PART 3

Community Nutrition and Health Care

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KEY CONCEPTS

- Modern food production, processing, and marketing have both positive and negative influences on food safety.
- Many organisms in contaminated food transmit disease.
- Poverty often prevents individuals and families from having adequate access to their community food supply.

FOOD SAFETY AND HEALTH PROMOTION

Government Control Agencies

The food supply in the United States has exploded in recent years. Keeping the food supply safe is no small task. Several federal agencies now help control food safety and quality. The FDA is the primary governing body of the American food supply, with the exception of meat and poultry. The USDA Food Safety and Inspection Service is responsible for food safety of both domestic and imported meat and poultry (Figure 13-1). The National Marine Fisheries Service governs the safety of seafood and fisheries. The Environmental Protection Agency regulates the use of pesticides and other chemicals and ensures the safety of public drinking water. Regulation of advertising...
and truthful marketing of food products is a large job and is the duty of the Federal Trade Commission. The CDC monitors and investigates cases of food-borne illness and is proactive in education and prevention. Multiple other federal, state, and local agencies participate in education and research to promote safety in the food supply.

Food and Drug Administration

Enforcement of Federal Food Safety Regulations. The FDA is a law enforcement agency charged by the U.S. Congress to ensure, among other things, that America's food supply is safe, pure, and wholesome. The agency enforces federal food safety regulations through various activities, including (1) enforcing food sanitation and quality control, (2) controlling food additives, (3) regulating the movement of foods across state lines, (4) maintaining the nutrition labeling of foods, (5) ensuring the safety of public food service, and (6) ensuring the safety of most food products. The agency's methods of enforcement are recall, seizure, injunction, and prosecution. The use of recalls is the most common method, followed by seizures of contaminated food. Injunction involves a court order to stop the sale and/or production of a food item. This procedure is not common and generally is in response to a claim that a food item is potentially harmful or has not undergone appropriate testing or acquired adequate approval for sale. One example of this is the court-ordered halt of the sale of genetically engineered alfalfa in March 2007. The Center for Food Safety filed a case against the USDA for not conducting an Environmental Impact Statement before approving sale of the alfalfa.

Consumer Education. The FDA's division of consumer education conducts an active program of protection through consumer education and general public information. Special attention is given to nutrition misinformation. Materials are prepared and distributed to individuals, students, and community groups. Consumer specialists work in all FDA district offices.

Research. Along with the USDA's Agricultural Research Service, FDA scientists continually evaluate foods and food components through their own research. For a more health-conscious public and a changing marketplace, the FDA is developing nutrition guidelines for a variety of food products, including main dishes, meat substitutes, fruit juices and fruit drinks, and snack foods. The FDA has a long history of food safety activities, research, programs, and initiatives. For information on past research and programs by the FDA that have positively promoted change, the National Food Safety Programs Historical Background Web site is frequently updated (www.foodsafety.gov/∼dms/fs-toe2.html).

Development of Food Labels

Early Development of Label Regulations

In the mid-1960s the FDA established "truth in packaging" regulations that dealt mainly with food standards. As food processing developed and the number of items grew, the labels included more nutrition information. Both types of label information are important to consumers.

Food Standards. The basic standard of identity requires that labels on foods not having an established reference standard must list all the ingredients in the order of amount found in the product. Other food standard information on labels relates to food quality, fill of container, and enrichment.

Nutrition Information. Under regulations adopted in 1973, the FDA began developing a labeling system that describes a food's nutritional value. Some producers began to add limited information on their own to meet this increasing market demand. Many people became concerned that nutrition labeling was inadequate, but the real problem was what and how much were being labeled and in what format. Information about nutrients and food constituents that consumer groups believed should be listed on labels included the amount of macronutrients (carbohydrate, protein, fat) and their total energy value (calories), key micronutrients (e.g., calcium, iron, vitamin A), sodium, cholesterol, trans fat, and saturated fat. Concerned public and professional groups also want nutrients to be identified in terms of percentages of the current DRI standard per defined portion. Surveys indicate that 60% to 80% of shoppers consult the food label before purchasing a new product and that 30% to 40% of that group make their decision to buy on the basis of the information provided.
Background of Present Food and Drug Administration Label Regulations

Over the past 10 years two factors have fueled rapid progress toward better food labels: (1) an increase in the variety of food products entering the U.S. marketplace and (2) changing patterns of American eating habits. Both factors led many health-conscious consumers and professionals alike to rely increasingly on nutrition labeling to help meet health goals. A number of labeling problems, including lack of uniformity, misleading health claims, and imprecise terms such as “natural” and “light” persisted.

These problems indicated a need to reorganize and coordinate the entire food-labeling system. This need had been reinforced by three previous landmark reports relating nutrition and diet to national health goals: The Surgeon General’s Report on Nutrition and Health, the National Research Council’s Diet and Health, and the Public Health Service’s national health goals and objectives to be reached by the year 2000, Healthy People 2000. (These goals were reached and thus not repeated in the Healthy People 2010 report.) On the basis of these reports, the Institute of Medicine of the National Academy of Sciences established a Committee on the Nutrition Components of Food Labeling to study and report on the scientific issues and practical needs involved in food labeling reform. The report of this committee provided basic guidelines for the rule-making process conducted by the FDA, USDA, and the USDHHS for submission to Congress to achieve the needed reforms (see the For Further Focus box, “Nutrition Labeling: Recommendations for a New Century”). Three areas of concern formed the basis of recommendations from the Institute of Medicine: (1) foods for mandatory regulations, (2) the format of label information, and (3) education of consumers. This report became the basic guideline for the final law and regulations enacted by the U.S. Congress in 1994.

Current Food Label Format

Nutrition Facts Label. The food label format that is so familiar now is quite different from the one used in the 1970s and 1980s. The title Nutrition Facts is printed in bold, eye-catching letters (Figure 13-2). Manufacturers of processed foods may choose to include additional information, such as calories from saturated fat, polyunsaturated fat, monounsaturated fat, potassium, soluble and insoluble fiber, sugar alcohol (e.g., sorbitol), other carbohydrates, or other vitamins and minerals.

Another key term is percent daily value (%DV). The FDA set 2000 calories as the reference amount for calculating the %DV, although individuals may vary greatly in their specific needs. As a reference tool, the %DVs can be used to determine the overall value for a specific nutrient in the food (see the For Further Focus box, “Glossary of Terms for Current Labels”). For example, if the %DV for

FOR FURTHER FOCUS

NUTRITION LABELING: RECOMMENDATIONS FOR A NEW CENTURY

Label Presentation

- The FDA and USDA should set standardized serving sizes.
- More complete ingredient listings should be provided on all foods.
- A modified regulatory scheme should be established for the development and approval of lower fat alternative foods that currently have standards of identity.

Educating Consumers

- A well-designed nutrition labeling program should be fashioned as one part of a comprehensive education program, concurrent with the adoption of regulations on the labeling of nutrition content and format, to help consumers make wise dietary choices.

From the beginning of the process, Congress wanted to develop legislative proposals to clarify the legal basis for reforms. The food industry, health professionals, and consumer groups wanted to promote changes in nutrition labeling that reflect the current DRIs and related product development. These recommendations of the committee have provided a helpful foundation for all concerned.
total fat in one serving of potato chips is 25%, a person eating the chips uses one quarter of the recommended total fat allowance for his or her entire day.

In addition, the serving size (i.e., the amount of the food customarily consumed at one time) must be given and expressed in household measures, followed by the metric weight in parentheses and the total number of servings per container.²

**Health Claims.** Health claims that link nutrients or food groups with risk for disease are strictly regulated. To make an association between a food product and a specific disease, the FDA must approve the claim, the food must meet the criteria set forth for that specific claim, and the wording used on the package must be approved. A list of nutrients currently approved for use in the United States and the specific diseases they are associated with is given in the For Further Focus box, "Glossary of Terms for Current Labels." An example of such a health claim would be the link between a diet low in saturated fat and cholesterol and a reduced risk of coronary heart disease. For a food to carry this label it must be low in saturated fat, low in cholesterol, and low in total fat. If the food is fish or game meat, it must be deemed "extra lean." The specific wording of this example claim must include the following: saturated fat and cholesterol, coronary heart disease, or heart disease, and a physician statement of the claim defining high or normal total cholesterol. The FDA also provides model claim statements that food producers may choose from. For this specific claim the model statement is, "although many factors affect heart disease, diets low in saturated fat and cholesterol may reduce the risk of this disease."³

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**Figure 13-2** Example of a food product label showing the detailed Nutrition Facts box of nutrition information mandated by the FDA under the Nutrition Labeling and Education Act. (Courtesy the FDA, Washington, DC.)
FOOD TECHNOLOGY

The character of America’s food supply has radically changed over the years. These changes, which have swept the food marketing system, are rooted in widespread social changes and scientific advances. The agricultural and food processing industries have developed various chemicals to increase and preserve the food supply. However, critics voice concerns about how these changes have affected food safety and the overall environment. Such concerns usually are focused on pesticide use and food additives.

GLOSSARY OF TERMS FOR CURRENT LABELS

To improve communication between producers and consumers, all producers must use standard wording supplied by the FDA. Whether these terms are used in the Nutrition Facts box or elsewhere as part of the manufacturer’s product description, they all must use commonly accepted terms. The following is a sampling.

**Nutrition Facts Box**

<table>
<thead>
<tr>
<th>Daily Values</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily Reference Value</td>
<td>As part of the DVs listed, the Reference Values (DRVs) are a set of standards for the following nine nutrients: total fat, saturated fat, trans fat, cholesterol, total carbohydrate, dietary fiber, protein, potassium, and sodium. DRVs do not appear on the label because they are part of a food’s DV.</td>
</tr>
<tr>
<td>Reference Daily Intake</td>
<td>As part of the DVs listed, the RDIs are a set of dietary standards based on the actual RDAs, when available, or the AIs. This replaced the old term “US RDA,” which was developed by food manufacturers as an estimate based on old RDAs. RDIs do not appear on the label because they are part of a food’s DV.</td>
</tr>
<tr>
<td>Descriptive Terms on Products</td>
<td>The FDA has specifically defined many terms that manufacturers must follow if they use the term on their product. The following are examples:</td>
</tr>
</tbody>
</table>

- **Fat free**: Less than 0.5 g of fat per serving.
- **Low cholesterol**: 20 mg of cholesterol or less per serving and per 100 g; 2 g saturated fat or less per serving. Any label claim about low cholesterol is prohibited for all foods that contain more than 2 g of saturated fat per serving.
- **Light or Lite**: At least a one-third reduction in kcalories. If fat contributes 50% or more of total kcalories, fat content must be reduced by 50% compared with the reference food.
- **Less sodium**: At least a 25% reduction; 140 mg or less per reference amount per serving.
- **High**: 20% or more of the DV per serving.
- **Reduced saturated fat**: At least 25% less saturated fat than an appropriate reference food.
- **Lean**: Applied to meat, poultry, and seafood; less than 10 g of fat, 4 g of saturated fat, and 95 mg of cholesterol per serving.
- **Extra lean**: Applied to meat, poultry, and seafood; less than 5 g of fat, 2 g of saturated fat, and 95 mg of cholesterol per serving.

For more information, refer to A Food Labeling Guide—Appendix A, from the Center for Food Safety and Applied Nutrition, at www.cfsan.fda.gov/~dms/flg6a.html.

Health Claims

The FDA guidelines indicate that any health claim on a label must be supported by substantial scientific evidence. The following claims meet this test:

- **Low sodium and the prevention of hypertension**
- **Low dietary fat and a reduced risk of cancer**
- **Low dietary cholesterol and saturated fat and reduced coronary heart disease risk**
- **Fiber-containing grain products, fruits, and vegetables and a reduced cancer risk**
- **Grain products and fruits and vegetables that contain fiber, especially soluble fiber, and the prevention of coronary heart disease**
- **Fruits and vegetables rich in vitamins A or C and lowered cancer risk**
- **Calcium and the prevention of osteoporosis and a reduced cancer risk**


FOOD TECHNOLOGY

The agricultural and scientific advances. The agricultural and wide-ranging changes and scientific advances. The agricultural and
Agricultural Pesticides

Reasons for Use
Large American agricultural corporations as well as individual farmers use a number of chemicals to improve crop yields. These materials have made possible advances in food production necessary to feed a growing population. For example, farmers use certain chemicals to control a wide variety of destructive insects that reduce crop yield (Figure 13-3).

Problems
Concerns and confusion continue about the use and effects of these chemicals. Problems have developed in four main areas: (1) pesticide residues on foods, (2) gradual leaching of the chemicals into groundwater and surrounding wells, (3) increased exposure of farm workers to these strong chemicals, and (4) increased amount of chemicals necessary as insects develop tolerance. Over time, use of these chemicals has created a pesticide dilemma: What do we do in the face of conflicting interests? Thousands of pesticides are in use, and assessing the risks of specific pesticides in use is an important but difficult task.

Alternative Agriculture
An increasing number of concerned farmers, with help from soil scientists, are turning from heavy pesticide use to alternative agricultural methods.

Organic Farming. Organic plant foods are grown without synthetic pesticides, fertilizers, sewage sludge, bioengineering, or ionizing radiation. Organic meat, poultry, eggs, and dairy products are from animals raised without antibiotics or growth hormones. In October 2002 the USDA enacted a set of nationally recognized standards to identify certified organic food. For a food to carry the USDA Organic Seal (Figure 13-4), the farm and processing plant where the food was grown and packaged must have undergone government inspections and have met the strict USDA organic standards (see the For Further Focus box, “Organic Food Standards”). All foods produced organically are not required to use the organic label; it is a voluntary program. However, companies using the label on their food without certification face a fine of up to $10,000. Sales of organic foods are rapidly growing and an increasing number of farmers, especially in California, the major supplier of U.S. fruits and vegetables, are using organic farming.

Certified organic foods are not recognized as being more safe or nutritious than conventionally produced foods. Organic farmers can still use natural pesticides and...
Organic foods have four labeling categories with specific guidelines for each, as follows:

1. **100% Organic**: Products carrying this label must be made or produced exclusively with certified organic ingredients and must have passed a government inspection. These products may use the USDA Organic Seal on their label and advertisements.

2. **Organic**: Products labeled as organic must contain 95% to 100% organic ingredients and also must have passed a government inspection. The National Organic Program must approve all other ingredients for use as nonagricultural substances or products not commercially available in organic form. These products also may use the USDA Organic Seal with the percent of organic ingredients listed.

3. **70% Organic ingredients**: Products made with at least 70% certified organic ingredients may state on the product label “made with organic ingredients” and list up to three ingredients or food groups. These foods also may meet the National Organic Program guidelines for growth or production without synthetic pesticides, fertilizers, sewage sludge, bioengineering or ionizing radiation. The USDA Organic Seal may not be displayed on these products or used in advertising.

4. **Less than 70% organic ingredients**: Foods made with less than 70% certified organic ingredients may not use the USDA Organic Seal or make any organic claims on the front panel of the package. They can list the specific organic ingredients on the side panel of the package.

All food products with at least 70% organic ingredients also must supply the name and address of the government-approved certifying agent on the product.


Fertilizers and therefore are not producing pesticide-free foods. Other common points of confusion are in the use of the following terms: natural, hormone free, and free range. These terms are not synonymous with organic. Truthful terms about the production of a food can appear on the food label but do not mean that the product is organic. The term “natural” may be used on products that contain no artificial ingredients, such as coloring or chemical preservatives, and the product and its ingredients are not more than minimally processed. The Food Safety and Inspection Service of the USDA does not approve the terms hormone free or antibiotic free. Instead, the phrases “raised without added hormones” and “raised without added antibiotics” are allowed, provided that the producer is able to supply an affidavit attesting to the production practices used to support the claim. One important note about the use of hormones is that they are approved for use only in beef cattle and lamb production. Therefore any such claim on a chicken product would be allowed only if it were immediately followed with the statement, “federal regulations prohibit the use of hormones in poultry.”

Organic farming is safer for the soil, water, agricultural workers, and birds. However, when compared with conventional farming, organic farming is less efficient. Without synthetic pesticides and fertilizers, crops are smaller and require more land. As a result, the products are more expensive.

**Genetic Modification.** Plant physiologists are developing strains of genetically modified (GM) foods that reduce the need for toxic pesticides and herbicides. Genetic manipulation in various forms has been used to improve crops for thousands of years, but most U.S. consumers are unaware of the extent to which these foods have entered the marketplace. In the United States, 87% of soybean crop acreage, and a steadily increasing percentage of corn crops, are GM herbicide-tolerant varieties (Figure 13-5). Most people in the United States have consumed some form of GM foods at some point, such as seedless oranges or watermelons. An example of biotechnology in today’s agriculture is the use of GM corn that expresses a specific protein that ultimately serves as an insecticide. Organic farmers have used this type of biotechnology for more than 40 years. Approved genetic modifications currently are used to protect against virus infections and insects on tomatoes, potatoes, squash, and papayas, among other crops. GM crops are extensively tested regarding composition, safety, and environmental effects. The National Institute of Health, Animal Plant Health Inspection Service of the USDA, FDA, and the Environmental Protection Agency are all involved in the strict regulation of GM foods in commercial use, which are the most heavily regulated new foods.
The benefits of genetic modifications are not limited to benefits to the producer. Technology is advancing to the point of engineering food to increase its nutritional value, medicinal properties, taste, and aesthetic appeal. Plants are produced with increased fiber, antioxidants, and essential amino acids, all of which are beneficial to the consumer and may have positive effects on human nutrition worldwide. More than 50 biotechnology crop products are approved for commercialization in the United States (Figure 13-6).

Such forms of agriculture remain controversial around the world because of many unknown factors regarding long-term effects on the environment and overall human health. Current testing procedures are unable to determine potential problems from long-term use, such as carcinogenicity or neurotoxicity. Research completed with soybeans revealed that wild-type and GM soybean varieties have exactly the same allergenicity; thus genetic modification did not increase the likelihood of allergies in this crop.6 This type of research will be important for all types of GM crops to ensure safety and improve consumer acceptability.

Irradiation. Irradiation can kill bacteria and parasites on the food after harvest. Irradiation helps prevent food-borne illness caused by *Escherichia coli*, *Salmonella*, *Campylobacter*, *Listeria*, *Cyclospora*, *Shigella*, and *Salmonella*.7 Three different methods of irradiation are used, all of which are approved by the WHO, CDC, USDA, and FDA. The use of irradiation is not a new science; wheat flour and white potatoes were approved for irradiation in the early 1960s. In addition to reducing or eliminating disease-causing germs, irradiation can be used to increase the shelf life of produce. Foods that are irradiated (1) have essentially unaltered nutritional value, (2) are not radioactive, (3) have no harmful substances introduced as a result of irradiation, but (4) may taste slightly different.7 A variety of foods have been approved for irradiation in the United States, including meat, poultry, grains, some seafood, fruits, vegetables, herbs, and spices. The FDA requires all irradiated foods be appropriately labeled with either the radura symbol for irradiation (Figure 13-7) or by a written description stating the food has been exposed to irradiation.

Consumer rejection in the United States and around the world mainly is the result of altered taste and fear of unknown long-term affects on human health. Irradiation also introduces trans fats in meats, a known health risk. The U.S. government continues to support the use and safety of such foods, but without consumer acceptance companies using such procedures have limited success.
The use of food additives (i.e., chemicals intentionally added to foods to prevent spoilage and extend shelf life) is not new to the food industry either. Table 13-1 lists examples of food additives. The two most common additives are sugar and salt, although consumers often do not recognize these basic ingredients as food additives. Some additives have been used for centuries as preservatives, especially salt in cured meats. The term “generally recognized as safe” is used to define additives that have been used in foods and do not need FDA approval.

### Table 13-1

<table>
<thead>
<tr>
<th>Function</th>
<th>Chemical Compound</th>
<th>Common Food Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acid, alkalis, buffers</td>
<td>Sodium bicarbonate</td>
<td>Baking powder</td>
</tr>
<tr>
<td></td>
<td>Tartaric acid</td>
<td>Fruit sherbets, cheese spreads</td>
</tr>
<tr>
<td>Antibiotics</td>
<td>Chlortetracycline</td>
<td>Dip for dressed poultry</td>
</tr>
<tr>
<td>Anticaking agents</td>
<td>Aluminum calcium silicate</td>
<td>Table salt</td>
</tr>
<tr>
<td>Antimycotics</td>
<td>Calcium propionate</td>
<td>Bread</td>
</tr>
<tr>
<td></td>
<td>Sodium propionate</td>
<td>Bread</td>
</tr>
<tr>
<td></td>
<td>Sorbic acid</td>
<td>Cheese</td>
</tr>
<tr>
<td>Antioxidants</td>
<td>Butylated hydroxyanisole</td>
<td>Fats</td>
</tr>
<tr>
<td></td>
<td>Benzylic acid</td>
<td>Fats</td>
</tr>
<tr>
<td></td>
<td>Chlorine dioxide</td>
<td>Wheat flour</td>
</tr>
<tr>
<td>Bleaching agents</td>
<td>Oxides of nitrogen</td>
<td>Green peas, maraschino cherries</td>
</tr>
<tr>
<td>Color preservative</td>
<td>Sodium benzoate</td>
<td>Bakery goods</td>
</tr>
<tr>
<td>Coloring agents</td>
<td>Annatto</td>
<td>Dairy products</td>
</tr>
<tr>
<td></td>
<td>Carotene</td>
<td>Confections</td>
</tr>
<tr>
<td>Emulsifiers</td>
<td>Lecithin</td>
<td>Soft drinks</td>
</tr>
<tr>
<td></td>
<td>Monoglycerides</td>
<td>Bakery goods</td>
</tr>
<tr>
<td></td>
<td>Diglycerides</td>
<td>Candy, ice cream</td>
</tr>
<tr>
<td></td>
<td>Propylene glycol alginate</td>
<td>Canned meats</td>
</tr>
<tr>
<td>Flavoring agents</td>
<td>Amyl acetate</td>
<td>Meat, vegetables, sauces</td>
</tr>
<tr>
<td></td>
<td>Benzaldehyde</td>
<td>Diet canned fruit</td>
</tr>
<tr>
<td></td>
<td>Methyl salicylate</td>
<td>Low-calorie soft drinks</td>
</tr>
<tr>
<td></td>
<td>Essential oils, natural extractives</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Monosodium glutamate</td>
<td></td>
</tr>
<tr>
<td>Nonnutritive sweeteners</td>
<td>Saccharin</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aspartame</td>
<td></td>
</tr>
<tr>
<td>Nutrient supplements</td>
<td>Potassium iodide</td>
<td>Iodized salt</td>
</tr>
<tr>
<td></td>
<td>Vitamin C</td>
<td>Fruit juices</td>
</tr>
<tr>
<td></td>
<td>Vitamin D</td>
<td>Milk</td>
</tr>
<tr>
<td></td>
<td>Vitamin A</td>
<td>Margarine</td>
</tr>
<tr>
<td></td>
<td>B vitamins, iron</td>
<td>Bread, cereal</td>
</tr>
<tr>
<td>Sequestrants</td>
<td>Sodium citrate</td>
<td>Dairy products</td>
</tr>
<tr>
<td></td>
<td>Calcium phosphoric acid</td>
<td></td>
</tr>
<tr>
<td>Stabilizers and thickeners</td>
<td>Pectin</td>
<td>Jellies</td>
</tr>
<tr>
<td></td>
<td>Vegetable gums</td>
<td>Dairy desserts, chocolate milk</td>
</tr>
<tr>
<td></td>
<td>(carob bean, carrageenan, guar)</td>
<td>Confections</td>
</tr>
<tr>
<td></td>
<td>Gelatin</td>
<td>“Low-calorie” salad dressings</td>
</tr>
<tr>
<td>Yeast foods and dough conditioners</td>
<td>Ammonium chloride</td>
<td>Bread, rolls</td>
</tr>
<tr>
<td></td>
<td>Calcium sulfate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Calcium phosphate</td>
<td></td>
</tr>
</tbody>
</table>
Over the past few decades the number and variety of food additives have increased in the food supply. The current variety of food market items would be impossible without them. Scientific advances have created processed food products, and the changing society has created the market demand. The expanding population, larger workforce, and more complex family life have increased the desire for more variety and convenience in foods as well as better safety and quality. Food additives help achieve these needs and serve many purposes. For example, additives (1) enrich foods with added nutrients; (2) produce uniform qualities (e.g., color, flavor, aroma, texture, and general appearance); (3) standardize many functional factors (e.g., thickening or stabilization [keeping parts from separating]); (4) preserve foods by preventing oxidation; and (5) control acidity or alkalinity to improve flavor, texture, and the cooked product. A number of micronutrients and antioxidants are used as additives in processed foods—not for their ability to increase nutrient content, but for their technical effects either during processing or in the final product.

**FOOD-BORNE DISEASE**

**Prevalence**

Many disease-bearing organisms inhabit the environment and can contaminate food and water. The Public Health Service estimates 76 million Americans become sick from food-borne illness annually, with a resulting 325,000 hospitalizations. Much has been learned in the past decade about the pathogens that commonly contaminate food and water and ways to prevent food-borne illness outbreaks. However, lapses in control still occur, resulting in high incidences of illness and death as well as economic burden. The estimated annual incidence of food-borne illness has been on the decline for most pathogens in recent years. Microbiologic diseases (bacterial and viral) represent the majority of these outbreaks nationwide, with a large range of costs associated with each type of infection. *Salmonella*, *Campylobacter*, *Shigella*, and *Cryptosporidium* are the most common infections in home and community outbreaks.

**Food Sanitation**

**Buying and Storing Food**

Control of food-borne disease focuses on strict sanitation measures and rigid personal hygiene. First, the food itself should be of good quality and not defective or diseased. Second, dry or cold storage should protect it from deterioration or decay, which is especially important for products such as refrigerated convenience foods, the fastest growing segment of the convenience food market and potentially the most dangerous because they are not sterile. These vacuum-packaged or modified-atmosphere chilled food products are only minimally processed, not sterilized, and are at risk of temperature abuse. Home refrigerator temperatures should be held at 40° F or lower. At temperatures greater than 45° F, any precooked or leftover foods are potential reservoirs for bacteria that survive cooking and can recontaminate cooked food. Food safety depends on the following critical actions (Figure 13-8):

- **Clean**: Wash hands and surfaces often.
- **Separate**: Do not cross-contaminate.
- **Cook**: Cook to proper temperatures.
- **Chill**: Refrigerate promptly.

All food preparation areas must be scrupulously clean, and foods must be washed or cleaned well. Cooking procedures and temperatures must be followed as directed. All utensils, dishes, and anything else that comes in contact with food must be clean. Leftover food should be stored and reheated appropriately or discarded (Table 13-2). Food does not need to be cooled to room temperature before refrigerating. This practice allows food to sit in the perfect temperature range for bacterial growth. Garbage must be contained and disposed of in a sanitary manner. Safe methods of food handling, cooking, and storage are simple and mostly common sense; they often are neglected, however, which leads to food-borne illness.

**Figure 13-8** The Partnership for Food Safety Education developed the Fight BAC! (bacteria) campaign to prevent food-borne illness. Campaign graphics are available at www.fightbac.org. (Courtesy Partnership for Food Safety Education, Washington, DC.)
## TABLE 13-2
COLD STORAGE CHART

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>REFRIGERATOR (40° F)</th>
<th>FREEZER (0° F)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Eggs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fresh, in shell</td>
<td>3 to 5 weeks</td>
<td>Do not freeze</td>
</tr>
<tr>
<td>Raw yolks and whites</td>
<td>2 to 4 days</td>
<td>1 year</td>
</tr>
<tr>
<td>Hard cooked</td>
<td>1 week</td>
<td>Does not freeze well</td>
</tr>
<tr>
<td><strong>Liquid Pasteurized Eggs, Egg Substitutes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opened</td>
<td>3 days</td>
<td>Does not freeze well</td>
</tr>
<tr>
<td>Unopened</td>
<td>10 days</td>
<td>1 year</td>
</tr>
<tr>
<td><strong>Mayonnaise, Commercial: Refrigerate after Opening</strong></td>
<td>2 months</td>
<td>Do not freeze</td>
</tr>
<tr>
<td><strong>Frozen Dinners and Entrees: Keep Frozen until Ready to Heat</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Deli and Vacuum-Packed Products: Store-Prepared (or Homemade) Egg, Chicken, Ham, Tuna, and Macaroni Salads</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hot Dogs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opened package</td>
<td>1 week</td>
<td>1 to 2 months</td>
</tr>
<tr>
<td>Unopened package</td>
<td>2 weeks</td>
<td>1 to 2 months</td>
</tr>
<tr>
<td><strong>Luncheon Meat</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opened package</td>
<td>3 to 5 days</td>
<td>1 to 2 months</td>
</tr>
<tr>
<td>Unopened package</td>
<td>2 weeks</td>
<td>1 to 2 months</td>
</tr>
<tr>
<td><strong>Bacon and Sausage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bacon</td>
<td>7 days</td>
<td>1 month</td>
</tr>
<tr>
<td>Sausage, raw: chicken, turkey, pork, beef</td>
<td>1 to 2 days</td>
<td>1 to 2 months</td>
</tr>
<tr>
<td>Smoked breakfast links, patties</td>
<td>7 days</td>
<td>1 to 2 months</td>
</tr>
<tr>
<td>Hard sausage: pepperoni, jerky sticks</td>
<td>2 to 3 weeks</td>
<td>1 to 2 months</td>
</tr>
<tr>
<td><strong>Summer Sausage, Labeled “Keep Refrigerated”</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opened</td>
<td>3 weeks</td>
<td>1 to 2 months</td>
</tr>
<tr>
<td>Unopened</td>
<td>3 months</td>
<td>1 to 2 months</td>
</tr>
<tr>
<td><strong>Corned beef, in pouch with pickling juices</strong></td>
<td>5 to 7 days</td>
<td>Drained, 1 month</td>
</tr>
<tr>
<td><strong>Ham, Canned, Labeled “Keep Refrigerated”</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opened</td>
<td>3 to 5 days</td>
<td>1 to 2 months</td>
</tr>
<tr>
<td>Unopened</td>
<td>6 to 9 months</td>
<td>Do not freeze</td>
</tr>
<tr>
<td><strong>Ham, Fully Cooked</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vacuum sealed at plant, undated, unopened</td>
<td>2 weeks</td>
<td>1 to 2 months</td>
</tr>
<tr>
<td>Vacuum sealed at plant, dated, unopened</td>
<td>“Use by” date on package</td>
<td>1 to 2 months</td>
</tr>
<tr>
<td>Whole</td>
<td>7 days</td>
<td>1 to 2 months</td>
</tr>
<tr>
<td>Half</td>
<td>3 to 5 days</td>
<td>1 to 2 months</td>
</tr>
<tr>
<td>Slices</td>
<td>3 to 4 days</td>
<td>1 to 2 months</td>
</tr>
<tr>
<td>Hamburger and stew meat</td>
<td>1 to 2 days</td>
<td>3 to 4 months</td>
</tr>
<tr>
<td>Ground Turkey, Veal, Pork, Lamb, and Mixtures</td>
<td>1 to 2 days</td>
<td>3 to 4 months</td>
</tr>
<tr>
<td><strong>Fresh Beef, Veal, Lamb, Pork</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steaks</td>
<td>3 to 5 days</td>
<td>6 to 12 months</td>
</tr>
<tr>
<td>Chops</td>
<td>3 to 5 days</td>
<td>4 to 6 months</td>
</tr>
<tr>
<td>Roasts</td>
<td>3 to 5 days</td>
<td>4 to 12 months</td>
</tr>
<tr>
<td>Variety meats: tongue, liver, heart, kidneys, chitterlings</td>
<td>1 to 2 days</td>
<td>3 to 4 months</td>
</tr>
<tr>
<td>Prestuffed, uncooked pork chops, lamb chops, or chicken breasts stuffed with dressing</td>
<td>1 day</td>
<td>Does not freeze well</td>
</tr>
<tr>
<td>Soups and stews, vegetable or meat added</td>
<td>3 to 4 days</td>
<td>2 to 3 months</td>
</tr>
<tr>
<td><strong>Fresh Poultry</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chicken or turkey, whole</td>
<td>1 to 2 days</td>
<td>1 year</td>
</tr>
<tr>
<td>Chicken or turkey, pieces</td>
<td>1 to 2 days</td>
<td>9 months</td>
</tr>
<tr>
<td>Giblets</td>
<td>1 to 2 days</td>
<td>3 to 4 months</td>
</tr>
</tbody>
</table>

Food safety publications for all types of foods and populations can be found at the Food Safety and Inspection Service Web site at: www.fsis.usda.gov/Fact_Sheets/index.asp.

Preparing and Serving Food
All persons handling food, especially those working in public food services, should follow strict measures to prevent contamination. For example, simple handwashing and clean clothing and aprons are imperative. Basic rules of hygiene should apply to all persons handling food, whether they work in food processing and packaging plants, process and package foods in markets, or prepare and serve food in restaurants. In addition, persons with an infectious disease should have limited access to direct food handling.

Following are minimal internal temperatures for various foods:
- Ground beef, hamburgers: 160°F
- Chicken breast: 170°F
- Whole chicken: 180°F
- Egg dishes: 160°F
- Fish: 145°F
- Pork: 160°F
- Steaks and roast: 145°F

The Hazard Analysis and Critical Control Point (HACCP) food safety system focuses on preventing food-borne illness through identifying critical points and eliminating hazards. Many organizations, including the USDA and FDA, use HACCP standards. The USDA has developed specific standards for a variety of food products. For more information on HACCP, visit www.cfsan.fda.gov/~lrd/haccp.html.

Food Contamination
Food-borne illness usually presents itself as flu-like symptoms but can advance to a lethal illness. Not all bacteria found in foods are harmful; some are even beneficial, such as the bacteria in yogurt. Bacteria that are harmful to people are referred to as pathogens. Certain subgroups of the population are at higher risk for developing food-borne illness because of age and physical condition. Groups at the highest risk are young children, pregnant women, elderly individuals, and people with compromised immune systems.

Bacterial Food Infections
Bacterial food infections result from eating food contaminated by large colonies of different types of bacteria. Specific diseases result from specific bacteria (e.g., salmonellosis, shigellosis, and listeriosis).

Salmonellosis. Salmonellosis is caused by Salmonella, a bacterium named for the American veterinarian pathologist Daniel Salmon (1850–1914), who first isolated and identified the species that commonly causes food-borne infections: S. typhi and S. paratyphi. Approximately 40,000 cases of salmonellosis are reported in the United States each year, although thousands of other cases are suspected to go unreported.11 These organisms readily grow in common foods such as milk, custard, egg dishes, salad dressing, and sandwich fillings. Seafood from polluted waters, especially shellfish such as oysters and clams, also may be a source of infection. Unsanitary handling of foods and utensils can spread the bacteria. Resulting cases of gastroenteritis may vary from mild to severe diarrhea. Immunization, pasteurization, and sanita-
tary regulations involving community water and food supplies, as well as food handlers, help control such outbreaks. Because incubation and multiplication of the bacteria take time (after the food is eaten), symptoms of food infection develop relatively slow (up to 72 hours later). Symptoms include diarrhea, fever, vomiting, and abdominal cramps. The illness usually lasts 4 to 7 days, with most affected individuals recovering completely. Severe dehydration from diarrhea and vomiting may require intravenous fluids.

**Shigellosis.** Shigellosis is caused by the bacteria *Shigella*, named for the Japanese physician Kiyoshi Shiga (1870–1957), who first discovered a main species of the organism, *S. dysenteriae*, during a dysentery epidemic in Japan in 1898. Approximately 18,000 cases are reported annually, but because many cases are not diagnosed the CDC estimates the actual number of cases may be as much as 20 times higher. Shigellosis usually is confined to the large intestine and may vary from a mild, transient intestinal disturbance in adults to fatal dysentery in young children. The bacteria grow easily in foods, especially milk, which is a common vehicle of transmission to infants and children. The boiling of water or pasteurization of milk kills the organisms, but the food or milk may easily be reinfected through unsanitary handling. The disease is spread similarly to how salmonella is transmitted (e.g., by feces, fingers, flies, milk, and food and articles handled by unsanitary carriers). Shigellosis, similar to salmonellosis, is more common in the summer and most commonly occurs in young children. Symptoms appear within 12 to 50 hours and include cramps, diarrhea, fever, vomiting, and blood or mucus in stools.

**Listeriosis.** Listeriosis is caused by the bacteria *Listeria*, which was named for the English surgeon Baron Joseph Lister (1827–1912), who first applied knowledge of bacterial infection to the principles of antiseptic surgery in a benchmark 1867 publication that led to “clean” operations and the development of modern surgery. However, only within the past 20 years has knowledge of bacteria’s role as a direct cause of food-borne illness increased and the major species causing human illness, *L. monocytogenes*, been identified. Before 1981 Listeria was thought to be only an organism of animal disease transmitted to people by direct contact with infected animals. However, this organism widely occurs in the environment and in high-risk individuals, such as elderly persons, pregnant women, infants, and patients with suppressed immune systems, and can produce a rare but often fatal illness with severe symptoms such as diarrhea, flu-like fever and headache, pneumonia, sepsis, meningitis, and endocarditis. Approximately one third of all listeriosis cases occur in pregnant women. Food-borne disease has been traced to a variety of foods, including soft cheese, poultry, seafood, raw milk, refrigerated raw liquid whole eggs, and meat products (e.g., pâté).

**Bacterial Food Poisoning**

Food poisoning is caused by the ingestion of bacterial toxins that have been produced in food by the growth of specific kinds of bacteria before the food is eaten. The powerful toxin is directly ingested, so symptoms of food poisoning develop rapidly. Two types of bacterial food poisoning, staphylococcal and clostridial, are most commonly responsible.

**Staphylococcal Food Poisoning.** Staphylococcal food poisoning was named for the causative organism, which is mainly *Staphylococcus aureus*, a round bacteria forming masses of cells. *S. aureus* is the most common form of bacterial food poisoning in the United States. Powerful preformed toxins in the contaminated food rapidly produce illness (1 to 6 hours after ingestion). The symptoms suddenly appear and include severe cramping and abdominal pain with nausea, vomiting, and diarrhea, usually accompanied by sweating, headache, fever, and sometimes prostration and shock. However, recovery is fairly rapid and symptoms subside within 24 hours (see the Clinical Applications box, “Case Study: A Community Food Poisoning Incident”). The amount of toxin ingested and the susceptibility of the individual eating it determine the degree of severity. The source of the contamination usually is a staphylococcal infection on the hand of a worker preparing the food. This infection often is minor and considered harmless or is even unnoticed by the food handler. Foods that are particularly effective carriers for staphylococci and their toxins include custard or cream-filled bakery goods, processed meats, ham, tongue, cheese, ice cream, potato salad, sauces, chicken and ham salads, and combination dishes such as spaghetti and casseroles. The toxin causes no change in the normal appearance, odor, or taste of the food, so the victim has no warning. A careful food history helps determine the source of the poisoning, and portions of the food are obtained for examination if possible. Few bacteria may be found because heating kills the organisms but does not destroy the toxins produced.

**Clostridial Food Poisoning.** Clostridial food poisoning was named for the spore-forming, rod-shaped bacteria, mainly *Clostridium perfringens* and *C. botulinum*, which also can form powerful toxins in infected foods. *C. perfringens* spores are widespread in the environment (in soil, water, dust, refuse, and many other places). This organism multiplies in cooked meat and meat dishes and develops its toxin in foods held at warm or room temperatures for extended periods. A number of...
outbreaks from food eaten in restaurants, college dining rooms, and school cafeterias have been reported. In most cases cooked meat is improperly prepared or refrigerated. Control depends on careful preparation and adequate cooking of meats, prompt service, and immediate refrigeration at sufficiently low temperatures. The bacteria

\[ C. \text{botulinum} \]

cause a far more serious, often fatal food poisoning, botulism, from ingestion of food containing its powerful toxin. Depending on the dose of toxin taken and the individual response, the illness may vary from mild discomfort to death within 24 hours. Mortality rates are high. Nausea, vomiting, weakness, and dizziness are initial symptoms. The toxin progressively irritates motor nerve cells and blocks transmission of neural impulses at the nerve terminals, causing gradual paralysis. Sudden respiratory paralysis with airway obstruction is the major cause of death. \[ C. \text{botulinum} \] spores are widespread in soil throughout the world and may be carried on harvested food to the canning process. Like all \[ \text{clostridia} \], this species is anaerobic, or nearly so. The relatively air-free can and the cannning temperatures (greater than 27° C [80° F])

\[ \text{anaerobic} \text{ a microorganism that can live and grow in an oxygen-free environment.} \]
provide good conditions for toxin production. The development of high standards in the commercial canning industry has eliminated this source of botulism but cases still result each year, mainly from ingestion of home-canned foods. Because boiling for 10 minutes destroys the toxin (not the spore), all home-canned food, no matter how well preserved it is considered to be, should be boiled for at least 10 minutes before it is eaten. Within the United States, Alaska and Washington have the highest incidence of botulism, with Alaska having by far the greater number of cases because of native habits of eating uncooked or partially cooked meat that has been fermented, dried, or frozen. Table 13-3 summarizes examples of bacterial sources of food contamination.

**Viruses**

Illnesses produced by viral contamination of food are few when compared with those produced by bacterial sources. These include upper respiratory infections (e.g., colds and influenza) and viral infectious hepatitis. Explosive epidemics of infectious hepatitis have occurred in schools, towns, and other communities after fecal contamination of water, milk, or food. Contaminated shellfish from polluted waters also have caused several outbreaks. Again, stringent control of community water and food supplies, as well as personal hygiene and sanitary practices of food handlers, is essential for prevention of disease.

| TABLE 13-3 |
| EXAMPLES OF BACTERIAL FOOD-BORNE DISEASE |

<table>
<thead>
<tr>
<th>FOOD-BORNE DISEASE</th>
<th>CAUSATIVE ORGANISMS (GENUS, SPECIES)</th>
<th>FOOD SOURCE</th>
<th>SYMPTOMS AND COURSE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bacterial Food Infections</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salmonellosis</td>
<td><em>Salmonella typhi</em>, <em>S. paratyphi</em></td>
<td>Milk, custards, egg dishes, salad dressings, sandwich fillings, polluted shellfish</td>
<td>Mild to severe diarrhea, cramps, vomiting; appearance 12-24 hours or more after eating; duration of 1-7 days</td>
</tr>
<tr>
<td>Shigellosis</td>
<td><em>Shigella dysenteriae</em></td>
<td>Milk and milk products, seafood, salads</td>
<td>Mild diarrhea to fatal dysentery (especially in young children); appearance 7-36 hours after eating; duration of 3-14 days</td>
</tr>
<tr>
<td>Listeriosis</td>
<td><em>Listeria monocytogenes</em></td>
<td>Soft cheese, poultry, seafood, raw milk, meat products (e.g., pâté)</td>
<td>Severe diarrhea, fever, headache, pneumonia, meningitis, endocarditis; symptoms appearing after 3-21 days</td>
</tr>
<tr>
<td><strong>Bacterial Food Poisoning (Enterotoxins)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staphylococcal</td>
<td><em>Staphylococcus aureus</em></td>
<td>Custards, cream fillings, processed meats, ham, cheese, ice cream, potato salad, sauces, casseroles</td>
<td>Severe abdominal pain, cramps, vomiting, diarrhea, sweating, headache, fever, prostration; sudden appearance 1-6 hours after eating; symptoms generally subsiding within 24 hours</td>
</tr>
<tr>
<td>Clostridial perfringens enteritis</td>
<td><em>Clostridium perfringens</em></td>
<td>Cooked meat, meat dishes held at warm temperature</td>
<td>Mild diarrhea, vomiting; appearance 8-24 hours after eating; duration of 1 day or less</td>
</tr>
<tr>
<td>Botulism</td>
<td><em>C. botulinum</em></td>
<td>Improperly home canned foods; smoked and salted fish, ham, sausage, shellfish</td>
<td>Symptoms ranging from mild discomfort to death within 24 hours; initial nausea, vomiting, weakness, and dizziness progressing to motor and sometimes fatal breathing paralysis</td>
</tr>
<tr>
<td>E. coli infection</td>
<td><em>Escherichia coli</em> 0157:H7</td>
<td>Meats; raw vegetables; unpasteurized milk, water, apple juice, and cider; person-to-person contact</td>
<td>Severe diarrhea and stomach cramps, dehydration, stroke; appearance within a few days after eating; duration of approximately 8 days</td>
</tr>
</tbody>
</table>
Parasites

The following two types of worms are of serious concern in relation to food: (1) roundworms, such as the *trichina* (*Trichinella spiralis*) worm found in pork; and (2) flatworms, such as the common tapeworms of beef and pork. The following control measures are essential: (1) laws controlling hog and cattle food sources and pastures to prevent transmission of the parasites to the meat produced for market and (2) avoidance of rare beef or undercooked pork as an added personal precaution.

Environmental Food Contaminants

Heavy metals such as lead and mercury also may contaminate food and water as well as the air and environmental objects. Although lead poisoning in the United States has dramatically declined since the removal of lead from gasoline, it remains to plague certain subgroups of the population (see the Cultural Considerations box, “The Continued Burden of Lead Poisoning”). The overall prevalence of high blood lead levels in the United States
population is 0.7%, with the highest prevalence occurring in children aged 1 to 5 years (1.6%). Children are especially vulnerable to lead poisoning, particularly those of poor families living in older homes, rental housing, or other impoverished areas with peeling lead paint. Eliminating blood lead levels of ≥10 mcg/dl or greater in children is one of the goals of Healthy People 2010.

Of all sources of lead, paint is the chief source of contamination. An estimated 38 million homes in the United States have lead in paint surfaces. Children living in these homes face lead exposure by eating paint chips or breathing airborne particles of paint dust from abrasive paint removal before remodeling. Drinking water may be a major source of lead in high-risk households whose water comes through lead service pipes or plumbing joints that have been sealed with lead solder. Current Environmental Protection Agency rules for public drinking water, however, have lowered the controlled lead exposure levels even further. Children with prolonged elevated blood lead levels may incur permanent neurological damage. Studies also have found this same high-risk population group to be deficient in iron, a condition that can increase lead absorption four- to five-fold, has a similar deleterious effect on neurology, and can thus further complicating lead toxicity.

Natural toxins produced by plants or microorganisms also contaminate the food and water supply. Mercury, found naturally in the environment in addition to human production, is converted to methyl mercury by bacteria. Methyl mercury is a toxin contaminating large bodies of water and the fish within that water. This contamination can pass through the food chain to people regularly consuming large, fatty fish. Aflatoxin, another natural toxin, is produced by fungi and may contaminate foods such as peanuts, tree nuts, corn, and animal feed.

Other food contaminants and pollutants that may pose a risk to human health come from a variety of sources (e.g., factories, sewage, and fertilizers) but end up leaching out into the ground, contaminating food production areas and the water supply.

**FOOD NEEDS AND COSTS**

**Hunger and Malnutrition**

**Worldwide Malnutrition**

Hunger, even famine and death, exist in many countries of the world today. Lack of sanitation, cultural inequality, overpopulation, and economic and political structures that do not appropriately use resources are all factors that may contribute to malnutrition. Chronic food or nutrient shortages within a population perpetuate the cycle of malnutrition, in which undernourished, pregnant women give birth to LBW infants. These infants are then more susceptible to infant death or growth retardation during childhood. When high-nutrient needs throughout childhood and adolescence are not met, the incidence of malnourished or growth-stunted adults with shorter life expectancy and reduced work capacity continues to rise. Malnutrition may result from total kilocalorie deficiency or single-nutrient deficiencies. The most common deficiencies in the world today are protein-energy malnutrition, vitamin A deficiency, iodine deficiency, and iron deficiency. Figure 13-9 shows the complicated interaction of many factors leading to malnutrition.

The United Nations Committee on World Food Security, the World Food Summit, was formed to address the 840 million people worldwide who do not have enough food to meet basic nutritional requirements. The long-term goal of this committee is to eliminate world hunger and establish a sustainable food supply for all people by 2015. The plan is composed of six commitments focused on stabilizing social, economic, and environmental production and distribution of nutritionally adequate food. The committee is responsible for monitoring, evaluating, and consulting on the international food security situation with follow-up reports. Information and updates on the progress of this committee can be found at www.fao.org/monitoringprogress/index_en.html.

**Malnutrition in America**

Hunger does not stop at the U.S. border. In the United States, one of the wealthiest countries on earth, studies continue to document hunger and malnutrition among the poor. More than 11 million households in the United States have food insecurity, which is defined as “limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways.” Individuals at highest risk of food insecurity within the United States are African Americans, Hispanics, single mothers, and households in central city and nonmetropolitan areas. At both the government and personal levels of any society, food availability and use involve money and politics. Various factors are implicated, such as land management practices, water distribution, food production and distribution policies, and food assistance programs for individuals and families in need. A “culture of poverty” often develops among the poor and is reinforced by society’s values and attitudes.

**Food Assistance Programs**

In situations of economic stress and natural disasters, individuals and families need financial help. Many people in the United States experience hunger every day. Dieti-
tians may need to discuss available food assistance programs and make appropriate referrals.

Commodity Supplemental Food Program
Under the Commodity Supplemental Food Program (CSFP), the USDA purchases food items that are good sources of nutrients often lacking in the diets of the target population (low-income pregnant and breastfeeding women, other new mothers up to 1 year postpartum, infants, children to age 5 years, and elderly people at least 60 years old). The USDA then distributes the food to state agencies and tribal organizations. From there, the food is dispersed to local agencies for public allocation. Local agencies, such as the departments of Health, Social Services, Education, or Agriculture, are responsible for evaluating eligibility, providing nutrition education, and dispersing food. This program is not currently available in every state. Information about CSFP can be found at www.fns.usda.gov/fdd/programs/csfp/default.htm.

Food Stamp Program
The Food Stamp Program began in the late depression years of the 1930s and was expanded in the 1960s and 1970s. This program has helped many poor persons purchase needed food, although federal cuts in the 1980s curtailed its help to many persons in need. The USDA estimated that 25.7 million people received food stamps in the United States each month in 2005, the majority of whom were children and the elderly.22 Under this program, the person or "household" is issued coupons, or food stamps, that are supposed to supplement the household’s food needs for 1 month. Households must have a monthly in-

Figure 13-9 Multiple causes of malnutrition. (Modified from Williams CD: Malnutrition, Lancet 2:342, 1962.)
come below the program's eligible poverty limit to qualify. The Food Stamp Program is in operation in the 50 states, the District of Columbia, Guam, and the U.S. Virgin Islands and is administered at the local level. More information about this program can be found at the USDA’s Food and Nutrition Service Web site at www.fns.usda.gov/fsp.

**Special Supplemental Food Program for Women, Infants, and Children**

WIC provides nutrition supplementation, education, and counseling in addition to referrals for health care and social services to women who are pregnant or postpartum and to their infants and children younger than 5 years. WIC has established criteria for participation, and each applicant must be income eligible and determined to be at nutritional risk. The food is either distributed free or purchased with vouchers. The average food cost per participant, as reported for FY 2007, was $39.14 per month. Vouchers are good for foods such as milk, eggs, cheese, juice, fortified cereals, and infant formulas. These foods supplement the diet with rich sources of protein, iron, and certain vitamins to help reduce risk factors such as poor growth patterns, low birth weight or prematurity, preeclampsia, miscarriage, and anemia.

WIC was established in 1972 and currently has more than 8 million participants. WIC offices are established in every state, the District of Columbia, Guam, Puerto Rico, American Samoa, and the U.S. Virgin Islands. A disproportionate amount of participants are found in three states: California, New York, and Texas. Figure 13-10 displays the distribution of individuals enrolled in WIC. Approximately half of all participants are children ages 1 to 5 years, and non-Hispanic Caucasians make up the largest race and ethnic percentage. More information can be found at www.fns.usda.gov/wic/default.htm.

![Figure 13-10 Distribution of individuals participating in the WIC program.](Modified from the Food and Nutrition Service, USDA, Washington, DC, 2006.)

**National School Lunch, Breakfast, and Special Milk Programs**

The national School Lunch, Breakfast, and Special Milk programs enable schools to provide nutritious meals to low-income students. The USDA offsets the cost of the program by donating large quantities of a variety of foods to public schools. Children eat free or at reduced rates, and these meals often are their main food intake of the day. The lunches provided must fulfill approximately one third of a child’s RDA for protein, vitamin A, vitamin C, iron, calcium, and calories and meet the *Dietary Guidelines for Americans*, which call for diets lower in total fat and contain more fruits, vegetables, and whole grains. The Special Milk Program provides milk to children who do not have access to the other meal programs. More information about the National School Lunch, Breakfast, and Special Milk programs can be found at www.fns.usda.gov/cnd. A National Summer Food Service Program also is available for low-income children that provides nutritionally balanced meals during the summer months when school is not in session.

**Nutrition Services Incentive Program**

The Nutrition Services Incentive Program, formerly known as the Nutrition Program for the Elderly, is operated through the USDHHS Administration on Aging.

This program provides cash or commodities from the USDA for the delivery of nutritious meals to the elderly. Regardless of income, all persons older than 60 years can eat hot lunches at a community center under the Congregate Meals Program or, if they are ill or disabled, receive meals at home under the Home-Delivered Meals Program. The act specifies that economically and socially needy persons be given priority. Both programs accept voluntary contributions for meals. More information can be found at www.fns.usda.gov/fdd/programs/nsip.

**Food Buying and Handling Practices**

For many American families, the problem is spending their limited food dollars wisely. Even on a low-cost plan for food purchasing, an average family of four can expect to spend approximately $630 to $738 per month on food alone. Shopping for food can be complicated, especially when each item in a supermarket’s overabundant supply shouts, “Buy me!” Food marketing is big business, and producers compete for prize placement and shelf space. A large supermarket may stock 10,000 or more different food items. A single food item may be marketed a dozen different ways at as many different prices. In diet counsel-
ing, clients and families typically express their greatest need as help with buying food. The following wise shopping and handling practices help provide healthy foods as well as control food costs.

**Planning Ahead**

Use sales circulars in newspapers, plan general menus, and keep a checklist of basic pantry supplies. Make a list ahead of time according to the location of items in a regularly used grocery store. Such planning controls impulse buying and reduces extra trips.

**Buying Wisely**

Understanding the packaging, carefully reading labels, and watching for sale items help improve purchasing power. Only buy in quantity if it results in real savings and the food can be adequately stored or used. Be cautious in selecting so-called convenience foods. The time saved may not be worth the added cost. For fresh foods, also try alternative food sources such as farmers’ markets, consumer cooperatives, and gardens.

**Storing Food Safely**

Control food waste and prevent illness from food spoilage or contamination. Conserve food by storing items according to their nature and use. Use dry storage, covered containers, and correct temperature refrigeration as needed. Keep opened and partly used food items at the front of the shelf for timely use. Avoid waste by preparing only the amount needed. Use leftovers in creative ways.

**Cooking Food Well**

Use cooking processes that retain maximal food value and maintain food safety. Cooking vegetables for shorter periods (e.g., stir frying, steaming) and with as little water as possible helps retain vitamin and mineral nutritive quality. Prepare food with imagination and good sense. Give zest and appeal to dishes with a variety of seasonings, combinations, and serving arrangements. No matter how much they know about nutrition and health, people usually eat because they are hungry and the food looks and tastes good, not necessarily because it is healthy.

**SUMMARY**

Common public concerns about the safety of the community food supply center on the use of chemicals such as pesticides and food additives. These substances have produced an abundant food supply but also have brought concerns and require control. The FDA is the main government agency established to maintain this control and conducts activities related to areas such as food safety, food labeling, food standards, consumer education, and research.

Numerous organisms such as bacteria, viruses, and parasites that can contaminate food may cause food-borne disease. Rigorous public health measures control sanitation of food areas and personal hygiene of food handlers. The same standards should apply to home food preparation and storage.

Families under economic stress may benefit from counseling about financial assistance. Various U.S. food assistance programs help families in need, and referrals can be made to appropriate agencies. Families also may need assistance buying and using food.

**CRITICAL THINKING QUESTIONS**

1. What is the basis of concern about food additives and pesticide residues?
2. What are some ways agriculture is changing to reduce the use of pesticides and their danger to workers as well as to protect the land?
3. Describe ways that various organisms may contaminate food. What standards of food preparation and handling should be used to keep food safe?
4. Kaycee is a single mother with two children and is working part time making minimum wage. During the school year, her children receive free breakfast and lunch at school. She is concerned for her children’s nutritional well-being during the summer months. For what assistance may Kaycee and her children qualify? What suggestions would you make to help establish a well-balanced diet for this family?
5. According to the food buying and handling practices described in this chapter, evaluate your own habits and describe potential hazardous points for food-borne illness contamination and ways to improve your food buying practices.
CHAPTER CHALLENGE QUESTIONS

True-False
Write the correct statement for each statement that is false.

1. True or False: U.S. surveys reveal little or no real malnutrition in the population.
2. True or False: The politics of a region or country is not involved in the nutritional status of the people.
3. True or False: The number of new processed food items that use food additives has declined in recent years because of public pressure and concern.
4. True or False: The use of pesticides on farm crops and food additives in processed foods is controlled by the USDA and FDA.

5. True or False: Food poisoning is always caused by viral contamination of food.
6. True or False: The WIC program buys agricultural food surpluses to support market prices of food and distributes these goods to needy persons.
7. True or False: The Nutrition Services Incentive Program provides group meals for all persons older than 60 years, regardless of their income.

Multiple Choice
1. Food additives are used in processed food items to do which of the following? (Circle all that apply.)
   a. Preserve food and lengthen its market life
   b. Enrich food with added nutrients
   c. Improve flavor, texture, and appearance
   d. Enhance or improve some physical property of the food

2. The use of food additives in food products is controlled by the
   a. U.S. Public Health Service.
   b. USDA.
   c. FDA.

Please refer to the Students’ Resource section of this text’s Evolve Web site for additional study resources.

REFERENCES


### FURTHER READING AND RESOURCES

ADA; Home Food Safety: www.homefoodsafety.org/index.jsp

CDC; Food-Related Diseases: www.cdc.gov/nccdod/diseases/food/index.htm

FDA; Biotechnology in Animals and Feeds: www.fda.gov/cvm/bioengineered.html

FDA; Center for Food Safety & Applied Nutrition: www.cfsan.fda.gov

FDA; Center for Food Safety & Applied Nutrition: Food Labeling and Nutrition, www.cfsan.fda.gov/label.html


USDA; Cooperative State Research, Education, and Extension Service: www.csrees.usda.gov

USDA and FDA Food Safety Information Center: foodsafety.nal.usda.gov/nal_display/index.php?info_center=16&tax_level=1

USDA Food Safety and Inspection Service food safety publications: www.fsis.usda.gov/Fact_Sheets/index.asp

National Restaurant Association Educational Foundation: www.nraef.org


The ADA addresses the need for and usefulness of food assistance programs geared toward children and adolescents. The role of the dietitian in such programs also is discussed.