



This is “Achieving Optimal Health: Wellness and Nutrition”, chapter 15 from the book [An Introduction to Nutrition \(index.html\)](#) (v. 1.0).

This book is licensed under a [Creative Commons by-nc-sa 3.0](http://creativecommons.org/licenses/by-nc-sa/3.0/) license. See the license for more details, but that basically means you can share this book as long as you credit the author (but see below), don't make money from it, and do make it available to everyone else under the same terms.

This content was accessible as of December 29, 2012, and it was downloaded then by [Andy Schmitz](#) (<http://lardbucket.org>) in an effort to preserve the availability of this book.

Normally, the author and publisher would be credited here. However, the publisher has asked for the customary Creative Commons attribution to the original publisher, authors, title, and book URI to be removed. Additionally, per the publisher's request, their name has been removed in some passages. More information is available on this project's [attribution page](http://2012books.lardbucket.org/attribution.html?utm_source=header).

For more information on the source of this book, or why it is available for free, please see [the project's home page](#) (<http://2012books.lardbucket.org/>). You can browse or download additional books there.

## Chapter 15

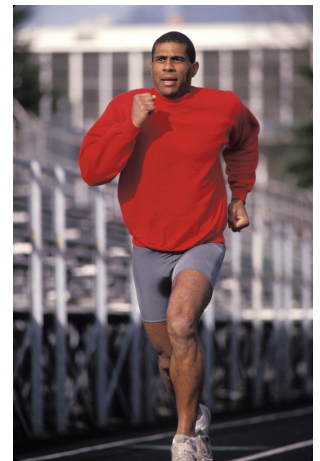
# Achieving Optimal Health: Wellness and Nutrition

### 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>.

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 cardiovascular disease over a long period of time in a large group of participants who had not yet developed overt symptoms.



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

© Thinkstock

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**<sup>1</sup>, 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](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.

### Functional Foods

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

1. Achieving balance and integration of aspects that affect quality of life, including physical, mental, emotional, social, environmental, and spiritual dimensions.
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<sub>12</sub>. 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	<ul style="list-style-type: none"> <li>• Recommended by the National Heart, Lung, and Blood Institute, the American Heart Association, and many physicians</li> <li>• Helps to lower blood pressure and cholesterol</li> <li>• Reduces risk of heart disease and stroke</li> <li>• Reduces risk of certain cancers</li> <li>• Reduces diabetes risk</li> </ul>	<ul style="list-style-type: none"> <li>• There are very few negative factors associated with the DASH diet</li> </ul>
Gluten-Free Diet	<ul style="list-style-type: none"> <li>• Reduces the symptoms of gluten intolerance, such as chronic diarrhea, cramping, constipation, and bloating</li> <li>• Promotes healing of the small intestines for people with celiac disease, preventing malnutrition</li> <li>• May support weight loss</li> <li>• May be beneficial for other autoimmune diseases, such as Parkinson’s disease, rheumatoid arthritis, and multiple sclerosis</li> </ul>	<ul style="list-style-type: none"> <li>• Risk of folate and iron deficiencies</li> <li>• Special gluten-free products can be hard to find and expensive</li> <li>• Requires constant vigilance and careful food label reading, since gluten is found in many products</li> </ul>

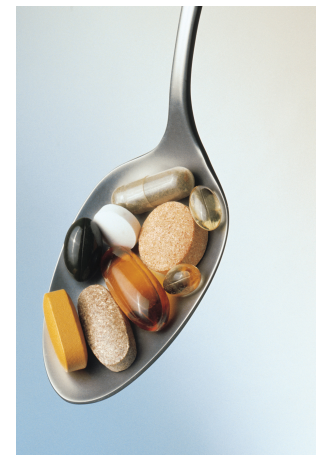
Diet	Pros	Cons
	<ul style="list-style-type: none"> <li>• May be helpful for Types 1 and 2 diabetes and anemia</li> </ul>	
Low-Carb Diet	<ul style="list-style-type: none"> <li>• Restricts refined carbohydrates, such as white flour and white sugar</li> <li>• May temporarily improve blood sugar or blood cholesterol levels</li> </ul>	<ul style="list-style-type: none"> <li>• Not entirely evidence-based</li> <li>• Results in higher fat and protein consumption</li> </ul>
Macrobiotic Diet	<ul style="list-style-type: none"> <li>• Low in saturated fats and high in fiber</li> <li>• Emphasizes whole foods and de-emphasizes processed foods</li> <li>• Rich in phytoestrogens, which may reduce the risk of estrogen-related cancers</li> </ul>	<ul style="list-style-type: none"> <li>• Not entirely evidence-based</li> <li>• Lacks certain vitamins and minerals; supplements are often required</li> <li>• Can result in a very low caloric intake</li> <li>• Lack of energy may result from inadequate protein</li> </ul>
Mediterranean Diet	<ul style="list-style-type: none"> <li>• A reduced risk of cardiovascular disease and mortality</li> <li>• A lower risk of cancer</li> </ul>	<ul style="list-style-type: none"> <li>• Does not specify daily serving amounts</li> </ul>

Diet	Pros	Cons
	<ul style="list-style-type: none"> <li>• De-emphasizes processed foods and emphasizes whole foods and healthy fats</li> <li>• Lower sodium intake, due to fewer processed foods</li> <li>• Emphasis on monosaturated fats leads to lower cholesterol</li> <li>• Highlighting fruits and vegetables raises consumption of antioxidants</li> </ul>	<ul style="list-style-type: none"> <li>• Potential for high fat and high calorie intake as nuts and oils are calorie-dense foods</li> <li>• Drinking one to two glasses of wine per day may not be healthy for those with certain conditions</li> </ul>
Raw Food Diet	<ul style="list-style-type: none"> <li>• Emphasizes whole foods</li> <li>• Focuses on nutritionally-rich foods</li> <li>• High in fiber</li> </ul>	<ul style="list-style-type: none"> <li>• Not entirely evidence-based</li> <li>• Very restrictive and limits protein and healthy fat intake</li> <li>• Could encourage the development of foodborne illness</li> <li>• Extremely difficult to follow</li> <li>• Can cause deficiencies in essential vitamins</li> </ul>

Diet	Pros	Cons
Vegetarianism and Veganism	<ul style="list-style-type: none"> <li>• May reduce cancer risk</li> <li>• May reduce heart disease risk</li> <li>• May reduce obesity risk</li> <li>• May help prevent Type 2 diabetes</li> <li>• Helps with weight reduction and weight maintenance</li> </ul>	<ul style="list-style-type: none"> <li>• Guidelines regarding fat and nutrient consumption must be followed</li> <li>• Requires vigilance to watch out for hidden animal products</li> <li>• Requires negotiating meals and holidays with meat-eating friends and family</li> </ul>

### Food Supplements and Food Replacements

Current trends also include the use of supplementation to promote health and wellness. Vitamins, minerals, herbal remedies, and **supplements**<sup>3</sup> 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?*

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.

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

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

© Thinkstock

- 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 groups
- 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>.

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?*

© Thinkstock

### The Essential Elements of Physical Fitness

Building **cardiorespiratory endurance**<sup>4</sup> 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<sub>2</sub> max** test. VO<sub>2</sub> max is your maximal oxygen uptake, and the VO<sub>2</sub> 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<sub>2</sub> max, 'V' meaning volume, and 'max' meaning the maximum amount of oxygen (O<sub>2</sub>) 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<sub>2</sub> 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<sub>2</sub> Max Test: The Human Body—A User's Guide*

[\(click to see video\)](#)

*Watch two athletes take a VO<sub>2</sub> max test to measure their cardiorespiratory endurance.*

**Muscle strength**<sup>5</sup> and **muscle endurance**<sup>6</sup> 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**<sup>7</sup> 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**<sup>8</sup>. 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 hour
- Mayo 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

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.



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

### 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.

© Thinkstock

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

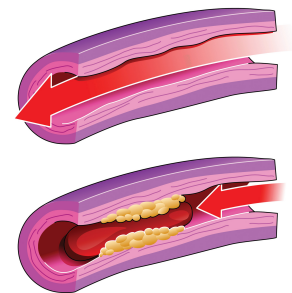
and wellness (such as diet). For example, a person who continuously eats a diet high in sugars, saturated fats, and red meat is at risk for becoming obese and developing Type 2 diabetes, cardiovascular disease, or several other conditions. Making more healthy dietary choices can greatly reduce that risk. 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 predisposition 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**<sup>9</sup>, 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.*

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**<sup>10</sup>. 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**<sup>11</sup>. 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**<sup>12</sup>. Blood clots in heart and brain arteries can cause heart attacks or strokes.

© Thinkstock

Table 15.2 The Risk Factors for Cardiovascular Disease

Unmodifiable Risk Factors	Modifiable Risk Factors
<ul style="list-style-type: none"> <li>• <b>Age.</b> Risk increases for men at forty-five, and for women at fifty-five.</li> <li>• <b>Sex.</b> Men have a higher risk than women, though the risk for women</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Cigarette smoking.</b> Nicotine constricts blood vessels, and carbon monoxide damages their inner lining, which increases the risk of atherosclerosis.</li> <li>• <b>Obesity.</b> Excess weight worsens other risk factors.</li> <li>• <b>Diabetes.</b> 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.</li> <li>• <b>Physical inactivity.</b> Lack of exercise is associated with heart disease.</li> <li>• <b>Cholesterol levels.</b> High levels of blood cholesterol can increase the risk. A high level of low-density lipoprotein (LDL), or</li> </ul>

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
<p>steeply rises after menopause.</p> <ul style="list-style-type: none"> <li>• <b>Family history.</b> The more family members who have heart disease, the greater the risk.</li> </ul>	<p>the “bad” cholesterol, is a common contributing factor. However, a low level of high-density lipoprotein (HDL), or “good” cholesterol, can also promote atherosclerosis.</p>

### 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**<sup>13</sup>, 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
<ul style="list-style-type: none"> <li>• <b>Age.</b> After fifty-five, the risk of developing high blood pressure is 90 percent.</li> <li>• <b>Race.</b> African-Americans are more likely to develop hypertension, manifest it at a younger age, and have higher blood pressure readings.</li> <li>• <b>Family history.</b> 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.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Weight.</b> Roughly 60 percent of people with hypertension are obese.</li> <li>• <b>Sodium consumption.</b> The more salt in a person's diet, the more likely they are to have high blood pressure.</li> <li>• <b>Alcohol.</b> Drinking more than two drinks per day for men and one drink for women increases the likelihood of hypertension.</li> <li>• <b>Diet.</b> In addition to salt and alcohol consumption, other dietary factors increase chances of developing hypertension.</li> </ul>

### 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**<sup>14</sup>. 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**<sup>15</sup>. 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
<ul style="list-style-type: none"> <li>• <b>Age.</b> Most cancers occur in people over the age of sixty-five. However, people of all ages, including children, can get cancer.</li> <li>• <b>Family history.</b> Certain types of cancer have a genetic link. However, environmental factors may also play a part.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Tobacco.</b> Smoking or chewing tobacco greatly increases the risk for certain cancers, including cancer of the lungs, bladder, cervix, kidneys, mouth, and pancreas.</li> <li>• <b>Alcohol.</b> Drinking alcohol is linked to cancers of the mouth, throat, esophagus, and breast, as well as to cancers of the neck and head.</li> <li>• <b>Obesity.</b> Linked to cancers of the colon, uterus, pancreas, esophagus, kidney, and breast.</li> <li>• <b>Cooking techniques.</b> Grilling, smoking, and preparing meat at high temperatures forms carcinogens.</li> <li>• <b>Red meat.</b> The risk of colon cancer seems to increase with the consumption of red meat and processed meat.</li> <li>• <b>Cured meats.</b> 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.</li> </ul>



Unmodifiable Risk Factors	Modifiable Risk Factors
	<ul style="list-style-type: none"> <li>• <b>Physical inactivity.</b> Linked to colon, breast, and other cancers.</li> <li>• <b>Exposure to chemicals.</b> 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.</li> <li>• <b>Viruses or bacteria.</b> 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.</li> </ul>

### 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](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 consequences 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**<sup>16</sup> is an autoimmune condition in which the pancreas does not produce insulin. Type 1 diabetes is not preventable, and its cause is unknown. Symptoms include excessive urination, thirst, persistent hunger, weight loss, vision problems, and fatigue.

Formerly known as adult-onset diabetes, **Type 2 diabetes**<sup>17</sup> 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**<sup>18</sup> 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
<ul style="list-style-type: none"> <li>• <b>Age.</b> Risk increases after age forty-five</li> <li>• <b>Medical history.</b> Diabetes during a previous pregnancy or recently giving birth to an infant who weighs more than 9 pounds.</li> <li>• <b>Family history.</b> A history of diabetes among one or more close relatives.</li> <li>• <b>Race and ethnicity.</b> Individuals from specific ethnic groups may have an increased risk for developing diabetes, including African Americans, Hispanic Americans, Asian Americans, and Native Americans.</li> <li>• <b>Viruses.</b> Exposure to: Epstein-Barr, Coxsackie, mumps, or cytomegalo viruses may trigger Type 1 diabetes.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Cigarette smoking.</b> Nicotine constricts blood vessels, and carbon monoxide damages their inner lining, which increases the risk of Type 2 diabetes.</li> <li>• <b>Obesity.</b> Excess body weight, especially around the waist, is a major contributing factor to Type 2 diabetes.</li> <li>• <b>Physical inactivity.</b> Lack of exercise is strongly associated with diabetes.</li> <li>• <b>High blood pressure.</b> Greater than or equal to 140/90 mmHg.</li> <li>• <b>Cholesterol levels.</b> HDL cholesterol under 35 mg/dL.</li> </ul>

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

Unmodifiable Risk Factors	Modifiable Risk Factors
	<ul style="list-style-type: none"> <li>• <b>Blood sugar.</b> Impaired glucose tolerance.</li> <li>• <b>Blood fats.</b> Elevated triglycerides (250 mg/dL or more).</li> </ul>

### 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](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**<sup>19</sup>, 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, occasional 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**<sup>20</sup>, 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

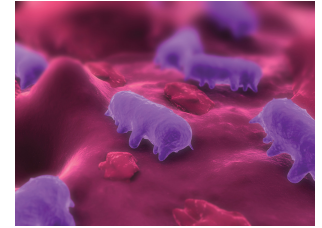
Both food infections and food intoxications can create a burden on health systems, when patients require treatment and support, and on food systems, when companies must recall contaminated food or address public concerns. It all begins with the agent that causes the contamination. When a person ingests 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.

© Thinkstock

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

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.



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

© Thinkstock

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**<sup>21</sup>, 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/](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 vomiting 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/](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 avocados, 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-e-home-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](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

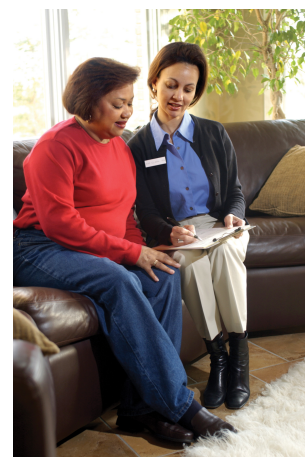
1. Think of a change you might want to make in your life to become healthier, and discuss ways you can use the transtheoretical model to make this change.

## 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**<sup>22</sup> and **nutritionists**<sup>23</sup> provide nutrition-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.*

© Thinkstock

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.