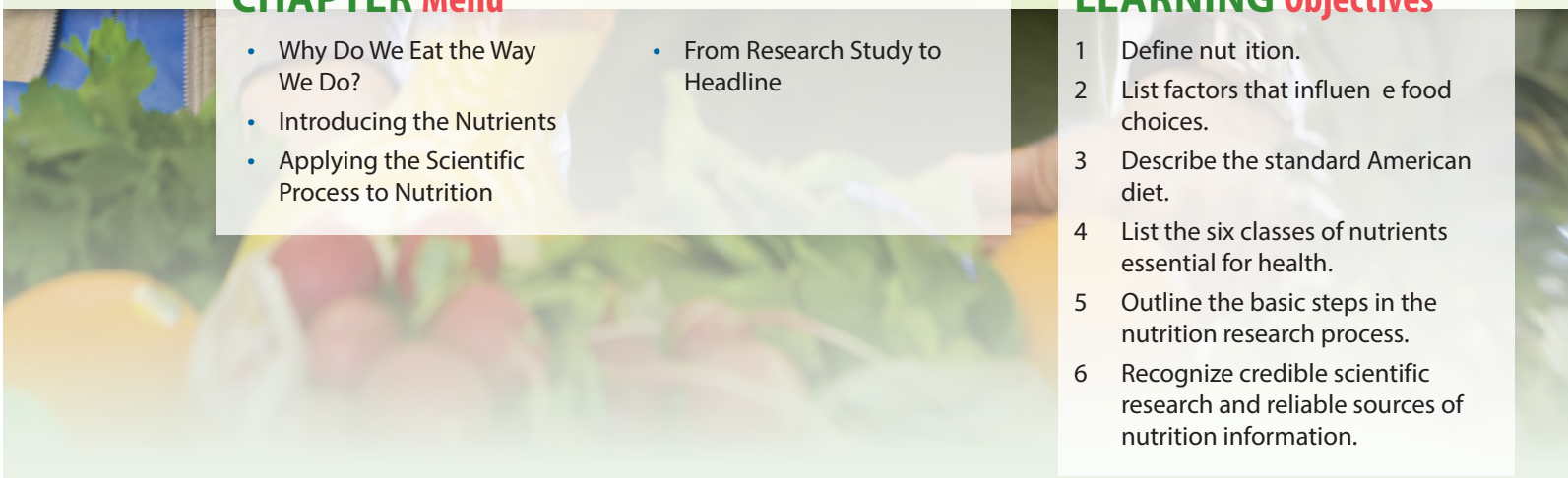
Chapter 1

Food Choices: Nutrients and Nourishment

Revised by Kimberley McMahon

THINK About It

1. What, if anything, might persuade or influen e you to change your food preferences?
2. Are there some foods you defini ely avoid? If so, do you know why?
3. How do you define nut ients?
4. How do you determine if the nutrition information you read is accurate?



CHAPTER Menu

LEARNING Objectives

1 Define nut ition.
2 List factors that influen e food choices.
3 Describe the standard American diet.
4 List the six classes of nutrients essential for health.
5 Outline the basic steps in the nutrition research process.
6 Recognize credible scientific research and reliable sources of nutrition information.

Consider these scenarios. 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 shakes salt on her meal after watching her parents do this. A man says hot dogs are his favorite food because they remind him of 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 all 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 may be 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 will help us to be informed and more likely to make good nutrition choices, which in turn may not only improve our health, but also reduce our risk of some diseases and may even help us to live longer. 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?

Why Is This Important? Many different factors play a role in determining why we choose to eat certain foods and avoid others. Understanding the influence of these factors can shape the way we eat and help us make more healthful food choices.

Do you "eat to live" or "live to eat"? For all of us, the first is certainly true—you must eat to live. But there may be times when our enjoyment of food is more important to us than the nourishment we get from it. 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. Factors such as age, gender, genetic makeup, occupation, lifestyle, family, and cultural background can all affect our daily and habitual food choices. In this book we refer to these daily and habitual food choices as a person's "diet." Unless otherwise indicated, the term *diet* is not used to describe a regimen of eating and drinking for the purpose of weight loss, such as "dieting to lose weight," but rather the term *diet* will refer to daily and habitual food choices that a person makes.

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 some of the most important things that influence our food choices; cost and convenience are important, too.[2]

THINK About It 1

Age is another factor in food choices. 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. 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. For example, an expecting mother who consumes a diet rich in healthy foods can help develop her 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.[4] 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 that when children are repeatedly exposed to a variety of foods, they are more likely to accept those foods, thus adding more variety to their diet and eating more healthfully. This result is even stronger for children whose willingness to try new foods is encouraged by their caregivers.[6]

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,

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

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

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 (the feeling of being full) 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**.)

THINK About It 2

Sensory Influence
Taste
Smell
Texture

Environmental Factors
Economic
Lifestyle
Food availability
Culture
Religion
Geographic location
Environment

Social, Emotional, and Cognitive Factors
Habits
Food likes and dislikes
Knowledge and attitudes related to diet and health
Personal values
Comfort/discomfort foods
Food marketing, advertising, and promotion
Food and diet trends

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 Influ nces: Taste, Smell, and Texture

In making food choices, what appeals to our senses also 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 do you know that there are more? One of these additional taste sensations is **umami**. Umami is a Japanese term used to describe the taste produced by glutamate.[7] It is the brothy, meaty, savory flavor in foods such as meat, seafood, and vegetables. A seasoning commonly added to Chinese food, canned vegetables, soups, and processed meats, called monosodium glutamate (MSG), enhances this umami flavor. Despite many people identifying themselves as being sensitive to MSG, the Food and Drug Administration (FDA) considers that adding MSG to foods is "generally recognized as safe." People who claim sensitivity report symptoms such as headache, flushing, sweating, and nausea; however, studies have not been able to consistently trigger these reactions.[8]

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 age 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.

- **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 Influ nces

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

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.

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 with 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 ill because someone had prepared those 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 may 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.

Food Advertising and Promotion

Aggressive and sometimes deceptive advertising can influence a person's food-buying decisions; 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. According to the Federal Trade Commission (FTC), businesses spend $9.6 billion annually marketing food and beverages, both on television and online. More than $1.79 billion specifically targets children and adolescents, promoting items such as sugared breakfast cereals, fast food, and soft drinks.[9] Exposure to food advertising increases the preference and purchase of the advertised foods, particularly by overweight or obese adults and children.[10]

Food and beverage advertising greatly influences children's eating behavior. Children and teens see about 12–16 TV advertisements per day for products generally high in saturated fat, sugar, and/or sodium.[11] One study suggests that advertising changes the way children consider the importance of taste when making food choices: after watching food commercials, children rely less on health values for their food choices, and instead place significantly more importance on taste.[12] In another study, children consumed 14% more high-sugar breakfast cereal for every 10 advertisements seen for that kind of cereal.[13]

Although the majority of food advertisements are for less healthy foods, positive food advertising also exists. We are seeing more innovative advertising that promotes locally grown, hormone- and pesticide-free foods, plus whole grains, nuts, berries, vegetarian foods, and other nutrient-dense products.

Eating Meals Prepared Outside the Home

In recent years there has been a general shift away from domestic cooking and toward the use of pre-prepared and ultra-processed foods. There has also been an upsurge in time and money devoted to dining out. In all, Americans spend almost half of their food budget on foods prepared away from home, however, they also underestimate the amount of calories and fat in these foods, which is likely contributing to increasing weight and obesity.[14] This trend has promoted an increased interest in

information on calories, fat, sodium, and other nutrients on menus. When calories are present on menus, people order foods with fewer calories compared to those ordering from menus without calories identified, and parents order foods with fewer calories for their children.[15] The Food and Drug Administration (FDA) has implemented guidelines in which nutrition labeling in chain restaurants and similar food establishments will provide consumers with clear and consistent nutrition information in a direct and accessible manner.

FIGURE 1.4 Food and Diet Trends. Online grocery shopping and delivery are becoming popular across the United States.
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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-carbohydrate diet became popular, there was a rise in low-carb and 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 unproven 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. Some notable food trends of the last decade include organic foods, locally grown and prepared foods, fermented foods that contain live cultures, and "craft foods" that hail from a particular locale and claim to have unique tastes. Other trends relate more to our behaviors than particular foods, but they ultimately affect our food purchases; they include snacking throughout the day, using online grocery shopping and delivery services, using apps to calculate the exact nutritional content of meals, and shopping at supermarkets converted into socializing spaces. (See **FIGURE 1.4**.)

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

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

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, also can restrict our food intake and selection. We might, for example, order nonmeat dishes when dining with a group of vegetarian friends.

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 also the most reliable?
© Jones & Bartlett Learning. Photographed by Sarah Cebulski.

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. Furthermore, consumers are placing a higher priority on foods for health and seeking foods with more protein, less sugar, and minimal processing.[16]

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 "scientific" or nutrient-based approach to food might not result in the most beneficial food choices, indicating that in these instances consumers lose sight of the big picture. It has been suggested that nutrition education that focuses on overall results, or how current nutrition decisions will effect overall health, may lead to better overall food choices.[17]

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; whether we choose to eat our meals at home or away from home; and knowledge of health and nutrition. 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, whom 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, food availability, culture, and religion. In the United States, our environment and the choices we make play a significant role in the current obesity epidemic. We live in what has been termed an **obesogenic environment**; in other words, an environment that promotes gaining weight and one that is not conducive to weight loss within the home or workplace.[18]

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

Economics

Where you live not only influences which foods are most accessible to you, but also affects 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 2014, middle income families spent an average of $5,992 on food, representing about 13 percent of income, whereas the lowest income households spent an average of $3,667 on food, representing 34 percent of income.[19] Rising food prices and falling incomes put pressure on food budgets. How much does it cost to follow dietary recommendations? For adults on a 2,000-calorie diet, the cost of meeting the *2015–2020 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).[20]

Food Availability

Poor access to healthy, nutritious foods can negatively affect food choices, and therefore health and well-being. Approximately 23.5 million Americans, including 6.5 million children, live in nutritional wastelands commonly referred to as **food deserts**.[21] 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.[22]

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 a lot of 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.

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 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.[24]

In many cultures, food has symbolic meanings related to family traditions, social status, and even 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 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. However, food habits may be among the last practices to change when an immigrant adapts to a new culture.

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 *2015–2020 Dietary Guidelines for Americans* is designed to illustrate how individual factors, environmental settings, various sectors of influence, and social and

▶ **food deserts** Low income areas where it is difficult to purchase food that is fresh, of good-quality, and affordable.

Quick Bite

Bad Food Habits Are Hard to Break

Bad habits like eating while watching TV, eating in the car, skipping breakfast, or eating too quickly are easy to develop and hard to break. But being aware of your behavior can help you take some steps toward positive change. For example, if you are guilty of eating too quickly, slow down, relax, chew your food, and enjoy the taste of what you are eating. It takes about 20 minutes for your stomach to tell your brain that it is full. If you wait to stop eating until you actually feel full, you have already overeaten!

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

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 lead to death. Chefs who prepare the puffer fish must have special training and licenses to prepare the fish properly, so diners feel nothing more than a slight numbing feeling.

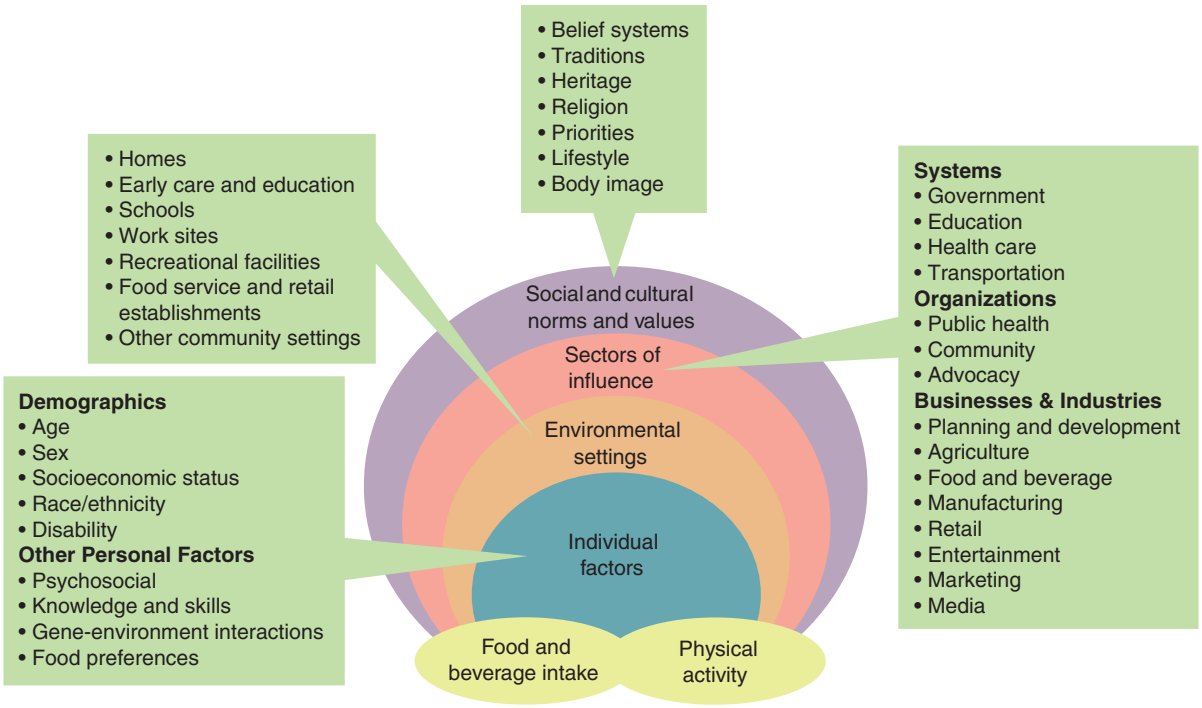


FIGURE 1.8 A social-ecological model. A framework for nutrition and physical activity decisions.

Modified from: (1) 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. (2) Institute of Medicine. *Preventing Childhood Obesity: Health in the Balance*. Washington (DC): The National Academies Press; 2005, page 85. (3) 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.

cultural elements of society overlap to form the food and physical activity choices for an individual.[25] The social-ecological model illustrates that implementing multiple changes at various levels is an effective way to improve eating and physical activity behavior. (See **FIGURE 1.8**.)

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 will adopt new behaviors consistent with their new homes. However, food habits are among the last to change. The social-ecological model can be used to help us understand how layers of influence converge to influence a person's food and physical activity choices.

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 that peers can have the same effect in the opposite direction, slowing the spread of obesity.

The Standard American Diet

What 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.

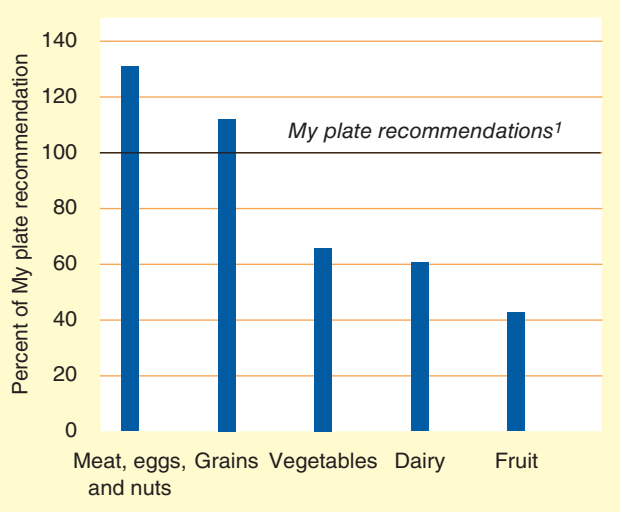
So, how healthful is the "American" diet? The average American falls short of the USDA's MyPlate recommendations for vegetables, dairy, and fruit. **TABLE 1.1** shows average U.S. consumption compared to the MyPlate recommendations.

For individuals age 2 years and older, the estimated average total intakes of the following foods are all well below the *Dietary Guidelines for Americans*: fruit intake is 1.03 cups, with 33 percent consumed as fruit juice; vegetable intake is 1.47 cups, of which 22 percent is potatoes and 20 percent is tomatoes; whole grains consumption is less than 1 ounce; average dairy intake is 1.8 cups, of which 44 percent is cheese and 51 percent is fluid milk; average solid fat intake is 37 grams, oil is 25 grams, and sugar intake is estimated to be 18.4 teaspoon equivalents. (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 contribute nearly 800 calories per day while providing minimal important nutrients.[26] 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 instinctively which foods to choose for good health. So, it is not surprising when national surveys indicate that although Americans know that nutrition and food choices are important factors in health, few have made the 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 taking this course in 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.

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.

Reproduced from USDA, Economic Research Service, Loss-Adjusted Food Availability Data.

TABLE 1.2
Estimated Average Intake Compared to the *Dietary Guidelines for 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.

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. Beliefs and traditions may be modified by geography, economics, or experiences, but core values and customs typically remain similar within a specific group.[a-b] However, as cultural diversity becomes more common among populations, regional food favorites become less foreign.

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 dishes 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.[c] 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.[d] It is believed that excesses in either direction cause illness. The illness must then be treated by eating 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 countries, 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 include 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 Food Culture and Tradition. Food, people and culture resources. http://www.food-links.com. Accessed August 12, 2017.
b Ethnomed. Cultures. http://ethnomed.org/culture. Accessed August 12, 2017.
c HerbMed. Top 20 herbs. http://www.herbmed.org/#param.wapp?sw_page=top20. Accessed August 12, 2017.
d China Highlights. Chinese medicinal cuisine/food therapy—healthy seasonal recipes. http://www.chinahighlights.com/travelguide/chinese-food/medicinal-cuisine.htm. Accessed August 12, 2017.

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

Why Is This Important? The body is made up of millions of cells that grow and change every day. Nutrients from foods that we eat provide the building blocks to replace cells when they die. Nutrients also provide the energy necessary to all body functions. Therefore, knowing about nutrients helps us understand their role in keeping us alive and healthy.

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.

Food is a mixture of chemicals called **nutrients**. You need nutrients for normal growth and development, for maintaining cells and tissues, for fuel to perform physical and metabolic work, and for regulating the hundreds of thousands of body processes that go on inside of you every second of every day. Some nutrients either exist in the body or the body can synthesize them. Examples of these nutrient are the amino acids alanine, arginine, asparagine, and others. These nutrients are referred to as **nonessential nutrients** because it is not necessary to obtain these nutrients from foods that we eat. On the other hand, there are nutrients that the body cannot synthesize, or cannot make enough of, and that must be provided through foods that we eat. These nutrients are termed **essential nutrients**. There are six classes of essential nutrients: carbohydrates, lipids (fats and oils), proteins, vitamins, minerals, and water. (See **FIGURE 1.9**.) The minimum diet for human growth, development, and maintenance must supply about 45 essential nutrients. Although termed nonessential and essential, all nutrients are required by the body for supporting daily processes and to maintain health. Adequate amounts of both nonessential and essential nutrients are necessary for optimal health.

- **nutrients** Any substances in food that the body can use to obtain energy, synthesize tissues, or regulate functions.
- **nonessential nutrients** Those nutrients that can be made by the body.
- **essential nutrients** Substances that must be obtained in the diet because the body either cannot make them or cannot make adequate amounts of them.

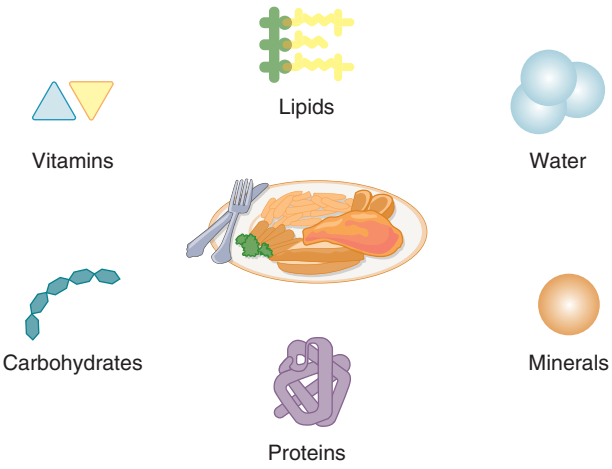


FIGURE 1.9 The six classes of nutrients. Water is the most important nutrient, and we cannot survive long without it. Because our bodies need large quantities of carbohydrate, protein, and fat, they are called macronutrients. Our bodies need comparatively small amounts of vitamins and minerals, so they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

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 whose absence 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 will 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 will reverse the change in health, if done before permanent damage occurs. 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.

THINK About It 3

Nutrients are not the only chemicals in food. Other substances add flavor and color, some contribute to texture, and others like caffeine have physiological effects on the body. **Phytochemicals** are compounds in plants that are believed to provide health benefits beyond those provided by traditional nutrients. **Zoochemicals** are the animal equivalent of phytochemicals in plants; that is, they are found in animal tissues that we consume. Although not nutrients, nor considered essential in the diet, phyto- and zoochemicals have important health benefits. For instance, research suggests that phytochemicals in fruit and vegetables provide **antioxidant** activity, which may reduce risk for heart disease or cancer.[29]

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 regulate

- **phytochemicals** Substances in plants that may 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.

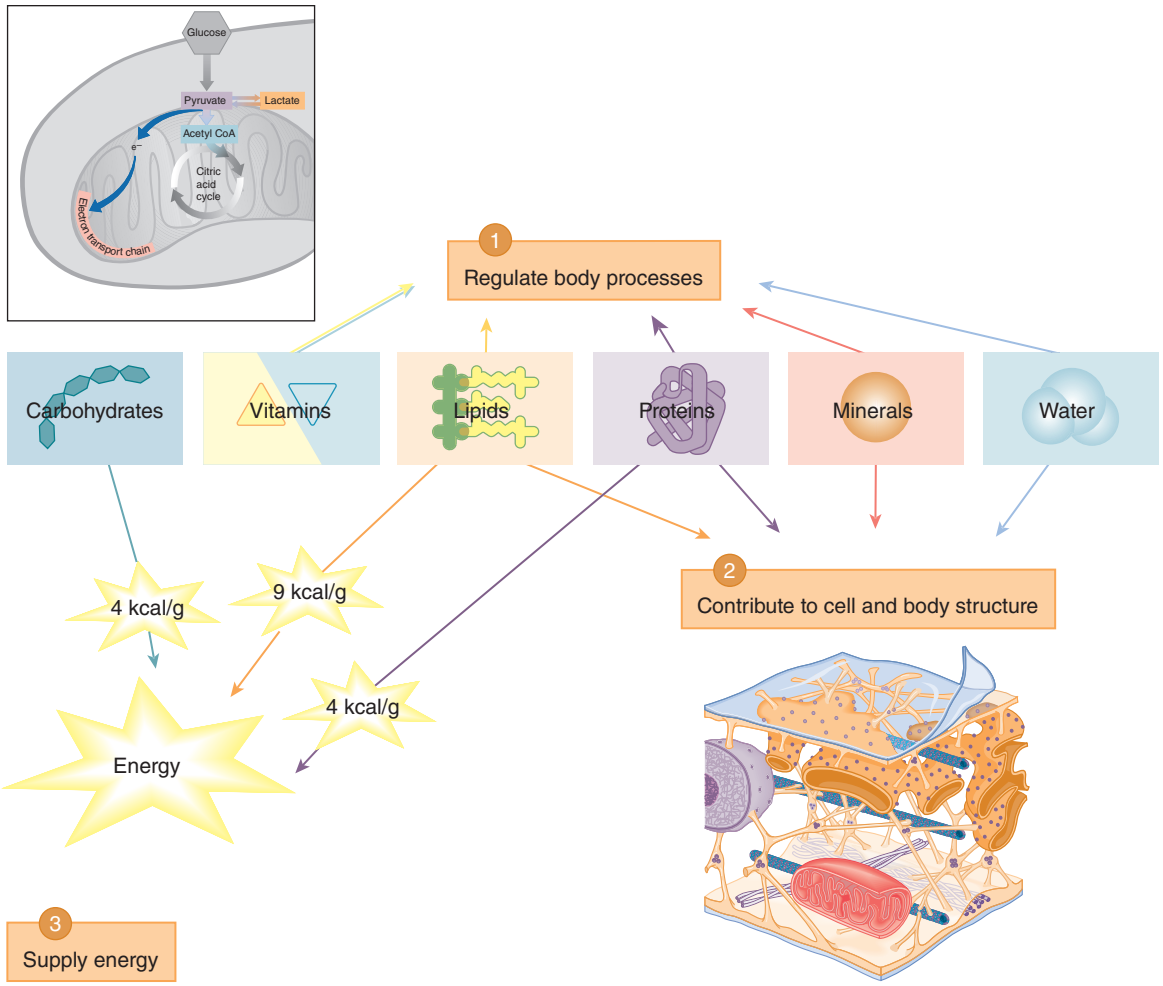


FIGURE 1.10 Nutrients have three general functions in your body. (1) Micronutrients, some lipids and proteins, and water help regulate body processes such as blood pressure, energy production, and temperature. (2) Lipids, proteins, minerals, and water help provide structure to bone, muscle, and other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

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. Even though micronutrients are needed in far smaller amounts than macronutrients, a healthy diet must supply both in adequate amounts.

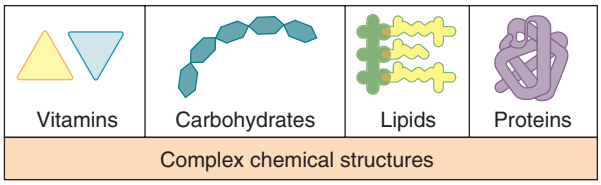
In addition to their functions, there are several other key differences among the classes of nutrients. First, the chemical composition of nutrients varies widely. One way to divide the nutrient groups is based on whether the compounds contain the element carbon. Substances that contain carbon are **organic** substances; 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

- **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).

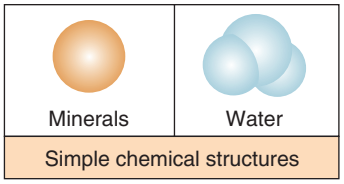
also is very simple in structure. The organic nutrients have more complex structures—the carbohydrates, lipids, and proteins we eat are made of smaller building blocks whereas the vitamins are elaborately structured compounds.

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 most 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 it's whole-grain bread you're eating, you also get fiber, which is not technically a nutrient, but is 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.



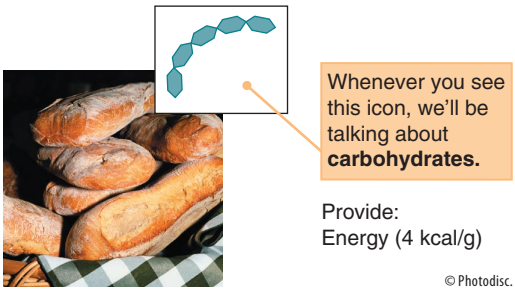
Organic – contains carbon



Inorganic – no carbon

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 made up of long chains of sugars that cannot be broken down by human digestive enzymes. Although fiber doesn't fit the classical definition of a nutrient, it plays important roles in the body, especially in improving digestive function. Your body converts most nonfiber dietary carbohydrates to glucose, a simple sugar compound that provides a source of energy for cells and tissues. **Circulation** moves glucose and other substances through the vessels of the cardiovascular or lymphatic system. Carbohydrates provide approximately 4 calories per gram.



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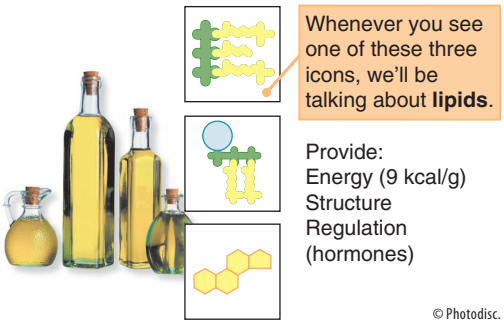

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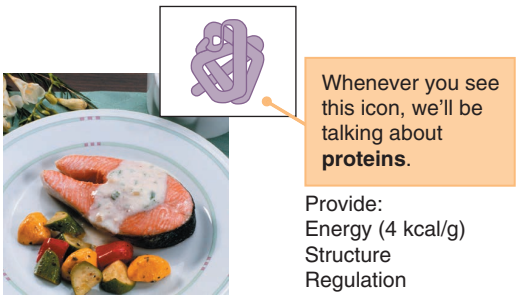
Lipids

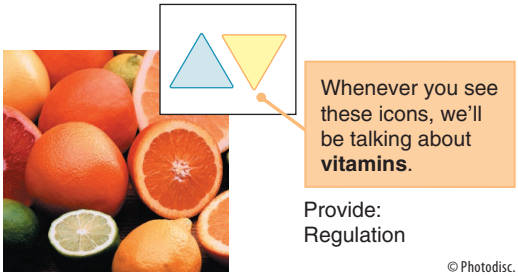
The term **lipids** refers to substances we know as fats and oils but also to fatlike substances in foods, such as cholesterol and phospholipids. Lipids are organic compounds and, like carbohydrates, contain carbon, hydrogen, and oxygen. Fats and oils—or, more correctly, **triglycerides**—are another 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 less obvious plant sources, such as coconut, olives, and avocado. Lipids provide approximately 9 calories per gram.

- **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.
- **legumes** A family of plants with edible seed pods, such as peas, beans, lentils, and soybeans. Also called *pulses*.
- **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.



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

Provide:
Energy (4 kcal/g)
Structure
Regulation



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

Provide:
Regulation

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. Meats and dairy products are concentrated sources of protein. Grains, legumes, and vegetables are also sources of protein, whereas fruits contribute negligible amounts. The amino acids that we get from dairy 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. Proteins regulate body processes and can also be used for energy. They provide approximately 4 calories per gram.

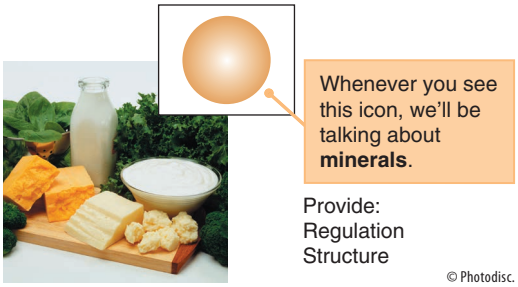
Vitamins

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 belong to 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. The water-soluble vitamins include vitamin C and eight B vitamins: thiamin, riboflavin, niacin, 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.

- **proteins** Large, complex compounds consisting of many amino acids connected in varying sequences and forming unique shapes.
- **amino acids** Compounds that function as the building blocks of protein.
- **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** Those minerals present in the body and required in the diet in relatively small amounts compared with major minerals. Also known as *microminerals*.



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

Provide:
Regulation
Structure

Minerals

Structurally, **minerals** are simple, inorganic substances. Minerals are important for keeping your body healthy, and your body uses minerals 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; these include calcium, phosphorus, magnesium, sodium, potassium, chloride, and sulfur. The body needs the remaining minerals only in 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

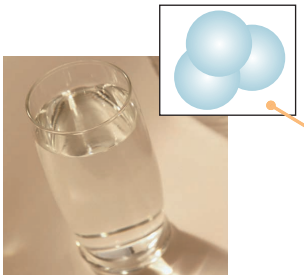
in bones and teeth) as well as regulatory roles (e.g., control of fluid balance, regulation of muscle contraction).

Food sources of minerals are just as diverse as mineral functions. Although we often associate minerals with animal foods, such as meats and milk, plant foods are important sources as well. Deficiencies of minerals—with the exception of iron, calcium, iodine (in patients with cystic fibrosis or pregnancy), 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.

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, 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.



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

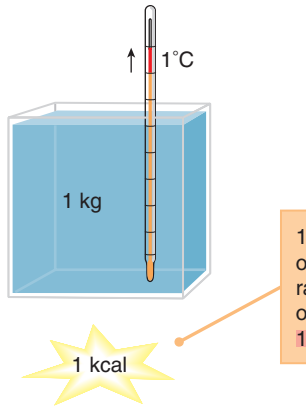
Provides:
Regulation
Structure

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.

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.



1 kcal is the amount of energy that will raise the temperature of 1 kg of water by 1° Celsius

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

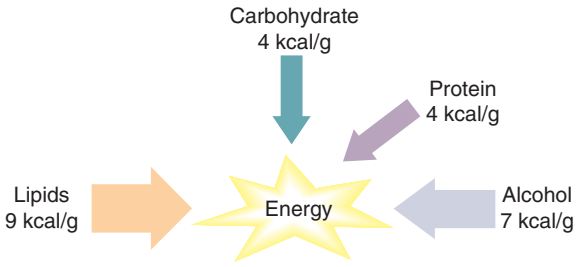


FIGURE 1.11 Energy sources. Carbohydrate, fat, protein, and alcohol provide different amounts of energy per gram.

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 determined 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.

CALCULATING THE ENERGY AVAILABLE FROM FOODS

g carbo × 4 = _____
\+ g protein × 4 = _____
\+ g fat × 9 = _____
= Total kcal

Example:
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

Printing Office, December 2010.

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 cream cheese contains 39 grams of carbohydrate, 10 grams of protein, and 16 grams of fat; thus, we can determine the available energy from each component.

39 g carbohydrate × 4 kcal/g	=	156 kcal
10 g protein × 4 kcal/g	=	40 kcal
16 g fat × 9 kcal/g	=	144 kcal
Total	=	340 kcal

CALCULATING THE PERCENTAGE OF KILOCALORIES FROM NUTRIENTS

g carbo × 4 = _____
÷ Total kcal × 100 = % carbo kcal
g protein × 4 = _____
÷ Total kcal × 100 = % protein kcal
g fat × 9 = _____
÷ Total kcal × 100 = % fat kcal

Example:
275 g carbohydrate × 4 = 1,100 kcal
1,100 kcal ÷ 2,000 kcal × 100 = 55% carbo kcal
75 g protein × 4 = 300 kcal
300 kcal ÷ 2,000 kcal × 100 = 15% protein kcal
67 g fat × 9 = 600 kcal (rounded from 603 kcal)
600 kcal ÷ 2,000 kcal × 100 = 30% fat kcal

Be Food Smart: Calculate the Percentages of Calories in Food

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

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

% 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. 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."[28] 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"[29] and can arise from environmental factors or specific infectious agents, such as bacteria or viruses. 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 may 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 more than half of the conditions listed. Heart disease and cancer, together, account for almost half of all deaths.[30]

▶ **disease** A particular quality, habit, or disposition regarded as adversely affecting a person or group of people.

The foods we choose 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 whereas a lack of the vitamin folate prior to conception and in early pregnancy can cause serious birth defects. Nonnutrient 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.

Physical Activity

A sedentary lifestyle is 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 also plays a significant role in long-term weight management. Current physical activity guidelines recommend that children and adolescents do 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

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	Accidents (unintentional injuries)
5	Stroke
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 Centers for Disease Control and Prevention. National Center for Health Statistics. Leading Causes of Death. Data from 2015. https://www.cdc.gov/nchs/fastats/leading-causes-of-death.htm. Accessed August 18, 2017.

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 shorter increments of time. 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.[31]

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.

Quick Bite

Correlation or Causation?

Recognizing the difference between correlation and causation in drawing conclusions of observational studies is important. A correlation means there is a relationship between two or more variables, such as when one increases the other increases, or when one increases the other decreases. For example, when weather temperatures go up, we can observe increases in the consumption of frozen food, such as ice cream, however, eating ice cream does not cause the air temperature to go up. Causation is when something results because of a certain effect. For example, being exposed to a poison ivy plant can be the cause of developing a poison ivy rash. In nutrition research, it is important to understand that correlation between two variables does not necessarily mean that one causes the other. Most of the research you read about indicates a correlation or association between variables, not causation.

Applying the Scientific Process to Nutrition

Why Should I Know This? Good nutrition research follows a specific process, which is important to understand in order to determine the validity of studies conducted.

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 a **hypothesis** that arises 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 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, that certain plant foods would cure scurvy, 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 the hypothesis is accepted or not.

▶ **hypothesis** A supposition or proposed explanation made on the basis of limited evidence as a starting point for further investigation.

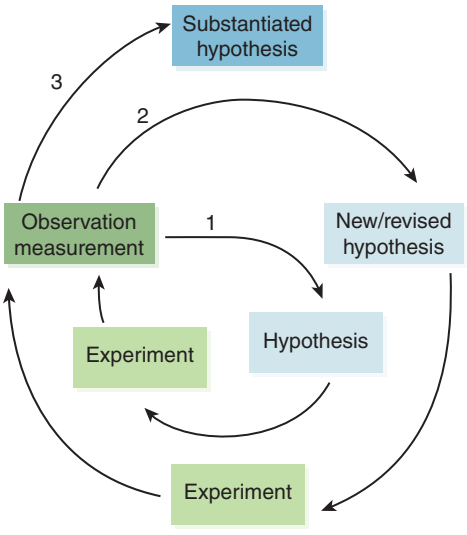


FIGURE 1.12 The scientific process. The scientific process follows these general steps: (1) make observations; (2) formulate a hypothesis; (3) test the hypothesis; (4) analyze data; and (5) communicate results.

TABLE 1.4
Common Study Designs Used in Nutrition Research

Human Studies *Epidemiological studies* compare disease rates among population groups and attempt 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 nor address cause and effect. Epidemiological studies can provide important clues that lead to animal and human studies that can further clarify diet and disease relationships.
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., a nutrient supplement, a controlled diet, or an exercise program) is used to determine its impact on certain health parameters. These studies include an **experimental group** (people who 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 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 will help 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.

Nutrition research is exciting. 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 ethical procedures in all areas of the study design. Common study designs used in nutrition research are defined in **TABLE 1.4**.

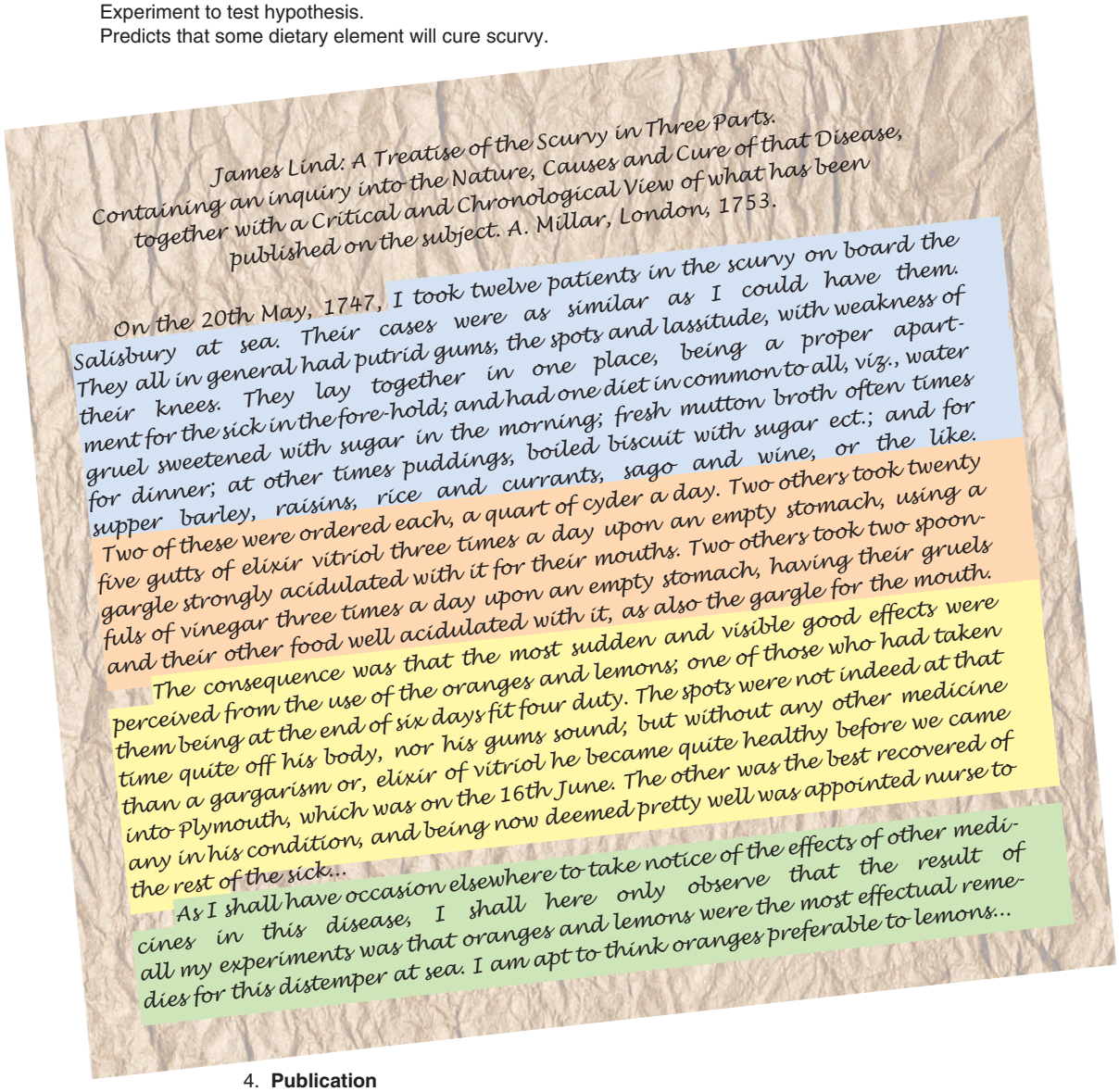
James Lind's experiments with sailors aboard the *Salisbury* in 1747 are considered to be the first dietary clinical trial. (See **FIGURE 1.13**.) His observation that oranges and lemons were the only dietary elements that seemed to cure scurvy was an important finding. However, it took more than 40 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 activity. 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,

1. **Observation**
   Sailors on long voyages all became ill with scurvy.
2. **Hypothesis**
   Lack of certain foods causes scurvy.
3. **Experimentation**
   Experiment to test hypothesis.
   Predicts that some dietary element will cure scurvy.

Key

- Controlled variables
- Experimental variables
- Results
- Conclusions


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.

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...

4. **Publication**
   Publication subjects the findings to peer review by fellow scientists.
5. **More experiments**
   Further experiments replicate the findings and extend knowledge.
6. **Theory**
   Scientists consolidate acquired knowledge into a theory that explains the observed phenomenon.

FIGURE 1.13 The first clinical trial. In 1758, physician James Lind reported the careful process of his clinical trial among British sailors afflicted with scurvy.

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

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

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 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.

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.

▶ **placebo effect** A physical or emotional change that is not due to 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.

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.

From Research Study to Headline

Why Should I Know This? Media headlines are written to grab your interest, but they can often be misleading. Having the tools to identify which headlines and stories are generated from sound nutrition research can go a long way in helping you assess nutrition information in the media.

How can you evaluate the nutrition and health headlines you see online or on television, or hear about from friends or family? 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. Let's take a look at what happens (or what *should* happen) before nutrition information becomes news.

Publishing Experimental Results

Once an experiment is complete, scientists publish the results in a scientific journal to communicate new information to other people who work in that field of study. 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. Examples of peer-reviewed journals are the *American Journal of Clinical Nutrition* and the *Journal of the Academy of Nutrition and Dietetics*.

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

Practice Paper: Academy of Nutrition and Dietetics

Communicating Accurate Food and Nutrition Information

Consumers are increasingly interested in food and nutrition information, and the channels for receiving information are expanding at a fast pace. In this paper, the Academy of Nutrition and Dietetics shows registered dietitian nutritionists (RDNs) how to reach diverse audiences with credible nutrition messages by providing guidelines. RDNs must actively take steps to position themselves as reliable sources of science-based food and nutrition information and communicate through a variety of new media and traditional channels. RDNs are uniquely qualified to evaluate and interpret nutrition research and appropriately translate the findings into positive and practical food and diet advice for the public.

From Journals to the Public

Let's examine the process by which the results of primary nutrition research reach most of us. There are usual several steps involved. Typically, secondary sources of information (e.g., scientific magazines such as *Discover* or *Scientific American*) will gather information from the primary-source journal article. This information is further translated into articles in general magazines (e.g., *Time*) and newspapers. Finally, mass-media outlets—such as various websites, nightly news broadcasts, and tabloids—will present the information. By this last step in the chain of information, the original research may have become a 30-second sound bite or a "click bait" headline that fails to reflect the caveats or limitations of the original study. In some cases, the study may be distorted, with its results misstated or overstated. (See **FIGURE 1.14**.)

Sorting Facts and Fallacies in the Media

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 no scientific evidence to support this claim. Although news stories may be based on reports in the scientific literature, the media may distort the facts through omission of details. The results of studies on certain hot topics, such as weight loss and which foods contribute to hyperactivity in children, are frequently taken out of context and presented as nutrition advice that may be ineffective or even harmful.

Evaluating Information on the Internet

Using the Internet 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. How do you evaluate the quality of information obtained online? Can you trust what you read?

First, it's important to remember that there are no rules for posting information online. 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.[32]

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? Educational institutions (.edu), government agencies (.gov), and organizations (.org) generally have more credibility than commercial (.com) sites, where selling rather than educating may be 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 were included? Was it a double-blind study? 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.

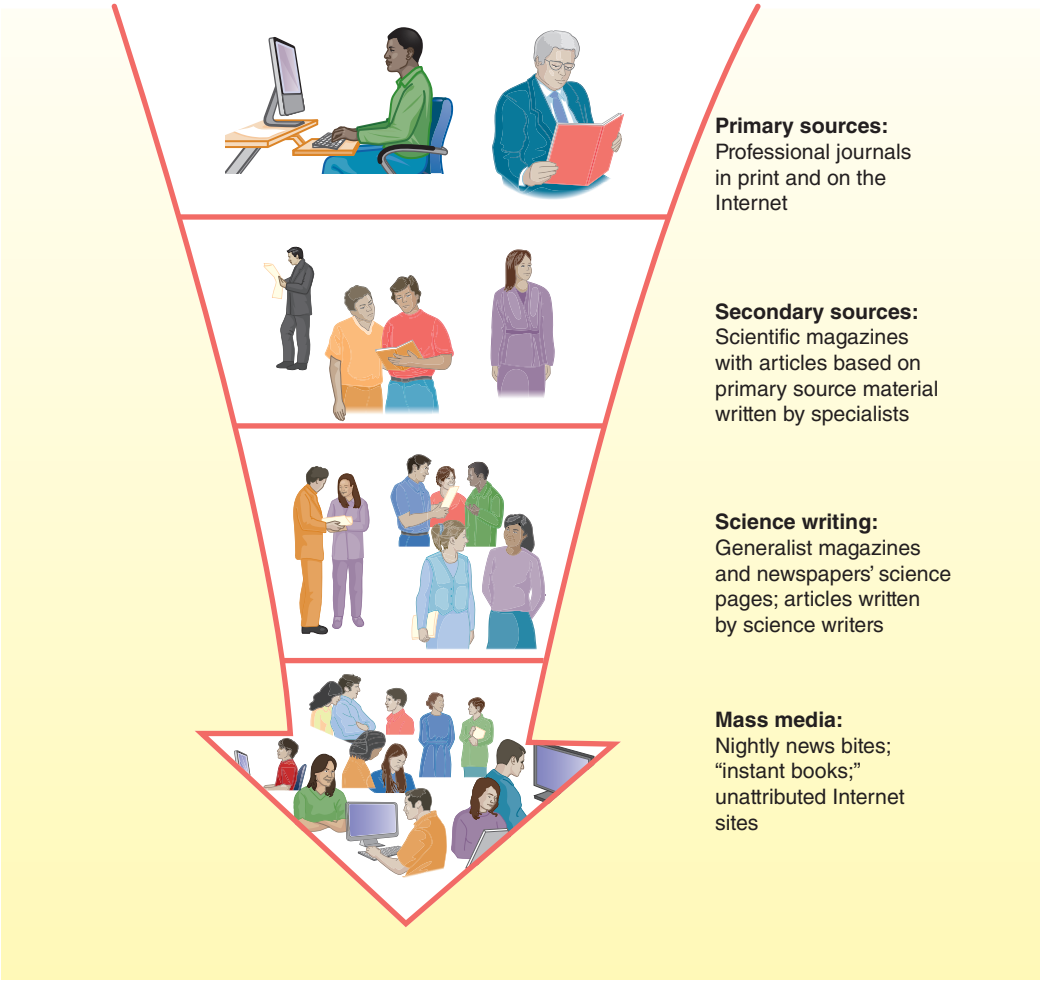


FIGURE 1.14 Sifting facts and fallacies. From original research to the evening news, each step along the way introduces biases as information is summarized and restated. Whether on television, radio, or the Internet, or in print, the best consumer information cites sources for reported facts.

THINK About It 4

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[33]

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

Practice Paper: Academy of Nutrition and Dietetics

Social Media and the Dietetics Practitioner: Opportunities, Challenges, and Best Practices

The potential role of social media in the profession of dietetics is far reaching, yet there are important guidelines to follow related to ethics and professionalism. When using social media, nutrition and dietetics practitioners must remember that they are governed by the same Code of Ethics that guides all other aspects of practice. The use of digital technologies can help practitioners connect with colleagues, promote public health, advocate for a cause, and advance their own careers. Social media policies, education, and peer-to-peer mentoring can help maximize the potential of social media, while maintaining ethical standards and professionalism.

Data from Academy of Nutrition and Dietetics. *Practice Paper: Social Media and the Dietetics Practitioner: Opportunities, Challenges and Best Practices*. 2016;116(11):1825-1835.

8. Recommendations made to help sell a product
9. Recommendations based on studies that are not peer reviewed
10. Recommendations from studies that ignore differences among individuals or groups

Use the Internet; it's fun and can be educational. However, 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.

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 the light of 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!

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 healthcare coverage, costs, and care provided by the law.[a]

Coverage

- *Ends preexisting condition exclusions:* Health plans can no longer deny or limit benefits due to a preexisting 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 they didn'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]

Healthcare 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]

References

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b Healthcare.gov. Accessed August 13, 2017.
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 August 13, 2015.
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e U.S. Department of Health & Human Services. About the Affordable Care Act. https://www.hhs.gov/healthcare/about-the-aca/index.html. Accessed September 11, 2017.

Learning Portfolio

Key Terms

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amino acids	16
antioxidant	13
calorie	17
carbohydrates	15
case control studies	21
circulation	15
clinical trials	21
control group	21
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kilocalories (kcal) [KILL-oh-kal-oh-rees]	17
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placebo	22
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triglycerides	15
umami [ooh-MA-mee]	5
vitamins	16
zoochemicals	13

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 and describe the main role of each class of nutrients in a healthy diet.
4. List the 13 vitamins.
5. What determines whether a mineral is a macromineral or a micro- (trace) mineral?
6. How many kilocalories are in 1 gram of carbohydrate, of protein, and of fat?
7. What is an epidemiological study?
8. What is the difference between an experimental and control group?
9. Describe how a placebo is used in research studies.

Try This

Try a New Cuisine Challenge

Expand your culinary taste buds and try a new cuisine. Go to the grocery store or a nearby restaurant and select a cuisine you are not very familiar with. If you go out to eat, take some friends along so you can order and share more than one dish. While you're there, don't be afraid to ask questions about the menu, so 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 that require you to do 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, 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 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. 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

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

Learning Portfolio (continued)

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.

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.

Upon completion of the exercise, ask yourself the following questions:

- 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?

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

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