Chapter 13

Nutrition through the Life Cycle: From Childhood to the Elderly Years

Big Idea

Good nutritional choices reduce the risk of chronic disease during the middle-aged years.

One hundred years ago, when many families sat down to dinner, they might have eaten boiled potatoes or corn, leafy vegetables such as cabbage or collards, fresh-baked bread, and, if they were fortunate, a small amount of beef or chicken. Young and old alike benefitted from a sound diet that packed a real nutritional punch. Times have changed. Many families today fill their dinner plates with fatty foods, such as french fries cooked in vegetable oil, a hamburger that contains several ounces of ground beef, and a white-bread bun, with a single piece of lettuce and a slice or two of tomato as the only vegetables served with the meal.

The emergence of the obesity epidemic not only relates to what we eat and drink, but also how much we consume on a daily basis.

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Our diet has changed drastically as processed foods, which did not exist a century ago, and animal-based foods now account for a large percentage of our calories. Not only has what we eat changed, but the amount of it that we consume has greatly increased as well, as plates and portion size have grown much larger. All of these choices impact our health, with short- and long-term consequences as we age. Possible effects in the short-term include excess weight gain and constipation. The possible long-term effects, primarily related to obesity, include the risk of cardiovascular disease, Type 2 diabetes, hypertension, stroke, osteoarthritis, sleep apenea, respiratory problems, liver and gallbladder disease, and certain cancers (endometrial, breast, and colon) among middle-aged and elderly adults.Centers for Disease Control and Prevention.

"Overweight and Obesity: Health Consequences." Last updated March 3, 2011. http://www.cdc.gov/obesity/causes/health.html.

It is best to start making healthy choices from a young age and maintain them as you mature. However, a recent report published in the *American Journal of Clinical Nutrition*, suggests that adopting good nutritional choices later in life, during the forties, fifties, and even the sixties, may still help to reduce the risk of chronic disease as you grow older.Rivlin, R. S. "Keeping the Young-Elderly Healthy: Is It Too Late to Improve Our Health through Nutrition?" *Am J Clin Nutr* 86, supplement (2007): 1572S–6S. Even if past nutritional and lifestyle choices were not aligned with dietary guidelines, older adults can still do a great deal to reduce their risk of disability and chronic disease. As we age, we tend to lose lean body mass. This loss of muscle and bone can have critical health implications. For example, a decrease in body strength can result in an increased risk for fractures because older adults with weakened muscles are more likely to fall, and to sustain serious injuries when they do. However, improving your diet while increasing physical activity helps to control weight, reduce fat mass, and maintain muscle and bone mass.

There are a number of changes middle-aged adults can implement, even after years of unhealthy choices. Choices include eating more dark, green, leafy vegetables, substituting high-fat proteins with lean meats, poultry, fish, beans, and nuts, and engaging in moderate physical activity for thirty minutes per day, several days per week. The resulting improvements in body composition will go a long way toward providing greater protection against falls and fractures, and helping to ward off cardiovascular disease and hypertension, among other chronic conditions.Rivlin, R. S. "Keeping the Young-Elderly Healthy: Is It Too Late to Improve Our Health through Nutrition?" *Am J Clin Nutr* 86, supplement (2007): 1572S–6S.

You Decide

What is one nutritional choice that you can make today to reduce your risk of chronic disease tomorrow?

In Chapter 12 "Nutrition through the Life Cycle: From Pregnancy to the Toddler Years", we focused on the effects of dietary choices during pregnancy, infancy, and the toddler years. Our examination of nutrition through the human life cycle continues as we study the remainder of childhood into adulthood and the elderly years. Nutritional choices remain critical throughout a person's life and influence

overall health and wellness. The nutritional choices we make today affect not only our present health, but also our future well-being.

Video 13.1

Weight Gain and Body-Composition Changes, Midlife into Older Age

(click to see video)

This video focuses on the consequences of changing body composition from the middle-aged years into old age.

13.1 The Human Life Cycle Continues

LEARNING OBJECTIVES

1. Identify and define the different stages of the human life cycle.
2. Explain how the human body develops from childhood through the elderly years.

As children mature, their friends can exert a strong influence on their nutritional choices.

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As discussed in Chapter 12 "Nutrition through the Life Cycle: From Pregnancy to the Toddler Years", all people need the same basic nutrients—essential amino acids, carbohydrates, essential fatty acids, and twenty-eight vitamins and minerals—to maintain life and health. However, the amounts of needed nutrients change as we pass from one stage of the human life cycle to the next. Young children require a higher caloric intake relative to body size to facilitate physical and mental development. On the other hand, inactive senior citizens need fewer calories than other adults to maintain their weight and stay healthy. Psychological, emotional, and social issues over the span of a human life can also influence diet and nutrition. For example, peer pressure during adolescence can greatly affect the nutritional choices a teenager makes. Therefore, it is important to weigh a number of considerations when examining how nutrient needs change. In this chapter, we will focus on diet, nutrition, and the human life cycle from the remainder of childhood into the elderly years.

Changes during Childhood

Early childhood encompasses infancy and the toddler years, from birth through age three. The remaining part of childhood is the period from ages four through eight and is the time when children enter school. A number of critical physiological and emotional changes take place during this life stage. For example, a child's limbs lengthen steadily, while the growth of other body parts begins to slow down. By age ten, the skull and the brain have grown to near-adult size.Beverly McMillan, *Human Body: A Visual Guide* (Sydney, Australia: Weldon Owen, 2006), 258. Emotional and psychological changes occur as well. Children's attitudes and opinions about food deepen. They not only begin taking their cues about food preferences from family members, but also from peers and the larger culture. All of these factors should

impact the nutritional choices parents make for their children. This time in a child's life provides an opportunity for parents and other caregivers to reinforce good eating habits and to introduce new foods into the diet, while remaining mindful of a child's preferences. Parents should also serve as role models for their children, who will often mimic their behavior and eating habits.

Changes during Puberty

The onset of **puberty**[1] is the beginning of **adolescence**[2], and is the bridge between the childhood years and young adulthood. Medically, adolescence is defined as the period between ages eleven and fourteen for girls and between twelve to fifteen for boys. For the purpose of discussing the influence of nutritional choices during the life cycle, this text will follow the *2010 Dietary Guidelines for Americans*, which divides the adolescent years into two stages: ages nine to thirteen, or puberty, and ages fourteen to eighteen, or late adolescence. We will discuss puberty first. Some of the important physiological changes that take place during this stage include the development of primary sex characteristics, or the reproductive organs, along with the onset of menstruation in females. This life stage is also characterized by the appearance of secondary sex characteristics, such as the growth of facial and body hair, the development of breasts in girls, and the deepening of the voice in boys. Other physical changes include rapid growth and alterations in body proportions.Elaine U. Polan, RNC, MS and Daphne R. Taylor, RN, MS, *Journey Across the Life Span: Human Development and Health Promotion* (Philadelphia: F. A. Davis Company, 2003), 170–71. All of these changes, as well as the accompanying mental and emotional adjustments, should be supported with sound nutrition.

Changes in Late Adolescence

The *Dietary Guidelines* defines the next phase of the human life cycle, late adolescence, as the period from ages fourteen to eighteen. After puberty, the rate of physical growth slows down. Girls stop growing taller around age sixteen, while boys continue to grow taller until ages eighteen to twenty. One of the psychological and emotional changes that takes place during this life stage includes the desire for independence as adolescents develop individual identities apart from their families.Elaine U. Polan, RNC, MS and Daphne R. Taylor, RN, MS, *Journey Across the Life Span: Human Development and Health Promotion* (Philadelphia: F. A. Davis Company, 2003), 171–76. As teenagers make more and more of their dietary decisions, parents or other caregivers and authority figures should guide them toward appropriate, nutritious choices.

1. The period of the human life cycle between ages nine to thirteen, nutritionally speaking.
2. The period of the human life cycle between ages fourteen to eighteen, nutritionally speaking.

Changes in Young Adulthood

The next phase, young adulthood, is the period from ages nineteen to thirty. It is a stable time compared to childhood and adolescence. Physical growth has been completed and all of the organs and body systems are fully developed. Typically, a young adult who is active has reached his or her physical peak and is in prime health. For example, vital capacity, or the maximum amount of air that the lungs can inhale and exhale, is at its peak between the ages of twenty and forty.Elaine U. Polan, RNC, MS and Daphne R. Taylor, RN, MS, *Journey Across the Life Span: Human Development and Health Promotion* (Philadelphia: F. A. Davis Company, 2003), 192–93. Proper nutrition and adequate physical activity at this stage not only promote wellness in the present, but also provide a solid foundation for the future.

Changes in Middle Age

Nutritionally speaking, middle age is defined as the period from age thirty-one to fifty. The early period of this stage is very different from the end. For example, during the early years of middle age, many women experience pregnancy, childbirth, and lactation. In the latter part of this life stage, women face perimenopause, which is a transition period that leads up to menopause, or the end of menstruation. A number of physical changes take place in the middle-aged years, including the loss of bone mass in women due to dropping levels of estrogen during menopause. In both men and women, visual acuity declines, and by age forty there can be a decreased ability to see objects at a close distance, a condition known as presbyopia.Elaine U. Polan, RNC, MS and Daphne R. Taylor, RN, MS, *Journey Across the Life Span: Human Development and Health Promotion* (Philadelphia: F. A. Davis Company, 2003), 192–93. All of these are signs of aging, as the human body begins to change in subtle and not-so-subtle ways. However, a middle aged person can remain vital, healthy, and near his or her physical peak with proper diet and adequate exercise.

Changes in the Older Adult Years

The senior, or elderly, years are the period from age fifty-one until the end of life. A number of physiological and emotional changes take place during this life stage. For example, many elderly adults face serious health challenges, such as cancer, heart disease, diabetes, or dementia. Both men and women experience a loss of muscle mass and strength and undergo changes in body composition. Fat deposits build up in the abdominal area, which increases the risk for Type 2 diabetes and cardiovascular disease. The skin becomes thinner and may take longer to heal after an injury. Around age seventy, men begin to experience bone loss when estrogen and testosterone levels begin to decline.American Medical Association, *Complete Guide to Prevention and Wellness* (Hoboken, NJ: John Wiley & Sons, Inc., 2008), 512.

Healthy nutritional choices can help to prevent or manage disability and chronic conditions.

In addition, disorders of the nervous system can have profound effects. **Dementia**[3] is the umbrella term for changes in the normal activity of the brain. Elderly adults who suffer from dementia may experience memory loss, agitation, and delusions. One in eight people over age sixty-four and almost half of all people over eighty-five suffer from the brain disorder Alzheimer's disease, which is the most common form of dementia.American Medical Association, *Complete Guide to Prevention and Wellness* (Hoboken, NJ: John Wiley & Sons, Inc., 2008), 421. Neurological disorder and psychological conditions, such as depression, can influence attitudes toward food, along with the ability to prepare or ingest food. They might lead some adults to overindulge to compensate for stress or emotions that are difficult to handle. Other adults might eat less or pay less attention to their diet and nutritional needs. Elderly adults may also need guidance from dietitians and health-care professionals to make the best dietary choices for this stage of life.

Changing Needs and Nutrition

Nutritional needs continue to change at each stage of life. It is important to adjust your diet and physical activity to meet these changing needs and ensure health and wellness throughout your life. Parents must continue to help their school-aged children and adolescents establish healthy eating habits and attitudes toward food. Their primary role is to bring a wide variety of health-promoting foods into the home, so that their children can make good choices. As children become adults, they must be mindful of the choices they make and how those choices affect their health, not only in the present but also in the future.

KEY TAKEAWAYS

- The human body constantly changes throughout the life cycle, from childhood into adulthood and old age.
- Proper nutrition and physical activity ensure health and wellness at each stage of the human life cycle.

3. A disorder of the nervous system characterized by changes in the normal activity of the brain.

DISCUSSION STARTER

1. In preparation for this chapter, predict how nutrient needs might change as a healthy young adult matures into old age. Then, after reading the text, discuss if your predictions were correct or incorrect.

13.2 Childhood and Nutrition

LEARNING OBJECTIVES

1. Summarize nutritional requirements and dietary recommendations for school-aged children.
2. Discuss the most important nutrition-related concerns during childhood.

Nutritional needs change as children leave the toddler years. From ages four to eight, school-aged children grow consistently, but at a slower rate than infants and toddlers. They also experience the loss of deciduous, or "baby," teeth and the arrival of permanent teeth, which typically begins at age six or seven. As new teeth come in, many children have some malocclusion, or malposition, of their teeth, which can affect their ability to chew food. Other changes that affect nutrition include the influence of peers on dietary choices and the kinds of foods offered by schools and afterschool programs, which can make up a sizable part of a child's diet. Food-related problems for young children can include tooth decay, food sensitivities, and malnourishment. Also, excessive weight gain early in life can lead to obesity into adolescence and adulthood.

Childhood (Ages Four to Eight): "Growing Pains"

At this life stage, a healthy diet facilitates physical and mental development and helps to maintain health and wellness. School-aged children experience steady, consistent growth, with an average growth rate of 2–3 inches (5–7 centimeters) in height and 4.5–6.5 pounds (2–3 kilograms) in weight per year. In addition, the rate of growth for the extremities is faster than for the trunk, which results in more adult-like proportions. Long-bone growth stretches muscles and ligaments, which results in many children experiencing "growing pains," at nighttime in particular.Elaine U. Polan, RNC, MS and Daphne R. Taylor, RN, MS, *Journey Across the Life Span: Human Development and Health Promotion* (Philadelphia: F. A. Davis Company, 2003), 150–51.

Energy

In school-aged children, muscle mass and strength increase and motor skills show improvement.

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Children's energy needs vary, depending on their growth and level of physical activity. Energy requirements also vary according to gender. Girls ages four to eight require 1,200 to 1,800 calories a day, while boys need 1,200 to 2,000 calories daily, and, depending on their activity level, maybe more. Also, recommended intakes of macronutrients and most micronutrients are higher relative to body size, compared with nutrient needs during adulthood. Therefore, children should be provided nutrient-dense food at meal- and snack-time. However, it is important not to overfeed children, as this can lead to childhood obesity, which is discussed in the next section. Parents and other caregivers can turn to the MyPlate website for guidance: http://www.choosemyplate.gov/.

Macronutrients

For carbohydrates, the Acceptable Macronutrient Distribution Range (AMDR) is 45–65 percent of daily calories (which is a recommended daily allowance of 135–195 grams for 1,200 daily calories). Carbohydrates high in fiber should make up the bulk of intake. The AMDR for protein is 10–30 percent of daily calories (30–90 grams for 1,200 daily calories). Children have a high need for protein to support muscle growth and development. High levels of essential fatty acids are needed to support growth (although not as high as in infancy and the toddler years). As a result, the AMDR for fat is 25–35 percent of daily calories (33–47 grams for 1,200 daily calories). Children should get 17–25 grams of fiber per day.

Micronutrients

Micronutrient needs should be met with foods first. Parents and caregivers should select a variety of foods from each food group to ensure that nutritional requirements are met. Because children grow rapidly, they require foods that are high in iron, such as lean meats, legumes, fish, poultry, and iron-enriched cereals. Adequate fluoride is crucial to support strong teeth. One of the most important micronutrient requirements during childhood is adequate calcium and vitamin D intake. Both are needed to build dense bones and a strong skeleton. Children who do not consume adequate vitamin D should be given a supplement of 10 micrograms (400 international units) per day. Table 13.1 "Micronutrient Levels during Childhood" shows the micronutrient recommendations for school-aged children. (Note that the recommendations are the same for boys and girls. As we progress through the different stages of the human life cycle, there will be some differences between males and females regarding micronutrient needs.)

Table 13.1 Micronutrient Levels during Childhood

Nutrient	Children, Ages 4–8
Vitamin A (mcg)	400.0
Vitamin B_6 (mcg)	600.0
Vitamin B_{12} (mcg)	1.2
Vitamin C (mg)	25.0
Vitamin D (mcg)	5.0
Vitamin E (mg)	7.0
Vitamin K (mcg)	55.0
Calcium (mg)	800.0
Folate (mcg)	200.0
Iron (mg)	10.0
Magnesium (mg)	130.0
Niacin (B_3) (mg)	8.0
Phosphorus (mg)	500.0
Riboflavin (B_2) (mcg)	600.0
Selenium (mcg)	30.0
Thiamine (B_1) (mcg)	600.0
Zinc (mg)	5.0

Source: Institute of Medicine. http://www.iom.edu.

Factors Influencing Intake

A number of factors can influence children's eating habits and attitudes toward food. Family environment, societal trends, taste preferences, and messages in the media all impact the emotions that children develop in relation to their diet. Television commercials can entice children to consume sugary products, fatty fast-foods, excess calories, refined ingredients, and sodium. Therefore, it is critical that parents and caregivers direct children toward healthy choices.

One way to encourage children to eat healthy foods is to make meal- and snack-time fun and interesting. Parents should include children in food planning and

preparation, for example selecting items while grocery shopping or helping to prepare part of a meal, such as making a salad. At this time, parents can also educate children about kitchen safety. It might be helpful to cut sandwiches, meats, or pancakes into small or interesting shapes. In addition, parents should offer nutritious desserts, such as fresh fruits, instead of calorie-laden cookies, cakes, salty snacks, and ice cream. Also, studies show that children who eat family meals on a frequent basis consume more nutritious foods.Dakota County, Minnesota. "Research on the Benefits of Family Meals." © 2006. Last revised April 30, 2012. http://www.co.dakota.mn.us/Departments/PublicHealth/Projects/ResearchFamilyMeals.htm.

Children and Malnutrition

Malnutrition is a problem many children face, in both developing nations and the developed world. Even with the wealth of food in North America, many children grow up malnourished, or even hungry. The US Census Bureau characterizes households into the following groups:

- food secure
- food insecure without hunger
- food insecure with moderate hunger
- food insecure with severe hunger

Millions of children grow up in food-insecure households with inadequate diets due to both the amount of available food and the quality of food. In the United States, about 20 percent of households with children are food insecure to some degree. In half of those, only adults experience food insecurity, while in the other half both adults and children are considered to be food insecure, which means that children did not have access to adequate, nutritious meals at times.Coleman-Jensen, A. et al. "Household Food Security in the United States in 2010." US Department of Agriculture, *Economic Research Report*, no. ERR-125 (September 2011).

Growing up in a food-insecure household can lead to a number of problems. Deficiencies in iron, zinc, protein, and vitamin A can result in stunted growth, illness, and limited development. Federal programs, such as the National School Lunch Program, the School Breakfast Program, and Summer Feeding Programs, work to address the risk of hunger and malnutrition in school-aged children. They help to fill the gaps and provide children living in food-insecure households with greater access to nutritious meals. You will learn more about food insecurity and the consequences for children and adults in Chapter 14 "Nutrition and Society: Food Politics and Perspectives".

The National School Lunch Program

Beginning with preschool, children consume at least one of their meals in a school setting. Many children receive both breakfast and lunch outside of the home. Therefore, it is important for schools to provide meals that are nutritionally sound. In the United States, more than thirty-one million children from low-income families are given meals provided by the National School Lunch Program. This federally-funded program offers low-cost or free lunches to schools, and also snacks to afterschool facilities. School districts that take part receive subsidies from the US Department of Agriculture (USDA) for every meal they serve. School lunches must meet the *2010 Dietary Guidelines for Americans* and need to provide one-third of the RDAs for protein, vitamin A, vitamin C, iron, and calcium. However, local authorities make the decisions about what foods to serve and how they are prepared.US Department of Agriculture. "National School Lunch Program Fact Sheet." 2011. Accessed March 5, 2012. http://www.fns.usda.gov/cnd/lunch/AboutLunch/NSLPFactSheet.pdf. The Healthy School Lunch Campaign works to improve the food served to children in school and to promote children's short- and long-term health by educating government officials, school officials, food-service workers, and parents. Sponsored by the Physicians Committee for Responsible Medicine, this organization encourages schools to offer more low-fat, cholesterol-free options in school cafeterias and in vending machines.Physicians Committee for Responsible Medicine. "Healthy School Lunches." Accessed March 5, 2012. http://healthyschoollunches.org/.

Video 13.2

The USDA Introduces New School Lunch Standards

(click to see video)

This video focuses on changes to the National School Lunch Program in the United States.

Children and Vegetarianism

Another issue that some parents face with school-aged children is the decision to encourage a child to become a vegetarian or a vegan. Some parents and caregivers decide to raise their children as vegetarians for health, cultural, or other reasons. Preteens and teens may make the choice to pursue vegetarianism on their own, due to concerns about animals or the environment. No matter the reason, parents with

vegetarian children must take care to ensure vegetarian children get healthy, nutritious foods that provide all the necessary nutrients.

Types of Vegetarian Diets

There are several types of vegetarians, each with certain restrictions in terms of diet:

- **Ovo-vegetarians.** Ovo-vegetarians eat eggs, but do not eat any other animal products.
- **Lacto-ovo-vegetarians.** Lacto-ovo-vegetarians eat eggs and dairy products, but do not eat any meat.
- **Lacto-vegetarians.** Lacto-vegetarians eat dairy products, but do not eat any other animal products.
- **Vegans.** Vegans eat food only from plant sources, no animal products at all.

Children who consume some animal products, such as eggs, cheese, or other forms of dairy, can meet their nutritional needs. For a child following a strict vegan diet, planning is needed to ensure adequate intake of protein, iron, calcium, vitamin B_{12}, and vitamin D. Legumes and nuts can be eaten in place of meat, soy milk fortified with calcium and vitamins D and B_{12} can replace cow's milk.

Food Allergies and Food Intolerance

As discussed in Chapter 12 "Nutrition through the Life Cycle: From Pregnancy to the Toddler Years", the development of food allergies is a concern during the toddler years. This remains an issue for school-aged children. Recent studies show that three million children under age eighteen are allergic to at least one type of food.American Academy of Allergy, Asthma and Immunology. "Allergy Statistics." Accessed on March 5, 2012. http://www.aaaai.org/about-the-aaaai/newsroom/allergy-statistics.aspx. Some of the most common allergenic foods include peanuts, milk, eggs, soy, wheat, and shellfish. An allergy occurs when a protein in food triggers an immune response, which results in the release of antibodies, histamine, and other defenders that attack foreign bodies. Possible symptoms include itchy skin, hives, abdominal pain, vomiting, diarrhea, and nausea. Symptoms usually develop within minutes to hours after consuming a food allergen. Children can outgrow a food allergy, especially allergies to wheat, milk, eggs, or soy.

Anaphylaxis[4] is a life-threatening reaction that results in difficulty breathing, swelling in the mouth and throat, decreased blood pressure, shock, or even death.

4. A life-threatening, extreme immune response to a food allergen. Anaphylaxis can result in difficulty breathing, swelling in the mouth and throat, decreased blood pressure, shock, and death.

Milk, eggs, wheat, soybeans, fish, shellfish, peanuts, and tree nuts are the most likely to trigger this type of response. A dose of the drug epinephrine is often administered via a "pen" to treat a person who goes into anaphylactic shock.National Institutes of Health, US Department of Health and Human Services. "Food Allergy Quick Facts." Accessed March 5, 2012. http://www.niaid.nih.gov/topics/foodallergy/understanding/pages/quickfacts.aspx.

Some children experience a food intolerance, which does not involve an immune response. A food intolerance is marked by unpleasant symptoms that occur after consuming certain foods. Lactose intolerance, though rare in very young children, is one example. Children who suffer from this condition experience an adverse reaction to the lactose in milk products. It is a result of the small intestine's inability to produce enough of the enzyme lactase, which is produced by the small intestine. Symptoms of lactose intolerance usually affect the GI tract and can include bloating, abdominal pain, gas, nausea, and diarrhea. An intolerance is best managed by making dietary changes and avoiding any foods that trigger the reaction.National Digestive Disease Information Clearinghouse, a service of National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health. "Lactose Intolerance." *NIH Publication No. 09–2751* (June 2009). Last updated April 23, 2012. http://digestive.niddk.nih.gov/ddiseases/pubs/lactoseintolerance/.

The Threat of Lead Toxicity

There is a danger of lead toxicity, or lead poisoning, among school-aged children. Lead is found in plumbing in old homes, in lead-based paint, and occasionally in the soil. Contaminated food and water can increase exposure and result in hazardous lead levels in the blood. Children under age six are especially vulnerable. They may consume items tainted with lead, such as chipped, lead-based paint. Another common exposure is lead dust in carpets, with the dust flaking off of paint on walls. When children play or roll around on carpets coated with lead, they are in jeopardy. Lead is indestructible, and once it has been ingested it is difficult for the human body to alter or remove it. It can quietly build up in the body for months, or even years, before the onset of symptoms. Lead toxicity can damage the brain and central nervous system, resulting in impaired thinking, reasoning, and perception.

Treatment for lead poisoning includes removing the child from the source of contamination and extracting lead from the body. Extraction may involve chelation therapy, which binds with lead so it can be excreted in urine. Another treatment protocol, EDTA therapy, involves administering a drug called ethylenediaminetetraacetic acid to remove lead from the bloodstream of patients with levels greater than 45 mcg/dL.Mayo Foundation for Medical Education and Research. "Lead poisoning." ©1998–2012 Accessed March 5, 2012. http://www.mayoclinic.com/health/lead-poisoning/FL00068. Fortunately, lead

toxicity is highly preventable. It involves identifying potential hazards, such as lead paint and pipes, and removing them before children are exposed to them.

KEY TAKEAWAYS

- The recommended intakes of macronutrients and micronutrients for children are higher relative to body size compared with nutrient needs during adulthood. Also, children's daily energy needs vary depending on their level of physical activity and their gender. Girls ages four to eight require 1,200 to 1,800 calories, while boys ages four to eight need 1,200 to 2,000 calories.
- Some food- and nutrition-related problems that can affect school-aged children include malnutrition, food allergies, food intolerances, and lead toxicity.

DISCUSSION STARTER

1. Which nutritional issues should parents who raise their children as vegans consider? Examine the vegan lifestyle and its impact on childhood development. Visit the following websites for more information on veganism:

   http://www.vrg.org/nutshell/kids.htm

   http://kidshealth.org/parent/nutrition_center/healthy_eating/vegan.html

   http://www.fcs.uga.edu/ext/pubs/html/FDNS-E-18.html

13.3 Puberty and Nutrition

LEARNING OBJECTIVES

1. Summarize nutritional requirements and dietary recommendations for preteens.
2. Discuss the most important nutrition-related concerns at the onset of puberty.
3. Discuss the growing rates of childhood obesity and the long-term consequences of it.

Puberty is the beginning of adolescence. The onset of puberty brings a number of changes, including the development of primary and secondary sex characteristics, growth spurts, an increase in body fat, and an increase in bone and muscle development. All of these changes must be supported with adequate intake and healthy food choices.

The Onset of Puberty (Ages Nine to Thirteen)

This period of physical development is divided into two phases. The first phase involves height increases from 20 to 25 percent. Puberty is second to the prenatal period in terms of rapid growth as the long bones stretch to their final, adult size. Girls grow 2–8 inches (5–20 centimeters) taller, while boys grow 4–12 inches (10–30 centimeters) taller. The second phase involves weight gain related to the development of bone, muscle, and fat tissue. Also in the midst of puberty, the sex hormones trigger the development of reproductive organs and secondary sexual characteristics, such as pubic hair. Girls also develop "curves," while boys become broader and more muscular.Beverly McMillan, *Illustrated Atlas of the Human Body* (Sydney, Australia: Weldon Owen, 2008), 258.

Puberty typically begins slightly earlier in girls than in boys. For girls, puberty often begins around age eleven, while for boys it begins around age twelve.

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Energy

The energy requirements for preteens differ according to gender, growth, and activity level. For ages nine to thirteen, girls should consume about 1,400 to 2,200

calories per day and boys should consume 1,600 to 2,600 calories per day. Physically active preteens who regularly participate in sports or exercise need to eat a greater number of calories to account for increased energy expenditures.

Macronutrients

For carbohydrates, the AMDR is 45 to 65 percent of daily calories (which is a recommended daily allowance of 158–228 grams for 1,400–1,600 daily calories). Carbohydrates that are high in fiber should make up the bulk of intake. The AMDR for protein is 10 to 30 percent of daily calories (35–105 grams for 1,400 daily calories for girls and 40–120 grams for 1,600 daily calories for boys). The AMDR for fat is 25 to 35 percent of daily calories (39–54 grams for 1,400 daily calories for girls and 44–62 grams for 1,600 daily calories for boys), depending on caloric intake and activity level.

Micronutrients

Key vitamins needed during puberty include vitamins D, K, and B_{12}. Adequate calcium intake is essential for building bone and preventing osteoporosis later in life. Young females need more iron at the onset of menstruation, while young males need additional iron for the development of lean body mass. Almost all of these needs should be met with dietary choices, not supplements (iron is an exception). Table 13.2 "Micronutrient Levels during Puberty" shows the micronutrient recommendations for young adolescents.

Table 13.2 Micronutrient Levels during Puberty

Nutrient	Preteens, Ages 9–13
Vitamin A (mcg)	600.0
Vitamin B_6 (mg)	1.0
Vitamin B_{12} (mcg)	1.8
Vitamin C (mg)	45.0
Vitamin D (mcg)	5.0
Vitamin E (mg)	11.0
Vitamin K (mcg)	60.0
Calcium (mg)	1,300.0
Folate (mcg)	300.0

Nutrient	Preteens, Ages 9–13
Iron (mg)	8.0
Magnesium (mg)	240.0
Niacin (B_3) (mg)	12.0
Phosphorus (mg)	1,250.0
Riboflavin (B_2) (mg)	900.0
Selenium (mcg)	40.0
Thiamine (B_1) (mcg)	900.0
Zinc (mg)	8.0

Source: Institute of Medicine. http://www.iom.edu.

Childhood Obesity

Children need adequate caloric intake for growth, and it is important not to impose very restrictive diets. However, exceeding caloric requirements on a regular basis can lead to childhood obesity, which has become a major problem in North America. Nearly one of three US children and adolescents are overweight or obese.Let's Move. "Learn the Facts." Accessed March 5, 2012. http://www.letsmove.gov/learn-facts/epidemic-childhood-obesity. In Canada, approximately 26 percent of children and adolescents are overweight or obese.Childhood Obesity Foundation. "Statistics." Accessed March 5, 2012. http://www.childhoodobesityfoundation.ca/statistics.

Frequent television, computer, and video game usage leads to a sedentary lifestyle, which, along with poor diet, contributes to childhood obesity.

© Thinkstock

There are a number of reasons behind this problem, including:

- larger portion sizes
- limited access to nutrient-rich foods
- increased access to fast foods and vending machines
- lack of breastfeeding support
- declining physical education programs in schools
- insufficient physical activity and a sedentary lifestyle

- media messages encouraging the consumption of unhealthy foods

Children who suffer from obesity are more likely to become overweight or obese adults. Obesity has a profound effect on self-esteem, energy, and activity level. Even more importantly, it is a major risk factor for a number of diseases later in life, including cardiovascular disease, Type 2 diabetes, stroke, hypertension, and certain cancers.World Health Organization. "Obesity and Overweight Fact Sheet." Last revised March 2011. http://www.who.int/mediacentre/factsheets/fs311/en/.

A percentile for body mass index (BMI) specific to age and sex is used to determine if a child is overweight or obese. This is more appropriate than the BMI categories used for adults because the body composition of children varies as they develop, and differs between boys and girls. If a child gains weight inappropriate to growth, parents and caregivers should limit energy-dense, nutrient-poor snack foods. Also, children ages three and older can follow the National Cholesterol Education Program guidelines of no more than 35 percent of calories from fat (10 percent or less from saturated fat), and no more than 300 milligrams of cholesterol per day. In addition, it is extremely beneficial to increase a child's physical activity and limit sedentary activities, such as watching television, playing video games, or surfing the Internet.

Programs to address childhood obesity can include behavior modification, exercise counseling, psychological support or therapy, family counseling, and family meal-planning advice. For most, the goal is not weight loss, but rather allowing height to catch up with weight as the child continues to grow. Rapid weight loss is not recommended for preteens or younger children due to the risk of deficiencies and stunted growth.

Video 13.3

Voice of America: Adolescent Obesity Raises Risk of Severe Obesity in Adulthood

(click to see video)

This video provides information about the link between adolescent obesity and adult obesity.

Avoiding Added Sugars

5. Sugars and other sweeteners (such as high-fructose corn syrup, honey, maple syrup, and molasses), that are added to food at the table, and are also ingredients in food products.

One major contributing factor to childhood obesity is the consumption of **added sugars**[5]. Added sugars include not only sugar added to food at the table, but also are ingredients in items such as bread, cookies, cakes, pies, jams, and soft drinks. The added sugar in store-bought items may be listed as white sugar, brown sugar, high-

fructose corn syrup, honey, malt syrup, maple syrup, molasses, anhydrous dextrose, crystal dextrose, and concentrated fruit juice. (Not included are sugars that occur naturally in foods, such as the lactose in milk or the fructose in fruits.) In addition, sugars are often "hidden" in items added to foods after they're prepared, such as ketchup, salad dressing, and other condiments. According to the National Center for Health Statistics, young children and adolescents consume an average of 322 calories per day from added sugars, or about 16 percent of daily calories.National Center for Health Statistics. "Consumption of Added Sugar among US Children and Adolescents, 2005–2008." *NCHS Data Brief*, no. 87, (March 2012). http://www.cdc.gov/nchs/data/databriefs/db87.pdf. The primary offenders are processed and packaged foods, along with soda and other beverages. These foods are not only high in sugar, they are also light in terms of nutrients and often take the place of healthier options. Intake of added sugar should be limited to 100–150 calories per day to discourage poor eating habits.

Tools for Change

The *2008 Physical Activity Guidelines for Americans* call for sixty minutes of moderate to vigorous physical activity daily for preteens and teens. This includes aerobic activity, along with bone- and muscle-strengthening exercises.US Department of Health and Human Services. "2008 Physical Activity Guidelines for Americans." Accessed March 5, 2012. http://www.health.gov/paguidelines/pdf/paguide.pdf. However, many young people fall far short of this goal. Preteens must be encouraged to lead more active lifestyles to prevent or treat childhood obesity. In the United States, the Let's Move! campaign inspires kids to start exercising. This program, launched in 2010 by First Lady Michelle Obama, works to solve the problem of rising obesity rates among children, preteens, and teens. It offers information to parents and educators, works to provide healthier food choices in schools and afterschool programs, and helps children become more active. One way the program promotes physical activity is by encouraging preteens and teens to find something they love to do. When kids find an activity they enjoy, whether riding a bike, playing football, joining a soccer team, or participating in a dance crew, they are more likely to get moving and stay healthy. You can learn more about Let's Move! and efforts to encourage physical activity among adolescents at this website: http://www.letsmove.gov/.

KEY TAKEAWAYS

- During puberty, preteens experience growth spurts, along with the development of primary and secondary sex characteristics.
- The daily energy requirements for preteens differ according to gender, growth, and activity level. Girls ages nine to thirteen should consume 1,400 to 2,200 calories per day, and boys should consume 1,600 to 2,600 calories per day.
- Nutritional concerns for older children include malnutrition and obesity.
- Preteens should be encouraged to develop good habits, including consuming a healthy diet and regularly participating in sports or an exercise program.

DISCUSSION STARTER

1. What would you recommend to help families prevent obesity among their children? What tips would you provide? What lifestyle changes might help? Use the dietary guidelines at this website to discuss suggestions.

   http://www.choosemyplate.gov/.

13.4 Older Adolescence and Nutrition

LEARNING OBJECTIVES

1. Summarize nutritional requirements and dietary recommendations for teens.
2. Discuss the most important nutrition-related concerns during adolescence.
3. Discuss the effect of eating disorders on health and wellness.

In this section, we will discuss the nutritional requirements for young people ages fourteen to eighteen. One way that teenagers assert their independence is by choosing what to eat. They have their own money to purchase food and tend to eat more meals away from home. Older adolescents also can be curious and open to new ideas, which includes trying new kinds of food and experimenting with their diet. For example, teens will sometimes skip a main meal and snack instead. That is not necessarily problematic. Their choice of food is more important than the time or place.

However, too many poor choices can make young people nutritionally vulnerable. Teens should be discouraged from eating fast food, which has a high fat and sugar content, or frequenting convenience stores and using vending machines, which typically offer poor nutritional selections. Other challenges that teens may face include obesity and eating disorders. At this life stage, young people still need guidance from parents and other caregivers about nutrition-related matters. It can be helpful to explain to young people how healthy eating habits can support activities they enjoy, such as skateboarding or dancing, or connect to their desires or interests, such as a lean figure, athletic performance, or improved cognition.

Adolescence (Ages Fourteen to Eighteen): Transitioning into Adulthood

As during puberty, growth and development during adolescence differs in males than in females. In teenage girls, fat assumes a larger percentage of body weight, while teenage boys experience greater muscle and bone increases. For both, primary and secondary sex characteristics have fully developed and the rate of growth slows with the end of puberty. Also, the motor functions of an older adolescent are comparable to those of an adult.Elaine U. Polan, RNC, MS and Daphne R. Taylor, RN, MS, *Journey Across the Life Span: Human Development and Health*

Promotion (Philadelphia: F. A. Davis Company, 2003), 171–173. Again, adequate nutrition and healthy choices support this stage of growth and development.

Energy

Adolescents have increased appetites due to increased nutritional requirements. Nutrient needs are greater in adolescence than at any other time in the life cycle, except during pregnancy. The energy requirements for ages fourteen to eighteen are 1,800 to 2,400 calories for girls and 2,000 to 3,200 calories for boys, depending on activity level. The extra energy required for physical development during the teenaged years should be obtained from foods that provide nutrients instead of "empty calories." Also, teens who participate in sports must make sure to meet their increased energy needs.

Macronutrients

Older adolescents are more responsible for their dietary choices than younger children, but parents and caregivers must make sure that teens continue to meet their nutrient needs. For carbohydrates, the AMDR is 45 to 65 percent of daily calories (203–293 grams for 1,800 daily calories). Adolescents require more servings of grain than younger children, and should eat whole grains, such as wheat, oats, barley, and brown rice. The Institute of Medicine recommends higher intakes of protein for growth in the adolescent population. The AMDR for protein is 10 to 30 percent of daily calories (45–135 grams for 1,800 daily calories), and lean proteins, such as meat, poultry, fish, beans, nuts, and seeds are excellent ways to meet those nutritional needs.

The AMDR for fat is 25 to 35 percent of daily calories (50–70 grams for 1,800 daily calories), and the AMDR for fiber is 25–34 grams per day, depending on daily calories and activity level. It is essential for young athletes and other physically active teens to intake enough fluids, because they are at a higher risk for becoming dehydrated.

Micronutrients

Micronutrient recommendations for adolescents are mostly the same as for adults, though children this age need more of certain minerals to promote bone growth (e.g., calcium and phosphorus, along with iron and zinc for girls). Again, vitamins and minerals should be obtained from food first, with supplementation for certain micronutrients only (such as iron).

The most important micronutrients for adolescents are calcium, vitamin D, vitamin A, and iron. Adequate calcium and vitamin D are essential for building bone mass. The recommendation for calcium is 1,300 milligrams for both boys and girls. Low-fat milk and cheeses are excellent sources of calcium and help young people avoid saturated fat and cholesterol. It can also be helpful for adolescents to consume products fortified with calcium, such as breakfast cereals and orange juice. Iron supports the growth of muscle and lean body mass. Adolescent girls also need to ensure sufficient iron intake as they start to menstruate. Girls ages twelve to eighteen require 15 milligrams of iron per day. Increased amounts of vitamin C from orange juice and other sources can aid in iron absorption. Also, adequate fruit and vegetable intake allows for meeting vitamin A needs. Table 13.3 "Micronutrient Levels during Older Adolescence" shows the micronutrient recommendations for older adolescents, which differ slightly for males and females, unlike the recommendations for puberty.

Table 13.3 Micronutrient Levels during Older Adolescence

Nutrient	Males, Ages 14–18	Females, Ages 14–18
Vitamin A (mcg)	900.0	700.0
Vitamin B_6 (mg)	1.3	1.2
Vitamin B_{12} (mcg)	2.4	2.4
Vitamin C (mg)	75.0	65.0
Vitamin D (mcg)	5.0	5.0
Vitamin E (mg)	15.0	15.0
Vitamin K (mcg)	75.0	75.0
Calcium (mg)	1,300.0	1,300.0
Folate mcg)	400.0	400.0
Iron (mg)	11.0	15.0
Magnesium (mg)	410.0	360.0
Niacin (B_3) (mg)	16.0	14.0
Phosphorus (mg)	1,250.0	1,250.0
Riboflavin (B_2) (mg)	1.3	1.0
Selenium (mcg)	55.0	55.0
Thiamine (B_1) (mg)	1.2	1.0
Zinc (mg)	11.0	9.0

Source: Institute of Medicine. http://www.iom.edu.

Eating Disorders

Many teens struggle with an **eating disorder**[6], which can have a detrimental effect on diet and health. A study published by North Dakota State University estimates that these conditions impact twenty-four million people in the United States and seventy million worldwide.North Dakota State University. "Eating Disorder Statistics." Accessed March 5, 2012. http://www.ndsu.edu/fileadmin/counseling/Eating_Disorder_Statistics.pdf. These disorders are more prevalent among adolescent girls, but have been increasing among adolescent boys in recent years. Because eating disorders oftenlead to malnourishment, adolescents with an eating disorder are deprived of the crucial nutrients their still-growing bodies need.

Eating disorders involve extreme behavior related to food and exercise. Sometimes referred to as "starving or stuffing," they encompass a group of conditions marked by undereating or overeating. Some of these conditions include:

- **Anorexia Nervosa.** Anorexia nervosa is a potentially fatal condition characterized by undereating and excessive weight loss. People with this disorder are preoccupied with dieting, calories, and food intake to an unhealthy degree. Anorexics have a poor body image, which leads to anxiety, avoidance of food, a rigid exercise regimen, fasting, and a denial of hunger. The condition predominantly affects females. Between 0.5 and 1 percent of American women and girls suffer from this eating disorder.
- **Binge-Eating Disorder.** People who suffer from binge-eating disorder experience regular episodes of eating an extremely large amount of food in a short period of time. Binge eating is a compulsive behavior, and people who suffer from it typically feel it is beyond their control. This behavior often causes feelings of shame and embarrassment, and leads to obesity, high blood pressure, high cholesterol levels, Type 2 diabetes, and other health problems. Both males and females suffer from binge-eating disorder. It affects 1 to 5 percent of the population.
- **Bulimia Nervosa.** Bulimia nervosa is characterized by alternating cycles of overeating and undereating. People who suffer from it partake in binge eating, followed by compensatory behavior, such as self-induced vomiting, laxative use, and compulsive exercise. As with anorexia, most people with this condition are female. Approximately 1 to 2 percent of American women and girls have this eating disorder.National Eating Disorders Association. "Learn Basic Terms and Information on a Variety of Eating Disorder Topics." Accessed March 5,

6. A behavioral condition that involves extreme attitudes and behaviors toward food and nutrition. These disorders are characterized by overeating or undereating, and include anorexia nervosa, binge-eating disorder, and bulimia nervosa.

2012. http://www.nationaleatingdisorders.org/information-resources/general -information.php.

Eating disorders stem from stress, low self-esteem, and other psychological and emotional issues. It is important for parents to watch for signs and symptoms of these disorders, including sudden weight loss, lethargy, vomiting after meals, and the use of appetite suppressants. Eating disorders can lead to serious complications or even be fatal if left untreated. Treatment includes cognitive, behavioral, and nutritional therapy.

Video 13.4

Eating Disorders: Anorexia

(click to see video)

This video provides more information about the eating disorder anorexia nervosa.

KEY TAKEAWAYS

- Older adolescents experience numerous physical changes and must increase their energy intake to support these changes and meet nutrient needs.
- Nutrient needs are greater during adolescence than at any other time in the life cycle, except during pregnancy.
- The daily energy requirements for ages fourteen to eighteen are 1,800 to 2,400 calories for girls, and 2,000 to 3,200 calories for boys, depending on activity level.
- Nutritional concerns for older adolescents include eating disorders.

DISCUSSION STARTER

1. Research the biological, social, and psychological aspects of eating disorders at this website. Then, brainstorm a list of risk factors and warning signs for parents, teachers, and physicians.

   http://www.nationaleatingdisorders.org/

13.5 Young Adulthood and Nutrition

LEARNING OBJECTIVES

1. Summarize nutritional requirements and dietary recommendations for young adults.
2. Discuss the most important nutrition-related concerns during young adulthood.
3. Explain how nutritional and lifestyle choices can affect current and future health.

With the onset of adulthood, good nutrition can help young adults enjoy an active lifestyle. For most people, this is the time when their bodies are in the best condition. The body of an adult does not need to devote its energy and resources to support the rapid growth and development that characterizes youth. However, the choices made during those formative years can have a lasting impact. Eating habits and preferences developed during childhood and adolescence influence health and fitness into adulthood. Some adults have gotten a healthy start and have established a sound diet and regular activity program, which helps them remain in good condition from young adulthood into the later years. Others carry childhood obesity into adulthood, which adversely affects their health. However, it is not too late to change course and develop healthier habits and lifestyle choices. Therefore, adults must monitor their dietary decisions and make sure their caloric intake provides the energy that they require, without going into excess.

Young Adulthood (Ages Nineteen to Thirty): At Your Peak

At this time, growth is completed and people reach their physical peak. Major organs and body systems have fully matured by this stage of the life cycle. For example, the human body reaches maximum cardiac output between ages twenty and thirty. Also, bone and muscle mass are at optimal levels, and physical activity helps to improve muscle strength, endurance, and tone.Elaine U. Polan, RNC, MS and Daphne R. Taylor, RN, MS, *Journey Across the Life Span: Human Development and Health Promotion* (Philadelphia: F. A. Davis Company, 2003), 192–193. In order to maintain health and fitness at this age, it is important to continue to practice good nutrition. Healthy eating habits promote metabolic functioning, assist repair and regeneration, and prevent the development of chronic conditions. In addition, the goals of a young adult, such as beginning a career or seeking out romantic relationships, can be supported with good habits.

Energy

Young men typically have higher nutrient needs than young women. For ages nineteen to thirty, the energy requirements for women are 1,800 to 2,400 calories, and 2,400 to 3,000 calories for men, depending on activity level. These estimates do not include women who are pregnant or breastfeeding, who require a higher energy intake (see Chapter 12 "Nutrition through the Life Cycle: From Pregnancy to the Toddler Years").

Macronutrients

For carbohydrates, the AMDR is 45 to 65 percent of daily calories. All adults, young and old, should eat fewer energy-dense carbohydrates, especially refined, sugar-dense sources, particularly for those who lead a more sedentary lifestyle. The AMDR for protein is 10 to 35 percent of total daily calories, and should include a variety of lean meat and poultry, eggs, beans, peas, nuts, and seeds. The guidelines also recommend that adults eat two 4-ounce servings (or one 8-ounce serving) of seafood per week.

It is also important to replace proteins that are high in trans fats and saturated fat with ones that are lower in solid fats and calories. All adults should limit total fat to 20 to 35 percent of their daily calories and keep saturated fatty acids to less than 10 percent of total calories by replacing them with monounsaturated and polyunsaturated fatty acids. Avoid trans fats by limiting foods that contain synthetic sources, such as partially hydrogenated oils. The AMDR for fiber is 22 to 28 grams per day for women and 28 to 34 grams per day for men. Soluble fiber may help improve cholesterol and blood sugar levels, while insoluble fiber can help prevent constipation.

Tools for Change

A healthy diet of nutrient-rich meals incorporates a variety of whole foods. Whole foods are unprocessed or unrefined, or have been created with as little processing as possible. They do not include a lot of added ingredients, such as sugar, sodium, or fat, and are free of preservatives or other chemicals that are often added to food products. Examples of whole foods with no processing include legumes and fresh fruits and vegetables. Examples of whole foods with minimal processing include whole-grain breads and cereals. Dietitians recommend consuming whole foods for a variety of reasons. Whole foods provide nutrients in their natural state, with all of the vitamins and minerals intact. Food processing can remove some nutrients during manufacturing. Also, diets rich in whole foods contain high concentrations of fiber and antioxidants, and can protect against chronic disease.

Micronutrients

Micronutrient needs in adults differ slightly according to sex. Young men and women who are very athletic and perspire a great deal also require extra sodium, potassium, and magnesium. Males require more of vitamins C and K, along with thiamine, riboflavin, and niacin. Females require extra iron due to menstruation. Therefore, it can be beneficial for some young adults to follow a daily multivitamin regimen to help meet nutrient needs. But as always, it is important to remember "food first, supplements second." Table 13.4 "Micronutrient Levels during Adulthood" shows the micronutrient recommendations for adult men and women.

Table 13.4 Micronutrient Levels during Adulthood

Nutrient	Adult Males	Adult Females
Vitamin A (mcg)	900.0	700.0
Vitamin B_6 (mg)	1.3	1.3
Vitamin B_{12} (mcg)	2.4	2.4
Vitamin C (mg)	90.0	75.0
Vitamin D (mcg)	5.0	5.0
Vitamin E (mg)	15.0	15.0
Vitamin K (mcg)	120.0	90.0

Nutrient	Adult Males	Adult Females
Calcium (mg)	1,000.0	1,000.0
Folate (mcg)	400.0	400.0
Iron (mg)	8.0	18.0
Magnesium (mg)	400.0	310.0
Niacin (B_3) (mg)	16.0	14.0
Phosphorus (mg)	700.0	700.0
Riboflavin (B_2) (mg)	1.3	1.1
Selenium (mcg)	55.0	55.0
Thiamine (B_1) (mg)	1.2	1.1
Zinc (mg)	11.0	8.0

Source: Institute of Medicine. http://www.iom.edu.

Nutritional Concerns in Young Adulthood

There are a number of intake recommendations for young adults. According to the IOM, an adequate intake (AI) of fluids for men is 3.7 liters per day, from both food and liquids. The AI for women is 2.7 liters per day, from food and liquids.Institute of Medicine. "Dietary Reference Intakes: Water, Potassium, Sodium, Chloride, and Sulfate." Accessed March 5, 2012. http://www.iom.edu/Reports/2004/Dietary-Reference-Intakes-Water-Potassium-Sodium-Chloride-and-Sulfate.aspx.

It is best when fluid intake is from water, instead of sugary beverages, such as soda. Fresh fruits and vegetables, including watermelon and cucumbers, are excellent food sources of fluid.

In addition, young adults should avoid consuming excessive amounts of sodium. The health consequences of high sodium intake include high blood pressure and its complications. Therefore, it is best to limit sodium to less than 2,300 milligrams per day.

Gastrointestinal Integrity

Good nutrition during the young adult years can help to support gastrointestinal integrity and prevent digestive disorders, such as constipation and diarrhea. Dietary fiber helps bind indigestible food together and normalize bowel

movements. It also holds more water in the stool to make it softer for those who suffer from constipation. Excellent sources of fiber include oats, barley, rye, wheat, brown rice, celery, carrots, nuts, seeds, dried beans, oranges, and apples. In addition, healthy intestinal microflora can be supported by prebiotics, which stimulate the growth of beneficial bacteria already in the colon and are found in fruits and vegetables, and probiotics, which change or improve the bacterial balance in the gut and are found in yogurt.

Obesity during Adulthood

Obesity remains a major concern into young adulthood. For adults, a BMI above 25 is considered overweight, and a BMI of 30 or higher is obese. By that measurement, about two-thirds of all adults in the United States are overweight or obese, with 35.7 percent considered to be obese.Centers for Disease Control, National Center for Health Statistics. "Prevalence of Obesity in the United States, 2009–2010." *NCHS Data Brief*, No. 82, January 2012, accessed on March 5, 2012. http://www.cdc.gov/nchs/data/databriefs/db82.pdf. As during childhood and adolescence, physical inactivity and poor dietary choices are major contributors to obesity in adulthood. Solid fats, alcohol, and added sugars (SoFAAS) make up 35 percent of total calories for most people, leading to high levels of saturated fat and cholesterol and insufficient dietary fiber. Therefore, it is important to limit unrefined carbohydrates and processed foods.

KEY TAKEAWAYS

- Young adults typically have reached their physical peak and can support health and wellness with adequate nutrition and exercise.
- For ages nineteen to thirty, the daily energy requirements are 1,800 to 2,400 calories for women and 2,400 to 3,000 calories for men, depending on activity level.
- Nutritional concerns for young adults include adequate energy and fluid intake, sodium intake, and the consumption of fiber.
- Young adults should avoid consuming solid fats, added sugars, and alcohol in excess.

DISCUSSION STARTER

1. How does your intake of carbohydrates, proteins, and fats compare to the AMDR? What can you do to make changes and meet the nutritional recommendations?

13.6 Middle Age and Nutrition

LEARNING OBJECTIVES

1. Summarize nutritional requirements and dietary recommendations for middle-aged adults.
2. Discuss the most important nutrition-related concerns during middle age.
3. Define "preventive nutrition" and give an applied example.

During this stage of the human life cycle, adults begin to experience the first outward signs of aging. Wrinkles begin to appear, joints ache after a highly active day, and body fat accumulates. There is also a loss of muscle tone and elasticity in the connective tissue.Elaine U. Polan, RNC, MS and Daphne R. Taylor, RN, MS, *Journey Across the Life Span: Human Development and Health Promotion* (Philadelphia: F. A. Davis Company, 2003), 212–213. Throughout the aging process, good nutrition can help middle-aged adults maintain their health and recover from any medical problems or issues they may experience.

Middle Age (Ages Thirty-One to Fifty): Aging Well

Many people in their late thirties and in their forties notice a decline in endurance, the onset of wear-and-tear injuries (such as osteoarthritis), and changes in the digestive system. Wounds and other injuries also take longer to heal. Body composition changes due to fat deposits in the trunk. To maintain health and wellness during the middle-aged years and beyond, it is important to:

- maintain a healthy body weight
- consume nutrient-dense foods
- drink alcohol moderately or not at all
- be a nonsmoker
- engage in moderate physical activity at least 150 minutes per week

Energy

The energy requirements for ages thirty-one to fifty are 1,800 to 2,200 calories for women and 2,200 to 3,000 calories for men, depending on activity level. These estimates do not include women who are pregnant or breastfeeding (see Chapter 12 "Nutrition through the Life Cycle: From Pregnancy to the Toddler Years"). Middle-

aged adults must rely on healthy food sources to meet these needs. In many parts of North America, typical dietary patterns do not match the recommended guidelines. For example, five foods—iceberg lettuce, frozen potatoes, fresh potatoes, potato chips, and canned tomatoes—account for over half of all vegetable intake.Adam Drewnowski and Nicole Darmon. "Food Choices and Diet Cost: an Economic Analysis." *The Journal of Nutrition*. © 2005 The American Society for Nutritional Sciences. Accessed March 5, 2012. http://jn.nutrition.org/content/135/4/900.full. Following the dietary guidelines in the middle-aged years provides adequate but not excessive energy, macronutrients, vitamins, and minerals.

Video 13.5

Caloric Restriction

(click to see video)

This video focuses on the possible connection between caloric restriction and longevity.

Macronutrients and Micronutrients

The AMDRs for carbohydrates, protein, fat, fiber, and fluids remain the same from young adulthood into middle age (see Section 13.5 "Young Adulthood and Nutrition" of this chapter). It is important to avoid putting on excess pounds and limiting an intake of SoFAAS to help avoid cardiovascular disease, diabetes, and other chronic conditions.

There are some differences, however, regarding micronutrients. For men, the recommendation for magnesium increases to 420 milligrams daily, while middle-aged women should increase their intake of magnesium to 320 milligrams per day. Other key vitamins needed during the middle-aged years include folate and vitamins B_6 and B_{12} to prevent elevation of homocysteine, a byproduct of metabolism that can damage arterial walls and lead to atherosclerosis, a cardiovascular condition. Again, it is important to meet nutrient needs with food first, then supplementation, such as a daily multivitamin, if you can't meet your needs through food.

Preventive/Defensive Nutrition

Brightly colored tomatoes are another example of foods that are high in antioxidants.

© Thinkstock

During the middle-aged years, **preventive nutrition**[7] can promote wellness and help organ systems to function optimally throughout aging. Preventive nutrition is defined as dietary practices directed toward reducing disease and promoting health and well-being. Healthy eating in general—such as eating unrefined carbohydrates instead of refined carbohydrates and avoiding trans fats and saturated fats—helps to promote wellness. However, there are also some things that people can do to target specific concerns. One example is consuming foods high in antioxidants, such as strawberries, blueberries, and other colorful fruits and vegetables, to reduce the risk of cancer.

Phytochemicals are compounds in fruits and vegetables that act as defense systems for plants. Different phytochemicals are beneficial in different ways. For example, carotenoids, which are found in carrots, cantaloupes, sweet potatoes, and butternut squash, may protect against cardiovascular disease by helping to prevent the oxidation of cholesterol in the arteries, although research is ongoing.Sari Voutilainen, Tarja Nurmi, Jaakko Mursu, and Tiina H. Rissanen. "Carotenoids and Cardiovascular Health." *Am J Clin Nutr* 83 (2006): 1265–71. http://www.ajcn.org/content/83/6/1265.full.pdf. According to the American Cancer Society, some studies suggest that a phytochemical found in watermelons and tomatoes called lycopene may protect against stomach, lung, and prostate cancer, although more research is needed.American Cancer Society. "Lycopene." Last revised May 13, 2010. http://www.cancer.org/Treatment/TreatmentsandSideEffects/ComplementaryandAlternativeMedicine/DietandNutrition/lycopene.

Omega-3 fatty acids can help to prevent coronary artery disease. These crucial nutrients are found in oily fish, including salmon, mackerel, tuna, herring, cod, and halibut. Other beneficial fats that are vital for healthy functioning include monounsaturated fats, which are found in plant oils, avocados, peanuts, and pecans.

Menopause

In the middle-aged years, women undergo a specific change that has a major effect on their health. They begin the process of menopause, typically in their late forties or early fifties. The ovaries slowly cease to produce estrogen and progesterone, which results in the end of menstruation. Menopausal symptoms can vary, but

7. The use of dietary practices to reduce disease and promote health and well-being.

often include hot flashes, night sweats, and mood changes. The hormonal changes that occur during menopause can lead to a number of physiological changes as well, including alterations in body composition, such as weight gain in the abdominal area. Bone loss is another common condition related to menopause due to the loss of female reproductive hormones. Bone thinning increases the risk of fractures, which can affect mobility and the ability to complete everyday tasks, such as cooking, bathing, and dressing.Academy of Nutrition and Dietetics. "Eating Right During Menopause." © 1995–2012. Accessed March 5, 2012. http://www.eatright.org/Public/content.aspx?id=6809. Recommendations for women experiencing menopause or perimenopause (the stage just prior to the end of the menstruation) include:

- consuming a variety of whole grains, and other nutrient-dense foods
- maintaining a diet high in fiber, low in fat, and low in sodium
- avoiding caffeine, spicy foods, and alcohol to help prevent hot flashes
- eating foods rich in calcium, or taking physician-prescribed calcium supplements and vitamin D
- doing stretching exercises to improve balance and flexibility and reduce the risk of falls and fractures

KEY TAKEAWAYS

- Middle-aged adults begin to experience signs of aging and must continue to support their health and wellness with nutrition and exercise.
- The daily energy requirements for ages thirty-one to fifty are 1,800 to 2,200 calories for women and 2,200 to 3,000 calories for men, depending on activity level.
- Nutritional concerns for middle-aged adults relate to menopause and the prevention of chronic disease.

DISCUSSION STARTER

1. Visit the following websites to learn more about nutrition during the years of perimenopause and menopause. Discuss with classmates what you believe to be the three most important nutritional concerns for women during this phase of life.

   http://www.medicinenet.com/script/main/art.asp?articlekey=59895

   http://www.webmd.com/menopause/guide/staying-healthy-through-good-nuitrition

13.7 Old Age and Nutrition

LEARNING OBJECTIVES

1. Summarize nutritional requirements and dietary recommendations for elderly adults.
2. Discuss the most important nutrition-related concerns during the senior years.
3. Discuss the influence of diet on health and wellness in old age.

Beginning at age fifty-one, requirements change once again and relate to the nutritional issues and health challenges that older people face. After age sixty, blood pressure rises and the immune system may have more difficulty battling invaders and infections. The skin becomes more wrinkled and hair has turned gray or white or fallen out, resulting in hair thinning. Older adults may gradually lose an inch or two in height. Also, short-term memory might not be as keen as it once was.Beverly McMillan, *Illustrated Atlas of the Human Body* (Sydney, Australia: Weldon Owen, 2008), 260.

In addition, many people suffer from serious health conditions, such as cardiovascular disease and cancer. Being either underweight or overweight is also a major concern for the elderly. However, many older adults remain in relatively good health and continue to be active into their golden years. Good nutrition is often the key to maintaining health later in life. In addition, the fitness and nutritional choices made earlier in life set the stage for continued health and happiness.

Older Adulthood (Ages Fifty-One and Older): The Golden Years

An adult's body changes during old age in many ways, including a decline in hormone production, muscle mass, and strength. Also in the later years, the heart has to work harder because each pump is not as efficient as it used to be. Kidneys are not as effective in excreting metabolic products such as sodium, acid, and potassium, which can alter water balance and increase the risk for over- or underhydration. In addition, immune function decreases and there is lower efficiency in the absorption of vitamins and minerals.

Older adults should continue to consume nutrient-dense foods and remain physically active. However, deficiencies are more common after age sixty, primarily due to reduced intake or malabsorption. The loss of mobility among frail, homebound elderly adults also impacts their access to healthy, diverse foods.

Regular exercise, along with a nutritious diet, can help older adults maintain their health.

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Energy

Due to reductions in lean body mass and metabolic rate, older adults require less energy than younger adults. The energy requirements for people ages fifty-one and over are 1,600 to 2,200 calories for women and 2,000 to 2,800 calories for men, depending on activity level. The decrease in physical activity that is typical of older adults also influences nutritional requirements.

Macronutrients

The AMDRs for carbohydrates, protein, and fat remain the same from middle age into old age (see Section 13.5 "Young Adulthood and Nutrition" of this chapter for specifics). Older adults should substitute more unrefined carbohydrates for refined ones, such as whole grains and brown rice. Fiber is especially important in preventing constipation and diverticulitis, and may also reduce the risk of colon cancer. Protein should be lean, and healthy fats, such as omega-3 fatty acids, are part of any good diet.

Micronutrients

An increase in certain micronutrients can help maintain health during this life stage. The recommendations for calcium increase to 1,200 milligrams per day for both men and women to slow bone loss. Also to help protect bones, vitamin D recommendations increase to 10–15 micrograms per day for men and women. Vitamin B_6 recommendations rise to 1.7 milligrams per day for older men and 1.5 milligrams per day for older women to help lower levels of homocysteine and protect against cardiovascular disease. As adults age, the production of stomach acid can decrease and lead to an overgrowth of bacteria in the small intestine. This can affect the absorption of vitamin B_{12} and cause a deficiency. As a result, older adults need more B_{12} than younger adults, and require an intake of 2.4 micrograms per day, which helps promote healthy brain functioning. For elderly women, higher iron levels are no longer needed postmenopause and recommendations decrease to 8 milligrams per day. People over age fifty should eat foods rich with all of these micronutrients.

Nutritional Concerns for Older Adults

Dietary choices can help improve health during this life stage and address some of the nutritional concerns that many older adults face. In addition, there are specific concerns related to nutrition that affect adults in their later years. They include medical problems, such as disability and disease, which can impact diet and activity level. For example, dental problems can lead to difficulties with chewing and swallowing, which in turn can make it hard to maintain a healthy diet. The use of dentures or the preparation of pureed or chopped foods can help solve this problem. There also is a decreased thirst response in the elderly, and the kidneys have a decreased ability to concentrate urine, both of which can lead to dehydration.

Sensory Issues

At about age sixty, taste buds begin to decrease in size and number. As a result, the **taste threshold**[8] is higher in older adults, meaning that more of the same flavor must be present to detect the taste. Many elderly people lose the ability to distinguish between salty, sour, sweet, and bitter flavors. This can make food seem less appealing and decrease the appetite. An intake of foods high in sugar and sodium can increase due to an inability to discern those tastes. The sense of smell also decreases, which impacts attitudes toward food. Sensory issues may also affect the digestion because the taste and smell of food stimulates the secretion of digestive enzymes in the mouth, stomach, and pancreas.

Gastrointestinal Problems

A number of gastrointestinal issues can affect food intake and digestion among the elderly. Saliva production decreases with age, which affects chewing, swallowing, and taste. Digestive secretions decline later in life as well, which can lead to atrophic gastritis (inflammation of the lining of the stomach). This interferes with the absorption of some vitamins and minerals. Reduction of the digestive enzyme lactase results in a decreased tolerance for dairy products. Slower gastrointestinal motility can result in more constipation, gas, and bloating, and can also be tied to low fluid intake, decreased physical activity, and a diet low in fiber, fruits, and vegetables.

Dysphagia

Some older adults have difficulty getting adequate nutrition because of the disorder dysphagia, which impairs the ability to swallow. Any damage to the parts of the brain that control swallowing can result in dysphagia, therefore stroke is a common cause. Dysphagia is also associated with advanced dementia because of overall brain

8. Minimum concentration at which taste sensitivity to a food or substance can be perceived.

function impairment. To assist older adults suffering from dysphagia, it can be helpful to alter food consistency. For example, solid foods can be pureed, ground, or chopped to allow more successful and safe swallow. This decreases the risk of aspiration, which occurs when food flows into the respiratory tract and can result in pneumonia. Typically, speech therapists, physicians, and dietitians work together to determine the appropriate diet for dysphagia patients.

Video 13.6

Dysphagia

(click to see video)

This video provides information about the symptoms and complications of dysphagia.

Obesity in Old Age

Similar to other life stages, obesity is a concern for the elderly. Adults over age sixty are more likely to be obese than young or middle-aged adults. As explained throughout this chapter, excess body weight has severe consequences. Being overweight or obese increases the risk for potentially fatal conditions that can afflict the elderly. They include cardiovascular disease, which is the leading cause of death in the United States, and Type 2 diabetes, which causes about seventy thousand deaths in the United States annually.Centers for Disease Control, National Center for Health Statistics. "Deaths and Mortality." Last updated January 27, 2012. http://www.cdc.gov/nchs/fastats/deaths.htm. Obesity is also a contributing factor for a number of other conditions, including arthritis.

For older adults who are overweight or obese, dietary changes to promote weight loss should be combined with an exercise program to protect muscle mass. This is because dieting reduces muscle as well as fat, which can exacerbate the loss of muscle mass due to aging. Although weight loss among the elderly can be beneficial, it is best to be cautious and consult with a health-care professional before beginning a weight-loss program.

The Anorexia of Aging

In addition to concerns about obesity among senior citizens, being underweight can be a major problem. A condition known as the **anorexia of aging**[9] is characterized by poor food intake, which results in dangerous weight loss. This major health problem among the elderly leads to a higher risk for immune deficiency, frequent falls, muscle loss, and cognitive deficits. Reduced muscle mass and physical activity

9. A condition that affects the elderly and is characterized by poor food intake.

mean that older adults need fewer calories per day to maintain a normal weight. It is important for health care providers to examine the causes for anorexia of aging among their patients, which can vary from one individual to another. Understanding why some elderly people eat less as they age can help health-care professionals assess the risk factors associated with this condition. Decreased intake may be due to disability or the lack of a motivation to eat. Also, many older adults skip at least one meal each day. As a result, some elderly people are unable to meet even reduced energy needs.

Nutritional interventions should focus primarily on a healthy diet. Remedies can include increasing the frequency of meals and adding healthy, high-calorie foods (such as nuts, potatoes, whole-grain pasta, and avocados) to the diet. Liquid supplements between meals may help to improve caloric intake.Morley, J. E. "Anorexia of Aging: Physiologic and Pathologic." *Am J Clin Nutr* 66 (1997): 760–73. http://www.ajcn.org/content/66/4/760.full.pdf. Health care professionals should consider a patient's habits and preferences when developing a nutritional treatment plan. After a plan is in place, patients should be weighed on a weekly basis until they show improvement.

Vision Problems

Many older people suffer from vision problems and a loss of vision. Age-related macular degeneration is the leading cause of blindness in Americans over age sixty.American Medical Association, *Complete Guide to Prevention and Wellness* (Hoboken, NJ: John Wiley & Sons, Inc., 2008), 413. This disorder can make food planning and preparation extremely difficult and people who suffer from it often must depend on caregivers for their meals. Self-feeding also may be difficult if an elderly person cannot see his or her food clearly. Friends and family members can help older adults with shopping and cooking. Food-assistance programs for older adults (such as Meals on Wheels) can also be helpful.

Diet may help to prevent macular degeneration. Consuming colorful fruits and vegetables increases the intake of lutein and zeaxanthin. Several studies have shown that these antioxidants provide protection for the eyes. Lutein and zeaxanthin are found in green, leafy vegetables such as spinach, kale, and collard greens, and also corn, peaches, squash, broccoli, Brussels sprouts, orange juice, and honeydew melon.American Medical Association, *Complete Guide to Prevention and Wellness* (Hoboken, NJ: John Wiley & Sons, Inc., 2008), 415.

Neurological Conditions

Elderly adults who suffer from dementia may experience memory loss, agitation, and delusions. One in eight people over the age sixty-four and almost half of all people over eighty-five suffer from Alzheimer's, which is the most common form of dementia. These conditions can have serious effects on diet and nutrition as a person increasingly becomes incapable of caring for himself or herself, which includes the ability to buy and prepare food, and to self-feed.

Longevity and Nutrition

The foods you consume in your younger years influence your health as you age. Good nutrition and regular physical activity can help you live longer and healthier. Conversely, poor nutrition and a lack of exercise can shorten your life and lead to medical problems. The right foods provide numerous benefits at every stage of life. They help an infant grow, an adolescent develop mentally and physically, a young adult achieve his or her physical peak, and an older adult cope with aging. Nutritious foods form the foundation of a healthy life at every age.

KEY TAKEAWAYS

- As adults age, physical changes impact nutrient needs and can result in deficiencies.
- The daily energy requirements for adults ages fifty-one and over are 1,600 to 2,200 calories for women and 2,000 to 2,800 calories for men, depending on activity level.
- Older adults are more susceptible to medical problems, such as disability and disease, which can impact appetite, the ability to plan and prepare food, chewing and swallowing, self-feeding, and general nutrient intake.
- A nutrient-dense, plant-based diet can help prevent or support the healing of a number of disorders that impact the elderly, including macular degeneration and arthritis.

DISCUSSION STARTER

1. Revisit the predictions you made at the beginning of this chapter about how nutrient needs might change as a healthy young adult matures into old age. Which predictions were correct? Which were incorrect? What have you learned?

13.8 End-of-Chapter Exercises

IT'S YOUR TURN

1. Visit http://www.choosemyplate.gov/ to research suggestions to help kids eat healthier foods. Create a list of tips for parents.
2. Visit http://www.webmd.com/diet/food-fitness-planner/default.htm to create a food and fitness plan that fits your current height, weight, and lifestyle.
3. Create a list of nutritional tips for adults who are caring for their elderly parents after watching the following video:

   Nutrition for Senior Citizens

   (click to see video)

APPLY IT

1. Visit http://www.health.gov/paguidelines/guidelines/default.aspx to study the *2008 Physical Activity Guidelines for Americans*. Then create a chart that suggests physical activities for teens, young adults, and middle-aged adults, and includes the amount of physical activity recommended for each group per week.
2. How do the physical changes that a preteen experiences during puberty relate to changing nutrient needs? Hold a small group discussion to talk about puberty and nutrition.
3. Research ways to help an older adult who suffers from poor intake to get enough nutrients at the following website: http://www.clevelandclinicmeded.com/medicalpubs/diseasemanagement/preventive-medicine/aging-preventive-health/. Then create a brochure for patients to explain your findings.

EXPAND YOUR KNOWLEDGE

1. Write a short speech that you would give to a group of school children between ages nine and thirteen. Explain to them how their sugar intake impacts their bodies and overall well-being.
2. Consider the changing needs of an older adolescent, along with a teen's access to food and desire to make dietary choices. Then create a three-day meal plan for a teenage boy or girl.

3. After watching the video, hold a small group discussion to discuss the influence of environment, economics, culture, and lifestyle on dietary choices.

The Obesity Epidemic

(click to see video)

Chapter 14

Nutrition and Society: Food Politics and Perspectives

Big Idea

Sustainability promotes nutrition today and protects natural resources for tomorrow.

As discussed in previous chapters, sustainability is a word that's often talked about in the realm of food and nutrition. The term relates to the goal of achieving a world that meets the needs of its present inhabitants while preserving resources for future generations. As awareness about sustainability has increased among the media and the public, both agricultural producers and consumers have made more of an effort to consider how the choices they make today will impact the planet tomorrow.

Raising free-range chickens that feed out in the open is one example of a sustainable agricultural practice.

© Thinkstock

However, defining sustainability can be difficult because the term means different things to different groups. For most, sustainable agriculture can best be described as an umbrella term that encompasses food production and consumption practices that do not harm the environment, that do support agricultural communities, and that are healthy for the consumer.Sustainable Table. "Introduction to Sustainability." Accessed October 10, 2011. http://www.sustainabletable.org/intro/. From factory farms to smaller-scale ranches and granges, sustainable farming practices are being implemented more and more as the long-term viability of the current production system has been called into question.

Yet, the concept of sustainability is not new to agricultural science, practice, or even policy. It has evolved throughout modern history as a way to achieve self-reliance. It is also a vehicle for maintaining rural communities and supporting the concept of conservation and protection of the land.Ecological Agriculture Projects. "A History of Sustainable Agriculture." © 1990 Rod MacRae. http://eap.mcgill.ca/

AASA_1.htm. In 1990, the US federal government defined sustainable agriculture in a piece of legislation known as the Farm Bill. The practice was described as an integrated system of plant and animal production that satisfies human needs for food, along with fiber for fabric and other uses. The Farm Bill further defines sustainable agriculture as a practice that enhances environmental quality and also the natural resource base upon which the agricultural economy depends. Sustainable agriculture also makes the most efficient use of nonrenewable resources, sustains the economic viability of farm operations, and supports the quality of life for farmers and society as a whole.Gold, M.V. "Sustainable Agriculture: Definitions and Terms." US Department of Agriculture, National Agricultural Library. *Special Reference Briefs Series* no. SRB 99-02 (September 1999, August 2007). http://www.nal.usda.gov/afsic/pubs/terms/srb9902.shtml#toc1.

In other words, the practice of sustainable agriculture strives to eschew conventional farming methods, including the cultivation of single crops and row crops continuously over many seasons, the dependency on agribusiness, and the rearing of livestock in concentrated, confined systems.Gold, M.V. "Sustainable Agriculture: Definitions and Terms." US Department of Agriculture, National Agricultural Library. *Special Reference Briefs Series* no. SRB 99-02 (September 1999, August 2007). http://www.nal.usda.gov/afsic/pubs/terms/srb9902.shtml#toc1. Instead, sustainability includes a focus on biodiversity among both crops and livestock; conservation and preservation to replenish the soil, air, and water; animal welfare; and fair treatment and wages for farm workers.Sustainable Table. "What Is Sustainable Agriculture?" Accessed October 10, 2011. http://www.sustainabletable.org/intro/whatis/. Sustainable agriculture also encourages the health of consumers by rejecting extensive use of pesticides and fertilizers and promoting the consumption of organic, locally produced food. Although many farmers and food companies work to implement these practices, some use the idea of sustainability to attract consumers without completely committing to the concept. "Greenwashing" is a derisive term (similar to "whitewashing") for a corporation or industry falsely utilizing a proenvironmental image or message to expand its market base.

Sustainability depends not only on agricultural producers, but also on consumers. The average person can do a number of things to consume a more sustainable diet, from eating less meat to purchasing fruits and vegetables grown on nearby farms. For example, produce sold in the Midwest typically travels an average of more than fifteen hundred miles from farm to supermarket. However, increasing the consumption of more locally-grown produce by 10 percent would save thousands of gallons in fossil fuel each year.Heller, M. C., G. A. Keoleian. "US Food System Factsheet." Center for Sustainable Systems, University of Michigan. *CSS Factsheets*, no. CSS01-06 (2001). http://www.css.snre.umich.edu/publication/css-factsheets-us-food-system.

You Decide

How will you adapt your lifestyle and dietary choices to help promote sustainable agricultural practices?

Some consumers are choosing to make smarter nutritional choices, eat healthier foods, and enjoy fresh, locally grown products. They read the labels on products in their local stores, make more home-cooked meals using whole-food ingredients, and pay attention to the decisions that legislators and other officials make regarding food production and consumption. Will you be one of them? How you can adjust your dietary selections to benefit not only your body and mind but also to help sustain the planet for future generations?

Video 14.1

Green Careers: Sustainable Agriculture

(click to see video)

This video focuses on the role of a farm manager on a small farm that follows sustainable agricultural practices.

14.1 Historical Perspectives on Food

LEARNING OBJECTIVE

1. Contrast ancient perspectives on food and nutrition with more modern explanatory systems.

Throughout history, our relationship with food has been influenced by changing practices and perspectives. From the invention of agriculture to the birth of refrigeration, technological advances have also affected what we eat and how we feel about our food. Therefore, it can be helpful to examine theories and customs related to diet and nutrition across different civilizations and time periods.

Civilizations and Time Periods

Flatbread made from barley or wheat was a staple in the traditional diet during the ancient era.

© Thinkstock

Diet and cuisine have undergone enormous changes from ancient times to today. The basic diet of the ancient era consisted of cereals, legumes, oil, and wine. These staples were supplemented by vegetables and meat or fish, along with other items, such as honey and salt. During the Middle Ages, poor people consumed meager diets that consisted of small game supplemented with either barley, oat, or rye, while the wealthy had regular access to meat and fish, along with wheat.Our Food Recipes. "European Medieval Food." © 2011–2012. http://www.our-food-recipes.com/medieval-food.html. During the Industrial Revolution, diets became more varied, partly because of the development of refrigeration and other forms of food preservation. In the contemporary era, many people have access to a wide variety of food that is grown locally or shipped from far-off places.

Hunters and Gatherers

Human beings lived as hunters and gatherers until the invention of agriculture. Following a nomadic lifestyle, early people hunted, fished, and gathered fruit and wild berries, depending on their location and the availability of wild plants and wild game. To aid their constant quest for food, humans developed weapons and tools,

including spears, nets, traps, fishing tackle, and the bow and arrow.Our Food Recipes. “Pre Historic Food.” © 2011–2012. http://www.our-food-recipes.com/pre-historic-food.html.

The Beginning of Agriculture

About ten thousand years ago, people began to cultivate crops and domesticate livestock in Mesopotamia, an area of the world that is known today as the Middle East. Agriculture flourished in this region due to the fertile floodplain between the Euphrates and Tigris Rivers, and early crops included wheat, barley, and dates. The development of agriculture not only enriched the diet of these early people, it also led to the birth of civilization as farmers began to settle into sizable, stable communities.Bioworld. “History of Agriculture.” Accessed October 10, 2011. http://www.bioworldusa.com/agriculture/history-agriculture.

One of the most fertile regions of the ancient world was located along the Nile River Valley in ancient Egypt. The rich soil yielded several harvests per year. Common crops were barley, wheat, lentils, peas, and cabbage, along with grapes, which were used to make wine. Even poor Egyptians ate a reasonably healthy diet that included fish, vegetables, and fruit. However, meat was primarily a privilege of the rich. Popular seasonings of this era included salt, pepper, cumin, coriander, sesame, fennel, and dill.Experience Ancient Egypt. “Ancient Egyptian Food: The Pharaonic Diet.” © 2009–2011. http://www.experience-ancient-egypt.com/ancient-egyptian-food.html.

The "Three Sisters"

Thousands of years ago, across an area that encompasses Mexico and Central America today,Foundation for the Advancement of Mesoamerican Studies. "Mesoamerica." Accessed October 10, 2011. http://www.famsi.org/. Mesoamerican farmers cultivated three major plants—squash, beans, and maize (also known as corn). Known as the "three sisters," these crops proved to be both complementary and sustainable. Corn provides a pole for bean vines to climb. The roots of bean vines provide nitrogen that helps corn grow. These vines also stabilize corn stalks by making them less vulnerable to the wind. Shallow-rooted squash vines prevent the evaporation of soil moisture, while their spiny plants discourage predators. Both of these attributes aid the cultivation of all three crops.Renee's Garden. "Celebrate the Three Sisters," During the post-Columbian era, Native American groups adopted the practice of interplanting squash, beans, and maize, and now thousands of years later, many small farmers continue to cultivate the "three sisters."

Meals Determined Social Status

In ancient Rome, differences in social standing affected the diet. For people of all socioeconomic classes, breakfast and lunch were typically light meals that were often consumed in taverns and cafes. However, dinners were eaten at home and were taken much more seriously. Wealthy senators and landowners ate meals with multiple courses, including appetizers, entrees, and desserts. Rich Romans also held extravagant dinner parties, where guests dined on exotic foods, such as roasted ostrich or pheasant. In contrast, people of the lower classes ate mostly bread and cereals.PBS. "Home Life." *The Roman Empire in the First Century*. © 2006 Devillier Donegan Enterprises. http://www.pbs.org/empires/romans/empire/home.html. The average person ate out of clay dishes, while wealthy people used bronze, gold, or silver.

Social status determined the kinds of food that people consumed in many other parts of the world as well. In ancient China, emperors used their wealth and power to hire the best chefs and acquire delicacies, such as honey, to sweeten food. Dishes of the ancient era included steamed Mandarin fish, rice and wheat noodles, and fried prawns. Imperial cuisine also included improved versions of dishes that were consumed by the common people, such as soups and cereals.China.org. "The History of Chinese Imperial Cuisines." © China Information Center. Accessed December 5, 2011. http://www.china.org.cn/english/imperial/25995.htm.

The Medieval Era

The eating habits of most people during the Medieval Era depended mainly on location and financial status. In the feudal system of Europe, the majority of the population could not afford to flavor their food with extravagant spices or sugar. In addition, transporting food was either outrageously expensive or out of the question due to the inability to preserve food for a long period of time. As a result, the common diet consisted of either wheat, meat, or fish, depending on location. The typical diet of the lower classes was based on cereals and grains, porridge, and gruel. These staples were supplemented with seasonal fruits, vegetables, and herbs. Wine, beer, and cider were also common, and were often safer to drink than the unsanitized, untreated water.

The Crusades

During the Medieval Era, soldiers from Europe waged war over religion in the Middle East in military campaigns that came to be known as the Crusades. Upon their return, the crusaders brought back new foods and spices, exposing Europeans of the Middle Ages to unusual flavors. Cooking with exotic spices, such as black pepper, saffron, and ginger, became associated with wealth because they were expensive and had to be imported.

Food Preservation in the Past

During the Medieval and Renaissance eras, most meals consisted of locally grown crops because it was extremely difficult to transport food over long distances. This was mostly due to an inability to preserve food for long periods. At that time, food preservation consisted mostly of drying, salting, and smoking. Pickling, which is also known as brining or corning, was another common practice and involved the use of fermentation to preserve food.

The Modern Era

The modern era began in North America and Europe with the dawn of the Industrial Age. Before that period, people predominantly lived in agrarian communities. Farming played an important role in the development of the United States and Canada. Almost all areas of the country had agrarian economies dictated by the harvesting seasons.

In the 1800s, society began to change as new machines made it easier to cultivate crops, and to package, ship, and store food. The invention of the seed drill, the steel plow, and the reaper helped to speed up planting and harvesting. Also, food could be transported more economically as a result of developments in rail and

refrigeration. These and other changes ushered in the modern era and affected the production and consumption of food.

Food Preservation in Modern Times

Technological innovations during the 1800s and 1900s also changed the way we cultivate, prepare, and think about food. The invention and refinement of the refrigerator and freezer made it possible for people to store food for much longer periods. This, in turn, allowed for the transportation of food over greater distances. For example, oranges grown in Florida would still be fresh when they arrived in Seattle.

Prior to refrigeration, people relied on a number of different methods to store and preserve food, such as pickling. Other preservation techniques included using sugar or honey, canning, and preparing a confit, which is one of the oldest ways to preserve food and involves salting meat and cooking it in its own fat. To store foods for long periods, people used iceboxes or kept vegetables, such as potatoes, onions, and winter squash, in cellars during the winter months.

The Great Depression

During the Great Depression of the 1930s, the United States faced incredible food shortages and many people went hungry. This was partly because extreme droughts turned parts of the Midwest into a Dust Bowl, where farmers struggled to raise crops. Millions of Americans were unemployed or underemployed and were forced to wait in long breadlines for free food. This was also a period of incredible reforms, as the government worked to provide for and protect the people. Some important changes included **subsidies**[1] and support for suffering farmers.

World War II

Food shortages also occurred during World War II in the 1940s. At that time, people voluntarily made due with less to ensure that soldiers training and fighting overseas had the supplies they needed. To focus on saving at home, government programs included rationing food (particularly meat, butter, and sugar), while the media encouraged families to plant their own fruits and vegetables in “victory” (backyard) gardens.

Contemporary Life

Today, agriculture remains a large part of the economy in many developing nations. In fact, nearly 50 percent of the world’s labor is employed in agriculture.Bioworld.

1. Federal funding given to an agricultural producer to provide assistance and support.

"History of Agriculture." Accessed October 10, 2011. http://www.bioworldusa.com/agriculture/history-agriculture. In the United States however, less than 2 percent of Americans produce food for the rest of the population.Gold, M.V. "Sustainable Agriculture: Definitions and Terms." US Department of Agriculture, National Agricultural Library. *Special Reference Briefs Series* no. SRB 99-02 (September 1999, August 2007). http://www.nal.usda.gov/afsic/pubs/terms/srb9902.shtml#toc1. Also, most farms are no longer small-scale or family-owned. Large-scale agribusiness is typical for both crop cultivation and livestock rearing, including concentrated animal feeding operations. Conventional farming practices can include abuses to animals and the land. Therefore, more and more consumers have begun to seek out organic and locally grown foods from smaller-scale farms that are less harmful to the environment.

Other changes also affect food production and consumption in the modern era. The invention of the microwave in the 1950s spurred the growth of frozen foods and TV dinners. Appliances such as blenders and food processors, toasters, coffee and espresso machines, deep fryers, and indoor grills have all contributed to the convenience of food preparation and the kinds of meals that people enjoy cooking and eating.

Diet Trends Over Time

Today, consumers can choose from a huge variety of dietary choices that were not available in the past. For example, strawberries can be purchased in New York City in wintertime, because they are quickly and easily transported from places where the crop is in season, such as California, Mexico, or South America. In the western world, especially in North America, food products are also relatively cheap. As a result, there is much less disparity between the diets of the lower and upper classes than in the past. It would not be unusual to find the same kind of meat or poultry served for dinner in a wealthy neighborhood as in a poorer community.

KEY TAKEAWAYS

- Perspectives and practices related to food and nutrition have greatly changed from the ancient era to today.
- In the ancient world, location and economic status had a profound effect on what people ate. Also, societies often were based on crop cultivation and livestock rearing, which influenced how people ate, worked, and lived.
- During the Medieval Era, people became more exposed to food from other parts of the world because of the growing ability to ship goods and because of the Crusades, among other factors.
- Technological advances, such as refrigeration and the microwave, have had huge effects on the way food is produced and consumed.

DISCUSSION STARTER

1. Compare and contrast the diet of a civilization from the ancient world or the Medieval Era to the food choices of today. In what ways has our diet changed? In what ways has it remained the same?

14.2 The Food Industry

LEARNING OBJECTIVE

1. Explain what is meant by the term "the food industry" and identify the food technologies and innovations that have shaped the current food system.

Agriculture is one of the world's largest industries. It encompasses trillions of dollars and employs billions of people. In the United States alone, customers spent about $500 billion annually on food products at grocery stores and supermarkets.Plunkett Research, Ltd. "US Food Industry Overview." Accessed December 5, 2011, http://www.plunkettresearch.com/food%20beverage%20grocery%20market %20research/industry%20statistics. The food industry includes a complex collective of businesses that touches on everything from crop cultivation to manufacturing and processing, from marketing and advertising to distribution and shipment, to food regulation.

The Food System

The food system is a network of farmers and related operations, including food processing, wholesale and distribution, retail, industry technology, and marketing. The milk industry, for example, includes everything from the farm that raises livestock, to the milking facility that extracts the product, to the processing company that pasteurizes milk and packages it into cartons, to the shipping company that delivers the product to stores, to the markets and groceries that stock and sell the product, to the advertising agency that touts the product to consumers. All of these components play a part in a very large system.

These cows are lined up at a milking facility.

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Food Preservation and Processing

Two important aspects of a food system are preservation and processing. Each provides for or protects consumers in different ways. Food preservation includes the handling or treating of food to prevent or slow down spoilage. Food processing involves transforming raw ingredients into packaged food, from fresh-baked goods

to frozen dinners. Although there are numerous benefits to both, preservation and processing also pose some concerns, in terms of both nutrition and sustainability.

Food Preservation

Food preservation protects consumers from harmful or toxic food. There are different ways to preserve food. Some are ancient methods that have been practiced for generations, such as curing, smoking, pickling, salting, fermenting, canning, and preserving fruit in the form of jam. Others include the use of modern techinques and technology, including drying, vacuum packing, pasteurization, and freezing and refrigeration. Preservation guards against food-bourne illnesses, and also protects the flavor, color, moisture content, or nutritive value of food.

Irradiation

Another method of preservation is **irradiation**[2], which reduces potential pathogens to enhance food safety. This process involves treating food with ionizing radiation, which kills the bacteria and parasites that cause toxicity and disease. Similar technology is used to sterilize surgical instruments to avoid infection.Centers for Disease Control and Prevention. "Food Irradiation." Accessed October 11, 2005. http://www.cdc.gov/ncidod/dbmd/diseaseinfo/foodirradiation.htm. Foods currently approved for irradiation by the FDA include flour, fruits and vegetables, juices, herbs, spices, eggs, and meat and poultry.

Most forms of preservation can affect the quality of food. For example, freezing slightly affects the nutritional content, curing and smoking can introduce carcinogens, and salting greatly increases the sodium. There are also concerns about the effects of using irradiation to preserve food. Studies have shown that this process can change the flavor, texture, color, odor, and nutritional content of food. For example, the yolks of irradiated eggs have less color than nonirradiated eggs.

Food Processing

Food processing includes the methods and techniques used to transform raw ingredients into packaged food. Workers in this industry use harvested crops or slaughtered and butchered livestock to create products that are marketed to the public. There are different ways in which food can be processed, from a one-off product, such as a wedding cake, to a mass-produced product, such as a line of cupcakes packaged and sold in stores.

2. The application of radiation for the purpose of sterilization and the removal of harmful pathogens.

The Pros and Cons of Food Processing

Pictured here are English muffins as they run along a conveyor belt at a bakery production plant.

© Thinkstock

Food processing has a number of important benefits, such as creating products that have a much longer shelf life than raw foods. Also, food processing protects the health of the consumer and allows for easier shipment and the marketing of foods by corporations. However, there are certain drawbacks. Food processing can reduce the nutritional content of raw ingredients. For example, canning involves the use of heat, which destroys the vitamin C in canned fruit. Also, certain food additives that are included during processing, such as high fructose corn syrup, can affect the health of a consumer. However, the level of added sugar can make a major difference. Small amounts of added sugar and other sweeteners, about 6 to 9 teaspoons a day or less, are not considered harmful.American Heart Association. "Sugar and Carbohydrates." Last updated October 12, 2010. http://www.heart.org/HEARTORG/GettingHealthy/NutritionCenter/HealthyDietGoals/Sugars-and-Carbohydrates_UCM_303296_Article.jsp#.

Food Regulation and Control

Food regulatory agencies work to protect the consumer and ensure the safety of our food. Food and drug regulation in the United States began in the late nineteenth century when state and local governments began to enact regulatory policies. In 1906, Congress passed the Pure Food and Drugs Act, which led to the creation of the US Food and Drug Administration (FDA). Today, a number of agencies are in charge of monitoring how food is produced, processed, and packaged.EH.Net Encyclopedia. "History of Food and Drug Regulation in the United States." February 4, 2010. http://eh.net/encyclopedia/article/Law.Food.and.Drug.Regulation.

Regulatory Agencies

Food regulation is divided among different agencies, primarily the FDA and the US Department of Agriculture (USDA). Regulatory agencies in Canada include the Canadian Food Inspection Agency and Health Canada. The North American public depends on these and other agencies to ensure that the food they purchase and consume from supermarkets, restaurants, and other sources is safe and healthy to eat. It can be confusing to know which agency monitors and manages which regulatory practice. For example, the FDA oversees the safety of eggs when they're in the shells, while the USDA is in charge of the eggs once they are out of their shells.

The Food and Drug Administration

The FDA enforces the safety of domestic and imported foods. It also monitors supplements, food labels, claims that corporations make about the benefits of products, and pharmaceutical drugs. Sometimes, the FDA must recall contaminated foods and remove them from the market to protect public health. For example, in 2011 contaminated peanut butter led to the recall of thousands of jars of a few popular brands.US Food and Drug Administration. “FDA 101: Product Recalls—From First Alert to Effectiveness Checks.” Last updated September 9, 2011. http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm049070.htm. Recalls are almost always voluntary and often are requested by companies after a problem has been discovered. In rare cases, the FDA will request a recall. But no matter what triggers the removal of a product, the FDA’s role is to oversee the strategy and assess the adequacy and effectiveness of the recall. You will read more about this practice in Chapter 15 "Achieving Optimal Health: Wellness and Nutrition".

Video 14.2

FDA 101: Product Recalls

(click to see video)

This video explains how the FDA recalls contaminated products to protect consumers.

The US Department of Agriculture

Headed by the Secretary of Agriculture, the USDA develops and executes federal policy on farming and food. This agency supports farmers and ranchers, protects natural resources, promotes trade, and seeks to end hunger in the United States and abroad. The USDA also assures food safety, and in particular oversees the regulation of meat, poultry, and processed egg products.

The Environmental Protection Agency

A third federal government agency, the Environmental Protection Agency (EPA), also plays a role in the regulation of food. The EPA works to protect human health and the environment. Founded in 1970, the agency conducts environmental assessment, education, research, and regulation. The EPA also works to prevent pollution and protect natural resources. Two of its many regulatory practices in the area of agriculture include overseeing water quality and the use of pesticides.

Food Safety and Hazard Analysis

Government regulatory agencies utilize HACCP programs to ensure food safety. HACCP, or hazard analysis and critical control points, is a system used to identify potential hazards and prevent foodbourne illnesses. Some of the seven aspects of an HACCP program include identifying the points in a manufacturing process during which potential hazards could be introduced, establishing corrective actions, and maintaining record-keeping procedures. The USDA uses HACCP to regulate meat, while the FDA uses the seven-point system to monitor seafood and juice. In these industries, HACCP systems are used in all stages of production, processing, packaging, and distribution.US Food and Drug Administration. "Hazard Analysis & Critical Control Points (HACCP)." Last updated April 27, 2011. http://www.fda.gov/food/foodsafety/hazardanalysiscriticalcontrolpointshaccp/default.htm. Currently, the use of HACCP is voluntary for all other food products.

Food Additives

If you examine the label for a processed food product, it is not unusual to see a long list of added materials. These natural or synthetic substances are **food additives**[3] and there are more than three hundred used during food processing today. The most popular additives are benzoates, nitrites, sulfites, and sorbates, which prevent molds and yeast from growing on food.How Stuff Works. "The Dangers of Food Additives." Accessed October 5, 2011. http://health.howstuffworks.com/wellness/food-nutrition/facts/dangers-of-food -additives.htm.

Food additives are introduced in the processing stage for a variety of reasons. Some control acidity and alkalinity, while others enhance the color or flavor of food. Some additives stabilize food and keep it from breaking down, while others add body or texture. Table 14.1 "Food Additives" lists some common food additives and their uses:

Table 14.1 Food Additives

Additive	Reason for Adding
Beta-carotene	Adds artificial coloring to food
Caffeine	Acts as a stimulant
Citric acid	Increases tartness to prevent food from becoming rancid
Dextrin	Thickens gravies, sauces, and baking mixes
Gelatin	Stabilizes, thickens, or texturizes food

3. Natural or man-made substance added to a food product during the processing stage to improve its quality.

Additive	Reason for Adding
Modified food starch	Keeps ingredients from separating and prevents lumps
MSG	Enhances flavor in a variety of foods
Pectin	Gives candies and jams a gel-like texture
Polysorbates	Blends oil and water and keep them from separating
Soy lecithin	Emulsifies and stabilizes chocolate, margarine, and other items
Sulfites	Prevent discoloration in dried fruits
Xanthan gum	Thickens, emulsifies, and stabilizes dairy products and dressings

Source: Center for Science in the Public Interest. "Chemical Cuisine: Learn about Food Additives." ©2012. Center for Science in the Public Interest. http://www.cspinet.org/reports/chemcuisine.htm.

The Pros and Cons of Food Additives

The FDA works to protect the public from potentially dangerous additives. Passed in 1958, the Food Additives Amendment states that a manufacturer is responsible for demonstrating the safety of an additive before it can be approved. The Delaney Clause that was added to this legislation prohibits the approval of any additive found to cause cancer in animals or humans. However, most additives are considered to be "generally recognized as safe," a status that is determined by the FDA and referred to as GRAS.

Food additives are typically included in the processing stage to improve the quality and consistency of a product. Many additives also make items more "shelf stable," meaning they will last a lot longer on store shelves and can generate more profit for store owners. Additives can also help to prevent spoilage that results from changes in temperature, damage during distribution, and other adverse conditions. In addition, food additives can protect consumers from exposure to rancid products and food-bourne illnesses.

Food additives aren't always beneficial, however. Some substances have been associated with certain diseases if consumed in large amounts. For example, the FDA estimates that sulfites can cause allergic reactions in 1 percent of the general population and in 5 percent of asthmatics. Similarly, the additive monosodium glutamate, which is commonly known as MSG, may cause headaches, nausea, weakness, difficulty breathing, rapid heartbeat, and chest pain in some individuals.Sustainable Table. "The Issues: Additives." Accessed October 10, 2011. http://www.sustainabletable.org/issues/additives/#fn14.

The Effect of New Technologies

As mentioned earlier, new technology has had a tremendous effect on the food we eat and the customs and culture related to food consumption. For example, microwaves are used to reduce cooking time or to heat up leftover food. Refrigerators and freezers allow produce to travel great distances and last longer. On the extreme end of making food last longer, there is special food for astronauts that is appropriate for consumption in space. It is safe to store, easy to prepare in the low-gravity environment of a spacecraft, and contains balanced nutrition to promote the health of people working in space. In the military, soldiers consume Meals Ready-to-Eat (MREs), which contain an entire meal in a single pouch.

Genetically Modified Foods

Genetically modified foods[4] (also known as GM or GMO foods), are plants or animals that have undergone some form of genetic engineering. In the United States, much of the soybean, corn, and canola crop is genetically modified. The process involves the alteration of an organism's DNA, which allows farmers to cultivate plants with desirable characteristics.Genomics.Energy.gov. "What Are Genetically Modified Foods?" Last modified November 5, 2008. http://www.ornl.gov/sci/techresources/Human_Genome/elsi/gmfood.shtml. For example, scientists could extract a gene that produces a chemical with antifreeze properties from a fish that lives in an arctic region (such as a flounder). They could then splice that gene into a completely different species, such as a tomato, to make it resistant to frost, which would enable farms to grow that crop year-round.Whitman, D. B. "Genetically Modified Foods: Harmful or Helpful?" *ProQuest Discovery Guides* (April 2000). http://www.csa.com/discoveryguides/gmfood/overview.php.

Certain modifications can be beneficial in resisting pests or pesticides, improving the ripening process, increasing the nutritional content of food, or providing resistance to common viruses. Although genetic engineering has improved productivity for farmers, it has also stirred up debate about consumer safety and environmental protection. Possible side effects related to the consumption of GM foods include an increase in allergenicity, or tendencies to provoke allergic reactions. There is also some concern related to the possible transfer of the genes used to create genetically engineered foods from plants to people. This could influence human health if antibiotic-resistant genes are transferred to the consumer. Therefore, the World Health Organization (WHO) and other groups have encouraged the use of genetic engineering without antibiotic-resistance genes. Genetically modified plants may adversely affect the environment as well and could lead to the contamination of nongenetically engineered organisms.World Health

4. Food products made from animals or plants that have undergone genetic engineering.

Organization. “Food Safety: 20 Questions on Genetically Modified Foods.” © 2011. http://www.who.int/foodsafety/publications/biotech/20questions/en/ .

Genetically modified foods fall under the purview of the EPA, the USDA, and the FDA. Each agency has different responsibilities and concerns in the regulation of GM crops. The EPA ensures that pesticides used for GM plants are safe for the environment. The USDA makes sure genetically engineered seeds are safe for cultivation prior to planting. The FDA determines if foods made from GM plants are safe to eat. Although these agencies act independently, they work closely together and many products are reviewed by all three.Whitman, D. B. “Genetically Modified Foods: Harmful or Helpful?” *ProQuest Discovery Guides* (April 2000).

Video 14.3

Too Much Controversy Over Genetically Modified Foods?

(click to see video)

Food Enrichment and Fortification

Many foods are enriched or fortified to boost their nutritional value. Enrichment involves adding nutrients to restore those that were lost during processing. For example, iron and certain B vitamins are added to white flour to replace the nutrients that are removed in the process of milling wheat. Fortification is slightly different than enrichment and involves adding new nutrients to enhance a food’s nutritive value. For example, folic acid is typically added to cereals and grain products, while calcium is added to some orange juice.

The Health of the Population

Certain enrichment and fortification processes have been instrumental in protecting public health. For example, adding iodine to salt has virtually eliminated iodine deficiencies, which protects against thyroid problems. Adding folic acid to wheat helps increase intake for pregnant women, which decreases the risk of neural tube defects in their children. Also, vegans or other people who do not consume many dairy products are able to drink orange juice or soy milk that has been fortified with calcium to meet the daily recommendations. However, there is some concern that foods of little nutritive value will be fortified in an effort to improve their allure, such as soft drinks with added vitamins.

KEY TAKEAWAYS

- The food industry encompasses all aspects of food production: manufacturing, distribution, marketing, retail, regulation, and consumption.
- Food preservation and processing have a number of benefits including improving the quality of food products, making them more shelf-stable, and aiding the marketing and advertising of food. There are more than three hundred additives used during food processing today.
- Food preservation and processing also have some drawbacks, including potentially damaging the nutritive value of food. The cultivation and consumption of genetically modified foods are also highly controversial, with many people opposed to the genetic modification of crops.
- There are three key government agencies that regulate food in the United States: the US Department of Agriculture, the US Food and Drug Administration, and the US Environmental Protection Agency.

DISCUSSION STARTER

1. Discuss the debate about the use of food additives, such as beta-carotene and citric acid. What are the benefits to using them? What are the drawbacks? Do you believe that food additives are more helpful or more harmful, and why?

14.3 The Politics of Food

LEARNING OBJECTIVE

1. Discuss how food has become politicized, and give specific examples of how food choices are related to food politics.

Some people have begun to view their choices regarding diet and nutrition in light of their political views. More and more, consumers weigh their thoughts on the environment and the world, while making decisions about what to purchase in the grocery store. For example, many people choose to eat free-range chickens due to concerns about animal welfare. Others worry about the higher cost of organically produced food or find that those products are not available in their communities. As a result, feelings about food have become a political mine field.

Food Politics

The production and sale of food is an extremely big business and touches people in all industries and walks of life. Food is not only crucial for day-to-day survival, but also strongly affects overall health and well-being, as well as the economy and culture of a region or a country. So, it is no wonder that more and more producers and consumers alike are speaking out about food to ensure that their interests are protected. Food politics can influence many stakeholders and interests, but always involve the production, regulation, inspection, distribution, and/or retail of food.

Stakeholders

Stakeholders in food politics include large and small farmers, along with large and small food companies. Other important stakeholders include restaurants and other food-service providers, food distributors, grocery stores and other retail outlets, consumers, and trade associations. Antihunger advocates, nutrition advocates, and food-industry lobbyists also have important roles to play. Nongovernmental organizations, such as the American Cancer Society and the WHO, also work to promote good health and nutrition. Each group has its own perspective and its own agenda in disputes related to food.

Disputes

Food politics can be influenced by ethical, cultural, medical, and environmental disputes over agricultural methods and regulatory policies. They are also greatly influenced by manufacturing processes, marketing practices, and the pursuit of the highest possible profit margin by food manufacturers and distributers. Common disputes and controversies include the genetic modification of plants, the potential dangers of food additives, chemical run-off from large-scale farms, and the reliance on factory-farming practices, such as the use of pesticides in crop cultivation and antibiotics in livestock feed. Additional issues and concerns include the use of sugar, salt, and other potentially unhealthy ingredients, the promotion of fast food and junk food to children, and sanitary standards related to livestock.

The Nitrate Dispute

One current dispute relates to the use of nitrates in agriculture. At the dawn of the twentieth century, German chemists Fritz Haber and Carl Bosch invented a system that synthesizes ammonia to produce nitrates on an industrial scale. The compound could then be used to make fertilizers, which along with pesticides and herbicides, made large-scale, modern agriculture possible. However, when nitrates are used in excess, they can create runoff that pollutes surface- and groundwater. For example, chemical runoff has had a profound effect on the Aral Sea and the surrounding area in Kazakhstan and Uzbekistan. The Aral Sea, which was once one of the four largest lakes in the world, was crucial to irrigation projects in the former Soviet Union. But when the lake became contaminated by farm runoff, salinity increased and the lake dramatically shrank, crippling the area's fishing industry. Also, as the lakebed became exposed, dust storms spread contaminated soil, and thousands of people were forced out of the region.Grant, L. "Nitrates: Dangerous Necessity." Environmentalism @ Suite 101.com. May 7, 2011. http://larry-grant.suite101.com/nitrates-dangerous-necessity-a369949. Contaminated runoff from the use of nitrates not only leads to serious consequences for the environment, but also to human health. Nitrate poisoning reduces the oxygen-carrying capacity of the blood and can be fatal to infants.US Environmental Protection Agency. "Ag 101: Nitrate." Last updated September 10, 2009. http://www.epa.gov/agriculture/ag101/impactnitrate.html. Therefore, significant efforts are being made to use nitrates and other agricultural chemicals in more environmentally friendly ways and to monitor drinking water for dangerous levels of contamination.

The Role of Government

Federal and state policy plays a major role in the politics of food production and distribution. As previously discussed, government agencies regulate the proper processing and preparation of foods, as well as overseeing shipping and storage. They pay particular attention to concerns related to public health. As a result, the enforcement of regulations has been strongly influenced by public concern over food-related events, such as outbreaks of food-bourne illnesses.

Food Production, Distribution, and Safety

Whole chickens are suspended at a meat production plant and will soon be separated into parts.

© Thinkstock

Many consumers have concerns about safety practices during the production and distribution of food. This is especially critical given recent outbreaks of food-borne illnesses. For example, during fall 2011 in the United States, there was an eruption of the bacteria *Listeria monocytogenes* in cantaloupe. It was one of the deadliest outbreaks in over a decade and resulted in a number of deaths and hospitalizations.Centers for Disease Control and Prevention. "Multistate Outbreak of Listeriosis Associated with Jensen Farms Cantaloupe—United States." August–September, 2011. http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6039a5.htm?s_cid=mm6039a5_w.

In January 2011, the Food Safety Modernization Act was passed to grant more authority to the FDA to improve food safety. The FDA and other agencies also address consumer-related concerns about protecting the nation's food supply in the event of a terrorist attack.

Addressing Hunger

Government agencies also play an important role in addressing hunger via federal food-assistance programs. The agencies provide debit cards (formerly distributed in the form of food vouchers or food stamps) to consumers to help them purchase food and they also provide other forms of aid to low-income adults and families who face hunger and nutritional deficits. This topic will be discussed in greater detail later in this chapter.

The Dual Role of the USDA

The USDA has a dual role in the advancement of American agribusiness and the promotion of health and nutrition among the public. This can create conflicts of

interest, and some question whether the USDA values the interests of the agriculture and food industries over consumer health.

However, there is no question that the USDA makes a great deal of effort to educate the public about diet and nutrition. Working with the US Department of Health and Human Services, the agency codeveloped the *Dietary Guidelines for Americans* to inform consumers about the ways their dietary habits affect their health. The USDA also implements all federal nutrition programs.

The Farm Bill

The Farm Bill (introduced in 1990) is a massive piece of legislation that determines the farm and food policy of the federal government. It addresses policy related to federal food programs and other responsibilities of the USDA. The Farm Bill also covers a wide range of agricultural programs and provisions, including farm subsidies and rural development. And, it influences international trade, commodity prices, environmental preservation, and food safety.

The massive Farm Bill is updated and renewed every five years. Over the decades, it has expanded to incorporate new issues, such as conservation and bioenergy. The Farm Bill passed in 2008, known as the Food, Conservation, and Energy Act, included new policy on horticulture and livestock provisions. The 2008 bill also differed from previous legislation in terms of the large number and scope of proposals that were raised.Johnson, R. and J. Monke, "What Is the 'Farm Bill'?" Congressional Research Service. *CRS Report for Congress*, no. RS22131 (January 3, 2011). http://www.nationalaglawcenter.org/assets/crs/RS22131.pdf.

Tools for Change

Start paying attention to the news when you hear about the next upcoming Farm Bill to learn about proposals that could affect the food that arrives in your local supermarket or that is served in your favorite restaurant. To learn more about the upcoming legislation, visit http://www.usda.gov/farmbill. You may also wish to "vote with your fork" and make choices about what you eat based on practices you approve of, such as choosing a vegetarian, vegan, organic, locavore, sustainable, slow-food movement or other type of diet.

Agricultural Subsidies

The Farm Bill can directly and indirectly have wide-ranging effects. For example, the bill dictates subsidies and other forms of agricultural funding or support. Farmers rely on this kind of support to offset varying crop yields and unfavorable weather conditions. The agricultural industry also depends on the federal government to provide some form of price control to guard against flooding the market and dragging down prices. As an example, major changes in the policy of agricultural subsidies were implemented in the 1970s to increase farm incomes and produce cheaper food. As a result of these policies and subsidies, much more corn was grown, giving rise to high fructose corn syrup as a primary sweetener in a number of products today, since corn syrup is cheaper to produce. It is also sweeter than cane sugar, which encouraged its widespread use.

Historically, Congress has pursued farm support programs to ensure that the US population has continued access to abundant and affordable food. However, some leaders worry about the effectiveness of government programs as well as the cost to taxpayers and consumers. Others question if continued farm support is even needed and wonder if it remains compatible with current economic objectives, domestic policy, trade policy, and regulatory restrictions.Johnson, R. and J. Monke, "What Is the 'Farm Bill'?" Congressional Research Service. *CRS Report for Congress*, no. RS22131 (January 3, 2011). http://www.nationalaglawcenter.org/assets/crs/RS22131.pdf. For example, federal dairy policies can raise the price of milk and other dairy products, which can detrimentally affect school lunch and food stamp programs. Regarding all of these issues, Congress must heed the demands of its constituents. In the end, it is inevitable that consumers' growing interest in food issues will affect not only the choices they make in the grocery store, but also the decisions they make in the voting booth.

KEY TAKEAWAYS

- Food politics reflect changing perspectives and policies in the areas of production, distribution, marketing, regulation, and consumption.
- Over the years, there have been a number of controversies and disputes over food, including concerns about additives and GM foods, the push for sustainable agriculture, and the need to alleviate hunger.
- In the United States, a massive piece of legislation known as the Farm Bill determines the agricultural and food policy of the federal government.

DISCUSSION STARTER

1. Debate a controversial issue related to food politics, such as sustainable agriculture, farm subsidies, or the Farm Bill. Identify the stakeholders involved with the issue and discuss the pros and cons of the differing sides.

14.4 Food Cost and Inflation

LEARNING OBJECTIVES

1. Cite a recent event that has had a profound effect on how consumers feel about the food supply.
2. Give a historical overview of the era of cheap food.

Statistics show that Americans spend more than $1.5 trillion on food each year at supermarkets, in restaurants, and from other food providers.Plunkett Research, Ltd. “US Food Industry Overview.” 2011. http://www.plunkettresearch.com/food%20beverage%20grocery%20market %20research/industry%20statistics. According to the USDA, a thrifty family of four spends about $540-$620 per month on groceries.US Department of Agriculture. “Official USDA Food Plans: Cost of Food at Home at Four Levels, US Average, August 2011.” Issued September 2011. http://www.cnpp.usda.gov/Publications/FoodPlans/2011/CostofFoodAug2011.pdf. A number of factors affect the rising cost of food. They include agricultural production, processing and manufacturing, wholesale distribution, retail distribution, and consumption.

Around the world, commodity prices rose sharply in 2010 as crop production shortfalls led to reduced supplies and a higher volatility in agricultural markets. Other factors that played a role in increasing food prices include a population boom that has drastically increased demand, droughts and other natural disasters that have crippled farmers, and trade policies and practices that are unfair to developing nations.

Rising agricultural commodity prices have led to concerns about food insecurity and hunger. In an agricultural outlook report for 2010–2020, the Secretary-General of the Organisation for Economic Co-operation and Development states, “While higher prices are generally good news for farmers, the effect on the poor in developing countries who spend a high proportion of their income on food can be devastating. That is why we are calling on governments to improve information and transparency of both physical and financial markets, encourage investments that increase productivity in developing countries, remove production and trade distorting policies, and assist the vulnerable to better manage risk and uncertainty.”Organisation for Economic Co-operation and Development. “OECD-FAO Agricultural Outlook 2010–2020.” June 17, 2011. http://www.oecd.org/document/31/0,3746,en_21571361_44315115_48182047_1_1_1_1,00.html.

Who Bears the Cost?

The cost of our food is influenced by the policies and practices of farms, food and beverage companies, food wholesalers, food retailers, and food service companies. These costs include the energy required to produce and distribute food products from farm field to supermarket to table. Rising prices also reflect the marketing and advertising of food. All of these factors affect all participants in a food system, but some participants are more affected than others. A 2011 report by the Economic Research Service of the USDA shows the division of the consumer food dollar among various aspects of the American food system. A far greater amount of the money you spend to buy a product goes toward the marketing components than toward the actual farmer.US Department of Agriculture, Economic Research Service. "Overview." Last updated November 19, 2012. http://www.ers.usda.gov/data-products/food-expenditures.aspx.

The Consumer Price Index

The Consumer Price Index (CPI) measures changes in the price level paid for goods and services. This economic indicator is based on the expenditures of the residents of urban areas, including working professionals, the self-employed, the poor, the unemployed, and retired workers, as well as urban wage earners and clerical workers. The CPI has subindices for many different types of products, including food and beverages. It is a closely-watched statistic that is used in a variety of ways, including measuring inflation and regulating prices.

Implications Around the World

Food prices and inflation disproportionately affect people at lower income levels. For the poorest people of the world, increasing prices can raise levels of hunger and starvation. In many developing countries where the cost for staple crops steadily rises, consumers have faced shortages or even the fear of shortages, which can result in hoarding and rioting. This happened in 2007 and 2008 during rice shortages in India and other parts of Asia. Rioters burned hundreds of food ration stores in the Indian region West Bengal. In the West African nation Burkina Faso, food rioters looted stores and burned government buildings as a result of rising prices for food and other necessities.Vivienne Walt, "The World's Growing Food-Price Crisis," *Time* Magazine, 27 February 2008. http://www.time.com/time/world/article/0,8599,1717572-1,00.html. In some poor countries, protests also have been fueled by concerns over corruption, because officials earned fortunes from oil and minerals, while locals struggled to put food on their tables. Bringing down prices would quell protests, but could take a decade or more to accomplish.

The End of the Era of Cheap Food

Concerns about food shortages and rising prices reflect the end of the era of cheap food. Following World War II, grain prices fell steadily around the world for decades. As farms grew in scale, factory-farm practices, such as the use of synthetic and mined fertilizers and pesticides, increased. Agribusinesses also invested in massive planting and harvesting machines. These practices pushed crop yields up and crop prices down. Food became so inexpensive that we entered what came to be called the "era of cheap food."

However, by 2008, economic experts had declared that the era of cheap food was over. The rapid growth in farm output had slowed to the point that it failed to keep pace with population increases and rising affluence in once-developing nations. Consumption of four staples—wheat, rice, corn, and soybeans—outstripped production and resulted in dramatic stockpile decreases. The consequence of this imbalance has been huge spikes felt moderately in the West and to a much greater degree in the developing world. As a result, hunger has worsened for tens of millions of poor people around the world.Justin Gillis, "A Warming Planet Struggles to Feed Itself," *The New York Times*, 4 June 2011. http://www.nytimes.com/2011/06/05/science/earth/05harvest.html?_r=2&hp.

Two major trends played a part in this shift. First, prosperity in India and China led to increased food consumption in general, but more specifically to increased meat consumption. Increased meat consumption has led to an increased demand for livestock feed, which has contributed to an overall rise in prices. The second trend relates to biofuels, which are made from a wide variety of crops (such as corn and palm nuts), which increasingly are used to make fuel instead of to feed people.

The world population in 2010 was 6.9 billion.United Nations. "World Population Prospects, the 2010 Revision." http://esa.un.org/wpp/Analytical-Figures/htm/fig_1.htm. It is projected to grow to 9.4 billion by 2050.Food and Agricultural Organization of the United Nations. "Executive Summary." http://www.fao.org/docrep/004/y3557e/y3557e03.htm. The rate of increase is particularly high in the developing world, and the increased population, along with poverty and political instability, are helping to foster long-term food insecurity. In the coming decades, farmers will need to greatly increase their output to meet the rising demand, while adapting to any future trends.Christian Science Monitor. "Why the Era of Cheap Food Is Over." December 31, 2007. http://www.csmonitor.com/2007/1231/p13s01-wogi.html.

KEY TAKEAWAYS

- Food prices are rising in the United States and around the world, which has greatly affected both agricultural producers and consumers.
- A number of factors have contributed to rising costs, including population booms, natural disasters, and the production of biofuels, among others.
- Economic experts have declared that the era of cheap food, which began after World War II, has ended due to rising population rates and decreased agricultural production worldwide. As a result, hunger has worsened for tens of millions of poor people globally.

DISCUSSION STARTER

1. Examine the graphics from http://www.ers.usda.gov/data-products/food-dollar-series/documentation.aspx. What does each image indicate about agriculture and the American economy?

14.5 The Issue of Food Security

LEARNING OBJECTIVE

1. Share an example of a food and nutrition program that seeks to mitigate hunger in the United States and/or Canada.

Physiologically, hunger relates to appetite and is the body's response to a need for nourishment. Through stomach discomfort or intestinal rumbling, the body alerts the brain that it requires food. This uneasy sensation is easily addressed with a snack or a full meal. However, the term "hunger" also relates to a weakened condition that is a consequence of a prolonged lack of food. People who suffer from this form of hunger typically experience malnourishment, along with poor growth and development.

Hunger

Adequate food intake that meets nutritional requirements is essential to achieve a healthy, productive lifestyle. However, millions of people in North America, not to mention globally, go hungry and are malnourished each year due to a recurring and involuntary lack of food. The economic crisis of 2008 caused a dramatic increase in hunger across the United States.World Hunger.org. "Hunger in America: 2011 United States Hunger and Poverty Facts." Accessed October 10, 2011. http://www.worldhunger.org/articles/Learn/us_hunger_facts.htm.

Key Hunger Statistics

In 2010, 925 million people around the world were classified as hungry. Although this was a decrease from a historic high of more than one billion people from the previous year, it is still an unbearable number. Every night, millions and millions of people go to sleep hungry due to a lack of the money or resources needed to acquire an adequate amount of food. This graph shows the division of hungry people around the globe.

Key Hunger Terms

A number of terms are used to categorize and classify hunger. Two key terms, **food security**[5] and **food insecurity**[6], focus on status and affect hunger statistics.

5. The state of having continual access to sufficient, safe, and nutritious food to achieve an active, healthy lifestyle.

6. The state of not having continual access to sufficient, safe, and nutritious food to achieve an active, healthy lifestyle.

Another term, malnutrition, refers to the deficiencies that a hungry person experiences.

Food Security

Most American households are considered to be food secure, which means they have adequate access to food and consume enough nutrients to achieve a healthy lifestyle. However, a minority of US households experiences food insecurity at certain points during the year, which means their access to food is limited due to a lack of money or other resources. This graphic shows the percentage of food-secure and food-insecure households in the United States during the year 2010.

Food Insecurity

Food insecurity is defined as not having adequate access to food that meets nutritional needs. According to the USDA, about 48.8 million people live in food-insecure households and have reported multiple indications of food access problems. About sixteen million of those have "very low food security," which means one or more people in the household were hungry at some point over the course of a year due to the inability to afford enough food. The difference between low and very low food security is that members of low insecurity households have reported problems of food access, but have reported only a few instances of reduced food intake, if any.Coleman-Jensen, A. et al. "Household Food Security in the United States in 2010." US Department of Agriculture, *Economic Research Report*, no. ERR-125 (September 2011). African American and Hispanic households experience food insecurity at much higher rates than the national average.Coleman-Jensen, A. et al. "Household Food Security in the United States in 2010." US Department of Agriculture, *Economic Research Report*, no. ERR-125 (September 2011).

Households with limited resources employ a variety of methods to increase their access to adequate food. Some families purchase junk food and fast food—cheaper options that are also very unhealthy. Other families who struggle with food security supplement the groceries they purchase by participating in government assistance programs. They may also obtain food from emergency providers, such as food banks and soup kitchens in their communities.

Malnutrition

A person living in a food-insecure household may suffer from malnutrition, which results from a failure to meet nutrient requirements. This can occur as a result of consuming too little food or not enough key nutrients. There are two basic types of malnutrition. The first is macronutrient deficiency and relates to the lack of

adequate protein, which is required for cell growth, maintenance, and repair. The second type of malnutrition is micronutrient deficiency and relates to inadequate vitamin and mineral intake.World Hunger. "2011 World Hunger and Poverty Facts and Statistics." Accessed October 10, 2011. http://www.worldhunger.org/articles/Learn/world%20hunger%20facts%202002.htm. Even people who are overweight or obese can suffer from this kind of malnutrition if they eat foods that do not meet all of their nutritional needs.

At-Risk Groups

Worldwide, three main groups are most at risk of hunger: the rural poor in developing nations who also lack access to electricity and safe drinking water, the urban poor who live in expanding cities and lack the means to buy food, and victims of earthquakes, hurricanes, and other natural and man-made catastrophes.Food and Agriculture Organization of the United Nations. "Hunger: Frequently Asked Questions." Accessed October 10, 2011. http://www.fao.org/hunger/en/ In the United States, there are additional subgroups that are at risk and are more likely than others to face hunger and malnutrion. They include low-income families and the working poor, who are employed but have incomes below the federal poverty level.

Senior citizens are also a major at-risk group. Many elderly people are frail and isolated, which affects their ability to meet their dietary requirements. In addition, many also have low incomes, limited resources, and difficulty purchasing or preparing food due to health issues or poor mobility. As a result, more than six million senior citizens in the United States face the threat of hunger.Meals on Wheels. "Our Vision and Mission." Accessed October 10, 2011. http://www.mowaa.org/page.aspx?pid=299

The Homeless

One of the groups that struggles with hunger are the millions of homeless people across North America. According to a recent study by the US Conference of Mayors, the majority of reporting cities saw an increase in the number of homeless families.The United States Conference of Mayors. "Hunger and Homelessness Survey: A Status Report on Hunger and Homelessness in America's Cities, a 27-City Survey." December 2009. http://usmayors.org/pressreleases/uploads/USCMHungercompleteWEB2009.pdf. Hunger and homelessness often go hand-in-hand as homeless families and adults turn to soup kitchens or food pantries or resort to begging for food.

Children

Rising hunger rates in the United States particularly affect children. Nearly one out of four children, or 21.6 percent of all American children, lives in a food-insecure household and spends at least part of the year hungry.Coleman-Jensen, A. et al. "Household Food Security in the United States in 2010." US Department of Agriculture, *Economic Research Report*, no. ERR-125 (September 2011). Hunger delays their growth and development and affects their educational progress because it is more difficult for hungry or malnourished students to concentrate in school. In addition, children who are undernourished are more susceptible to contracting diseases, such as measles and pneumonia.World Hunger. "2011 World Hunger and Poverty Facts and Statistics." Accessed October 10, 2011.

Video 14.4

Going Hungry in America

(click to see video)

This video examines the effect of hunger on many American children.

Government Programs

The federal government has established a number of programs that work to alleviate hunger and ensure that many low-income families receive the nutrition they require to live a healthy life. A number of programs were strengthened by the passage of the Healthy, Hunger-Free Kids Act of 2010. This legislation authorized funding and set the policy for several key core programs that provide a safety net for food-insecure children across the United States.

The Federal Poverty Level

The federal poverty level (FPL) is used to determine eligibility for food-assistance programs. This monetary figure is the minimum amount that a family would need to acquire shelter, food, clothing, and other necessities. It is calculated based on family size and is adjusted for annual inflation. Although many people who fall below the FPL are unemployed, the working poor can qualify for food programs and other forms of public assistance if their income is less than a certain percentage of the federal poverty level, along with other qualifications.

USDA Food Assistance Programs

Government food and nutrition assistance programs that are organized and operated by the USDA work to increase food security. They provide low-income households with access to food, the tools for consuming a healthy diet, and education about nutrition. The USDA monitors the extent and severity of food insecurity via an annual survey. This contributes to the efficiency of food assistance programs as well as the effectiveness of private charities and other initiatives aimed at reducing food insecurity.Coleman-Jensen, A. et al. "Household Food Security in the United States in 2010." US Department of Agriculture, *Economic Research Report*, no. ERR-125 (September 2011).

The Supplemental Nutrition Assistance Program

Formerly known as the Food Stamp Program, the Supplemental Nutrition Assistance Program (SNAP) provides monthly benefits for low-income households to purchase approved food items at authorized stores. Clients qualify for the program based on available household income, assets, and certain basic expenses. In an average month, SNAP provides benefits to more than forty million people in the United States.Coleman-Jensen, A. et al. "Household Food Security in the United States in 2010." US Department of Agriculture, *Economic Research Report*, no. ERR-125 (September 2011).

The program provides Electronic Benefit Transfers (EBT) which work similarly to a debit card. Clients receive a card with a certain allocation of money for each month that can be used only for food. In 2010, the average benefit was about $134 per person, per month and total federal expenditures for the program were $68.2 billion.Coleman-Jensen, A. et al. "Household Food Security in the United States in 2010." US Department of Agriculture, *Economic Research Report*, no. ERR-125 (September 2011).

The Special, Supplemental Program for Women, Infants, and Children

The Special, Supplemental Program for Women, Infants and Children (WIC) provides food packages to pregnant and breastfeeding women, as well as to infants and children up to age five, to promote adequate intake for healthy growth and development. Most state WIC programs provide vouchers that participants use to acquire supplemental packages at authorized stores. In 2010, WIC served approximately 9.2 million participants per month at an average monthly cost of about forty-two dollars per person.Coleman-Jensen, A. et al. "Household Food Security in the United States in 2010." US Department of Agriculture, *Economic Research Report*, no. ERR-125 (September 2011).

The National School Lunch Program

The National School Lunch Program (NSLP) and School Breakfast Program (SBP) ensure that children in elementary and middle schools receive at least one healthy meal each school day, or two if both the NSLP and SBP are provided. According to the USDA, these programs operate in over 101,000 public and nonprofit private schools and residential child-care institutions.US Department of Agriculture. "National School Lunch Program." October 2011. http://www.fns.usda.gov/cnd/Lunch/AboutLunch/NSLPFactSheet.pdf. In 2010, the programs provided meals to an average of 31.6 million children each school day. Fifty-six percent of the lunches served were free, and an additional 10 percent were provided at reduced prices.

Other Food-Assistance Programs for Children

Other government programs provide meals for children after school hours and during summer breaks. The Child and Adult Care Food Program (CACFP) offers meals and snacks at child-care centers, daycare homes, and after-school programs. Through CACFP, more than 3.2 million children and 112,000 adults receive nutritious meals and snacks each day.US Department of Agriculture. "Child & Adult Care Food Program." Last modified June 10, 2011. http://www.fns.usda.gov/cnd/care/. The Summer Food Service Program provides meals to children during summer break. Sponsors include day camps and other recreation programs where at least half of the attendees live in households with incomes below the federal poverty level.US Department of Agriculture. "Summer Food Service Program." st.TER 14 2011r Congressbrary. Last modified July 20, 2011. http://www.summerfood.usda.gov/default.htm. These and other programs help to fill in the gaps during the typical day of a food-insecure child.

The Head Start Program

Head Start is a health and development program for children ages three to five, from low-income families. The philosophy behind the organization is that early intervention can help address the educational, social, and nutritional deficiencies that children from lower-income families often experience. Launched in 1965, it is one of the longest-running, poverty-related programs in the United States. Today, Head Start programs include education, meals, snacks, and access to other social services and health guidance.US Department of Health and Human Services. "About the Office of Head Start." Last reviewed February 23, 2011. http://www.acf.hhs.gov/programs/ohs/about/index.html.

Other Forms of Assistance

Other forms of assistance include locally-operated charitable organizations, such as food banks and food pantries, which acquire food from local manufacturers, retailers, farmers, and community members to give to low-income families. Neighborhood soup kitchens provide meals to the homeless and other people in need. These and other organizations are run by nonprofit groups, as well as religious institutions, to provide an additional safety net for those in need of food.

Meals on Wheels

An organization known as Meals on Wheels delivers meals to elderly people who have difficulty buying or making their own food because of poor health or limited mobility. It is the oldest and largest program dedicated to addressing the nutritional needs of senior citizens. Each day, Meals on Wheels volunteers deliver more than one million meals across the United States. The first Meals on Wheels program began in Philadelphia in the 1950s. In the decades since, the organization has expanded into a vast network that serves the elderly in all fifty states and several US territories. Today, Meals on Wheels remains committed to ending hunger among the senior citizen community.Meals on Wheels. “The Meals on Wheels Association of America.” Accessed October 10, 2011. http://www.mowaa.org/page.aspx?pid=212.

KEY TAKEAWAYS

- Around the world, nearly one billion people suffer the effects of constant hunger.
- Key terms related to hunger include food security, which means having continual access to safe, sufficient, nutritious food, and food insecurity, which means not having continual access to safe, sufficient, nutritious food.
- There are two types of malnutrition. The first is macronutrient deficiency and relates to the lack of adequate protein, which is required for cell growth, maintenance, and repair. The second type of malnutrition is micronutrient deficiency and relates to inadequate vitamin and mineral intake.
- There are a number of groups at risk for hunger, including the unemployed and underemployed, poor families, the elderly, and the homeless.
- The United States has a number of federal and state programs, as well as local charities, which provide assistance and education for people who fall into the category of food insecurity.

DISCUSSION STARTER

1. Do you believe there are enough government programs currently in place to address the problem of hunger? Why or why not? If not, what additional solutions would you recommend?

14.6 Nutrition and Your Health

LEARNING OBJECTIVE

1. Relate the research on home-cooked family meals to comprehensive health and wellness, taste, sustainability, and the strengthening of family bonds.

The adage, "you are what you eat," seems to be more true today than ever. In recent years, consumers have become more conscientious about the decisions they make in the supermarket. Organically grown food is the fastest growing segment of the food industry. Also, farmers' markets and chains that are health-food-oriented are thriving in many parts of North America. Shoppers have begun to pay more attention to the effect of food on their health and well-being. That includes not only the kinds of foods that they purchase, but also the manner in which meals are cooked and consumed. The preparation of food can greatly affect its nutritional value. Also, studies have shown that eating at a table with family members or friends can promote both health and happiness.

Family Meals

Home-cooked meals provide parents an opportunity to teach their children about nutrition.

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In the past, families routinely sat down together to eat dinner. But in recent decades, that comfortable tradition has fallen by the wayside. In 1900, 2 percent of meals were eaten outside of the home. By 2010, that figure had risen to 50 percent.Mark Hyman, MD, "How Eating at Home Can Save Your Life," Huffington Post.com, 9 January 2011. http://www.huffingtonpost.com/dr-mark-hyman/family-dinner-how_b_806114.html? Today, family members often go their own way at mealtimes and when they do sit down together, about three times a week, the meal often lasts less than twenty minutes and is spent eating a microwaved meal in front of a television.

However, recent studies have shown that home-cooked, family meals really matter. Family meals usually lead to the consumption of healthy food packed with nutrition, rather than an intake of empty calories. Other benefits include

strengthening familial bonds, improving family communication, and helping young children learn table manners. Increased frequency of family meals has also been associated with certain developmental assets, such as support, boundaries and expectations, commitment to learning, positive values, and social competency.Rochford, M. "Do Family Meals Still Matter?" *Visions: Family and Community Health Sciences* (Rutgers University) 21, no. 3 (2009).

Home-prepared meals provide an opportunity for more balanced and better-portioned meals with fewer calories, sodium, and less saturated fat. When families prepare food together, parents or caregivers can also use the time to teach children about the ways their dietary selections can affect their health.

The Adolescent Diet

Teenagers' dietary choices are influenced by their family's economic status, the availability of food inside and outside the home, and established traditions. Studies have found links between the prevalence of family meals during adolescence and the establishment of healthy dietary behaviors by young adulthood. Yet, many of today's teenagers make food selections on their own, which often means eating junk food or fast food on the go.

However, adolescents who regularly consume family meals or have done so in the past are more likely to eat breakfast and to eat more fruits and vegetables. Research has shown that adolescents who have regular meals with their parents are 42 percent less likely to drink alcohol, 50 percent less likely to smoke cigarettes, and 66 percent less likely to use marijuana. Regular family dinners also help protect teens from bulimia, anorexia, and diet pills. In addition, the frequency of family meals was inversely related to lower academic scores and incidents of depression or suicide.Mark Hyman, MD, "How Eating at Home Can Save Your Life," Huffington Post.com, 9 January 2011. http://www.huffingtonpost.com/dr-mark-hyman/family-dinner-how_b_806114.html?

Sustainable Eating

As discussed at the beginning of this chapter, sustainable agricultural practices provide healthy, nutritious food for the consumers of today, while preserving natural resources for the consumers of tomorrow. Sustainability not only has economic and environmental benefits, but also personal benefits, including reduced exposure to pesticides, antibiotics, and growth hormones. Sustainable eaters do all of the following:

- **Consume less processed food.** People who eat sustainably focus on whole foods that are high in nutritive value, rather than heavily processed foods with lots of additives.
- **Eat more home-cooked meals.** Sustainable eaters go out to restaurants less often, and when they do, they dine at establishments that provide dishes made from whole-food ingredients.
- **Consume a plant-based diet.** Research has shown that a plant-based diet, focused on whole grains, vegetables, fruits, and legumes, greatly reduces the risk of heart disease.
- **Buy organic food products.** Organically produced foods have been cultivated or raised without synthetic pesticides, antibiotics, or genetic engineering. Certified organic foods can be identified by the USDA's stamp.
- **Buy locally grown foods.** Buying locally benefits the environment by reducing the fossil fuels needed to transport food from faraway places. Also, farmers keep eighty to ninety cents for every dollar spent at a farmer's market.

Disease Prevention and Management

Eating fresh, healthy foods not only stimulates your taste buds, but also can improve your quality of life and help you to live longer. As discussed, food fuels your body and helps you to maintain a healthy weight. Nutrition also contributes to longevity and plays an important role in preventing a number of diseases and disorders, from obesity to cardiovascular disease. Some dietary changes can also help to manage certain chronic conditions, including high blood pressure and diabetes. A doctor or a nutritionist can provide guidance to determine the dietary changes needed to ensure and maintain your health.

Heart Health

According to the WHO, cardiovascular disease is the leading cause of death on the planet.World Health Organization. "The Top 10 Causes of Death." Accessed http://www.who.int/mediacentre/factsheets/fs310/en/. However, a healthy diet can go a long way toward preventing a number of conditions that contribute to cardiovascular malfunction, including high levels of blood cholesterol and narrowed arteries. As discussed in this text, it is extremely helpful to reduce the intake of trans fat, saturated fat, and sodium. This can considerably lower the risk of cardiovascular disease, or manage further incidents and artery blockages in current heart patients. It is also beneficial to eat a diet high in fiber and to include more omega-3 fatty acids, such as the kind found in mackerel, salmon, and other oily fish.

High Blood Pressure

Blood pressure is the force of blood pumping through the arteries. When pressure levels become too high, it results in a condition known as hypertension, which is asymptomatic but can lead to a number of other problems, including heart attacks, heart failure, kidney failure, and strokes. For people with high blood pressure, it can be beneficial to follow the same recommendations as those for heart patients. First of all, it is crucial to reduce the intake of sodium to prevent pressure levels from continuing to rise. It can also be helpful to increase potassium intake. However, patients should check with a doctor or dietitian first, especially if there are kidney disease concerns.

Tools for Change

The Dietary Approaches to Stop Hypertension, or DASH diet, is highly recommended to lower blood pressure. This program promotes an increased intake of potassium and calcium by emphasizing fruits, vegetables, whole grains, low-fat dairy products, and limited amounts of lean meat. The DASH diet also decreases the intake of saturated fat and sugar. Studies have shown that blood-pressure patients on the DASH diet were able to reduce their diastolic pressure levels (the lower measurement, which is taken between beats when the heart is relaxed) by up to 5 mmHg regardless of age, gender, or ethnicity. You can learn more about the DASH diet at http://dashdiet.org/.

Diabetes

The rising rates of diabetes have triggered a health crisis in the United States and around the world. In diabetics, the levels of blood glucose, or blood sugar, are too high because of the body's inability to produce insulin or to use it effectively. There are two types of this disease. Although the causes of Type 1 diabetes are not completely understood, it is known that obesity and genetics are major factors for Type 2.

Nutrition plays a role in lowering the risk of Type 2 diabetes or managing either form of the disease. However, it is a myth that there is one diabetes diet that every patient should follow. Instead, diabetics should keep track of the foods they consume that contain carbohydrates to manage and control blood-glucose levels. Also, a dietitian can help patients create a specific meal plan that fits their preferences, lifestyle, and health goals.

The Crisis of Obesity

Excessive weight gain has become an epidemic. According to the National Institutes of Health, over two-thirds of American adults are overweight, and one in three is obese. Obesity in particular puts people at risk for a host of complications, including Type 2 diabetes, heart disease, high cholesterol, hypertension, osteoarthritis, and some forms of cancer. The more overweight a person is, the greater his or her risk of developing life-threatening complications. There is no single cause of obesity and no single way to treat it. However, a healthy, nutritious diet is generally the first step, including consuming more fruits and vegetables, whole grains, and lean meats and dairy products.National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health. "Overweight and Obesity Statistics." *NIH Publication No. 04-4158*. Updated February 2010. http://win.niddk.nih.gov/publications/PDFs/stat904z.pdf.

Kidney Disease

Chronic kidney failure is the gradual loss of kidney function and can cause dangerous levels of fluid and waste to build up in the body. Nutrition is very important in managing end-stage renal disease, and a patient with this condition should discuss a meal plan with a dietitian and physician. Certain macro- and micronutrients will need to be monitored closely, including protein, potassium, sodium, and phosphorus. Kidney patients must also keep track of their caloric intake and dietitians may recommend consuming more fast-releasing carbohydrates and low-saturated fats to boost the number of calories consumed each day.

Cancer

Certain cancers are linked to being overweight or obese. Additionally, some foods are related to either an increased or decreased risk for certain cancers. Foods linked to decreased cancer risk include whole grains, high-fiber foods, fruits, and vegetables. Foods linked to increased cancer risk include processed meats and excess alcohol.

Digestive Disorders

Digestive disorders can include constipation, heartburn or gastroesophageal reflux disease, inflammatory bowel disease, including Crohn's and ulcerative colitis, and

irritable bowel syndrome. These disorders should be addressed with a physician. However, for many of them, diet can play an important role in prevention and management. For example, getting enough fiber and fluids in your diet and being active can help to alleviate constipation.

KEY TAKEAWAYS

- More and more consumers are weighing nutritional considerations as they choose which foods to purchase and prepare for their families.
- Studies have shown that family meals and home-cooked food not only benefit a person's health, but also their overall well-being. Family meals lead to the consumption of healthy food, tighter familial bonds, improved communication, and the teaching of table manners to young children.
- Diet plays a key role in the prevention and management of many chronic conditions or diseases, such as hypertension and diabetes.

DISCUSSION STARTER

1. What would you recommend to help people who are struggling with diabetes? What tips would you provide? What lifestyle changes might help? Use the dietary guidelines at the Mayo Clinic's website to help provide specific suggestions.

   http://www.mayoclinic.com/health/diabetes-diet/DA00027.

14.7 Diets around the World

LEARNING OBJECTIVES

1. Give examples of how local taste preferences and availability influence food choices in different regions of the globe.
2. Explain what is meant by Alice Waters' statement: "Food is precious."

In the past, people's culture and location determined the foods they ate and the manner in which they prepared their meals. For example, in the Middle East, wheat was a staple grain and was used to make flatbread and porridge, while halfway around the world in Mesoamerica, maize was the staple crop and was used to make tortillas and tamales. Today, most people have access to a wide variety of food and can prepare them any way they choose. However, customs and traditions still strongly influence diet and cuisine in most areas of the world.

Comparing Diets

There are a multitude of diets across the globe, in all regions and cultures. Each is influenced by the traditions of the past, along with the produce and livestock available. Local tastes, agricultural economics, and incomes still have a profound effect on what many people eat around the world. In this section, you will read a few examples of cuisines in different countries and regions, demonstrating differences in preferences. We will also compare common dietary choices in each region for a key meal—breakfast.

North America

The people of the United States and Canada consume a wide variety of food. Throughout both countries, people enjoy eating all kinds of cuisine from barbecue, pizza, peanut butter sandwiches, and pie to sushi, tacos, chow mein, and roti (an Indian flatbread). This is partly due to the influence of immigration. As people emmigrated to North America, they brought their dietary differences with them. In the 1800s, for example, Italian immigrants continued to cook spaghetti, pesto, and other cultural dishes after arriving in the United States. Today, Italian cuisine is enjoyed by many Americans from all backgrounds.

The variety of North American cuisine has also been impacted by regional variations. For example, fried chicken, cornbread, and sweet tea are popular in the

southern states, while clam chowder, lobster rolls, and apple cider are enjoyed in New England. Also, as more people seek to support sustainable agriculture, locally grown crops and whole-food cooking practices often factor into what Americans eat and how they eat it.

Breakfast in North America

Meals can vary widely from one region of the world to another. Therefore, it can be interesting and informative to compare the choices made for a particular meal around the globe. Throughout this section, we will explore the kinds of foods that people consume as they begin their day. Breakfast is a vital meal in any part of the world because it breaks the long overnight fast. An adequate breakfast also provides fuel for the first part of the day and helps improve concentration and energy levels.

Let's begin with breakfast in North America. On weekdays, North Americans often eat breakfast in a hurry or on the go. Therefore, many people choose breakfast foods that are quick and easy to prepare or can be eaten during the trip to school or the office. As a result, breakfast cereals with milk are extremely popular, and also oatmeal, toast, or bagels. However, on the weekends, some people spend a longer time enjoying a hearty breakfast or going out for brunch. Typical choices emphasize hot foods and include egg dishes, such as omelettes and scrambled or fried eggs, along with pancakes, waffles, french toast, bacon or sausage, and orange juice, coffee, or tea to drink.

Central and South America

Both Central America and South America feature cuisines with rich Latin flavors. In addition, rice and corn are staples in both and form the basis for many dishes. Both regions are also affected by the mixture of influences from the native populations and the cultural traditions brought by Spanish and Portuguese immigrants during the 1600s and beyond.

South America has a diverse population, which is reflected in dietary choices across the continent. The northwestern region boasts some of the most exotic food in Latin America. In northeastern South America, many dishes feature a contrast of sweet and salty tastes, including raisins, prunes, capers, and olives. Also, rice grown in the area and seafood off the coast are key ingredients in South American-style paella. The north central part of the continent reflects a Spanish influence. Many of the dominant spices—cumin, oregano, cinnamon, and anise—came from Spain, along with orange and lime juices, wine, and olive oil. The south is cattle country and the locals enjoy grass-fed beef cooked in the form of asados, which are large cuts roasted in a campfire. Another popular meat dish is parrilladas, which are

thick steaks grilled over oak.Cooking Light. “South American Cuisine.” © 2012 Time Inc. Lifestyle Group. http://www.cookinglight.com/food/world-cuisine/south-american-cuisine -00400000001391/.

From Mexico in the North to Panama in the South, Central American cuisine features some of the world’s favorite foods, including rice, beans, corn, peppers, and tropical fruits. This area combines a variety of culinary traditions derived from the native Maya and Aztec populations, arrivals from Spain, and African and Latin-influenced neighbors along the Caribbean. In this region of the world, tamales are common. Spicy seasonings, including hot chili peppers, are also very popular.

Typical Southern and Central American Foods

Typical foods in South and Central America include quinoa, which is a grain-like crop that is cultivated for its edible seeds. Quinoa has a high protein and fiber content, is gluten-free, and is particulary tasty cooked in pilafs. Another popular grain product is the tortilla, which is a flatbread made from wheat or corn. Tortillas are used to make a number of dishes, including burritos, enchiladas, and tacos. Fruits and vegetables that are common in Mexico, Central America, and South America include corn, avocados, yucca, peppers, potatoes, mangoes, and papayas. Rice, beans, and a soft cheese known as queso fresco are common to the cuisine in this area of the world as well.

Tamales, which are popular in Mexico and parts of Central and South America, are made from a shell called a masa that is stuffed with meat or vegetables and steamed or boiled in a wrapper of dried corn leaves. The wrapping is discarded prior to eating.

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Breakfast in Central America

In this region, the first meal of the day commonly includes huevos rancheros (fried eggs served over a tortilla and topped with tomato sauce). Other popular breakfast dishes include pan dulce (a sweetened bread), along with fried plantains, and a spicy sausage called chorizo. The typical beverage is coffee, which is available in many forms, including café con leche (which is sweetened with lots of milk) and café de olla (with cinnamon and brown sugar). Hot chocolate is also popular and tends to be thick, rich, and flavored with spices such as cinnamon or achiote. In the Yucatan region, huevos motulenos are prepared by spreading refried beans onto fresh tortillas with fried eggs, peas, chopped ham, and cheese.

Europe

European cuisine is extremely diverse. The diet in Great Britain is different from what people typically consume in Germany, for example. However, across the continent, meat dishes are prominent, along with an emphasis on sauces. Potatoes, wheat, and dairy products are also staples of the European diet.

The nations along the Mediterranean Sea are particularly renowned for their flavorful food. This part of the world boasts a number of famous dishes associated with their countries of origin. They include Italy's pasta, France's coq au vin, and Spain's paella.

Italy

Although Italy is a relatively small nation, the difference in cuisine from one region to another can be great. For example, the people of northern Italy tend to rely on dairy products such as butter, cream, and cheeses made from cow's milk, because the land is flatter and better suited to raising cattle. In southern Italy, there is greater reliance on olive oil than butter, and cheeses are more likely to be made from sheep's milk.Cooking Light. "Regional Italian Cuisine." © 2012 Time Inc. Lifestyle Group. http://www.cookinglight.com/food/world-cuisine/regional-italian-cuisine -00400000001340/.

However, there are a number of common ingredients and dishes across the country. Italian cuisine includes a variety of pasta, such as spaghetti, linguine, penne, and ravioli. Other well-known dishes are pizza, risotto, and polenta. Italians are also known for cooking with certain spices, including garlic, oregano, and basil.

France

For centuries, the French have been famous for their rich, extravagant cuisine. Butter, olive oil, pork fat, goose fat, and duck fat are all key ingredients. Common French dishes include quiche, fondue, baguettes, and also creams and tarts. Frites, or French fries, are cut in different shapes and fried in different fats, depending on the region. Fresh-baked bread is also found across the nation from the skinny baguettes of Paris to the sourdough breads in other parts of the country.

Every region of France seems to have its version of coq au vin (braised chicken most often cooked with garlic, mushrooms, and pork fat in wine). For instance, in the northeast, the dish is prepared a la biere (in beer). In Normandy in the northwest, coq au vin is cooked au cidre (in apple cider).Cooking Light. "France's Regional

Cuisine." © 2012 Time Inc. Lifestyle Group. http://www.cookinglight.com/food/world-cuisine/frances-regional-cuisine -00400000001365/.

Spain

One of the most popular Spanish dishes is paella, a gumbo of rice, seafood, green vegetables, beans, and various meats. The ingredients can vary wildly from one region to another, but rice is always the staple of the dish. Spain is also renowned for its tapas, which are appetizers or snacks. In restaurants that specialize in preparing and serving tapas, diners often order a number of different dishes from a lengthy menu and combine them to make a full meal.

Cooks in Spain rely on a variety of olive oils known for their flavors, ranging from smooth and subtle to fruity and robust. Spanish cuisine combines Roman, Moorish, and New World flavors. Key ingredients include rice, paprika, saffron, chorizo, and citrus fruits.Cooking Light. "Spanish Flavor." © 2012 Time Inc. Lifestyle Group. http://www.cookinglight.com/food/world-cuisine/specialties-spanish -00400000001203/.

Video 14.5

The Mediterranean Diet

(click to see video)

This video shows the cultural history of the cuisine enjoyed by many people who live in the Mediterranean region of Europe.

Breakfast in Europe

In some countries, such as France, Italy, and Belgium, coffee and bread are common breakfast foods. However, the people of Great Britain and Ireland tend to enjoy a bigger breakfast with oatmeal or cold cereal, along with meats like bacon and sausage, plus eggs and toast. Tea is also popular in this area, not only for breakfast, but throughout the day. The continental-style breakfast is most commonly associated with France and includes fresh-baked croissants, toast, or a rich French pastry called brioche, along with a hot cup of tea, coffee, or café au lait.

Africa

The continent of Africa is home to many different countries and cultural groups. This diversity is reflected in the cuisine and dietary choices of the African people.

Traditionally, various African cusines combine locally grown cereals and grains, with fruits and vegetables. In some regions, dairy products dominate, while in others meat and poultry form the basis of many dishes.

Ethiopia

Ethiopia, located along the Horn of Africa, is one of the few African countries never colonized by a foreign nation prior to the modern era. So, outside influences on the culture were limited. Religious influences from Jewish, Islamic, and Catholic traditions played a larger role on the shaping of Ethiopian cuisine, because of the need to adhere to different dietary restrictions. For example, approximately half of Ethiopians are Muslim and must abstain from eating pork or using spices and nuts to flavor dishes. Ethiopia is also known for dishes that use local herbs and spices, including fenugreek, cumin, cardamom, coriander, saffron, and mustard. Many dishes also reflect a history of vegetarian cooking since meat was not always readily available.Cooking Light. "Ethiopian Tastes." © 2012 Time Inc. Lifestyle Group. http://www.cookinglight.com/food/vegetarian/ethiopian-tastes-00400000037116/.

In addition, Ethiopians use their hands to eat. First, diners tear off pieces of injera, a spongy, tangy flatbread made from teff flour. Then, they use the pieces as utensils to scoop up vegetables, legumes, and meats from a communal plate.Ethiopian Restaurant.com. "Injera." © 2004–2012. http://www.ethiopianrestaurant.com/injera.html Teff is a grass that grows in the highlands of Ethiopia and is a staple of the diet.

Central and West Africa

Stretching from mountains in the north to the Congo River, Central Africa primarily features traditional cuisine. Meals are focused on certain staples, including cassava, which is a mashed root vegetable, and also plantains, peanuts, and chili peppers. In West Africa, which includes the Sahara Desert and Atlantic coast, the cuisine features dishes made from tomatoes, onions, chili peppers, and palm nut oil. Popular dishes in both regions include stews and porridges, such as ground nut stew made from peanuts, and also fufu, a paste made from cassava or maize.

Breakfast in Africa

African breakfast choices are strongly influenced by the colonial heritage of a region. The people of West Africa typically enjoy the French continental-style breakfast. However, in the eastern and southern parts of the continent, the traditional English breakfast is more common. In North Africa, breakfast is likely to include tea or coffee, with breads made from sorghum or millet. In East and West

Africa, a common breakfast dish is uji, a thick porridge made from cassava, millet, rice, or corn. Kitoza is a delicacy made from dried strips of beef that are eaten with porridge in Madagascar. In Algeria, French bread, jam, and coffee is a typical breakfast. The people of Cameroon eat beignets, which is a doughnut eaten with beans or dipped in a sticky, sugary liquid called bouilli.

Asia

Asia is a massive continent that encompasses the countries of the Middle East, parts of Russia, and the island nations of the southeast. Due to this diversity, Asian cuisine can be broken down into several regional styles, including South Asia, which is represented for our purposes here by India, and East Asia which is represented for our purposes by China, Korea, and Japan. Even with this variety, the Asian nations have some dietary choices in common. For example, rice is a staple used in many dishes across the continent.

India

In India, there is much variety between the different provinces. The nation's many kinds of regional cuisines can date back thousands of years and are influenced by geography, food availability, economics, and local customs. However, vegetarian diets are common across the nation for religious reasons, among others. As a result, Indian dishes are often based on rice, lentils, and vegetables, rather than meat or poultry. Indian cooking also features spicy seasonings, including curries, mustard oil, cumin, chili pepper, garlic, ginger, and garam masala, which is a blend of several spices.Curry Dishes.com. "Guide to Easy Indian Recipes, Curry Recipes and Curry Spices." © 2009. http://www.currydishes.com/. India is also known for its breads, including the flatbreads roti and chapati. Dishes that are popular not only in India but around the world include samosa, a potato-stuffed pastry; shahi paneer, a creamy curry dish made out of soft cheese and tomato sauce; and chana masala, chickpeas in curry sauce.Food-India.com. "Your Guide to Indian Food." © 2003–2011. http://www.food-india.com/.

China

China has the world's most sizable population. As a result, there are many different culinary traditions across this vast country, which is usually divided into eight distinct cuisine regions. For example, Cantonese cuisine, which is also known as Guangdong, features light, mellow dishes that are often made with sauces, including sweet-and-sour sauce and oyster sauce. Cantonese-style cuisine has been popularized in Chinese restaurants around the world. Another cuisine is known as Zhejiang, which is often shortened to Zhe, and originates from a province in southern China. It features dishes made from seafood, freshwater fish, and bamboo

shoots.eChinacities.com. “China’s Eight Cuisines Revealed and How to Identify Them.” ©2008–2011 http://www.echinacities.com/expat-corner/china-s-8-cuisines-revealed -and-how-to-indentify-them.html Key ingredients that are used in several, but not all, of the different regions include rice, tofu, ginger, and garlic. Tea is also a popular choice in most parts of the country.

Chinese use chopsticks as utensils. These small tapered sticks can be made from a variety of materials, including wood, plastic, bamboo, metal, bone, and ivory. Both chopsticks are held in one hand, between the thumb and fingers, and are used to pick up food.

Korea

Korean cuisine is primarily centered around rice, vegetables, and meat. Commonly-used ingredients include sesame oil, soy sauce, bean paste, garlic, ginger, and red pepper. Most meals feature a number of side dishes, along with a bowl of steam-cooked, short grain rice. Kimchi, a fermented cabbage dish, is the most common side dish served in Korea and is consumed at almost every meal. Another signature dish, bibimbap, is a bowl of white rice topped with sautéed vegetables and chili pepper paste and can include egg or sliced meat. Bulgogi consists of marinated, barbecued beef.Korea Tourism Organization. “Food in Korea.” Accessed October 10, 2011. http://visitkorea.or.kr/enu/1051_Food.jsp.

Japan

As in other parts of Asia, rice is a staple in Japan, along with seafood, which is plentiful on this island nation. Other commonly-used ingredients include noodles, teriyaki sauce, dried seaweed, mushrooms and other vegetables, meat, and miso, which is soybean paste. Some favorite foods include the raw fish dishes sashimi and sushi, which are not only popular in Japan, but are also around the world. Typical beverages include green tea and also sake, which is a wine made of fermented rice.Web MD. “Diets of the World: The Japanese Diet.” © 2005–2011. http://www.webmd.com/diet/features/diets-of-world-japanese-diet.

The traditional table setting in Japan includes placing a bowl of rice on the left and a bowl of miso soup on the right side. Behind the rice and the soup are three flat plates which hold the accompanying side dishes. Similar to China, chopsticks are used in Japan and are generally placed at the front of the table setting. At school or work, many Japanese people eat out of a bento lunch box, which is a single-portion takeout or home-cooked meal. Bento boxes typically include rice, fish or meat, and cooked or pickled vegetables.

The Middle East

Middle Eastern cuisine encompasses a number of different cooking styles from Asian countries along the Mediterranean, as well as from North African nations, such as Egypt and Libya. In this part of the world, lamb is the most commonly consumed meat and is prepared in a number of ways, including as a shish kebab, in a stew, or spit-roasted. However, kosher beef, kosher poultry, and fish are eaten as well. Other staples include the fruits and vegetables that grow in the hills of many Middle Eastern countries, such as dates, olives, figs, apricots, cucumber, cabbage, potatoes, and eggplant. Common grains include couscous, millet, rice, and bulghur. Popular dishes include Syrian baba ganoush, which is pureed eggplant, and kibbeh, or lamb with bulghur wheat, from Lebanon.Saveur. "Middle Eastern Recipes." Accessed December 5, 2011. http://www.saveur.com/solrSearchResults.jsp?fq=Cuisine:Middle\%20Eastern& sitesection=recipes. A flatbread called pita served with hummus, or pureed chickpeas, is another popular dish in this region of the world.

Most people who reside in the Arab countries of the Middle East are Muslim, which can affect their diet. Many Muslims do not consume alcohol or pork. They also observe certain diet-related religious traditions, such as a daytime fast during the month of Ramadan. Other residents of the Middle East include Jews and Christians, and their traditions also affect what foods they eat and how they prepare it. For example, many Jews in Israel keep kosher and follow a set of dietary laws that impact food choices, storage, and preparation.

Breakfast in Asia

To continue the comparison of breakfast around the world, let's examine the first meal of the day in many parts of Asia. In India, the first meal of the day commonly includes eggs scrambled with spices, potatoes, and onions, as well as fresh fruit and yogurt. Breakfast in China often consists of rice complemented by vegetables, meat, or fish. In Korea, a traditional breakfast would include soup made of either beef ribs or pork intestines, a selection of bread and pastries, rice, and kimchi, which is believed to promote intestinal health. Breakfast in Japan does not greatly differ from any other meal. It typically consists of a bowl of steamed white rice, a small piece of fish, a bowl of miso soup with tofu, vegetables, green tea, and occasionally pickled plums called umeboshi. Hot bowls of noodles in broth topped with pork slices, scallions, and bamboo shoots are also common.

Congee is a common breakfast food across Asia. This dish is a porridge made of rice that is consumed in a number of Asian countries, including Vietnam, Thailand, Burma, and Bangladesh. Congee can be prepared both savory and sweet and contain a variety of ingredients, usually meats, vegetables, and herbs. It can be eaten alone or served as a side dish.

In the different regions of China, congee is prepared with various types of rice, which results in different consistencies.

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The Diversity of Palates and Habits

Around the globe, people enjoy different foods and different flavors. In some cultures, the main dishes are meat-based, while others focus on plant-based meals. You can also find different staples in different regions of the world, including rice, potatoes, pasta, corn, beans, root vegetables, and many kinds of grains. Different flavors are also popular on different parts of the planet, from sweet to salty to sour to spicy.

Food Availability

People tend to eat what grows or lives nearby. For example, people in coastal areas tend to consume more seafood, while those in inland areas tend to structure their diet around locally-grown crops, such as potatoes or wheat. In many developing countries, a large part of the diet is composed of cereal grains, starchy roots, and legumes. However, a number of common staples are consumed worldwide, including rice, corn, wheat, potatoes, cassava, and beans.

Income and Consumption

In addition to regional dissimilarities in diets, income also plays a major role in what foods people eat and how they prepare them. The average global calorie consumption has increased to record levels in recent years. This is a consequence of rising incomes, which have allowed consumers in many regions to expand both the variety and the quantity of food they eat. Among developing countries, the daily intake of calories per person rose by nearly 25 percent from the early 1970s to the mid-1990s.US Department of Agriculture, Foreign Agricultural Service. “Diets Around the World: How the Menu Varies.” Last modified October 14, 2004. http://www.fas.usda.gov/info/agexporter/2000/Apr/diets.htm.’ Centers for Disease Control and Prevention. “Caloric Consumption on the Rise in the United States, Particularly Among Women.” NCHS Press Room, February 5, 2004. http://www.cdc.gov/nchs/pressroom/04news/calorie.htm. People in the western world were able to increase their consumption of meat and poultry, fruits and vegetables, and fats and oils. However, those gains were minimal in the poorest

countries, where many continue to struggle with hunger and a limited diet.US Department of Agriculture, Foreign Agricultural Service. “Diets Around the World: How the Menu Varies.” Last modified October 14, 2004. http://www.fas.usda.gov/info/agexporter/2000/Apr/diets.htm.

Different Ways of Eating

People from different parts of the world consume their food in different ways and what is common in one country may be considered impolite in another. For example, in some areas people eat with their fingers, while in others using a fork is much more acceptable. In some regions of the world, people slurp their soup, while in others they quietly sip it. In some places, diners eat off of individual plates, while in others people sit at a table with a large communal plate from which everyone eats.

No matter where you travel, you will find that food production, purchase, and preparation affect all facets of life, from health and economics to religion and culture. Therefore, it is vital for people from all walks of life to consider the choices they make regarding food, and how those decisions affect not only their bodies, but also their world. Alice Waters, an influential chef and founder of the nonprofit program Edible Schoolyard, as well as an advocate for sustainable production and consumption, has said, “Remember food is precious. Good food can only come from good ingredients. Its proper price includes the cost of preserving the environment and paying fairly for the labor of the people who produce it. Food should never be taken for granted.”Waters, A. “The Art of Eating.” PlanetGreen.com. March 31, 2009. http://planetgreen.discovery.com/feature/earth-day/alice-waters-eat-green.html.

Video 14.6

Alice Waters: Edible Education

(click to see video)

In this video, Edible Schoolyard founder Alice Waters talks about the value of growing a garden and learning about food.

KEY TAKEAWAYS

- Many people around the world have access to a wide variety of food and can prepare it any way they choose.
- However, cuisine remains strongly influenced by location, culture, tradition, and economics.
- People from all cultures and all walks of life should consider the choices they make regarding food, and how those decisions affect not only their bodies, but also the world.

DISCUSSION STARTER

1. Compare and contrast breakfast in different parts of the world. What are common attitudes about the first meal of the day? How are the choices that people make the same? How are they different? Are there any breakfast dishes in common?

14.8 End-of-Chapter Exercises

IT'S YOUR TURN

1. Visit a store and study the labels for one kind of processed food. List all of the additives it contains and research them at the library or on the Internet. Why was each substance included during the processing stage?
2. Create a brochure for tourists to explain the kinds of foods they can expect to encounter in one region of the world. Reference a few popular dishes and a few considerations they might need to keep in mind during their travels.
3. How can you move toward a more sustainable diet? Make a list of the kinds of changes you could make to the foods you choose and the ways you prepare them.

APPLY IT

1. Create a short newsletter for parents explaining the value of home-cooked, family meals. Describe how sitting down together for a few meals each week can benefit different members of the family. You may also wish to include one or two tips that parents can use to encourage their children to make mealtimes a priority.
2. Plan a website that addresses the rising price of food around the world. Describe the look and focus of the main page, along with subsections that you will include. Also provide links to related material already available online.
3. Research one of the different cuisines described in this chapter, such as the Indian or Ethiopian diet. Explore the history of the diet, along with the climate, soil, and other factors that affect the foods that farmers grow and how consumers prepare them. Then create a report to explain your findings.

EXPAND YOUR KNOWLEDGE

1. Write a short script for a public service announcement that explains the benefits and risks of food additives. What do you believe the public should know about the natural and synthetic substances that are introduced to foods during the processing stage?
2. Summarize in a written discussion why economic experts believe the era of cheap food is over. What factors have contributed to rising food prices around the globe?
3. Draw a comic strip that shows the different facets of a food system for a particular crop, from production to consumption.

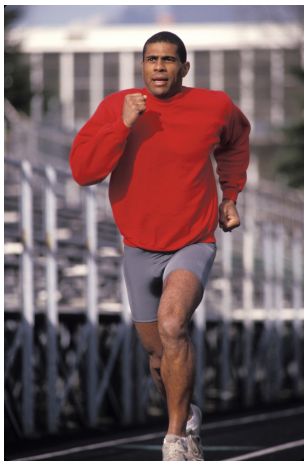
Chapter 15

Achieving Optimal Health: Wellness and Nutrition

Big Idea

A groundbreaking study revealed the risk factors that can affect heart health.

The terms *risk factor*, *good cholesterol*, and *bad cholesterol* were not always on the tip of everyone's tongue when it came to cardiovascular disease. In fact, at one time doctors didn't even consider the concept of managing cholesterol levels to prevent heart disease. However, that was more than fifty years ago, before the Framingham Heart Study became one of the most important epidemiological studies in American health history. Conducted by what is now known as the National Heart, Lung, and Blood Institute in Massachusetts, the study changed the way healthcare professionals and consumers alike regard the prevention of heart disease.Framingham Heart Study. "History of the Framingham Heart Study." © 2011. http://www.framinghamheartstudy.org/about/history.html.



Scientific evidence continues to correlate the relationship between good dietary habits, adequate exercise, and a healthy body.

© Thinkstock

In the 1940s, little was known about the general causes of heart disease and stroke. Most doctors thought a hardening of the arteries was a natural part of aging, and that rising blood pressure with age was not a serious issue. Yet, the death rates for cardiovascular disease had been increasing steadily since the early 1900s and had become an American epidemic. Growing concern led the US Public Health Service to commission a study to determine which biologic and environmental factors were behind the growing problem. The objective was to follow the development of cadiovascular disease over a long period of time in a large group of participants who had not yet developed overt symptoms.

Researchers believed this approach would enable them to identify common characteristics and factors.

In 1948, researchers enrolled more than five thousand participants between ages thirty and sixty-two from Framingham, Massachusetts. The participants returned to the study every two years for a detailed medical examination and laboratory tests. In 1971, the Framingham Heart Study enrolled a second generation—the original participants' adult children and their spouses. In 2002, a third generation—the grandchildren of the original group—joined the study. Recognizing the need to establish a new study reflecting a more diverse population, an additional group of participants was selected in 1994.Framingham Heart Study. "History of the Framingham Heart Study." © 2011. http://www.framinghamheartstudy.org/about/history.html.

The findings of these extensive, long-term studies have created a treasure trove of data for scientists that has revolutionized the way our nation looks at heart disease. The results revealed high blood pressure, diabetes, cholesterol, and LDL cholesterol in particular, as risk factors for heart disease. The study also identified lifestyle choices as factors which increased the risk of cardiovascular disease, including eating an unhealthy diet, remaining sedentary, and smoking. By utilizing new diagnostic technologies, the Framingham Study continues to make important strides in learning about heart disease. Framingham investigators also collaborate with leading researchers from around the world on projects related to osteoporosis, arthritis, and diabetes. In addition, they have initiated the Framingham Nutrition Studies, which examine the connection between diet and nutrition to the risk and outcomes of cardiovascular disease. The discoveries of Framingham researchers can help discern opportunities for preventive nutrition intervention.Framingham Heart Study. "History of the Framingham Heart Study." © 2011. http://www.framinghamheartstudy.org/about/history.html.

Video 15.1

The Framingham Study

(click to see video)

Dr. Hans Diehl discusses the driving forces behind the Framingham Heart Study.

You Decide

Are you ready to make the necessary changes to achieve optimal health?

How will you benefit from the knowledge about nutrition that you have gained thus far? The link between good nutrition and good health is an undebatable scientific fact. Given the consequences of poor dietary choices and lifestyle habits, it is worthwhile to assess your current food and activity profile to determine areas for improvement. It is important to remember that there are no quick fixes, but with dedication, hard work, and persistence, much can be accomplished. Of course, giving up what we once found enjoyable may not be the easiest task. In fact, it can be very hard to develop new thinking patterns that will translate into better dietary and lifestyle choices. Are you willing to put forth the effort necessary to create change in your life? As you read this chapter, you will be presented with tools and concepts to help you with this task. After that, it will be up to you.

15.1 Diet Trends and Health

LEARNING OBJECTIVES

1. Identify and describe the nutritional pros and cons of diets and food trends.
2. Discuss the role of dietary supplements and the importance of using food as your primary nutritional source.

In the past, health was regarded merely as the absence of illness. However, a growing understanding of the complexity and potential of the human condition has prompted a new way of thinking about health. Today, we focus on the idea of **wellness**[1], which involves a great deal more than just not being sick. Wellness is a state of optimal well-being that enables an individual to maximize their potential. This concept includes a host of dimensions—physical, mental, emotional, social, environmental, and spiritual—which affect one's quality of life.University of Illinois at Urbana-Champaign, McKinley Health Center. "What Is Wellness?" © 2011 The Board of Trustees of the University of Illinois at Urbana-Champaign. http://www.mckinley.illinois.edu/Units/Health_Ed/wellness.htm. Striving for wellness begins with an examination of dietary choices.

Dietary Food Trends

Hundreds of years ago, when food was less accessible and daily life required much more physical activity, people worried less about obesity and more about simply getting enough to eat. In today's industrialized nations, conveniences have solved some problems and introduced new ones, including the hand-in-hand obesity and diabetes epidemics. Fad diets gained popularity as more North Americans struggled with excess pounds. However, new evidence-based approaches that emphasize more holistic measures are on the rise. These new dietary trends encourage those seeking to lose weight to eat healthy, whole foods first, while adopting a more active lifestyle. These sound practices put dietary choices in the context of wellness and a healthier approach to life.

1. Achieving balance and integration of aspects that affect quality of life, including physical, mental, emotional, social, environmental, and spiritual dimensions.

Functional Foods

Many people seek out foods that provide the greatest health benefits. This trend is giving rise to the idea of **functional foods**[2], which not only help meet basic nutritional needs but also are reported to fight illness and aging. According to the

2. Foods which do more than meet basic nutritional needs and could provide additional health benefits.

Academy of Nutrition and Dietetics (AND), formerly known as the The Academy of Nutrition and Dietetics, functional foods may reduce the risk of disease or promote optimal health. The AND recognizes four types of functional foods.The Academy of Nutrition and Dietetics. "Functional Foods." *J Am Diet Assoc* 109, no. 4 (April 2009): 735–46. http://www.eatright.org/About/Content.aspx?id=8354. They are: conventional foods, modified foods, medical foods, and special dietary use foods.

The first group, **conventional foods**, represents the simplest form of functional foods. They are whole foods that have not been modified. Examples include whole fruits and vegetables (which are abundant in phytochemicals and antioxidants), yogurt and kefir (which contain natural probiotic bacteria that can help maintain digestive system health), and dark chocolate (which contains antioxidants).

Modified foods have been fortified, enriched, or enhanced with additional nutrients or bioactive compounds. Foods are modified using biotechnology to improve their nutritional value and health attributes. Examples of modified foods include calcium-fortified orange juice, breads enriched with B vitamins, iodized salt, cereals fortified with vitamins and minerals, margarine enhanced with plant sterols, and energy drinks that have been enriched with herbs (ginseng or guarana) or amino acids (taurine). It is important to consider that the health claims of some modified foods may be debatable, or entirely fraudulent. Check with a health professional regarding the effects of modified foods on your health.

Medical foods are designed for enteric administration under the guidance of a medical professional. (During enteric administration, food is treated so that it goes through the stomach undigested. Instead, the food is broken down in the intestines only.) Medical foods are created to meet very specific nutritional requirements. Examples of medical foods include liquid formulas for people with kidney disease, liver disease, diabetes, or other health issues. Medical food is also given to comatose patients through a gastronomy tube because they cannot eat by mouth.

Special dietary use foods do not have to be administered under a doctor's care and can be found in a variety of stores. Similar to medical foods, they address special dietary needs and meet the nutritional requirements of certain health conditions. For example, a bottled oral supplement administered under medical supervision is a medical food, but it becomes a special dietary use food when it is sold to retail customers. Examples of special dietary use foods include gluten-free foods, lactose-free dairy products, and formulas and shakes that promote weight loss.

Popular Diets

The concept of functional foods represents initiatives aimed at addressing health problems. Certain diet plans take this concept one step further, by striving to prevent or treat specific conditions. For example, it is widely understood that people with diabetes need to follow a particular diet. Although some of these diet plans may be nutritionally sound, use caution because some diets may be fads or be so extreme that they actually *cause* health problems.Web MD. "Alternative Diet Programs: Topic Overview." Last modified June 30, 2009. http://www.webmd.com/diet/tc/alternative-diet-programs-topic-overview. Before experimenting with a diet, discuss your plans with your doctor or a registered dietitian. Throughout this section, we will discuss some of the more popular diets. Some fall under the category of fad diets, while others are backed by scientific evidence. Those that fall into the latter category provide a good foundation to build a solid regimen for optimal health.

The DASH Diet

The Dietary Approaches to Stop Hypertension, or DASH diet, focuses on reducing sodium intake to either 2,300 milligrams per day (as recommended by the *Dietary Guidelines for Americans*) or 1,500 milligrams per day. The DASH diet is an evidence-based eating plan that can help reduce high blood pressure. This plan may also decrease the risk of heart attack, stroke, diabetes, osteoporosis, and certain cancers.DASH Diet Oregon. "DASH Diet Eating Plan." © 2011 Nutrition Education Services/Oregon Dairy Council. http://www.dashdietoregon.org/. DASH tips to lower sodium include:

- Using spices instead of salt to add flavor
- Reading sodium content on processed or canned food labels, and choosing low-sodium options
- Removing some sodium from canned foods (such as beans) by rinsing the product before consumption
- Avoiding salt when cooking

DASH dieters eat lots of whole grains and high-fiber fruits and vegetables, and moderate amounts of low-fat dairy products, lean meats, and heart-healthy fish. In addition, DASH limits the use of saturated fats to less than 7 percent of total calories, and restricts the consumption of sweets and alcohol. The DASH diet also calls for consuming less added sugar and drinking fewer sugar-sweetened drinks. It replaces red meat with fish and legumes and calls for increased calcium, magnesium, potassium, and fiber. Also, even though some people on the DASH diet may find it lowers their HDL (good) cholesterol along with their LDL (bad) cholesterol, it still has a positive cumulative effect on heart health.DASH Diet

Oregon. “DASH Diet Eating Plan.” © 2011 Nutrition Education Services/Oregon Dairy Council. http://www.dashdietoregon.org/.

The Gluten-Free Diet

The gluten-free diet helps people whose bodies cannot tolerate **gluten**, a protein found in wheat, barley, and rye. One of the most important ways to treat this condition is to avoid the problematic foods, which is not easy. Although following a gluten-free diet is challenging, it is prescribed for patients with gluten intolerance and celiac disease, an autoimmune disorder with a genetic link. People who have celiac disease cannot consume gluten products without damaging their intestinal lining. Eating a gluten-free diet means finding replacements for bread, cereal, pasta, and more. It also means emphasizing fresh fruits, vegetables, and other foods without gluten. However, it is important to note that the gluten-free trend has become something of a fad even for those without a gluten intolerance. Celiac disease is a relatively rare condition found in only 1 percent of the population. Therefore, a gluten-free diet should be followed only with a physician’s recommendation.

Low-Carb Diets

Low-carb diets, which include the Atkins Diet and the South Beach Diet, focus on limiting carbohydrates—such as grains, fruit, and starchy vegetables—to promote weight loss. The theory behind the low-carb diet is that insulin prevents the breakdown of fat by allowing sugar in the form of blood glucose to be used for energy. Proponents of this approach believe that because limiting carbs generally lowers insulin levels, it would then cause the body to burn stored fat instead. They believe this method not only brings about weight loss, but also reduces the risk factors for a number of conditions. However, some studies have shown that people who followed certain low-carb diet plans for two years lost an average of nearly 9 pounds, which is similar to the amount of weight lost on higher carbohydrate diets.The Mayo Clinic. “Low-Carb Diet: Can It Help You Lose Weight?” Accessed December 21, 2011. http://www.mayoclinic.com/health/low-carb-diet/NU00279.

The benefits of this kind of diet include an emphasis on whole, unprocessed foods and a de-emphasis of refined carbohydrates, such as white flour, white bread, and white sugar. However, there are a number of downsides. Typically, the first two weeks allow for only 20 grams of carbs per day, which can be dangerously low. In addition, dieters using the low-carb approach tend to consume twice as many saturated fats as people on a diet high in healthy carbohydrates. Low-carb diets are also associated with a higher energy intake, and the notion that “calories don’t count,” which is prevalent in this kind of diet, is not supported by scientific evidence.Steele, V. “Health and Nutritional Effects of Popular Diets.” Kellogg

Nutrition Symposium, The Team of Registered Dietitians & Nutrition Professionals at Kellogg Canada Inc. Insert to *Canadian Journal of Dietetic Practice and Research* 64, no. 3 (Fall 2003).

The Macrobiotic Diet

The macrobiotic diet is part of a health and wellness regimen based in Eastern philosophy. It combines certain tenets of Zen Buddhism with a vegetarian diet and supports a balance of the oppositional forces *yin* and *yang*. Foods are paired based on their so-called yin or yang characteristics. Yin foods are thought to be sweet, cold, and passive, while yang foods are considered to be salty, hot, and aggressive.

Whole grains make up about 50 percent of the calories consumed and are believed to have the best balance of yin and yang. Raw and cooked vegetables comprise about 30 percent of the diet and include kale, cabbage, collards, bok choy, and broccoli on a daily basis, along with mushrooms and celery a few times a week. Bean or vegetable-based soups and broths can make up 5 to 10 percent of daily caloric intake. Additionally, the diet allows small amounts of fish and seafood several times a week, along with a few servings of nuts. The macrobiotic diet prohibits certain foods, such as chocolate, tropical fruits, and animal products, because they are believed to fall on the far end of the yin-yang spectrum, which would make it difficult to achieve a Zen-like balance.

The macrobiotic diet focuses on foods that are low in saturated fats and high in fiber, which can help to lower the risk of cardiovascular disease. Proponents of this diet also believe that it may protect against cancer. However, many nutritionists and healthcare providers express concerns, particularly if the diet is followed strictly. Extreme macrobiotic eating can be low in protein, low in calories, and pose a risk for starvation. In addition, the diet is also very low in essential vitamins and minerals.Zelman, K.M. “Macrobiotic Diet.” Web MD. Accessed December 21, 2011. http://www.webmd.com/diet/features/macrobiotic-diet.

The Mediterranean Diet

The traditional Mediterranean diet incorporates many elements of the dietary choices of people living in Greece and southern Italy. The Mediterranean diet focuses on small portions of nutritionally-sound food. This diet features food from plant sources, including vegetables, fruits, whole grains, beans, nuts, seeds, breads and potatoes, and olive oil. It also restricts the consumption of processed foods and recommends eating locally grown foods rich in micronutrients and antioxidants. Other aspects of this eating plan include consuming fish and poultry at least twice per week, eating red meat only a few times per month, having up to seven eggs per

week, and drinking red wine in moderation and with meals. Unlike most diets, the Mediterranean diet does not cut fat consumption across the board. Instead, it incorporates low-fat cheese and dairy products, and it substitutes olive oil, canola oil, and other healthy oils for butter and margarine.

More than fifty years of nutritional and epidemiological research has shown that people who follow the Mediterranean diet have some of the lowest rates of chronic disease and the highest rates of longevity among the populations of the world. Studies have shown that the Mediterranean diet also helps to decrease excess body weight, blood pressure, blood fats, and blood sugar and insulin levels significantly.Kovacs, J. S. "Popular Diets of the World: The Mediterranean Diet." Web MD. Accessed December 21, 2011. http://www.webmd.com/diet/features/the-mediterranean-diet.

Tools for Change

For six years, researchers from the University of Bordeaux in France followed the dietary habits of more than seven thousand individuals age sixty-five and over. Participants who described greater consumption of extra-virgin olive oil reportedly lowered their risk of suffering a stroke by 41 percent. The study controlled for stroke risk factors, such as smoking, alcohol intake, high blood pressure, and a sedentary lifestyle. To increase the amount of olive oil in your diet, try spreading olive oil instead of butter on your toast, making your own salad dressing using olive oil, vinegar or lemon juice, and herbs, cooking with olive oil exclusively, or simply adding a dose of it to your favorite meal.Holohan, E. "More Olive Oil in Diet Could Cut Stroke Risk: Study." HealthFinder.gov, US Department of Health and Human Services. © 2011 Health Day. http://healthfinder.gov/news/newsstory.aspx?docID=653917.

The Raw Food Diet

The raw food diet is followed by those who avoid cooking as much as possible in order to take advantage of the full nutrient content of foods. The principle behind **raw foodism** is that plant foods in their natural state are the most wholesome for the body. The raw food diet is not a weight-loss plan, it is a lifestyle choice. People who practice raw foodism eat only uncooked and nonprocessed foods, emphasizing whole fruits and vegetables. Staples of the raw food diet include whole grains, beans, dried fruits, seeds and nuts, seaweed, sprouts, and unprocessed produce. As a

result, food preparation mostly involves peeling, chopping, blending, straining, and dehydrating fruits and vegetables.

The positive aspects of this eating method include consuming foods that are high in fiber and nutrients, and low in calories and saturated fat. However, the raw food diet offers little in the way of protein, dairy, or fats, which can cause deficiencies of the vitamins A, D, E, and K. In addition, not all foods are healthier uncooked, such as spinach and tomatoes. Also, cooking eliminates potentially harmful microorganisms that can cause foodborne illnesses. Therefore, people who primarily eat raw foods should thoroughly clean all fruit and vegetables before eating them. Poultry and other meats should *always* be cooked before eating.Web MD. "Raw Food Diet." Accessed December 21, 2011. http://www.webmd.com/diet/guide/raw-food-diet.

Vegetarian and Vegan Diets

Vegetarian and vegan diets have been followed for thousands of years for different reasons, including as part of a spiritual practice, to show respect for living things, for health reasons, or because of environmental concerns. For many people, being a vegetarian is a logical outgrowth of "thinking green." When a food system is heavily focused on meat production there are deforestation issues, overgrazing of land and pasturage, and animal abuses. By avoiding animal flesh, vegetarians hope to look after their own health and that of the planet at the same time. Broadly speaking, vegetarians eat beans, grains, and fruits and vegetables, and do not eat red meat, poultry, seafood, or any other animal flesh. Some vegetarians, known as lactovegetarians, will eat dairy products. Others, known as lacto-ovo vegetarians, will eat dairy products and eggs. A vegan diet is the most restrictive vegetarian diet—vegans do not eat dairy, eggs, or other animal products, and some do not eat honey.

Vegetarian diets have a number of benefits. Well-balanced eating plans can lower the risk of a number of chronic conditions, including heart disease, diabetes, and obesity. They also help to promote sustainable agriculture. However, if a vegetarian does not vary his or her food choices, the diet may be insufficient in calcium, iron, omega-3 fatty acids, zinc, and vitamin B_{12}. Also, if people who follow these diets do not plan out their meals, they may gravitate toward foods high in fats.

Table 15.1 The Pros and Cons of Seven Popular Diets

Diet	Pros	Cons
DASH Diet	• Recommended by the National Heart, Lung, and Blood Institute, the American Heart Association, and many physicians • Helps to lower blood pressure and cholesterol • Reduces risk of heart disease and stroke • Reduces risk of certain cancers • Reduces diabetes risk	• There are very few negative factors associated with the DASH diet
Gluten-Free Diet	• Reduces the symptoms of gluten intolerance, such as chronic diarrhea, cramping, constipation, and bloating • Promotes healing of the small intestines for people with celiac disease, preventing malnutrition • May support weight loss • May be beneficial for other autoimmune diseases, such as Parkinson's disease, rheumatoid arthritis, and multiple sclerosis	• Risk of folate and iron deficiencies • Special gluten-free products can be hard to find and expensive • Requires constant vigilance and careful food label reading, since gluten is found in many products

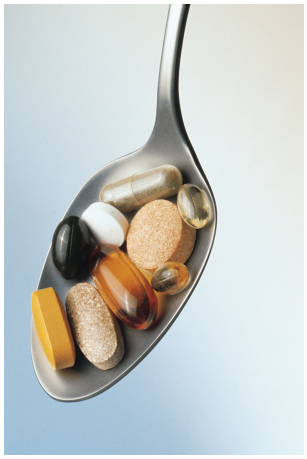
Diet	Pros	Cons
	• May be helpful for Types 1 and 2 diabetes and anemia	
Low-Carb Diet	• Restricts refined carbohydrates, such as white flour and white sugar • May temporarily improve blood sugar or blood cholesterol levels	• Not entirely evidence-based • Results in higher fat and protein consumption
Macrobiotic Diet	• Low in saturated fats and high in fiber • Emphasizes whole foods and de-emphasizes processed foods • Rich in phytoestrogens, which may reduce the risk of estrogen-related cancers	• Not entirely evidence-based • Lacks certain vitamins and minerals; supplements are often required • Can result in a very low caloric intake • Lack of energy may result from inadequate protein
Mediterranean Diet	• A reduced risk of cardiovascular disease and mortality • A lower risk of cancer	• Does not specify daily serving amounts

Diet	Pros	Cons
	• De-emphasizes processed foods and emphasizes whole foods and healthy fats • Lower sodium intake, due to fewer processed foods • Emphasis on monosaturated fats leads to lower cholesterol • Highlighting fruits and vegetables raises consumption of antioxidants	• Potential for high fat and high calorie intake as nuts and oils are calorie-dense foods • Drinking one to two glasses of wine per day may not be healthy for those with certain conditions
Raw Food Diet	• Emphasizes whole foods • Focuses on nutritionally-rich foods • High in fiber	• Not entirely evidence-based • Very restrictive and limits protein and healthy fat intake • Could encourage the development of foodborne illness • Extremely difficult to follow • Can cause deficiencies in essential vitamins

Diet	Pros	Cons
Vegetarianism and Veganism	• May reduce cancer risk • May reduce heart disease risk • May reduce obesity risk • May help prevent Type 2 diabetes • Helps with weight reduction and weight maintenance	• Guidelines regarding fat and nutrient consumption must be followed • Requires vigilance to watch out for hidden animal products • Requires negotiating meals and holidays with meat-eating friends and family

Food Supplements and Food Replacements

Current trends also include the use of supplementation to promote health and wellness. Vitamins, minerals, herbal remedies, and **supplements**[3] of all kinds constitute big business and many of their advertising claims suggest that optimal health and eternal youth are just a pill away. The main types of dietary supplements are macronutrients (amino acids, proteins, essential fatty acids), micronutrients (vitamins and minerals that promote healthy body functions), probiotics (beneficial bacteria such as the kind found in the intestines), and herbal supplements, which often target a specific body part, such as bones.



Are dietary supplements really necessary to achieve optimal health?

Some public health officials recommend a daily multivitamin due to the poor diet of most North Americans. The US Preventive Task Force also recommends a level of folate intake which can be easier

3. Vitamins, minerals, and herbs which are taken in addition to your regular diet to promote healthy body functions or to target specific body parts.

to achieve with a supplement. In addition, the following people may benefit from taking daily vitamin and mineral supplements:

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- women who are pregnant or breast-feeding
- premenopausal women who may need extra calcium and iron
- older adults
- people with health issues that affect their ability to eat
- vegetarians, vegans, and others avoiding certain food groupsWatson, S. "How to Evaluate Vitamins and Supplements." Web MD. Accessed December 21, 2011. http://www.webmd.com/vitamins-and-supplements/lifestyle-guide -11/how-to-evaluate-vitamins-supplements.

However, before you begin using dietary supplementation, consider that the word *supplement* denotes something added. Vitamins, minerals, and other assorted remedies should be considered as extras. They are add-ons—not replacements—for a healthy diet. As food naturally contains nutrients in its proper package, remember that food should always be your primary source of nutrients. When considering taking supplements, it is important to recognize possible drawbacks that are specific to each kind:

Micronutrient Supplements. Some vitamins and minerals are toxic at high doses. Therefore, it is vital to adhere to the Tolerable Upper Intake Levels (UL) so as not to consume too much of any vitamin. For example, too much vitamin A is toxic to the liver. Symptoms of vitamin A toxicity can include tinnitus (ringing in the ears), blurred vision, hair loss, and skin rash. Too much niacin can cause a peptic ulcer, hyperglycemia, dizziness, and gout.

Herbal Supplements. Some herbs cause side effects, such as heart palpitations and high blood pressure, and must be taken very carefully. Also, some herbs have contraindications with certain medicines. For example, Valerian and St. John's Wort negatively interact with certain prescription medications, most notably antidepressants. Additionally, there is a real risk of overdosing on herbs because they do not come with warning labels or package inserts.

Amino Acid Supplements. Certain amino acid supplements, which are taken by bodybuilders among others, can increase the risk of consuming too much protein. An occasional amino acid drink in the place of a meal is not a problem. However, problems may arise if you add the supplement to your existing diet. Most Americans receive two to three times the amount of protein required on a daily basis from their existing diets—taking amino acid supplements just adds to the

excess.Web MD. “Choosing a Vitamin and Mineral Supplement—Topic Overview.” Last revised May 4, 2011. http://www.webmd.com/food-recipes/tc/choosing-a-vitamin -and-mineral-supplement-topic-overview.

Supplement Claims and Restrictions

The Food and Drug Administration (FDA) regulates supplements, but it treats them like food rather than pharmaceuticals. Dietary supplements must meet the FDA’s Good Manufacturing Standards, but are not required to meet the standards for drugs, although some companies do so voluntarily. Also, although supplement manufacturers are allowed to say a particular ingredient may reduce the risk of a disease or disorder, or that it might specifically target certain body systems, these claims are not approved by the FDA. This is why labels that make structural and functional claims are required to carry a disclaimer saying the product is not intended “to diagnose, treat, cure, or prevent any disease.” In addition, in the United States, supplements are taken off the market only after the FDA has proven that they are hazardous.Watson, S. “How to Evaluate Vitamins and Supplements.” Web MD. Accessed December 21, 2011. http://www.webmd.com/vitamins-and-supplements/lifestyle-guide-11/how-to-evaluate-vitamins-supplements.

Before Taking Supplements

The phrase *caveat emptor* means “buyer beware,” and it is important to keep the term in mind when considering supplementation. Just because a product is “natural” that does not mean it can’t be harmful or dangerous, particularly if used inappropriately. The following are helpful questions to explore before deciding to take a supplement:

- Does the scientific community understand how this supplement works and are all its effects well known?
- Is there proof that the supplement actually performs in the manner that it claims?
- Does this supplement interact with food or medication?
- Is taking this supplement necessary for my health?
- Is the supplement affordable?
- Is the supplement safe and free from contaminants?

Lastly, please remember that a supplement is only as good as the diet that accompanies it. We cannot overstate the importance of eating a healthy, well-balanced diet designed to provide all of the necessary nutrients. Food contains many more beneficial substances, such as phytochemicals and fiber, that promote good health and cannot be duplicated with a pill or a regimen of supplements. Therefore, vitamins and other dietary supplements should never be a substitute for food. Nutrients should always be derived from food first.

KEY TAKEAWAYS

- Attitudes toward food change over time, so it is important to ground dietary choices in fact, not fashion.
- Popular, evidence-based diets, such as the Mediterranean diet, the DASH diet, vegetarianism, and the gluten-free diet offer different approaches to promoting health, and each has its own benefits and risks.
- It is important to weigh the pros and cons of dietary supplementation. There are risks of overdosing and risks of contraindications with certain medications. Although supplements can be helpful, it is important to remember—food first!

DISCUSSION STARTER

1. Discuss the Mediterranean diet. What foods do you already consume that are recommended by this diet? What changes could you make to follow the diet more closely? How can you modify any concerns so that this diet will work for you?

15.2 Fitness and Health

LEARNING OBJECTIVES

1. Define fitness and explain the essential elements of physical fitness.
2. List the physical, mental, and emotional benefits of physical activity.

Becoming physically fit is an important part of achieving optimal health. A well-rounded exercise program is crucial to become and remain healthy. Physical activity improves your health in a number of ways. It promotes weight loss, strengthens muscles and bones, keeps the heart and lungs strong, and helps to protect against chronic disease. There are four essential elements of physical fitness: cardiorespiratory endurance, muscle strength, muscle endurance, and flexibility. Some enthusiasts might argue the relative importance of each, but optimal health requires some degree of balance between all four. Neither a muscle-bound weight lifter unable to bend down to tie his shoes nor a flexible yoga enthusiast who cannot lift her suitcase can be considered completely fit. All four elements of physical fitness are vital.

What does it mean to be physically fit? What does physical fitness encompass?

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The Essential Elements of Physical Fitness

Building **cardiorespiratory endurance**[4] through aerobic exercise is an excellent way to maintain a healthy weight. Working on this element of physical fitness also improves your circulatory system. It boosts your ability to supply the body's cells with oxygen and nutrients, and to remove carbon dioxide and metabolic waste. In addition, aerobic exercise makes you breathe faster and more deeply, which maximizes oxygen levels in the blood. Regular, moderate aerobic activity, about thirty minutes at a time for five days per week, trains the body to deliver oxygen more efficiently, which strengthens the heart and lungs, and reduces the risk of cardiovascular disease.Mayo Clinic. "Fitness Training: Elements of a Well-Rounded Routine." September 3, 2011. http://www.mayoclinic.com/health/fitness-training/HQ01305.

4. The cardiovascular system's ability to deliver oxygen and nutrients efficiently to fuel physical activity.

The most common standard for evaluating cardiorespiratory endurance is the **VO_2 max** test. VO_2 max is your maximal oxygen uptake, and the VO_2 max test measures the amount of oxygen (in relation to body weight) that you can use per minute. A test subject usually walks or runs on a treadmill with an air mask over their face to measure oxygen consumption as exercise intensity increases (see Note 15.14 "Video 15.2"). At some point, the amount of oxygen consumed no longer increases despite an increase in exercise intensity. This value of oxygen consumption is referred to as VO_2 max, 'V' meaning volume, and 'max' meaning the maximum amount of oxygen (O_2) consumed independent of exercise intensity. The higher the number, the more oxygen you can consume, and the faster or longer you can walk, run, bike, or swim, among other aerobic activities.Ed Eyestone, "How to Improve Your VO_2 Max," *Runner's World*, 9 January 2008. http://www.runnersworld.com/article/0,7120,s6-238-244--12408-0,00.html.

Video 15.2

VO_2 Max Test: The Human Body—A User's Guide

(click to see video)

Watch two athletes take a VO_2 max test to measure their cardiorespiratory endurance.

Muscle strength[5] and **muscle endurance**[6] are two other essential elements of physical activity. They are not just crucial for athletes and bodybuilders—building muscle strength and endurance is important for children, seniors, and everyone in between. The support that your muscles provide allows you to work, play, and live more efficiently. Strength training involves the use of resistance machines, resistance bands, free weights, or other tools. However, you do not need to pay for a gym membership or expensive equipment to strengthen your muscles. Homemade weights, such as plastic bottles filled with sand, can work just as well. You can also use your own body weight and do push-ups, leg squats, abdominal crunches, and other exercises to build your muscles. If strength training is performed at least twice a week, it can help to improve muscle strength and endurance, and to increase bone strength. Strength training can also help you to maintain muscle mass during a weight-loss program.Mayo Clinic. "Fitness Training: Elements of a Well-Rounded Routine." September 3, 2011. http://www.mayoclinic.com/health/fitness-training/HQ01305.

Flexibility[7] is the range of motion available to your joints. Yoga, tai chi, Pilates, and stretching exercises work to improve this element of fitness. Stretching not only improves your range of motion, it also promotes better posture, and helps you perform activities that can require greater flexibility, such as chores around the

5. Maximum amount of muscular force that can be exerted in a single movement or action.
6. Quality of a muscle, or a group of muscles, to perform repetitive movements for a lengthy period of time.
7. Capability of joints to move in a whole, wide range of motion.

house. In addition to working on flexibility, older adults should include balance exercises in their regular routine. Balance tends to deteriorate with age, which can result in falls and fractures.Mayo Clinic. “Fitness Training: Elements of a Well-Rounded Routine.” September 3, 2011. http://www.mayoclinic.com/health/fitness-training/HQ01305.

Some forms of exercise confer multiple benefits, which can help you to balance the different elements of physical fitness. For example, riding a bicycle for thirty minutes or more not only builds cardiorespiratory endurance, it also improves muscle strength and muscle endurance. Some forms of yoga can also build muscle strength and endurance, along with flexibility. However, addressing fitness standards in all four categories generally requires incorporating a range of activities into your regular routine.

Metabolic Fitness

Being fit also encompasses **metabolic fitness**[8]. It relates to the number of calories you require to survive and the number of calories you burn during physical activity. Recall from Chapter 11 "Energy Balance and Body Weight" that **metabolism** is the sum of all chemical reactions that occur in the human body to conduct life’s processes. Some are catabolic reactions that break down nutrients to supply the body with cellular energy. The rate at which a person burns calories depends on body shape, body composition, sex, age, nutritional status, and genetics.

One measurement of metabolic fitness is **resting metabolic rate**, or RMR, which is a measurement of the amount of energy required for the body to maintain its basic functions while at rest, i.e. breathing, heart beats, liver and kidney function, and so on. On average, RMR accounts for between 50 and 70 percent of a person’s total daily energy expenditure. Different factors can affect the RMR, and as a result it is not a perfect measurement for metabolic fitness. For example, a slender person who is tall has more body surface area and therefore has a higher RMR. Also, muscle utilizes more energy at rest than fat, and a person with more muscle mass has a higher RMR.Moninger, J. “Metabolism Hacks: Tap into Your Calorie-Burning Power.” Web MD. Accessed December 21, 2011. http://www.webmd.com/diet/features/metabolism-hacks.

A second measurement of metabolic fitness is the number of calories burned during physical activity. The amount of calories burned depends on the rate at which the heart beats, how much oxygen is delivered to tissues, and how efficiently metabolic reactions consume oxygen and burn calories. One of the best estimates of energy expenditure during exercise is how much oxygen a person consumes. Recall that VO_2 max is used to measure cardiorespiratory endurance. Greater VO_2 max is

8. Ability to provide energy to the muscles during physical activity.

indicative of better oxygen metabolism and cardiovascular fitness, meaning more calories burned. In contrast to RMR, VO_2 max increases significantly with exercise training, from increasing blood flow to tissues to increasing the strength of heart muscle contraction. Greater blood flow into the tissues means more oxygen to muscle, which means more calories burned.

Increasing your daily activity and shedding excess weight helps to improve metabolic fitness. However, you do not have to be the perfect weight to be metabolically fit. Metabolic fitness is highly individualized. Also, any improvement to metabolic fitness is beneficial and means a decrease in the risk for developing diabetes, or other chronic conditions.

Keeping Fit: The Benefits of Physical Activity

Regular physical activity is one of the best things you can do to achieve optimal health. Individuals who are physically active for about seven hours per week lower the risk of dying early by 40 percent compared to those who are active for less than thirty minutes per week.Centers for Disease Control and Prevention. “Physical Activity and Health: The Benefits of Physical Activity.” Last updated February 16, 2011. http://www.cdc.gov/physicalactivity/everyone/health/index.html. Improving your overall fitness involves sticking with an exercise program on a regular basis. If you are nervous or unsure about becoming more active, the good news is that moderate-intensity activity, such as brisk walking, is safe for most people. Also, the health advantages of becoming active far outweigh the risks. Physical activity not only helps to maintain your weight, it also provides a wealth of benefits—physical, mental, and emotional.

Physical Benefits

Getting the recommended amount of physical activity each week, about 150 minutes of moderate, aerobic exercise, such as power walking or bicycling, does not require joining a gym, wearing spandex, or taking expensive, complicated classes. If you can’t commit to a formal workout four to five days per week, you can become more active in simple ways—by taking the stairs instead of the elevator, by walking more instead of driving, by going out dancing with your friends, or by doing your household chores at a faster pace. It is not necessary to perform at the level of a professional dancer or athlete, or to work out for several hours every day, to see real gains from exercise. Even slightly increased activity can lead to physical benefits, such as:

- **Longer life.** A regular exercise program can reduce your risk of dying early from heart disease, certain cancers, and other leading causes of death.
- **Healthier weight.** Exercise, along with a healthy, balanced eating plan, can help you lose extra weight, maintain weight loss, or prevent excessive weight gain.
- **Cardiovascular disease prevention.** Being active boosts HDL cholesterol and decreases unhealthy triglycerides, which reduces the risk of cardiovascular diseases.
- **Management of chronic conditions.** A regular routine can help to prevent or manage a wide range of conditions and concerns, such as metabolic syndrome, Type 2 diabetes, depression, arthritis, and certain types of cancer.
- **Energy boosts.** Regular physical activity can improve muscle tone and strength and provide a boost to your cardiovascular system. When the heart and lungs work more efficiently, you have more energy.
- **Strong bones.** Research shows that aerobic activity and strength training can slow the loss of bone density that typically accompanies aging.

Mental and Emotional Benefits

The benefits of an exercise program are not just physical, they are mental and emotional as well. Anyone who has gone for a walk to clear their head knows the mental benefits of exercise firsthand. Also, you do not have to be a marathoner on a "runner's high" to enjoy the emotional benefits of becoming active. The mental and emotional benefits of physical activity include:

- **Mood improvement.** Aerobic activity, strength-training, and more contemplative activities such as yoga, all help break cycles of worry, absorption, and distraction, effectively draining tension from the body.
- **Reduced risk of depression, or limited symptoms of it.** Some people have called exercise "nature's antidepressant," and studies have shown that physical activity reduces the risk of and helps people cope with the symptoms of depression.
- **Cognitive skills retention.** Regular physical activity can help people maintain thinking, learning, and judgement as they age.
- **Better sleep.** A good night's sleep is essential for clear thinking, and regular exercise promotes healthy, sound sleep. It can also help you fall asleep faster and deepen your rest.

Changing to a More Active Lifestyle

A physically active lifestyle yields so many health benefits that it is recommended for everyone. Change is not always easy, but even small changes such as taking the stairs instead of the elevator, or parking farther away from a store to add a bit more walking into your day can lead to a more active lifestyle and set you on the road to optimal health. When people go one step further by walking or biking on a regular basis, or becoming active by growing and maintaining a garden, they do more than promote their own health—they safeguard the health of the planet, too.

As you change to a more active lifestyle, select an activity that you can integrate into your schedule smoothly, so you can maintain it. For example, instead of making time to get coffee with friends, you might suggest a walk, roller blading, or going for a swim in the campus pool. Also, find an activity that you will be motivated to do. Some people decide to participate in team sports, such as local soccer or softball leagues, because they enjoy being active with others or like knowing that a team relies on them. Others prefer to take a class, such as spinning or yoga, that is led by an instructor who will motivate them. Still others prefer more solitary pursuits, such as taking a jog alone in their neighborhood. No matter what your preference, you are more likely to stick to a workout program if you enjoy it.

Whatever activities people choose to do, if they expend an extra 500 calories per day, they will lose 1 pound per week, become more physically fit, and maintain a healthy nutritional profile. The exact number of calories expended per hour will vary, depending on an individual's weight and level of exertion. However, it can be helpful to keep these numbers in mind (which are for an adult who weighs about 160 pounds) when considering a program of aerobic activity:

- Walking at two miles per hour burns 204 calories per hour
- Bicycling burns 292 calories per hour
- Jogging burns 606 calories per hour
- Golf burns 314 calories per hour, if players carry their clubs
- Ballroom dance burns 219 calories per hour
- Tennis burns 584 calories per hourMayo Clinic. "Exercise for Weight Loss: Calories Burned in 1 Hour." © 1998–2012 Mayo Foundation for Medical Education and Research. Last updated August 2, 2011. http://www.mayoclinic.com/health/exercise/SM00109.

KEY TAKEAWAYS

- Physical fitness is an important part of the pursuit of optimal health. Regular exercise yields multiple benefits in terms of preventing disease and promoting health.
- The four essential elements of physical fitness are cardiorespiratory endurance, muscle strength, muscle endurance, and flexibility.

DISCUSSION STARTER

1. If exercise helps people feel better, why don't more people do it regularly? Discuss some ways to motivate more people to exercise. What are some of the ways that a regular routine could benefit someone currently leading a sedentary lifestyle?

15.3 Threats to Health

LEARNING OBJECTIVE

1. Discuss the roles of nutrition and lifestyle choices in the prevention and management of chronic disease.

Chronic Diseases

Obesity is a risk factor for a number of conditions, including arthritis and certain cancers.

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Chronic diseases are ongoing, life-threatening, and life-altering health challenges. They are the leading cause of death worldwide. Chronic conditions are increasing in frequency. They cause significant physical and emotional suffering and are an impediment to economic growth and vitality. It is important, now more than ever, to understand the different risk factors for chronic disease and to learn how to prevent their development.

The Risk Factors of Chronic Disease

A **risk factor** is a signal that your chances for acquiring a chronic disease may be increased. You might liken a risk factor to the flags that lifeguards sometimes set up at beaches. When you see these flags, you know immediately that swimming within the marked areas could be hazardous, and that if you choose to swim within these parameters anyway, you are doing so at your own risk. But, if you heed the warnings, you are taking the necessary step to protect your safety and health. Similarly, risk factors are warning signs that coincide with the development and progression of disease. However, risk factors are not a 100-percent guarantee that a person will develop a chronic disease, only that the conditions are right. For example, if a person gets sick with the flu, we can say with certainty that the illness was caused by a virus. However, we cannot say that a sedentary lifestyle caused the onset of cardiovascular disease in a patient, because a risk factor indicates a correlation, not a causation.

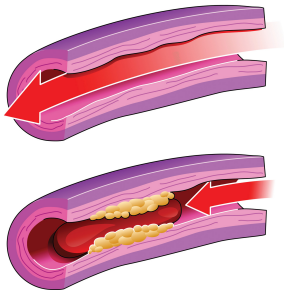
Chronic disease usually develops alongside a combination of the following risk factors: genetics, a prior disease such as obesity or hypertension, dietary and lifestyle choices, and environmental problems. Risk factors such as genetics and age cannot be changed. However, some risk factors can be altered to promote health

and wellness (such as diet). For example, a person who continuously eats a diet high in sugars, saturated fats, and red meat is at risk for becoming obese and developing Type 2 diabetes, cardiovascular disease, or several other conditions. Making more healthy dietary choices can greatly reduce that risk. Being a woman over age sixty-five is a risk factor for developing osteoporosis, but that cannot be changed. Also, people without a genetic predisposition for a particular chronic illness can still develop it. Not having a genetic predipostion for a chronic disease is not a guarantee of immunity.

Identifying Your Risk Factors

To estimate your own risk factors for developing certain chronic diseases, search through your family's medical history. What diseases do you note showing up among close blood relatives? This may be of concern to you. At your next physical, pay attention to your blood tests and ask the doctor if any results are out of normal range. It is also helpful to note your vital signs, particularly your blood pressure and resting heart rate. In addition, you may wish to keep a food diary to make a note of the dietary choices that you make on a regular basis and be aware of foods that are high in saturated fat, among other unhealthy options. As a general rule, it is important to look for risk factors that you can modify.to promote your health. For example, if you discover that your grandmother, aunt, and uncle all suffered from high blood pressure, then you may decide to avoid a high sodium diet. Identifying your risk factors can arm you with the information you need to help ward off disease.

Cardiovascular Disease



Throughout the remainder of this section, we will examine some of the more prevalent chronic diseases, their risk factors, and the choices that can help to discourage their development or progression. Let's begin with cardiovascular disease. According to the Centers for Disease Control and Prevention (CDC), heart disease is the leading cause of death in the United States.Centers for Disease Control and Prevention. "Leading Causes of Death." Last updated September 6, 2011. http://www.cdc.gov/nchs/fastats/lcod.htm. The disease generally starts with **atherosclerosis**[9], or a hardening of the arteries, a chronic condition so common that most people show signs of it by the time they

9. Disease that is characterized by the deposition of plaques and fatty material in the walls of the body's artery, vein and blood vessel network.

turn thirty. Arteries start to narrow and harden when fats accumulate along their inner walls and form plaques. A plaque is made of fat, cholesterol, calcium, and other substances found in blood.

Plaque formation along arterial walls impedes blood flow and can create a thrombus, or stationary blood clot.

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Plaque formation causes arteries to narrow and harden, which elevates blood pressure because the vessels can't expand effectively to accommodate blood pulses. Higher blood pressure strains the heart and causes more damage. Arterial walls can become so weakened due to high blood pressure that they balloon and form what is known as an **aneurysm**[10]. If the aneurysm bursts, it becomes a life-threatening event. The plaques themselves can also rupture due to a spike in blood pressure or a tremor along an arterial wall, and the body responds to this perceived injury by forming blood clots. These clots are serious health threats, whether they are stationary (a thrombus) or moving (an embolus). A stable clot can slowly kill off surrounding tissue, or grow so big that it blocks blood circulation and causes **thrombosis**[11]. When a moving clot becomes stuck in an artery too small for its passage, it cuts off blood flow and causes cell death. This is referred to as an **embolism**[12]. Blood clots in heart and brain arteries can cause heart attacks or strokes.

Table 15.2 The Risk Factors for Cardiovascular Disease

Unmodifiable Risk Factors	Modifiable Risk Factors
• **Age.** Risk increases for men at forty-five, and for women at fifty-five. • **Sex.** Men have a higher risk than women, though the risk for women	• **Cigarette smoking.** Nicotine constricts blood vessels, and carbon monoxide damages their inner lining, which increases the risk of atherosclerosis. • **Obesity.** Excess weight worsens other risk factors. • **Diabetes.** This condition is associated with an increased risk of heart disease. Both types have certain risk factors in common, including obesity and high blood pressure. • **Physical inactivity.** Lack of exercise is associated with heart disease. • **Cholesterol levels.** High levels of blood cholesterol can increase the risk. A high level of low-density lipoprotein (LDL), or

10. Swelling or enlargement of the artery due to a weakening in the artery wall.
11. Development of a blood clot inside of a blood vessel.
12. Blood vessel obstruction caused by a mass, such as a detached blood clot or other foreign body, that circulates in the bloodstream.

Unmodifiable Risk Factors	Modifiable Risk Factors
steeply rises after menopause. • **Family history.** The more family members who have heart disease, the greater the risk.	the "bad" cholesterol, is a common contributing factor. However, a low level of high-density lipoprotein (HDL), or "good" cholesterol, can also promote atherosclerosis.

Steps to Reducing the Risk of Cardiovascular Disease

Diet and nutrition can play a significant role in reducing the risk of cardiovascular disease. It is helpful to lower sodium intake, increase consumption of dietary fiber, and limit consumption of saturated fat, which promotes plaque formation. In addition, it is important to replace refined starches and added sugar, which can boost triglycerides, with whole grains, fruits, and vegetables. Eating foods rich in omega-3 fatty acids, especially fish, using alcohol in moderation, and opting for low or no-fat dairy products can all help reduce your cardiovascular disease risk. Emphasizing vegetable-based sources of protein, such as beans and legumes, can be beneficial, as well as consuming more soy products. It is also important to maintain a healthy weight, manage cholesterol levels, and avoid smoking or chewing tobacco.

Hypertension

Chronic high blood pressure, also known as **hypertension**[13], is a significant health hazard affecting one out of three adults in the United States.Centers for Disease Control and Prevention. "High Blood Pressure Facts." Last updated March 21, 2011. http://www.cdc.gov/bloodpressure/facts.htm. This chronic condition is a major cause of heart attacks and strokes, yet it has no symptoms until blood pressure reaches very high levels, which is why it is known as "the silent killer." The only way to find out if you have high blood pressure is to get an accurate reading of your resting blood pressure rate, which is best done by a medical professional and should be monitored regularly.

13. Medical condition in which the force of blood against the arterial walls is high enough that it could lead to heart disease or other health problems.

High blood pressure is such an important factor in cardiovascular disease, that keeping it within a healthy range is vitally important. As explained in Chapter 1 "Nutrition and You", blood pressure readings consist of two numbers. The top number measures **systolic** pressure (when the heart contracts) and the bottom number measures **diastolic** pressure (when the heart is at rest). The key blood pressure numbers to keep in mind are:

- **Ideal.** 120 over 80 or below
- **Prehypertension.** Higher than 120 over 80 and lower than 139 over 89
- **Hypertension.** Greater than 139 over 89

Table 15.3 The Risk Factors for Hypertension

Unmodifiable Risk Factors	Modifiable Risk Factors
• **Age.** After fifty-five, the risk of developing high blood pressure is 90 percent. • **Race.** African-Americans are more likely to develop hypertension, manifest it at a younger age, and have higher blood pressure readings. • **Family history.** There is a strong genetic component to high blood pressure, and an individual's risk goes up along with the number of family members who have hypertension.	• **Weight.** Roughly 60 percent of people with hypertension are obese. • **Sodium consumption.** The more salt in a person's diet, the more likely they are to have high blood pressure. • **Alcohol.** Drinking more than two drinks per day for men and one drink for women increases the likelihood of hypertension. • **Diet.** In addition to salt and alcohol consumption, other dietary factors increase chances of developing hypertension.

Steps to Reducing the Risk of High Blood Pressure

Although it is not possible to change one's age or genetics, there are actions that people can take to decrease their risk of hypertension. Techniques to reduce blood pressure include becoming physically active, maintaining a healthy weight, reducing sodium intake below 2,400 milligrams per day (or below 1,500 milligrams if you are in a high-risk group or already have been diagnosed with hypertension), using alcohol moderately, and following the DASH diet, which was outlined in Section 15.1 "Diet Trends and Health". Additionally, vitamin C, calcium, and potassium have all been shown to promote healthy blood pressure. It is also vital to monitor your blood pressure levels on a regular basis. Prompt intervention when readings rise above the ideal level (120 over 80) can save lives, which is why everyone should know the status of their blood pressure.

Cancer

More than one hundred diseases are classified as different forms of cancer, all of them characterized by the uncontrolled growth of abnormal cells. Cancer is triggered by mutations in a cell's genetic material. The cause of these changes may be inherited, or it may result from exposure to carcinogens, which are agents that can cause cancer. Carcinogens include chemicals, viruses, certain medical treatments such as radiation, pollution, or other substances and exposures that are known or suspected to cause cancer.American Cancer Society. "Known and Probable Human Carcinogens." Last medical review June 29, 2011. http://www.cancer.org/Cancer/CancerCauses/OtherCarcinogens/GeneralInformationaboutCarcinogens/known-and-probable -human-carcinogens. The National Institutes of Health has classified fifty-four different compounds as known cancer-causing agents in humans.Brett Israel, "How Many Cancers Are Caused by the Environment?" *Scientific American*, 21 May 2010. http://www.scientificamerican.com/article.cfm?id=how-many -cancers-are-caused-by-the-environment.

Under normal conditions, a healthy cell will either repair any damage that has been done or self destruct so that no future cells will be affected. Cells become cancerous when their DNA is damaged, but they do not self-destruct or stop reproducing as normal cells would. As these abnormal cells continue their rapid growth, in most cancers they coalesce in a mass called a **tumor**[14]. Cancer cells can overwhelm healthy cells and interfere with the healthy functioning of the body. They can also invade other organs and spread throughout the body in a process known as **metastasis**[15]. Scientists and the medical community are giving considerable attention to the early stages of cancer, from the moment a healthy cell is exposed to a carcinogen to the point where cells with damaged DNA are replicating out of control. Intervention at any of these early stages could prove to be quite beneficial,

14. Abnormal mass of body tissue that results from uncontrolled and progressive cell growth.

15. Spread of cancerous cells from an original location to one or more new sites within the body.

because it is thought that most cancers are the result of lifestyle choices and environmental exposure.

The risk factors for different cancers can vary. For example, exposure to ultraviolet radiation from the sun and from tanning beds is a risk factor for skin cancer, while exposure to asbestos is a risk factor for mesothelioma cancer. Table 15.4 "The Risk Factors for Cancer" shows some common risk factors for a number of different types of cancer.

Table 15.4 The Risk Factors for Cancer

Unmodifiable Risk Factors	Modifiable Risk Factors
• **Age.** Most cancers occur in people over the age of sixty-five. However, people of all ages, including children, can get cancer. • **Family history.** Certain types of cancer have a genetic link. However, environmental factors may also play a part.	• **Tobacco.** Smoking or chewing tobacco greatly increases the risk for certain cancers, including cancer of the lungs, bladder, cervix, kidneys, mouth, and pancreas. • **Alcohol.** Drinking alcohol is linked to cancers of the mouth, throat, esophagus, and breast, as well as to cancers of the neck and head. • **Obesity.** Linked to cancers of the colon, uterus, pancreas, esophagus, kidney, and breast. • **Cooking techniques.** Grilling, smoking, and preparing meat at high temperatures forms carcinogens. • **Red meat.** The risk of colon cancer seems to increase with the consumption of red meat and processed meat. • **Cured meats.** According to a recent study, there is a mild risk of pancreatic cancer with the consumption of cured meats, such as sausage, pepperoni, bacon, ham, smoked turkey, salami, and hot dogs.

Unmodifiable Risk Factors	Modifiable Risk Factors
	• **Physical inactivity.** Linked to colon, breast, and other cancers. • **Exposure to chemicals.** People who have jobs that expose them to chemicals on a regular basis, such as construction workers and painters, have an increased risk of cancer. • **Viruses or bacteria.** Certain viruses or bacteria may increase the risk of developing cancer. For example, human papillomaviruses, which are sexually transmitted, are the primary cause of cervical cancer.

Steps to Reducing the Risk of Cancer

According to the American Cancer Society, half of all American men and one-third of American women will be diagnosed with some form of cancer in their lifetime.American Cancer Society. "What Is Cancer?" Last medical review March 19, 2010. http://www.cancer.org/Cancer/CancerBasics/what-is-cancer. Although cancer is one of the leading causes of death worldwide, ongoing research and innovations in treatment have improved the outlook for cancer patients to the point where millions now survive or live with cancer, making it a chronic disease.

The American Institute for Cancer Research (AICR) has published guidelines for preventing cancer and staying healthy. They include several dietary and lifestyle choices, such as participating in physical activity for thirty minutes per day or more, and maintaining a healthy weight. In addition, AICR recommends consuming a plant-based diet.American Institute for Cancer Research. "Guidelines for Cancer Prevention." No. E93-GL. © November 2007. http://preventcancer.aicr.org/site/DocServer/Guidelines_Brochure.pdf?docID=3561. Several epidemiological studies have found a link between eating plenty of fruits and vegetables and a low incidence of certain cancers. Fruits and vegetables containing a wide variety of nutrients and phytochemicals may either prevent or reduce the oxidative damage to cell structures. Cruciferous vegetables, such as cauliflower, broccoli, and Brussels sprouts, may also reduce the risk of certain cancers, such as endometrial, esophageal, and others. Also, studies have shown that the more fiber you have in your diet, the lower your risk of colon cancer.

Supplementation may also be helpful to a limited degree. Vitamin D and antioxidants have been linked to lowering the risk of some cancers (however taking an iron supplement may promote others). But, obtaining vital nutrients from food first is the best way to help prevent or manage cancer. In addition, regular and vigorous exercise can lower the risk of breast and colon cancers, among others. Also, wear sunblock, stay in the shade, and avoid the midday sun to protect yourself from skin cancer, which is one of the most common kinds of cancer.Mayo Clinic. "Cancer Prevention: 7 Steps to Reduce Your Risk." September 21, 2010. Accessed December 21, 2011. http://www.mayoclinic.com/health/cancer -prevention/CA00024.

Diabetes

The World Health Organization reports that more than 346 million people around the world have diabetes and they predict that deaths due to the consquences of diabetes will double from 2005 to 2030.World Health Organization. "Diabetes." *Fact Sheet*, no. 312. August 2011. http://www.who.int/mediacentre/factsheets/fs312/en/. **Diabetes mellitus** is a metabolic disorder that results when the pancreas does not produce enough insulin to meet its needs or the body does not effectively utilize the insulin that it does produce. Insulin is the hormone that regulates blood glucose levels. The most common complication is hyperglycemia (elevated blood sugar), which gradually leads to damage in many of the body's systems, most notably the eyes, kidneys, nerves, and heart and blood vessels.

There are three kinds of diabetes: Type 1, Type 2, and gestational. Formerly known as juvenile or childhood-onset diabetes, **Type 1 diabetes**[16] is an autoimmune condition in which the pancreas does not produce insulin. Type 1 diabetes is not preventable, and it's cause is unknown. Symptoms include excessive urination, thirst, persistant hunger, weight loss, vision problems, and fatigue.

Formerly known as adult-onset diabetes, **Type 2 diabetes**[17] results when the pancreas produces enough insulin initially, but the body is unable to use the hormone properly (insulin resistance). Until recently, this disease was only found in adults. However, it is now found among children, too. More than 90 percent of diabetics have Type 2.National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health. "Diabetes Overview." *NIH Publication No. 09–3873* (November 2008). http://diabetes.niddk.nih.gov/dm/pubs/overview/. Major contributing factors to the development of Type 2 diabetes include excessive body weight and physical inactivity. The symptoms for Type 2 diabetes are similar to Type 1, but are much less noticeable. As a result, Type 2 diabetes may remain undiagnosed for several years after the onset, generally after complications have already manifested.

16. An autoimmune condition in which the pancreas does not produce insulin.

17. Occurs when the pancreas produces enough insulin initially, but the body is unable to use the hormone properly (insulin resistance).

About 3 to 8 percent of pregnant women develop **gestational diabetes**[18] during the latter stages of pregnancy. This condition is caused by a shortage of insulin or by pregnancy hormones. Gestational diabetes has symptoms similar to Type 2 diabetes, and some women may not experience any symptoms at all. In general, gestational diabetes fades away after the birth of the baby. However, women who have had gestational diabetes are at a greater risk of developing Type 2 diabetes within five to ten years. Also, infants born of mothers who suffer from this condition are at an increased risk of developing Type 2 diabetes as they grow older.National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health. "Diabetes Overview." *NIH Publication No. 09–3873* (November 2008). http://diabetes.niddk.nih.gov/dm/pubs/overview/.

Table 15.5 The Risk Factors for Diabetes

Unmodifiable Risk Factors	Modifiable Risk Factors
• **Age.** Risk increases after age forty-five • **Medical history.** Diabetes during a previous pregnancy or recently giving birth to an infant who weighs more than 9 pounds. • **Family history.** A history of diabetes among one or more close relatives. • **Race and ethnicity.** Individuals from specific ethnic groups may have an increased risk for developing diabetes, including African Americans, Hispanic Americans, Asian Americans, and Native Americans. • **Viruses.** Exposure to: Epstein-Barr, Coxsackie, mumps, or cytomegalo viruses may trigger Type 1 diabetes.	• **Cigarette smoking.** Nicotine constricts blood vessels, and carbon monoxide damages their inner lining, which increases the risk of Type 2 diabetes. • **Obesity.** Excess body weight, especially around the waist, is a major contributing factor to Type 2 diabetes. • **Physical inactivity.** Lack of exercise is strongly associated with diabetes. • **High blood pressure.** Greater than or equal to 140/90 mmHg. • **Cholesterol levels.** HDL cholesterol under 35 mg/dL.

18. A condition caused by a shortage of insulin or by pregnancy hormones.

Unmodifiable Risk Factors	Modifiable Risk Factors
	• **Blood sugar.** Impaired glucose tolerance. • **Blood fats.** Elevated triglycerides (250 mg/dL or more).

Steps to Reducing the Risk of Diabetes

Unfortunately, Type 1 diabetes is almost impossible to prevent, although some clinical research suggests that breastfeeding an infant for at least three months may decrease the child's risk of developing this condition. However, people who are at risk for Type 2 or gestational diabetes can take steps to avoid the disease. For example, it is crucial to achieve and maintain a healthy body weight through regular physical activity. If you are at risk, strive for at least thirty minutes of moderate to intense exercise at least three times per week. Proper nutrition is also vital, and it is important to restrict sugary snacks, beverages, and desserts, and to limit the intake of trans fats and saturated fats. In addition, those who are at risk should consume whole grains, legumes, fruits, and vegetables, along with two servings of nonfried fish per week.

For people over age forty-five, it is important to have a glucose test every three years. Regular testing should begin at a younger age, and be performed frequently if you have any risk factors for developing Type 2 diabetes. In order to assess your health status, the following is recommended:

- Early diagnosis through blood testing
- Blood pressure measurement
- Blood lipid measurement

Video 15.3

Steer Clear of Chronic Disease: Does One Size Fit All?

(click to see video)

This video addresses common steps to prevent chronic diseases.

Food: The Best Medicine

As mentioned in Chapter 1 "Nutrition and You", poor dietary choices and a sedentary lifestyle account for about 300–600 thousand deaths every year according to the US Department of Health and Human Services. That number is thirteen times higher than the deaths due to gun violence.Nutrition Policy, Center for Science in the Public Interest. “Why Good Nutrition Is Important.” Accessed December 21, 2011. http://www.cspinet.org/nutritionpolicy/nutrition_policy.html. The typical North American diet is too high in saturated fat, sodium, and sugar, and too low in fiber in the form of whole fruits, vegetables, and whole grains to keep people healthy. With so many threats to optimal health it is vital to address those factors that are under your control, namely dietary and lifestyle choices. A diet that supplies your body with the needed energy and nutrients daily will result in efficient body functioning and in protection from disease. Making sound nutritional choices can also provide support for individuals undergoing treatment for short-term or chronic conditions. Finding a balance between nutritional needs with concerns about drug interactions can hasten recovery, improve quality of life, and minimize the side effects from treatment protocols.

KEY TAKEAWAYS

- Chronic diseases such as cardiovascular disease, high blood pressure, cancer, and diabetes are major public health threats, and major causes of mortality.
- Knowing the modifiable risk factors (such as diet, level of physical activity, and cigarette smoking) for certain diseases can help you to adapt your lifestyle to protect them.
- By following a healthy diet, becoming active, and making other sound lifestyle choices, individuals can reduce their risk of developing chronic diseases, or better manage their condition to prevent further complications.

DISCUSSION STARTER

1. Assess your risk for developing one of the four chronic diseases discussed in this section. Which risk factors can be modified? Which risk factors can’t be modified? What can you do to lessen the chance that you will develop the disease?

15.4 Foodborne Illness and Food Safety

LEARNING OBJECTIVES

1. Describe the ideal environment for microorganisms to reproduce.
2. Give examples of bacteria, viruses, parasites, and molds that have the potential to cause foodborne illness.
3. Discuss government efforts to protect the health of the population, and precautions consumers can take to protect themselves.

Foodborne illness is another serious threat to health. Sometimes called "food poisoning," foodborne illness is a common public health problem that can result from exposure to a pathogen or a toxin via food or beverages. Raw foods, such as seafood, produce, and meats, can all be contaminated during harvest (or slaughter for meats), processing, packaging, or during distribution, though meat and poultry are the most common source of foodborne illness. For all kinds of food, contamination also can occur during preparation and cooking in a home kitchen or in a restaurant. In many developing nations, contaminated water is also a major source of foodborne illness.

Many people are affected by foodborne illness each year, making food safety a very important issue. Annually, one out of six Americans becomes sick after consuming contaminated foods or beverages.Centers for Disease Control and Prevention. "Food Safety at CDC." Last updated June 28, 2011. http://www.cdc.gov/foodsafety/facts.html. Foodborne illness can range from mild stomach upset to severe symptoms, or even fatalities. The problem of food contamination can not only be dangerous to your health, it can also be harmful to your wallet. Medical costs and lost wages due to salmonellosis, just one foodborne disease, are estimated at over $1 billion per year.

At-Risk Groups

No one is immune from consuming contaminated food. But, whether you become seriously ill depends on the microorganism, the amount you have consumed, and your overall health. In addition, some groups have a higher risk than others for developing severe complications to foodborne disease. Who is most at risk? Young children, elderly people, and pregnant women all have a higher chance of becoming very sick after consuming contaminated food. Other high-risk groups include people with compromised immune systems due to HIV/AIDS, immunosuppressive medications (such as after an organ transplant), and long-term steroid use for asthma or arthritis. Exposure to contaminated food could also pose problems for diabetics, cancer patients, people who have liver disease, and people who have stomach problems as a result of low stomach acid or previous stomach surgery. People in all of these groups should handle food carefully, make sure that what they eat has been cooked thoroughly, and avoid taking any chances that could lead to exposure.

The Major Types of Foodborne Illness

Foodborne illnesses are either infectious or toxic in nature. The difference depends on the agent that causes the condition. Microbes, such as bacteria, cause food infections, while toxins, such as the kind produced by molds, cause intoxications. Different diseases manifest in different ways, so signs and symptoms can vary with the source of contamination. However the illness occurs, the microbe or toxin enters the body through the gastrointestinal tract, and as a result common symptoms include diarrhea, nausea, and abdominal pain. Additional symptoms may include vomiting, dehydration, lightheadedness, and rapid heartbeat. More severe complications can include a high fever, diarrhea that lasts more than three days, prolonged vomiting, bloody stools, and signs of shock.

One of the biggest misconceptions about foodborne illness is that it is always triggered by the last meal that a person ate. However, it may take several days or more before the onset of symptoms. If you develop a foodborne illness, you should rest and drink plenty of fluids. Avoid antidiarrheal medications, because they could slow the elimination of the contaminant.

Food Infection

According to the CDC, more than 250 different foodborne diseases have been identified.Centers for Disease Control and Prevention. "Food Safety at CDC." Last updated June 28, 2011. http://www.cdc.gov/foodsafety/facts.html. Most are **food infections**[19], which means they are caused from food contaminated by microorganisms, such as bacteria, by microscopic animals called parasites, or by viruses. The infection then grows inside the body and becomes the source of symptoms. Food infections can be sporadic and often are not reported to physicians. However, ocassional outbreaks occur that put communities, states and provinces, or even entire nations at risk. For example, in 1994, an outbreak of the infection salmonellosis occurred in the United States due to contaminated ice cream. An estimated 224,000 people became ill. In 1988, contaminated clams resulted in an outbreak of hepatitis A in China, which affected about 300,000 people.World Health Organization. "Food Safety and Foodborne Illness." *Fact Sheet*, no. 237. Last reviewed March 2007. http://www.who.int/mediacentre/factsheets/fs237/en/.

The Reproduction of Microorganisms

Bacteria, one of the most common agents of food infection, are single-celled microorganisms that are too small to be seen with the human eye. Microbes live, die, and reproduce, and like all living creatures, they depend on certain conditions to survive and thrive. In order to reproduce within food, microorganisms require the following:

- **Temperature.** Between 40°F and 140°F, which is called the danger zone, bacteria grow rapidly.
- **Time.** More than two hours in the danger zone.
- **Water.** High moisture content is helpful. Fresh fruits and vegetables have the highest moisture content.
- **Oxygen.** Most microorganisms need oxygen to grow and multiply, but a few are anaerobic and do not.
- **Acidity and pH Level.** Foods that have a low level of acidity (or a high pH level) provide an ideal environment, since most microorganisms grow best around 7.0 pH and not many will grow below 4.0 pH. Examples of higher pH foods include meat, seafood, milk, and corn. Examples of low pH foods include citrus fruits, sauerkraut, tomatoes, and pineapples.
- **Nutrient Content.** Microorganisms need protein, starch, sugars, fats, and other compounds to grow. Typically high-protein foods are better for bacterial growth.

19. Foodborne illness caused by bacteria, viruses, or parasites.

Food Intoxication

Other kinds of foodborne illness are **food intoxications**[20], which are caused by natural toxins or harmful chemicals. These and other unspecified agents are major contributors to episodes of acute gastroenteritis and other kinds of foodborne illness.Scallan, E. et al. "Foodborne Illness Acquired in the United States—Unspecified Agents." *Emerg Infect Diseases* 17, no. 1. Like pathogens, toxins and chemicals can be introduced to food during cultivation, harvesting, processing, or distribution. Some toxins can lead to symptoms that are also common to food infection, such as abdominal cramping, while others can cause different kinds of symptoms and complications, some very severe. For example, mercury, which is sometimes found in fish, can cause neurological damage in infants and children. Exposure to cadmium can cause kidney damage, typically in elderly people.

The Causes of Food Contamination

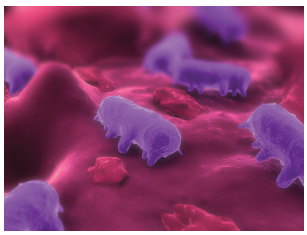
Both food infections and food intoxications can create a burden on health systems, when patients require treatment and support, and on food systems, when companies must recall contaminated food or address public concerns. It all begins with the agent that causes the contamination. When a person ingests a food contaminant, it travels to the stomach and intestines. There, it can interfere with the body's functions and make you sick. In the next part, we will focus on different types of food contaminants and examine common microbes, toxins, chemicals, and other substances that can cause food infections and intoxications. Let's begin with pathogens, which include bacteria and viruses. About one hundred years ago, typhoid fever, tuberculosis, and cholera were common diseases caused by food and water contaminated by pathogens. Over time, improvements in food processing and water treatment eliminated most of those problems in North America. Today, other bacteria and viruses have become common causes of food infection.

Bacteria

All foods naturally contain small amounts of bacteria. However, poor handling and preparation of food, along with improper cooking or storage can multiply bacteria and cause illness. In addition, bacteria can multiply quickly when cooked food is left out at room temperature for more than a few hours. Most bacteria grow undetected because they do not change the color or texture of food or produce a bad odor. Freezing and refrigeration slow or stop the growth of bacteria, but does not destroy the bacteria completely. The microbes can reactivate when the food is taken out and thawed.

20. Foodborne illness caused by natural toxins or harmful chemicals.

Many different kinds of bacteria can lead to food infections. One of the most common is *Salmonella*, which is found in the intestines of birds, reptiles, and mammals. *Salmonella* can spread to humans via a variety of different animal-origin foods, including meats, poultry, eggs, dairy products, and seafood. The disease it causes, salmonellosis, typically brings about fever, diarrhea, and abdominal cramps within twelve to seventy-two hours after eating. Usually, the illness lasts four to seven days, and most people recover without treatment. However, in individuals with weakened immune systems, *Salmonella* can invade the bloodstream and lead to life-threatening complications, such as a high fever and severe diarrhea. Centers for Disease Control and Prevention. "Salmonella." Last updated December 19, 2011. http://www.cdc.gov/salmonella/.



Salmonella was first identified in 1885 and many types of this kind of bacteria exist. The incidence of Salmonella infections has risen dramatically in the past few decades.

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The bacterium *Listeria monocytogenes* is found in soft cheeses, unpasteurized milk, and seafood. It causes a disease called listeriosis that can bring about fever, headache, nausea, and vomiting. *Listeria monocytogenes* mostly affects pregnant women, newborns, older adults, and people with cancer and compromised immune systems.

The food infection *E. coli* is caused by *Escherichia coli*. Sources include raw or undercooked meat, raw vegetables, unpasteurized milk, minimally processed ciders and juices, and contaminated drinking water. Symptoms can occur a few days after eating, and include watery and bloody diarrhea, severe stomach cramps, and dehydration. More severe complications may include colitis, neurological symptoms, stroke, and hemolytic uremic syndrome. In young children, an *E. coli* infection can cause kidney failure and death.

The bacterium *Clostridium botulinum* causes botulism. Sources include improperly canned foods, lunch meats, and garlic. An infected person may experience symptoms within four to thirty-six hours after eating. Symptoms could include nerve dysfunction, such as double vision, inability to swallow, speech difficulty, and progressive paralysis of the respiratory system. Botulism can also be fatal.

Campylobacter jejuni causes the disease campylobacteriosis. It is the most commonly identified bacterial cause of diarrhea worldwide. Consuming undercooked chicken, or food contaminated with the juices of raw chicken, is the most frequent source of this infection. Other sources include raw meat and unpasteurized milk. Within two to five days after consumption, symptoms can begin and include diarrhea, stomach

cramps, fever, and bloody stools. The duration of this disease is about seven to ten days.

The food infection shigellosis is caused by *Shigella*, of which there are several types. Sources include undercooked liquid or moist food that has been handled by an infected person. The onset of symptoms occurs one to seven days after eating, and can include stomach cramps, diarrhea, fever, and vomiting. Another common symptom is blood, pus, or mucus in stool. Once a person has had shigellosis, the individual is not likely to get infected with that specific type again for at least several years. However, they can still become infected with other types of *Shigella*.

Staphylococcus aureus causes staphylococcal food poisoning. Food workers who carry this kind of bacteria and handle food without washing their hands can cause contamination. Other sources include meat and poultry, egg products, cream-filled pastries, tuna, potato and macaroni salad, and foods left unrefrigerated for long periods of time. Symptoms can begin thirty minutes to eight hours after eating, and include diarrhea, vomiting, nausea, stomach pain, and cramps. This food infection usually lasts one to two days.

Found in raw oysters and other kinds of seafood, *Vibrio vulnificus* belongs to the same family as the bacteria which cause cholera. This food contaminant can result in the *Vibrio* infection. Symptoms can begin anywhere from six hours to a few days after consumption, and include chills, fever, nausea, and vomiting. This disease is very dangerous and can result in fatalities, especially in people with underlying health problems.Centers for Disease Control and Prevention. “Food Safety at CDC.” Last updated June 28, 2011. http://www.cdc.gov/foodsafety/facts.html.

Virus

Viruses are another type of pathogen that can lead to food infections, however they are less predominant than bacteria. **Hepatitis A** is one of the more well-known food-contaminating viruses. Sources include raw shellfish from polluted water, and food handled by an infected person. This virus can go undetected for weeks and, on average, symptoms do not appear until about one month after exposure. At first, symptoms include malaise, loss of appetite, nausea, vomiting, and fever. Three to ten days later, additional symptoms can manifest, including jaundice and darkened urine. Severe cases of a hepatitis A can result in liver damage and death.

The most common form of contamination from handled foods is the **norovirus**, which is also known as the Norwalk-like virus, or the calicivirus. Sources include raw shellfish from polluted water, salads, sandwiches, and other ready-to-eat foods handled by an infected person. The norovirus causes gastroenteritis and within one

to three days it leads to symptoms, such as nausea, vomiting, diarrhea, stomach pain, headache, and a low-grade fever.Centers for Disease Control and Prevention. "Food Safety at CDC." Last updated June 28, 2011. http://www.cdc.gov/foodsafety/facts.html.

Parasitic Protozoa

Food-contaminating parasitic protozoa are microscopic organisms that may be spread in food and water. Several of these creatures pose major problems to food production worldwide. They include *Anisakis*, microscopic worms that invade the stomach or the intestines. Sources of this parasite include raw fish. This parasite can result in the Anisakis infection, with symptoms that begin within a day or less and include abdominal pain, which can be severe.

Cryptosporidium lives in the intestines of infected animals. Another common source is drinking water, when heavy rains wash animal wastes into reservoirs. One major problem with this pathogen is that it is extremely resistant to disinfection with chlorine. *Cryptosporidium* causes the disease cryptosporidiosis, with symptoms that begin one to twelve days after exposure and include watery stools, loss of appetite, vomiting, a low-grade fever, abdominal cramps, and diarrhea. For HIV/AIDS patients and others with weakened immune systems, the disease can be severe, and sometimes can lead to death.

Giardia lamblia is another parasite that is found in contaminated drinking water. In addition, it lives in the intestinal tracts of animals, and can wash into surface water and reservoirs, similar to *Cryptosporidium*. *Giardia* causes giardiasis, with symptoms that include abdominal cramping and diarrhea within one to three days. Although most people recover within one to two weeks, the disease can lead to a chronic condition, especially in people with compromised immune systems.

The parasite *Toxoplasma gondii* causes the infection toxoplasmosis, which is a leading cause of death attributed to foodborne illness in the United States. More than sixty million Americans carry *Toxoplasma gondii*, but very few have symptoms. Typically, the body's immune system keeps the parasite from causing disease. Sources include raw or undercooked meat and unwashed fruits and vegetables. Handling the feces of a cat with an acute infection can also lead to the disease.Centers for Disease Control and Prevention. "Parasites." Last updated November 2, 2010. http://www.cdc.gov/parasites/food.html.

Mold Toxins

Mold can grow on fruits, vegetables, grains, meats, poultry, and dairy products, and typically appears as gray or green "fur."

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Warm, humid, or damp conditions encourage mold to grow on food. **Molds** are microscopic fungi that live on animals and plants. No one knows how many species of fungi exist, but estimates range from ten- to three-hundred thousand. Unlike single-celled bacteria, molds are multicellular, and under a microscope look like slender mushrooms. They have stalks with spores that form at the ends. The spores give molds their color and can be transported by air, water, or insects. Spores also enable mold to reproduce. Additionally, molds have root-like threads that may grow deep into food and be difficult to see. The threads are very deep when a food shows heavy mold growth. Foods that contain mold may also have bacteria growing alongside it.

Some molds, like the kind found in blue cheese, are desirable in foods, while other molds can be dangerous. The spores of some molds can cause allergic reactions and respiratory problems. In the right conditions, a few molds produce **mycotoxins**[21], which are natural, poisonous substances that can make you sick if they are consumed. Mycotoxins are contained in and around mold threads, and in some cases, may have spread throughout the food. The Food and Agriculture Organization of the United Nations estimates that mycotoxins affect 25 percent of the world's food crops. They are found primarily in grains and nuts, but other sources include apples, celery, and other produce.

The most dangerous mycotoxins are **aflatoxins**, which are produced by strains of fungi called *Aspergillus* under certain temperature and humidity conditions. Contamination has occurred in peanuts, tree nuts, and corn. Aflatoxins can cause aflatoxicosis in humans, livestock, and domestic animals. Symptoms include vomiting and abdominal pain. Possible complications include liver failure, liver cancer, and even death. Many countries try to limit exposure to aflatoxins by monitoring their presence on food and feed products.US Department of Agriculture, Food Safety and Inspection Service. "Molds on Food: Are They Dangerous?" Last modified March 4, 2010. http://www.fsis.usda.gov/FactSheets/Molds_On_Food/.

Poisonous Mushrooms

Like molds, mushrooms are fungi and the poisonous kind produces mycotoxins that can cause food intoxication. Toxic mushrooms, also known as toadstools, can cause severe vomitting and other symptoms. However, only a few varieties are fatal. Toxic mushrooms cannot be made safe by cooking, freezing, canning, or processing. The

21. Natural, poisonous substance produced by certain molds and mushrooms that can cause foodborne illness.

only way to avoid food intoxication is to refrain from eating them. Mushroom guides can help wild gatherers distinguish between the edible and toxic kinds.US Department of Agriculture, Food Safety and Inspection Service. "Molds on Food: Are They Dangerous?" Last modified March 4, 2010. http://www.fsis.usda.gov/FactSheets/Molds_On_Food/.

Pesticides

Pesticides are important in food production to control diseases, weeds, insects, and other pests. They protect crops and ensure a large yield. However, synthetic pesticides can leave behind residues, particularly on produce, that can be harmful to human health. Foods that contain the highest levels of pesticide residue include conventionally-grown peaches, apples, bell peppers, celery, nectarines, strawberries, cherries, pears, spinach, lettuce, and potatoes. Foods that contain the lowest levels of pesticide residue include avocadoes, pineapples, bananas, mangoes, asparagus, cabbage, and broccoli.Hoffman, M. MD. "Safer Foods for a Healthier You." Web MD. © 2009 WebMD, LLC. http://www.webmd.com/health-ehome-9/pesticides-hormones-in-food. In many cases, the amount of pesticide exposure is too small to pose a risk. However, harmful exposures can lead to certain health problems and complications, including cancer. Also, infants and young children are more susceptible to the hazards of pesticides than adults. In addition, using synthetic pesticides, herbicides, and fertilizers contributes to soil and water pollution and can be hazardous to farm workers.

To protect the public and their workers, many farmers now rely on alternatives to synthetic pesticide use, including crop rotation, natural pesticides, and planting nonfood crops nearby to lure pests away. Some consumers choose to reduce their exposure to pesticides by purchasing organic produce. Organic foods are grown or produced without synthetic pesticides or fertilizer, and all growers and processors must be certified by the US Department of Agriculture (USDA). However, conventionally-grown produce should be fine for fruits and vegetables that appear on the low-residue list.

Pollutants

Pollutants are another kind of chemical contaminant that can make food harmful. Chemical runoff from factories can pollute food products and drinking water. For example, **dioxins** are chemical compounds created in industrial processes, such as manufacturing and bleaching pulp and paper. Fish that swim in dioxin-polluted waters can contain significant amounts of this pollutant, which causes cancer. When metals contaminate food, it can result in serious and even life-threatening health problems. A common metal contaminant is lead, which can be present in

drinking water, soil, and air. Lead exposure most often affects children, who can suffer from physical and mental developmental delays as a result.

Methyl mercury occurs naturally in the environment and is also produced by human activities. Fish can absorb it, and the predatory fish that consume smaller, contaminated fish can have very high levels. This highly toxic chemical can cause mercury poisoning, which leads to developmental problems in children, as well as autoimmune effects. A condition called Minamata disease was identified in 1956 in Japan. It was named for the town of Minamata, which was the site of an environmental disaster when methyl mercury was released into the surface water near a factory. Many residents experienced neurological issues, including numbness in hands and feet, muscle weakness, a narrowing of the field of vision, damage to hearing and speech, and ataxia, which is a lack of muscle coordination.Ministry of the Environment, Government of Japan. "Minamata Disease: The History and Measures." © 2002. Accessed December 21, 2011. http://www.env.go.jp/en/chemi/hs/minamata2002/.

PCBs, or polychlorinated biphenyls, are man-made organic compounds that are used commercially. Like methyl mercury, higher concentrations of this contaminant are found in predatory fish. Health effects include physical and neurological development in children, and this compound is potentially a carcinogen. PCB contamination also can affect the immune, reproductive, nervous, and endocrine systems.US Environmental Protection Agency. "Health Effects of PCBs." Last updated August 08, 2008. http://www.epa.gov/epawaste/hazard/tsd/pcbs/pubs/effects.htm.

Protecting the Public Health

Most foodborne infections go unreported and undiagnosed. However, the CDC estimates that about seventy-six million people in the United States become ill from foodborne pathogens or other agents every year. In North America, a number of government agencies work to educate the public about food infections and intoxications, prevent the spread of disease, and quell any major problems or outbreaks. They include the CDC, the FDA, the USDA, and Health Canada, among other organizations.

Efforts on the Governmental Level

As discussed in Chapter 14 "Nutrition and Society: Food Politics and Perspectives", a number of government agencies work to ensure food safety and to protect the public from foodborne illness. The USDA and the FDA enforce laws regarding the safety of domestic and imported food. In addition, the Federal Food, Drug, and

Cosmetic Act of 1938 gives the FDA authority over food ingredients. The CDC tracks outbreaks, identifies the causes of food infection and intoxication, and recommends ways to prevent foodborne illness. Other government agencies that play a role in protecting the public include the Food Safety and Inspection Service, a division of the USDA, which enforces laws regulating meat and poultry safety. The Agricultural Research Service, which is the research arm of the USDA, investigates a number of agricultural practices, including those related to animal and crop safety. The National Institute of Food and Agriculture conducts research and education programs on food safety for farmers and consumers. Also, the Environmental Protection Agency (EPA) regulates public drinking water.

Government agencies also monitor the use of pesticides. The EPA approves pesticides and other chemicals used in agriculture, and sets limits on how much residue can remain on food. The FDA analyzes food for surface residue and waxes. Processing methods can either reduce or concentrate pesticide residue in foods. Therefore, the Food Quality Protection Act, which was passed in 1996, requires manufacturers to show that pesticide levels are safe for children.

In Canada, Health Canada works with local governments, industries, and consumers to establish food safety throughout the nation. The agency's scientists assess health risks from foodborne contaminants, conduct research, and evaluate data to better understand the effects of pathogens, chemicals, and other foodborne agents on the body. Health Canada also monitors the levels of contaminants in foods and estimates the exposure of consumers. Another organization, the Canadian Food Inspection Agency, enforces the safety policies and standards set by Health Canada. They safeguard livestock, along with crops and other plants, to protect the public.

Efforts within the Food Industry

As discussed in Chapter 14 "Nutrition and Society: Food Politics and Perspectives", the Hazard Analysis Critical Control Points (HACCP) is a system within the food industry designed to promote food safety and prevent contamination by identifying all areas in food production and retail where contamination could occur. Companies and retailers determine the points during processing, packaging, shipping, or shelving where hazards could occur. Those companies or retailers must then take measures to prevent, control, or eliminate the potential for food contamination. The USDA requires the food industry to follow HACCP for meat and poultry, while the FDA requires it for seafood, low-acid canned-food, and juice. HACCP is voluntary for all other food products.

Efforts on the Consumer Level: What You Can Do

Consumers can also take steps to prevent foodborne illness and protect their health. Although you can often detect when mold is present, you can't see, smell, or taste bacteria or other agents of foodborne disease. Therefore, it is crucial to take measures to protect yourself from disease. The four most important steps for handling, preparing, and serving food are:

1. **Clean.** Wash hands thoroughly. Clean surfaces often and wash utensils after each use. Wash fruits and vegetables (even if you plan to peel them).
2. **Separate.** Don't cross-contaminate food during preparation and storage. Use separate cutting boards for produce and for meat, poultry, seafood, and eggs. Store food products separately in the refrigerator.
3. **Cook.** Heat food to proper temperatures. Use a food thermometer to check the temperature of food while it is cooking. Keep food hot after it has been cooked.
4. **Chill.** Refrigerate any leftovers within two hours. Never thaw or marinate food on the counter. Know when to keep food and when to throw it out. It can be helpful to check the website http://www.stilltasty.com, which explains how long refrigerated food remains fresh.US Department of Health and Human Services. "Keep Food Safe." Food Safety.gov. Accessed December 21, 2011. http://www.foodsafety.gov/keep/index.html.

Buying Food

It is best to buy your food from reputable grocers with clean, sanitary facilities, that keep products at appropriate temperatures. Consumers should examine food carefully before they purchase it. It is important to look at food in glass jars, check the stems on fresh produce, and avoid bruised fruit. Do not buy canned goods with dents or bulges, which are at risk for contamination with *Clostridium botulinum*. Fresh meat and poultry are usually free from mold, but cured and cooked meats should be examined carefully. Also, avoid torn, crushed, or open food packages, and do not buy food with frost or ice crystals, which indicates that the product has been stored for a long time, or thawed and refrozen. It is also a good idea to keep meat, poultry, seafood, and eggs separate from other items in your shopping cart as you move through the grocery store.

Video 15.4

Start at the Store: Prevent Foodborne Illness

(click to see video)

This video provides tips to follow when selecting and purchasing food at the supermarket to help to prevent foodborne illness and protect your health.

Storing Food

Refrigerate perishable foods quickly; they should not be left out for more than two hours. The refrigerator should be kept at 40°F (or 4°C) or colder, and checked periodically with a thermometer. Store eggs in a carton on a shelf in the refrigerator, and not on the refrigerator door where the temperature is warmest. Wrap meat packages tightly and store them at the bottom of the refrigerator, so juices won't leak out onto other foods. Raw meat, poultry, and seafood should be kept in a refrigerator for only two days. Otherwise, they should be stored in the freezer, which should be kept at 0°F (or –18°C). Store potatoes and onions in a cool, dark place, but not under a sink because leakage from pipes could contaminate them. Empty cans of perishable foods or beverages that have been opened into containers, and promptly place them in a refrigerator. Also, be sure to consume leftovers within three to five days, so mold does not have a chance to grow.

Preparing Food

Wash hands thoroughly with warm, soapy water for at least twenty seconds before preparing food and every time after handling raw foods. Washing hands is important for many reasons. One is to prevent cross-contamination between foods. Also, some pathogens can be passed from person to person, so hand washing can help to prevent this. Fresh fruits and vegetables should also be rinsed thoroughly under running water to clean off pesticide residue.California Department of Pesticide Regulation. "Pesticides and Food: How We Test for Safety." *Pesticide Info: What You Should Know about Pesticides,* no. #E09/REV. Accessed December 21, 2011. http://www.cdpr.ca.gov/docs/dept/factshts/residu2. This is particularly important for produce that contains a high level of residue, such as apples, pears, spinach, and potatoes. Washing also removes most dirt and bacteria from the surface of produce.

Other tips to keep foods safe during preparation include defrosting meat, poultry, and seafood in the refrigerator, microwave, or in a water-tight plastic bag submerged in cold water. Never defrost at room temperature because that is an ideal temperature for bacteria to grow. Also, marinate foods in the refrigerator and discard leftover marinade after use because it contains raw juices. Always use clean cutting boards, which should be washed with soap and warm water by hand or in a dishwasher after each use. Another way to sanitize cutting boards is to rinse them with a solution of 5 milliliters (1 teaspoon) chlorine bleach to about 1 liter (1 quart) of water. If possible, use separate cutting boards for fresh produce and for raw

meat. Also, wash the top before opening canned foods to prevent dirt from coming into contact with food.

Cooking Food

Cooked food is safe to eat only after it has been heated to a temperature that is high enough to kill bacteria. You cannot judge the state of "cooked" by color and texture alone. Instead, use a food thermometer to be sure. The appropriate minimum cooking temperature varies depending on the type of food. Seafood should be cooked to an internal temperature of 145°F, beef, lamb, and pork to 160°F, ground chicken and turkey to 165°F, poultry breasts to 170°F, and whole poultry and thighs to 180°F. When microwaving, rotate the dish and stir contents several times to ensure even cooking.

Serving Food

After food has been cooked, the possibility of bacterial growth increases as the temperature drops. So, food should be kept above the safe temperature of 140°F, using a heat source such as a chafing dish, warming tray, or slow cooker. Cold foods should be kept at 40°F or lower. When serving food, keep it covered to block exposure to any mold spores hanging in the air. Use plastic wrap to cover foods that you want to remain moist, such as fresh fruits, vegetables, and salads. After a meal, do not keep leftovers at room temperature for more than two hours. They should be refrigerated as promptly as possible. It is also helpful to date leftovers, so they can be used within a safe time, which is generally three to five days when stored in a refrigerator.

KEY TAKEAWAYS

- Foodborne illness is caused by pathogens, such as bacteria and viruses, toxins, such as those produced by molds and poisonous mushrooms, and chemical contaminants, such as pesticide residues and pollutants.
- A number of government agencies work to regulate food, manage outbreaks, and inform the public about foodborne illness and food safety.
- Consumers also should take measures to protect their health, including following the rules for four key steps: clean, separate, cook, and chill.

DISCUSSION STARTER

1. Discuss tactics that government agencies or consumer groups could take to educate the public about food safety. What key points do you think consumers need to know about foodborne illness and food safety? How do you think government organizations or other groups can best get that information out to the public?

15.5 Start Your Sustainable Future Today

LEARNING OBJECTIVES

1. Discuss forms of activism in areas of food and nutrition.
2. List steps individuals can take to support sustainable agriculture.

As we near the end of our journey in the world of health and nutrition, let's address how to adjust your lifestyle today to ensure better health and wellness tomorrow. Adopting sustainable practices can go a long way toward helping you achieve optimal health, while also helping to protect the health of our planet. Remember, that sustainability involves meeting present nutritional needs while preserving resources for the future. It includes agricultural practices and processes, along with the choices that consumers make when they shop for their food. Ideally, sustainable practices include methods that are healthy, conserve the environment, protect livestock, respect food industry workers, provide fair wages to farmers, and support farming communities. When a practice or a process is sustainable, it can be maintained for decades, or even centuries, to come.

Living a Sustainable Lifestyle

There are a number of steps you can take to live a more sustainable lifestyle. Utilizing an environmentally-friendly approach to good nutrition is a great way to remain and stay healthy. As an initial step, you might try to buy more whole foods rather than processed foods. You might also drink more water, rather than sodas and juices with added sugar. It is also a good idea to drink from a reusable water bottle to avoid adding more plastic to your local landfill, not to mention saving the fuel it takes to ship bottles of water. Here are some other suggestions to live a more sustainable lifestyle:

Learn more about food. Learn about your local food system, what is native to the area, what is imported or shipped in, how food moves from farms to processors to retail in your area, and what practices are used. Read labels to see where food comes from and what the growing and processing practices are. You might also try taking a cooking class to learn more about food in general.

Eat a plant-based diet. A plant-based diet is not necessarily vegetarian or vegan; it simply emphasizes whole grains, fruits, vegetables, and legumes over meat and poultry. Plant-based foods are good sources of carbohydrates, protein, fat, vitamins,

and minerals. They also help to decrease your risk for cancer and other chronic conditions.

Support local farmers. Purchase more locally grown food to promote sustainability. This could involve going to a farmer's market or a nearby farm. Locally grown food requires less fossil fuel because it does not have to travel great distances. Locally grown food also puts money back into your community and helps farmers in your area. Shopping at a farmer's market or a local farm may also provide an opportunity to talk to the farmer who grew the food to learn more about what you put on your plate.

Join a community garden. You can't get more local than food that is grown in your own backyard. Consider growing your own food, or trying a community garden if you do not have the space at your home. Produce from a local garden will not only be fresher, it will often taste better. In addition, it will provide an opportunity to get to know like-minded individuals in your community.

Help spread the word. Talk to friends and family members about food, nutrition, and living a sustainable lifestyle. Also, pay attention to food and nutrition policy at the federal, state, and local levels. Take a look at what foods are available in your community. Are there supermarkets or corner stores? What is available in the university dining hall? If healthy options are lacking, can you talk to someone to bring about changes?

Tools for Change

Another option to support local farmers is to sign up for a CSA (community-supported agriculture). Prior to a planting season, consumers who join a CSA purchase a produce share from a local farmer. When harvesting begins, farmers provide in-season, locally grown vegetables to shareholders at a local drop spot each week throughout the growing season. Some CSAs also include fruit, dairy products, meat, and more. CSA farmers often will allow you to visit the farm to learn more about the crops they grow or even volunteer to help with the harvest. Joining a CSA provides a direct connection between the local farming community and you.

Changing Your Behavior

Living a sustainable lifestyle and achieving optimal health is not easy. Taking steps to exercise more, eat healthier foods, and work harder to avoid food contamination may involve making major changes in your life. However, change is a process, and researchers have long studied the various stages of that process, as well as what helps or hinders it. While creating and implementing change is not easy, the more conscious you are of the process, and the more you prepare, the greater the chances are for success. Learning about the different stages of behavioral change can help you take a proactive approach to living a sustainable lifestyle.

The Transtheoretical Model of Behavioral Change

The Transtheoretical Model of Behavioral Change identifies the five stages of change, along with things that can help people move through these different stages. It also includes strategies which help people make, create, and continue behavioral change. Learning about these different stages and techniques helps you decide how to best approach making healthy changes in your life. The five stages of the Transtheoretical Model of Behavioral Change are:

1. **Precontemplation.** At this stage, an individual has no plans to make any changes, and may not be aware that change is needed. For example, a person who has never thought of eating healthier or being more active is in the precontemplation stage. In this stage, a person often underestimates the pros of changing, and underestimates the cons of maintaining the status quo.
2. **Contemplation.** An individual begins to see the importance of altering behavior, and plans to do so within the next six months. Someone who has realized that they need to add more physical activity to their life, but hasn't made any concrete plans to start doing it, is in the contemplation stage. Although they may be more aware of the benefits of change, the individual may still exaggerate the negative aspects of change.
3. **Preparation.** At this stage, an individual becomes serious about making a change, and plans to implement that change within thirty days. The person may have already started to alter behavior, or told friends about any plans or intentions. For example, someone who wants to eat better and has started gathering healthier recipes is in the preparation stage.
4. **Action.** At this point, an individual is in the midst of change or has made a consistent change in behavior within the past six months. For example, someone in the action stage would have started eating better and exercising on a regular basis.

5. **Maintenance.** At this final stage, an individual has successfully changed their behavior for six months or more and intends to maintain it in the future.

Adopting a healthier lifestyle requires changes not only in behavior, but also in attitude and perception. The Transtheoretical Model calls them *decisional balance* and *self-efficacy*. Decisional balance means a person has realized that the benefits of making healthy changes outweigh any risks. Self-efficacy means a person has self-belief and the confidence to make and maintain positive changes. Both decisional balance and self-efficacy help people progress through the different stages of change. The Theoretical Model of Behavioral Change also includes ten techniques and strategies for bringing about change:

1. **Consciousness-raising.** Different methods that are used to raise awareness of healthier choices.
2. **Dramatic Relief.** The use of emotions through testimonials, role-playing, and the media to support change.
3. **Environmental Reevaluation.** Helping people become aware of how they affect others, and how a change on their part can also help those around them.
4. **Social Liberation.** Helping individuals realize that society may be more welcoming if they change their behavior.
5. **Self-Liberation.** Allowing people to believe in their ability to change, and make a commitment to it.
6. **Helping Relationships.** Providing connections between people seeking positive change with others who support their efforts.
7. **Counterconditioning.** Finding healthier substitutes for the unhealthy behavior.
8. **Reinforcement Management.** Increasing rewards for healthy behavior and reducing those for negative behavior.
9. **Stimulus Control.** Being aware of and eliminating cues for unhealthy behavior, and replacing them with cues for healthy choices.
10. **Self-reevaluation.** Changing your self-image to fit with a newer, healthier lifestyle.

Some of these processes of change are more effective at different points in the process. A person who is not even contemplating change could tune out emotional appeals or reinforcement management. However, combining knowledge of the change process with the effective use of strategies can help everyone turn their good intentions into healthier lifestyles.Center for Health Communications Research. “Transtheoretical Model (Stages of Change).” © 2009 The Regents of University of Michigan. Accessed December 21, 2011. http://chcr.umich.edu/how_we_do_it/health_theories/healththeories5/chcr_document_view.

KEY TAKEAWAYS

- Living a sustainable lifestyle can help you to work toward achieving optimal health.
- There are a number of steps you can take to promote sustainable practices, such as buying locally grown food, eating a plant-based diet, and becoming aware of food and nutrition issues in your community.
- The Transtheoretical Model of Behavioral Change outlines the different stages of the process of change, and provides tools and techniques to enable major changes.

DISCUSSION STARTER

1. Think of a change you might want to make in your life to become healthier, and discuss ways you can use the transtheoretical model to make this change.

15.6 Careers in Nutrition

LEARNING OBJECTIVE

1. List some of the jobs available to students who are interested in a career in food and nutrition.

If you are considering a career in nutrition, it is important to understand the opportunities that may be available to you. Both **dietitians**[22] and **nutritionists**[23] provide nutrion-related services to people in the private and public sectors. A dietitian is a healthcare professional who has registered credentials and can provide nutritional care in the areas of health and wellness for both individuals and groups. A nutritionist is an unregistered professional who may have the credentials of a dietitian, or may have acquired the knowledge via other avenues. People in both professions work to apply nutritional science, using evidence-based best practices, to help people nourish their bodies and improve their lives.

Some dietitians and nutritionists work with individual clients to help them tackle personal issues, such as weight loss or managing diabetes.

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Becoming a registered dietitian requires a Bachelor's or Master's degree in dietetics, including courses in biology, chemistry, biochemistry, microbiology, anatomy and physiology, nutrition, and food-service management. Other suggested courses include economics, business, statistics, computer science, psychology, and sociology. In addition, people who pursue this path must complete a dietetic internship and pass a national exam. Also, some states have licensure that requires additional forms and documentation. To become a registered dietetic technician you must complete a dietetic technician program that involves supervised practice. Forty-seven states have licensure requirements for registered dietitians and nutritionists. A few remaining states do not have laws that regulate this profession.Bureau of Labor Statistics. "Dietitians and Nutritionists." *Occupational Outlook Handbook, 2010-11 Edition.* Last modified April 7, 2010. http://www.bls.gov/oco/ocos077.htm. Go to http://www.cdrnet.org/certifications/licensure/index.cfm to learn more.

22. Health-care professional who has registered credentials and can implement nutritional care.

23. Health-care professional who works in the field of nutrition, but does not have registered credentials.

Working in Nutrition

Dietitians and nutritionists plan food and nutrition programs, promote healthy eating habits, and recommend dietary modifications. For example, a dietitian might teach a patient with hypertension how to follow the DASH diet and reduce their sodium intake. Nutrition-related careers can be extremely varied. Some individuals work in the government, while others are solely in the private sector. Some jobs in nutrition focus on working with athletes, while others provide guidance to patients with long-term, life-threatening diseases. But no matter the circumstance or the clientele, working in the field of diet and nutrition focuses on helping people improve their dietary habits by translating nutritional science into food choices.

In the public sector, careers in nutrition span from government work to community outreach. Nutritionists and dietitians who work for the government may become involved with federal food programs, federal agencies, communication campaigns, or creating and analyzing public policy. On the local level, clinical careers include working in hospitals and nursing-care facilities. This requires creating meal plans and providing nutritional guidance to help patients restore their health or manage chronic conditions. Clinical dietitians also confer with doctors and other health-care professionals to coordinate dietary recommendations with medical needs. Nutrition jobs in the community often involve working in public health clinics, cooperative extension offices, and HMOs to prevent disease and promote the health of the local community. Nutrition jobs in the nonprofit world involve antihunger organizations, public health organizations, and activist groups.

Nutritionists and dietitians can also find work in the private sector. Increased public awareness of food, diet, and nutrition has led to employment opportunities in advertising, marketing, and food manufacturing. Dietitians working in these areas analyze foods, prepare marketing materials, or report on issues such as the impact of vitamins and herbal supplements. Consultant careers can include working in wellness programs, supermarkets, physicians' offices, gyms, and weight-loss clinics. Consultants in private practice perform nutrition screenings for clients and use their findings to provide guidance on diet-related issues, such as weight reduction. Nutrition careers in the corporate world include designing wellness strategies and nutrition components for companies, working as representatives for food or supplement companies, designing marketing and educational campaigns, and becoming lobbyists. Others in the private sector work in food-service management at health-care facilities or at company and school cafeterias. Sustainable agricultural practices are also providing interesting private sector careers on farms and in food systems. There are employment opportunities in farm management, marketing and sales, compliance, finance, and land surveying and appraisal.

Working toward Tomorrow

Whether you pursue nutrition as a career or simply work to improve your own dietary choices, what you have learned in this course can provide a solid foundation for the future. Remember, your ability to wake up, to think clearly, communicate, hope, dream, go to school, gain knowledge, and earn a living are totally dependent upon one factor—your health. Good health allows you to function normally and work hard to pursue your goals. Yet, achieving optimal health cannot be underestimated. It is a complex process, involving multiple dimensions of wellness, along with your physical or medical reality. The knowledge you have now acquired is also key. However, it is not enough to pass this nutrition class with good grades. Nutrition knowledge must be applied to make a difference in your life, throughout your life.

Throughout this textbook, we have focused on the different aspects of nutritional science, which helps to optimize health and prevent disease. Scientific evidence provides the basis for dietary guidelines and recommendations. In addition, researchers in the field of nutrition work to advance our knowledge of food production and distribution. Nutritional science also examines the ill effects of malnutrition and food insecurity. The findings that are uncovered today will influence not only what we eat, but how we grow it, distribute it, prepare it, and even enjoy it tomorrow.

Video 15.5

Farms of the Future

(click to see video)

This video examines the philosophy and science behind vertical farming. Could it provide our nutrients in the future?

KEY TAKEAWAY

- There are many paths that one can take to become a professional in the field of nutrition, including working as a nutritionist or becoming a registered dietitian.

DISCUSSION STARTER

1. Compare and contrast nutrition-related careers in the public and private sectors. Discuss which area would most interest you and the reasons why.

15.7 End-of-Chapter Exercises

IT'S YOUR TURN

1. Summarize the four elements of physical fitness in a table.
2. Create a list of toxins and chemical compounds that can cause foodborne illness.
3. Write a short newspaper article about interesting, nutrition-related careers.

APPLY IT

1. People who are over eighteen, in good health, and want to acquire a better sense of their overall fitness can take the President's Challenge and participate in the Adult Fitness Test. The challenge involves tests in key fitness areas, after which you have the option to send in your results and receive an evaluation online. Go to this website to learn more: http://www.presidentschallenge.org/challenge/adult.shtml.
2. Provide a list of three or four tips for a patient who suffers from hypertension. What foods would you recommend? What items would you limit? For more information on the ways that food and nutrition can affect blood pressure visit the following website: http://dashdiet.org/.
3. Identify common risk factors for cardiovascular disease and diabetes, along with steps to avoid these chronic conditions.

EXPAND YOUR KNOWLEDGE

1. Write a short script for a public service announcement that explains the dangers of foodborne illness. What do you believe the public should know about the agents that cause food infection and food intoxication?
2. Draw a comic strip that shows the different ways consumers can protect themselves from foodborne illness and promote food safety.
3. In a written essay, summarize steps that people can take to live a more sustainable lifestyle and approach making major changes in their lives.

Chapter 16

Appendix A

Dietary Reference Intakes Tables

To view the DRI Tables, visit the following link:

http://www.iom.edu/Activities/Nutrition/SummaryDRIs/~/media/Files/Activity%20Files/Nutrition/DRIs/5_Summary%20Table%20Tables%201-4.pdf.