 kcal × 100 = 15% protein kcal

67 g fat × 9 kcal/g = 600 kcal (rounded from 603 kcal)

600 kcal ÷ 2,000 kcal × 100 = 30% fat kcal

In this example, the 2,000 kcal have provided 55% of calories from carbohydrate, 15% of calories from protein, and 30% of calories from fat. As you will learn later, this macronutrient breakdown falls within the recommended intake ranges.

more than half of the conditions listed. Heart disease and cancer, together, account for almost half of all deaths.[33]

The foods we choose to eat do more than provide us with an adequate diet. The balance of energy sources can affect our risk of chronic disease. For example, high-fat diets have been linked to heart disease and cancer. Excess calories contribute to obesity, which also increases disease risk. Other nutrients, such as the minerals sodium, chloride, calcium, and magnesium, affect blood pressure, and a lack of the vitamin folate prior to conception and in early pregnancy can cause serious birth defects. Non-nutrient components in the diet (e.g., phytochemicals) may have antioxidant or immune-enhancing properties that also can keep us healthy. The choices we make can reduce our disease risk as well as provide energy and essential nutrients.

TABLE 1.3
Leading Causes of Death: United States

Rank	Cause of Death
1	Heart disease[a]
2	Cancer[a]
3	Chronic lower respiratory diseases
4	Stroke
5	Accidents (unintentional injuries)
6	Alzheimer's disease
7	Diabetes mellitus[a]
8	Influenza and pneumonia
9	Kidney disease[a]
10	Intentional self-harm (suicide)

[a] Causes for which nutrition is thought to be important in the prevention or treatment of the condition.

Reproduced from Kochanek KD, Xu J, Murphy SL, Miniño AM, Kung H-C. Deaths: preliminary data for 2009. *National Vital Statistics Reports*. 2011;59(4). http://www.cdc.gov/nchs/data/nvsr/nvsr59/nvsr59_04.pdf. Accessed December 18, 2015.

Physical Activity

A sedentary lifestyle is also a significant risk factor for chronic disease. Physically active people generally outlive those who are inactive, and, as a risk factor for heart disease, inactivity can be almost as significant as high blood pressure, smoking, or high blood cholesterol. Physical activity plays a significant role in long-term weight management. Current physical activity guidelines recommend that children and adolescents participate in 60 minutes or more of physical activity each day. Children should be encouraged to participate in activities that are age-appropriate, are enjoyable, and offer variety. Aerobic activity should make up most of a child's activity time, but muscle strengthening, such as gymnastics or doing push-ups, and bone strengthening, such as jumping rope or running, count as well. For adults, the Centers for Disease Control and Prevention set the recommendations to be measured as a weekly total, with the understanding that one can reach the suggested weekly time goals by breaking up exercise time into smaller chunks. Recommendations for adults include 150 minutes of moderate-intensity aerobic activity every week and muscle-strengthening activity on 2 or more days a week, or 75 minutes of vigorous-intensity aerobic activity every week and muscle-strengthening activities on 2 or more days a week.[34]

Key Concepts All cells and tissues need energy to keep the body functioning. Energy in foods and in the body is measured in kilocalories. The carbohydrates, lipids, and proteins in food are potential sources of energy, meaning that the body can extract energy from them. Excess energy intake is a contributing factor to obesity, a major public health issue. All individuals should aim to be physically active.

Applying the Scientific Process to Nutrition

Whether it's identifying essential nutrients, establishing recommended intake levels, or exploring the effects of vitamins on cancer risk, scientific studies are the cornerstone of nutrition. Although we may use creative, artistic talents to choose and serve a pleasing array of healthful foods, the fundamentals of nutrition are developed through the scientific process of observation and inquiry.

The scientific process enables researchers to test the validity of **hypotheses** that arise from observations of natural phenomena. A hypothesis is a supposition or proposed explanation made on the basis of limited evidence as a starting point for further investigation. For example, it was common knowledge in the eighteenth century that sailors on long voyages would likely develop scurvy (which we now know results from a deficiency of vitamin C). Scurvy had been recognized since ancient times, and its common symptoms—pinpoint skin hemorrhages, swollen and bleeding gums, joint pain, fatigue and lethargy, and psychological changes such as depression and hysteria—were

▶ **hypotheses** Scientists' educated guesses to explain phenomena.

well known. Native populations discovered plant foods that would cure this illness; among Native Americans, these included cranberries in the Northeast and many tree extracts in other parts of the country. From observations such as these come questions that lead to hypotheses, or "educated guesses," about factors that might be responsible for the observed phenomenon. Scientists then test hypotheses using appropriate research designs. Poorly designed research can produce useless results or false conclusions. By following the steps of the scientific process (**FIGURE 1.12**), researchers can minimize influences that may arise during a research study (such as bias, prejudice, or coincidence). The scientific process (also referred to as the scientific method) follows these general steps: (1) Make observations, ask questions, or describe phenomena; (2) formulate a hypothesis to explain the observation, question, or phenomena; (3) test the hypothesis by conducting an experiment; (4) analyze data and draw conclusions; and (5) communicate results indicating whether or not the hypothesis is accepted.

Nutrition research is exciting and always changing. Scientists ask questions to be answered and define problems to be solved. Investigators choose a study design that will best answer their research question or hypothesis. Throughout the research process, researchers must follow rigorous ethical procedures in all areas of the study design. Common study designs used in nutrition research are defined in **TABLE 1.4**.

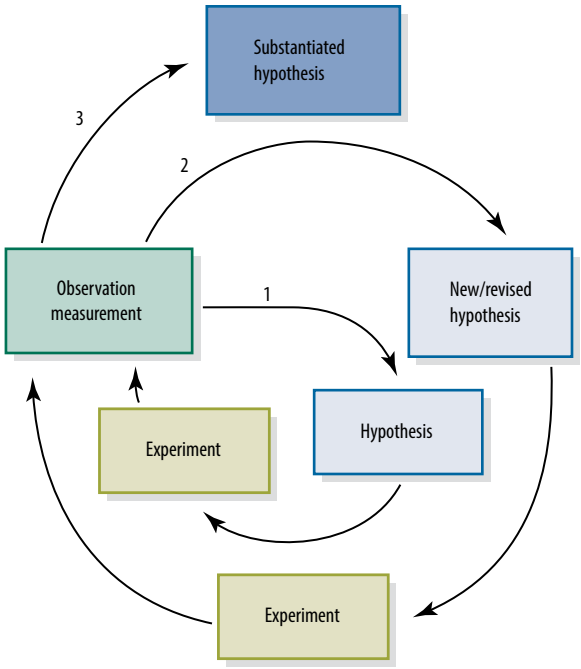


FIGURE 1.12 The scientific process. The scientific process (also referred to as the scientific method) follows these general steps: (1) make observations; (2) formulate a hypothesis; (3) test the hypothesis; (4) analyze the data and draw conclusions; and (5) communicate results.

TABLE 1.4
Common Study Designs Used in Nutrition Research

Study Type	Description
Human Studies	
Epidemiological studies	An epidemiological study compares disease rates among population groups and attempts to identify related conditions or behaviors such as diet and smoking habits. Epidemiological studies can provide useful information about relationships but often do not clarify cause and effect. The results of these studies show **correlations**—relationships between two or more factors; however, they do not establish or address cause and effect. Epidemiological studies can provide important clues and insights that lead to animal and human studies that can further clarify diet and disease relationships. The relationship between inadequate vitamin C intake and scurvy is one example of this.
Case control studies	**Case control studies** are small-scale epidemiological studies in which individuals who have a condition (e.g., breast cancer) are compared with similar individuals who do not have the condition. Researchers then identify factors other than the disease in question that differ between the two groups. These factors provide researchers with clues about the cause, progression, and prevention of the disease.
Clinical trials	**Clinical trials**, also called **intervention studies**, are controlled studies where some type of intervention (e.g., nutrient supplement, controlled diet, exercise program) is used to determine its impact on certain health parameters. These studies include an **experimental group** (the people experience the intervention) and a **control group** (similar people who are not treated). Scientists measure aspects of health or disease in each group and compare the results.
Animal Studies	Animal studies can provide preliminary data that often lead to human studies or can be used to study hypotheses that cannot be tested on humans. Although animal studies give scientists important information that furthers nutrition knowledge, the results of animal studies cannot be extrapolated directly to humans. Animal studies need to be followed with cell culture studies and ultimately human clinical studies to determine specific effects in humans.
Cell Culture Studies	Another way to study nutrition is to isolate specific types of cells and grow them in the laboratory. Scientists then can use these cells to study the effects of nutrients or other components on metabolic processes in the cell. An important area of nutrition research, called **nutrigenomics**, explores the effect of specific nutrients and other chemical compounds on gene expression. This area of molecular biology helps us explain individual differences in chronic disease risk factors and may lead to designing diets based on an individual's genetic profile.

▶ **correlations** Connections co-occurring more frequently than can be explained by chance or coincidence but without a proven cause.

▶ **case control studies** Investigations that use a group of people with a particular condition rather than a randomly selected population. These cases are compared with a control group of people who do not have the condition.

▶ **clinical trials** Studies that collect large amounts of data to evaluate the effectiveness of a treatment.

▶ **intervention studies** See *clinical trials*.

▶ **experimental group** A set of people being studied to evaluate the effect of an event, substance, or technique.

▶ **control group** A set of people used as a standard of comparison to the experimental group. The people in the control group have characteristics similar to those in the experimental group and are selected at random.

▶ **nutrigenomics** The study of how nutrition interacts with specific genes to influence a person's health.

James Lind: A Treatise of the Scurvy in Three Parts.
Containing an inquiry into the Nature, Causes and Cure of that Disease,
together with a Critical and Chronological View of what has been
published on the subject. A. Millar, London, 1753.

On the 20th May, 1747, I took twelve patients in the scurvy on board the Salisbury at sea. Their cases were as similar as I could have them. They all in general had putrid gums, the spots and lassitude, with weakness of their knees. They lay together in one place, being a proper apartment for the sick in the fore-hold; and had one diet in common to all, viz., water gruel sweetened with sugar in the morning; fresh mutton broth often times for dinner; at other times puddings, boiled biscuit with sugar ect.; and for supper barley, raisins, rice and currants, sago and wine, or the like. Two of these were ordered each, a quart of cyder a day. Two others took twenty five gutts of elixir vitriol three times a day upon an empty stomach, using a gargle strongly acidulated with it for their mouths. Two others took two spoonfuls of vinegar three times a day upon an empty stomach, having their gruels and their other food well acidulated with it, as also the gargle for the mouth. Two of the worst patients, with the tendons in the ham rigid (a symptom none the rest had) were put under, a course of sea water. Of this they drank half a pint every day and sometimes more or less as it operated by way of gentle physic. Two others had each, two oranges and one lemon given them every day. These they eat with greediness at different times upon an empty stomach. They continued but six days under, this course, having consumed the quantity that could be spared. The two remaining patients took the bigness of a nutmeg three times a day of an electuray recommended by an hospital surgeon made of garlic, mustard seed, rad. raphan., balsam of Peru and gum myrrh, using for common drink narley water well acidulated with tamarinds, by a decoction of wich, with the addition of cremor tartar, they were gently purged three or four times during the course.

The consequence was that the most sudden and visible good effects were perceived from the use of the oranges and lemons; one of those who had taken them being at the end of six days fit four duty. The spots were not indeed at that time quite off his body, nor his gums sound; but without any other medicine than a gargarism or, elixir of vitriol he became quite healthy before we came into Plymouth, which was on the 16th June. The other was the best recovered of any in his condition, and being now deemed pretty well was appointed nurse to the rest of the sick...

As I shall have occasion elsewhere to take notice of the effects of other medicines in this disease, I shall here only observe that the result of all my experiments was that oranges and lemons were the most effectual remedies for this distemper at sea. I am apt to think oranges preferable to lemons...

FIGURE 1.13 The first clinical trial. In 1753, physician James Lind reported the careful process of his clinical trial among British sailors afflicted with scurvy.

James Lind's experiments with sailors aboard the *Salisbury* in 1747 are considered to be the first dietary clinical trial (see **FIGURE 1.13**). His observation that oranges and lemons were the only dietary elements that seemed to cure scurvy was an important finding. However, it took more than 40 years before the British Navy began routinely giving all sailors citrus juice or fruit, such as lemons or limes—a practice that led to the nickname "limeys" when referring to British sailors. It took nearly 200 years (until the 1930s) for scientists to isolate the compound we call vitamin C and show that it had antiscurvy properties.[35] The chemical name for vitamin C, ascorbic acid, comes from its role as an antiscorbutic (antiscurvy) compound.

Modern clinical trials include several important elements: random assignment to groups, use of placebos, and the double-blind method. Subjects are

assigned randomly—as by the flip of a coin—to the experimental group or the control group. Randomization potentially reduces, minimizes, or eliminates selection and volunteer bias. People in the experimental group receive the treatment or specific protocol (e.g., consuming a certain nutrient at a specific level). People in the control group do not receive the treatment but usually receive a **placebo**. A placebo is an imitation treatment (such as a sugar pill) that looks the same as the experimental treatment but has no effect. The placebo also is important for reducing bias because subjects do not know if they are receiving the intervention and are less inclined to alter their responses or reported symptoms based on what they think should happen. The *expectation* that a medication will be effective can be nearly as effective as the medication itself—a phenomenon called the **placebo effect**. Because the placebo effect can exert a powerful influence, research studies must take it into account.

When the members of neither the experimental nor the control group know what treatment they are receiving, we say the subjects are "blinded" to the treatment. If a clinical trial is designed so that neither the subjects nor the researchers collecting data are aware of the subjects' group assignments (experimental or control), the study is called a **double-blind study**. This reduces the possibility that researchers will see the results they want to see even if these results do not occur. In this case, another member of the research team holds the code for subject assignments and does not participate in the data collection. Double-blind, placebo-controlled clinical trials are considered the gold standard of nutrition studies. These studies can show clear cause-and-effect relationships but often require large numbers of subjects and are expensive and time consuming to conduct.

▶ **placebo** An inactive substance that is outwardly indistinguishable from the active substance whose effects are being studied.

▶ **placebo effect** A physical or emotional change that is not caused by properties of an administered substance. The change reflects participants' expectations.

▶ **double-blind study** A research study set up so that neither the subjects nor the investigators know which study group is receiving the placebo and which is receiving the active substance.

Key Concepts The scientific method is used to expand our nutrition knowledge. Hypotheses are formed from observations and are then tested by experiments. Epidemiological studies observe patterns in populations. Animal and cell culture studies can test the effects of various treatments. For human studies, randomized, double-blind, placebo-controlled clinical trials are the best research tools for determining cause-and-effect relationships.

From Research Study to Headline

What about the health headlines we see in the newspapers, hear on television, or read on the Internet daily? Consumers often are confused by what they see as the "wishy-washiness" of scientists—for example, coffee is good, then coffee is bad. Margarine is better than butter…. No wait, maybe butter is better after all. These contradictions, despite the confusion they cause, show us that nutrition is truly a science: dynamic, changing, and growing with each new finding.

Publishing Experimental Results

Once an experiment is complete, scientists publish the results in a scientific journal to communicate new information to other scientists. Generally, before articles are published in scientific journals, other scientists who have expert knowledge of the subject critically review them. This **peer review** greatly reduces the chance that low-quality research is published. Peer-reviewed journals such as the *American Journal of Clinical Nutrition* and the *Journal of the Academy of Nutrition and Dietetics* are not the main sources of information presented in the popular media. Often, a new article becomes a 30-second sound bite that often fails to reflect the original data. In some cases, the study may be distorted, with its results misstated or overstated (see **FIGURE 1.14**).

▶ **peer review** An appraisal of research against accepted standards by professionals in the field.

Quick Bite

Controlling the Pesky Placebo

When researchers tested the effectiveness of a medication in reducing binge eating among people with bulimia, they used a double-blind, placebo-controlled study to eliminate the placebo effect. After a baseline number of binge-eating episodes was determined, 22 women with bulimia were given the medication or a placebo. After a period of time, the number of binge-eating episodes was reassessed. The group taking the medication had a 78 percent reduction in binge-eating episodes. Sounds good, right? But, the placebo group had a similar reduction of 70 percent. The placebo effect was nearly as powerful as the medication.

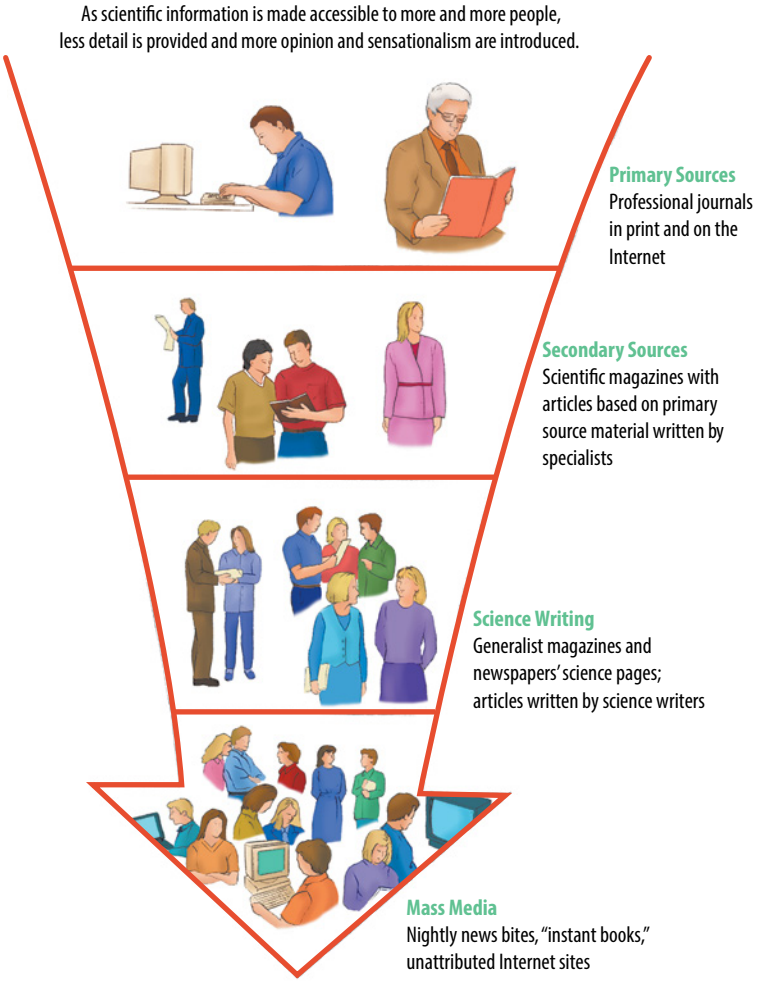


FIGURE 1.14 Sorting facts and fallacies. From original research to the evening news, each step along the way introduces biases as information is summarized and restated. Whether on television, radio, the Internet or in print, the best consumer information cites sources for reported facts.

Sorting Facts and Fallacies in the Media

THINK About It 4

People tend to believe what they hear repeatedly. Even when it has no basis in fact, a claim can seem credible if heard often enough. For example, do you believe that sugar makes kids hyperactive? There is little scientific evidence

to support this claim! Although news stories may be based on reports in the scientific literature, the media can distort the facts through omission of details.

Evaluating Information on the Internet

Surfing the Web has made life easier in many ways. You can buy a car, check stock prices, search out sources for a paper you're writing, chat with like-minded people, and stay up-to-date on news or sports scores. Hundreds of websites are devoted to nutrition and health topics, and you may be asked to visit such sites as part of your course requirements. So, how do you evaluate the quality of information on the Web? Can you trust what you see?

First, it's important to remember that there are no rules for posting on the Internet. Anyone who has the equipment can set up a website and post any content he or she likes. Although the Health on the Net Foundation has set up a Code of Conduct for medical and health websites, following its eight principles is completely voluntary.[36]

Second, consider the source, if you can tell what it is. Many websites do not specify where the content came from, who is responsible for it, or how often it is updated. If the site lists the authors, what are their credentials? Who sponsors the site itself? Educational institutions (.edu), government agencies (.gov), and organizations (.org) generally have more credibility than commercial (.com) sites, where selling rather than educating is the primary motive. Identifying the purpose for a site can give you more clues about the validity of its content.

Third, when you see claims for nutrients, dietary supplements, or other products and the results of studies or other information, keep in mind the scientific method and the basics of sound science. Who did the study? What type of study was it? How many subjects? Was it double-blind? Were the results published in a peer-reviewed journal? Think critically about the content, look at other sources, and ask questions of experts before you accept information as truth. What is true of books, magazines, and newspapers also applies to the Internet: Just because it is in print or online doesn't mean it's true.

Finally, be on the lookout for "junk science"—sloppy methods, interpretations, and claims that lead to public misinformation. The Food and Nutrition Science Alliance (FANSA) is a coalition of several health organizations, including the Academy of Nutrition and Dietetics. FANSA has developed the "10 Red Flags of Junk Science" to help consumers identify potential misinformation. Use these red flags to evaluate websites.

The 10 Red Flags of Junk Science[37]

1. Recommendations that promise a quick fix
2. Dire warnings of danger from a single product or regimen
3. Claims that sound too good to be true
4. Simplistic conclusions drawn from a complex study
5. Recommendations based on a single study
6. Statements refuted by reputable scientific organizations
7. Lists of "good" and "bad" foods
8. Recommendations made to help sell a product
9. Recommendations based on studies that were not peer reviewed
10. Recommendations from studies that ignore differences among individuals or groups

Use the Internet; it's fun and can be educational. Don't forget about the library, though, because many scientific journals are not available online. Treat claims as "guilty until proven innocent"—in other words, don't accept what you read at face value until you have evaluated the science behind it. If it sounds too good to be true, it probably is!

The Affordable Care Act and Nutrition

The Affordable Care Act (ACA), also known as Obamacare, was signed into law on March 23, 2010. By 2014, much of the new policy had been implemented. Here is a brief summary of health coverage, costs, and care provided by the law.[a]

Coverage

- *Ends pre-existing condition exclusions:* Health plans can no longer deny or limit benefits due to a pre-existing condition.
- *Keeps young adults covered:* If you are under 26, you may be eligible to be covered under your parents' health plan.
- *Ends arbitrary withdrawals of insurance coverage:* Insurers can no longer cancel your coverage just because you made an honest mistake.
- *Guarantees the right to appeal:* You now have the right to ask that your plan reconsider its denial of payment.

Costs

- *Ends lifetime limits on coverage:* There are no longer limits on the amount paid out for most benefits over a lifetime.
- *Reviews premium increases:* Insurance companies must now publicly justify any unreasonable rate hikes.
- *Helps you get the most from your premium dollars:* The majority of your premium dollars (amount charged for your plan) must be spent primarily on health care—not administrative costs.

Care

- *Covers preventive care at no cost to you:* You may be eligible for recommended preventive health services with no copayment.
- *Protects your choice of doctors:* From your plan's network, you can choose the primary care doctor you want.
- *Removes insurance company barriers to emergency services:* You can seek emergency care at a hospital outside of your health plan's network.[b]

Benefits to College Students

Before the ACA, what was health insurance like for college students? Most colleges required students to either purchase health insurance or continue enrollment in their parents' plans. As previously mentioned, under the ACA students are now able to stay on their parents' health-insurance plans until age 26—even if they are married or have coverage through employers.

Since 2014, college students, like other sectors of the population, have had to abide by the "individual mandate" in the ACA, which requires most people to obtain insurance or pay tax penalties. That's where the *exchanges* come in for students who aren't on their parents' plans and don't want to purchase insurance through their schools: Each state provides health insurance exchanges for qualified Americans to purchase affordable coverage. Each state also has its own exchange that offers a variety of coverage options from private, state-regulated insurance companies—often cheaper than other options. However, the National Center for Public Policy calculated that a college student's penalty for nonenrollment ($325 or 2% of income in 2015) could be cheaper in the short-term (if you don't get sick) than paying for health insurance.

Alternatively, students who can't afford insurance may qualify for Medicaid if their income is below a certain threshold. To see whether you're eligible, check with your state department of health insurance.

Another option for those under 30 is to purchase a *catastrophic health plan*. These plans usually feature low monthly premiums, but the insured are required to pay all their medical costs up to a certain amount, usually several thousand dollars. The insurance company pays for essential health benefits over that amount, essentially providing participants with protection in the event of serious accidents or illnesses.

Finally, individuals with nonimmigrant status, including people on worker visas and student visas, can qualify for insurance coverage through the exchanges.[c]

Heath Care Reform, Preventive Care, and Nutrition

The ACA emphasizes prevention through wellness plans, outreach campaigns, and more opportunities to see registered dietitian nutritionists. The law supports counseling and behavioral interventions in the areas of obesity, breastfeeding, chronic diseases, blood pressure, and cholesterol. It requires most plans to cover calcium and vitamin D testing for women over 60 at risk for osteoporosis, anemia screening for most pregnant women, folic acid pills, and type 2 diabetes screening for adults with high blood pressure.

The ACA also requires proper nutrition labeling in chain restaurants and vending machines, which informs consumers about calories so that they will be aware of the recommended daily caloric intake and its effect on obesity. Should the consumer request it, the following information must be available on menus or display items: total calories, calories from fat, total fat, saturated fat, cholesterol, trans fat, sodium, total carbohydrates, sugars, dietary fiber, and protein.[d,e]

[a] U.S. Department of Health and Human Services, Health Resources and Services Administration, Maternal and Child Health. The Affordable Care Act (ACA) and the nutrition workforce: A summary report. http://www.mchb.hrsa.gov/training/pgm-hi-nutri.asp. Accessed December 18, 2015.

[b] HealthCare.gov. Accessed May 6, 2015.

[c] *Christian Science Monitor.* Obamacare 101: What to know if you opt out of buying health insurance. http://www.csmonitor.com/USA/DC-Decoder/2013/1001/Obamacare-101-What-to-know-if-you-opt-out-of-buying-health-insurance. Accessed December 18, 2015.

[d] Obamacare Facts. Summary of provisions in the Patient Protection and Affordable Care Act. http://obamacarefacts.com/summary-of-provisions-patient-protection-and-affordable-care-act. Accessed December 18, 2015.

[e] WebMD. Understanding the Affordable Care Act and women's health. http://www.webmd.com/health-insurance/covered-preventive-tests-screenings. Accessed January 15, 2015.

As you learn about nutrition, you will undoubtedly be more aware not only of your eating and shopping habits, but also of nutrition-related information in the media. As you see and hear reports, stop to think carefully about what you are hearing. Headlines and news reports often overstate the findings of a study. Two other things to keep in mind: One study does not provide all the answers to our nutrition questions; and if it sounds too good to be true, it probably is!

Your study of nutrition is just beginning. As you learn about the essential nutrients, their functions, and food sources, be alert to your food choices and the factors that influence them. When the discussion turns to the role of diet in health, think about your preconceived ideas and evaluate your beliefs in light of the current scientific evidence. Keep an open mind, but also think critically. Most of all, remember that food is more than the nutrients it provides; it is part of the way we enjoy and celebrate life!

Learning Portfolio

Key Terms

Study Points

- Most people make food choices for reasons other than nutrient value.
- Taste and texture are the two most important factors that influence food choices.
- In all cultures, eating is the primary way of maintaining social relationships.
- Although most North Americans know about healthful food choices, their eating habits do not always reflect this knowledge.
- Food is a mixture of chemicals. Essential chemicals in food are called nutrients.
- Carbohydrates, lipids, proteins, vitamins, minerals, and water are the six classes of nutrients found in food.
- Nutrients have three general functions in the body: They serve as energy sources, structural components, and regulators of metabolic processes.
- Vitamins regulate body processes such as energy metabolism, blood clotting, and calcium balance.
- Minerals contribute to body structures and to regulating processes such as fluid balance.
- Water is the most important nutrient in the body. We can survive much longer without the other nutrients than we can without water.
- Energy in foods and the body is measured in kilocalories. Carbohydrates, fats, and proteins are sources of energy.
- Carbohydrate and protein have a potential energy value of 4 kilocalories per gram, and fat provides 9 kilocalories per gram.
- Scientific studies are the cornerstone of nutrition. The scientific method uses observation and inquiry to test hypotheses.
- Double-blind, placebo-controlled clinical trials are considered the gold standard of nutrition studies.
- Research designs used to test hypotheses include epidemiological, animal, cell culture, and human studies.
- Information in the public media is not always an accurate or complete representation of the current state of the science on a particular topic.

Study Questions

1. Name three sensory aspects of food that influence our food choices.
2. How do our health beliefs affect our food choices?
3. List the six classes of nutrients.
4. List the 13 vitamins.
5. What determines whether a mineral is a macromineral or a micromineral (trace mineral)?
6. How many kilocalories are in 1 gram of carbohydrate? One gram of protein? One gram of fat?

7. What is an epidemiological study?
8. What is the difference between an experimental and a control group?
9. What is a placebo?

Try This

Try a New Cuisine Challenge

Expand your culinary taste buds and try a new cuisine. Go to the grocery store or nearby restaurant and select a cuisine you are not very familiar with. If you go out to eat, take some friends along for dinner so that you can order and share more than one dish. While you're there, don't be afraid to ask questions about the menu so that you can gain a better understanding of the foods, preparation techniques, spices, and even the cultural meaning attached to some of the dishes. If you select food from the grocery store, choose food or dishes with minimal preparation—maybe something from the frozen section. As you try the new food(s), think about your eating experience in terms of sensory properties. Are the smells, flavors, and textures different from what you are used to eating? Do you like the new foods you are trying, and/or do you think that after multiple exposures to the food you would learn to like it?

Food Label Puzzle

The purpose of this exercise is to put the individual pieces of the food label together to determine how many kilocalories are in a serving. Pick six foods in your dorm room or home that have complete food labels. On a separate sheet of paper, write down the value for grams of total carbohydrate, protein, and fat in one serving. Now, using information from this chapter, calculate the amount of calories per serving, using the macronutrient amounts. Check your answer against the package information. Remember that the term *calories* on a food label is really referring to kilocalories. Your job is to determine how many kilocalories are in a serving of each of these foods. You can do this by putting together the individual pieces (carbohydrate, protein, and fat). If you need help, review this chapter and pay close attention to the section on the energy-yielding nutrients. How many kilocalories does each have per gram? You may find that the results of your calculations don't exactly match the numbers on the label. Within labeling guidelines, food manufacturers can round values.

Getting Personal

Why Are You Eating?

Choose one day this week to evaluate why you are eating. Using the table below, list all of the foods and drinks that you consume in a 24-hour period. Select a day where your schedule is fairly predictable and you are eating what is considered normal for you. Using factors that influence food choices as discussed in the section "Why Do We Eat the Way We Do?," identify why you consumed each food that you ate. Example reasons could be: you felt hungry; you wanted the flavor of a particular food that was available; it is a habit to eat at that particular time; or everyone else was eating right then. Keep in mind that there may be more than one reason for eating. Also, using the Hunger/Fullness scale below, rate how hungry you were before you started eating and rate how full you were after you finished eating.

Time	Food or Drink	Amount	Why I Ate	Hunger and Fullness Rating: Before	Hunger and Fullness Rating: After

Rating System to Determine How Hungry and How Full You Are Feeling

0 or 1: Empty feeling in your stomach; you feel grumpy and irritable.

2 or 3: Feeling very hungry; you want to eat just about any type of food.

4: Feeling some hunger pangs; particular foods are starting to sound good to you.

5: Neutral; you have no strong feelings of hunger or fullness.

6 or 7: Satisfied; you are content with your recent food choices and the amount of food that you have eaten.

8: Full; you feel like you may have overeaten just a bit.

9: Stuffed; you feel like you have overeaten.

10: Sick feeling in your stomach; you feel like you ate much more than you should have.

Learning Portfolio (continued)

Questions to ask yourself

- Was there one reason that you ate that appeared more often than any other? If so, what was that reason?
- Are health and nutrition concerns ever a reason for your eating? If not, how can you make eating for health and nutrition concerns a priority?
- Looking at your hunger and fullness ratings, are you eating when you are hungry and stopping when you are satisfied? What changes can you make to become a more mindful and healthy eater?

*Hunger and Fullness Scale adapted from: Tribole E, Resch E. *Intuitive Eating: A Revolutionary Program That Works*. New York: St. Martin's Griffin; 2003.

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