



OKLAHOMA
CareerTech

Introduction to Agriscience

Unit 3
The Food Industry

Student Edition

CIMC

AG3001

Unit 3

The Food Industry

What did you have for dinner last night? Do you ever think about where your food comes from? What about 100 years ago? Do we eat the same things as our ancestors? Food is a necessity in life. It has evolved over time from farmers raising crops to provide food for their own families to one farmer feeding more than 155 people. Today, an entire industry, from grocery stores to restaurants, is focused on providing tasty, safe and healthy foods to consumers. The food industry consists of numerous operations. As food consumers, it is important to understand the system that assures the safety of the food supply, where food comes from, and food customs from around the world.



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OBJECTIVES

1. Discuss major operations that occur in the food industry.
2. Identify government requirements and other assurance of food quality.
3. Discuss food preparation and safety guidelines.
4. Identify sources of food products and by-products.
5. Discuss food customs of major world populations.

KEY WORDS

carbohydrates
complete protein
convenience store
food processing
fortified
Good Manufacturing Practices
grades
harvesting
Hazard Analysis of Critical Control Point

marketing
migratory worker
multipurpose retailer
retail
saturated fat
supermarket
unsaturated fat
value-added
wholesale

Food Industry Operations

Many consumers take for granted the availability and selection of products in the United States. But getting a product from the producer to the final consumer requires different steps such as production, harvesting, processing, transportation, and marketing. Each of these areas plays a vital role in taking food from the farm to the table. Technologies have been developed in each area to efficiently complete the processes necessary to make a variety of foods available for the consumer.

Consumers are better able to make informed choices on the foods they purchase by being aware of the processes involved in the food industry and how they affect the final product. When any part of the food industry has an increase in cost, that cost is often ultimately passed on to the consumer. For example, if producers must spend more on livestock feed, the price of beef will increase.

Production

Whether it is planting crops or raising livestock, production must occur for products to become available to consumers. The producer must make decisions on many different aspects of production. A crop producer must make decisions such as what crops will be best to plant, when to plant, and what types of fertilizers or pesticides to use. Animal production operations require that animals be properly taken care of and given the correct feed, space, and medical treatment. Many factors can affect production. Drought can destroy crops, affecting many consumer products that rely on that crop. Drought can also affect animal production as livestock producers may not have as much forage for grazing animals. A producer who is successful in production will have either a crop to harvest or animals that are ready to be processed for meat products.



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Harvesting

Harvesting is the process of gathering mature crops from the area where they are grown or produced, or the slaughtering of animals for meat products. It is important the crop is harvested at the correct stage of maturity. Harvesting at the optimum time will allow for the best yield, as well as the best product quality. Animals for meat production must also be harvested at the proper time for product quality and profit.

The methods of harvesting have changed greatly over the past few decades. Harvesting is now highly mechanized. Machines are available for many

harvesting operations, which make harvesting more efficient. Crops can be harvested quickly while still maximizing yield. Labor is also necessary for harvesting because some crops require more hand picking than others. When hand picking is required, migratory labor is often used. A **migratory worker** moves from place to place as harvesting occurs, such as custom wheat harvesters. Harvesting of animals for meat production generally occurs through processing facilities often with the use of mechanical systems. The Humane Methods of Slaughter Act was originally passed in 1958 and is enforced by the USDA Food Safety and Inspection Service. The act requires the proper treatment and humane handling of all food animals slaughtered in USDA inspected slaughter plants. The Humane Methods of Slaughter Act does not apply to chickens or other birds.

Processing

Food processing includes all the steps involved in transforming raw ingredients into food products for consumers. Some foods require minimal processing while others require extensive methods. The term **value-added** is used to describe foods that have been processed. The value of the product has increased due to the addition of ingredients or the processing that occurs. Value-added products are more appealing to the consumer.

There are many benefits to food processing such as increased food consistency and self-life. Processing also improves the marketability, convenience, and seasonable availability of food. Probably the most important benefit is increased convenience. Consumers demand foods that are quick and easy to fix. Today's American lifestyle does not allow for long hours of meal preparation. Food products are designed to be conveniently prepared. Some foods are precooked, while others are pre-assembled and cooked at home.

Transportation

The food industry has evolved from farmers growing their own food for their families to consumers purchasing food from various retail outlets. Today most food production and processing occur in facilities across the

Oklahoma Food and Agricultural Products Center

The Oklahoma Food and Agricultural Products Center (FAPC) is located on the campus of Oklahoma State University in Stillwater, Oklahoma. The primary goal of the center is to help develop successful, value-added businesses in Oklahoma. The center houses animal harvesting, food manufacturing, grain milling, sensory profiling, food microbiology, and laboratory facilities. This diverse facility allows entrepreneurs or businesses to develop and test value-added food and agricultural products.

FAPC was the location for the development of peanut butter slices. Other food items that have been developed or tested at FAPC include salsa, barbeque sauce, and chili - just to name a few. Do you have a food product idea? FAPC is the place in Oklahoma to begin the development of a new or improved food item.

world. A complex global food system allows consumers to have access to fresh and processed foods year-round. Trucks, trains, boats, and planes are all part of a system that allows food to be transported worldwide.

The transportation system of the food industry allows consumers to obtain perishable foods from distant areas. Trucks are the main source of transportation. Insulated and refrigerated trucks allow for the transportation of perishable foods year-round. Planes allow perishable foods to be imported from other countries. Bananas and other fruits are available to people all year even though they are grown in warmer climates. Trains are used to ship less perishable foods such as potatoes. The complex food transportation system allows consumers in the United States to have a large variety of foods available at all times of the year.

Marketing

Marketing is the way in which a product is sold to a target audience. It involves research and planning to develop the best approach for selling a product. Marketing also includes the development of new and improved products.

Good marketing is about understanding what people need and want, then persuading those people that a specific product meets those needs or wants. There is an important distinction between a need and a want: a need is something one must have, such as food or shelter; a want is something that one desires but could live without. As an example, people need food to live, but they want specific types of food. Some people want healthy food, others want a comfort food, and still others look for a convenience food. Marketing food products is all about understanding these various wants that different people have.



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There are two types of food marketing: wholesale and retail. **Wholesale** marketing sells in large quantity to a buyer who then resells the product. Most agricultural food products are sold through wholesale. In some instances, small, local farmers may sell directly to a local grocery store or natural food store. Wholesalers purchase food from the packing house or food processing plant.

Retail marketing consists of the sale of food for personal consumption. There are several types of retail stores where consumers can purchase food products. Three of the predominant types of stores are supermarkets, convenience stores, and multipurpose retailers. The number of items stocked and the size of the facility differentiate between the types of stores.

A **supermarket** is a large retail store that has between 25,000 and 35,000 food items commonly used in a home. The benefit of a supermarket is the large variety of food items and brands. The supermarket has expanded to include bank branches, pharmacies, and floral departments, making it the most popular type of food store in the United States.

SAE IDEA:
Entrepreneurship
**Make jams and jellies to sell
at a farmer's market.**

A **convenience store** is a smaller store that stocks a limited number of food and household items. Convenience stores are usually associated with a gas station. One important aspect of a convenience store is its location. Convenience stores are located close to main streets and highways, allowing consumers to pick up items in a convenient manner.

One-stop shopping has become very popular for many. A **multipurpose retailer** offers consumers a place to buy food items as well as clothing, electronics, toys, hardware, and other household items. These large stores can offer lower prices than smaller, hometown retailers.

Quality Assurance

People expect to purchase high-quality food that is fresh and wholesome. There are numerous systems in place to ensure that consumers receive food that is safe and flavorful. There are two main agencies in charge of food inspection. The United States Department of Agriculture (USDA) focuses on protecting the public from foodborne illness. The USDA ensures that the meat, poultry, and egg products processed in the United States are safe for consumption. The Food and Drug Administration (FDA) is responsible for ensuring safety and labeling accuracy of all food products except for meat, poultry, and egg products. With these two agencies in place, consumers can trust that their food supply is safe and of high quality.



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Quality Grades

Quality grading creates a set of standards that gives buyers and sellers a common language to use when setting prices and marketing agricultural commodities. Consumers also use information from quality grades to help them make food-purchasing decisions.

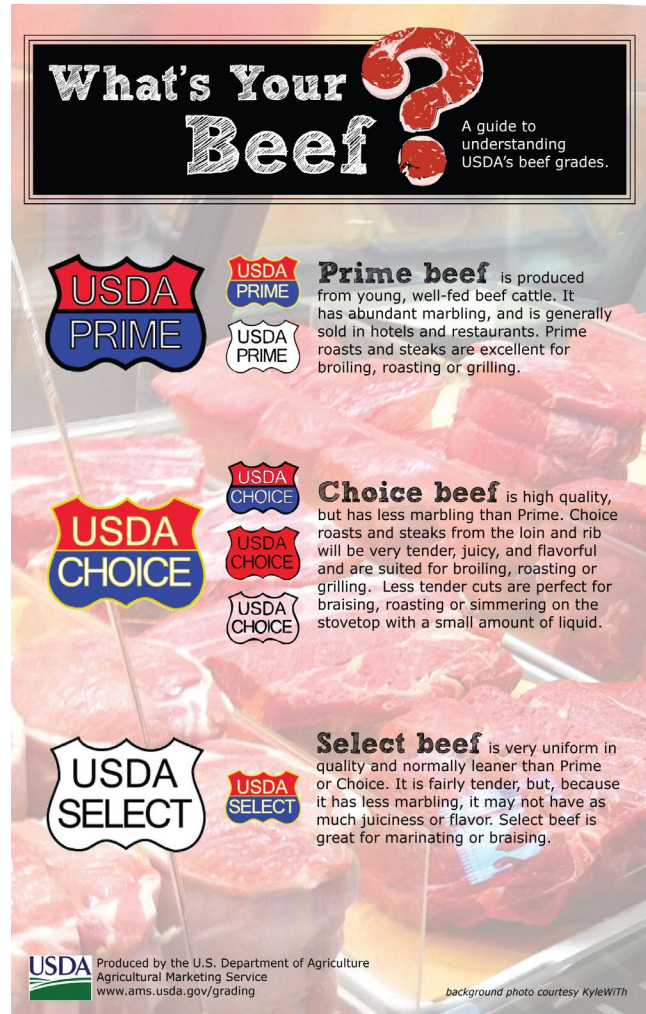
The USDA has established a grading system that provides a uniform set of standards. These quality standards are used to determine **grades**. Quality grades are established for dairy, poultry, livestock, fresh fruit and vegetables, processed fruit and vegetables, and nuts. These grades are based on quality factors such as taste, texture, and appearance.

Sanitation and Safety

The United States has the safest food supply in the world due to the strict safety regulations set by the USDA and FDA. The USDA inspects processing plants and slaughter facilities to ensure the food sent to consumers is safe. Strict attention to cleanliness is essential to produce safe, wholesome food. A clean, properly regulated production environment ensures that food is not contaminated with harmful substances.

Food safety must start with the production of crops and animals for consumption. Crop producers must follow pesticide and fertilizer guidelines. Producers that raise animals must follow withdrawal times for medications given to animals before they are slaughtered. Consumers have become more aware of issues in production such as the use of antibiotics and hormones. By understanding food production and issues surrounding it, consumers can make informed food choices.

The issue of genetically modified organisms (GMOs) in food production has also caused consumers to show a greater interest in understanding the food production process. GMOs must undergo a regulatory approval process before being grown in the United States. The safety of GMOs is regulated by the USDA, FDA, and the Environmental Protection Agency (EPA). The Environmental Protection Agency (EPA) helps to ensure that GMOs are safe for the environment.



Source: USDA

The food industry uses proven scientific methods, in addition to compliance with federal regulations, to keep food safe from contamination. Approved cleaning and sanitizing food production and preparation areas. This includes all equipment, utensils, and surfaces. Specific detergents, sanitizing agents, and cleaning routines are used to minimize the presence of microbes. In addition to cleanliness and sanitation, two other common systems are used in food processing and preparation: Good Manufacturing Practices (GMP) and Hazard Analysis of Critical Control Points (HACCP).

**SAE IDEA:
Research
Research incidents of
food-borne illnesses in
the community.**

Good Manufacturing Practices are procedures that have been developed to ensure a safe food product, as well as a safe working environment. GMP is regulated by the FDA in the United States. GMP regulations require a quality approach to food processing, enabling companies to minimize or eliminate contamination or errors.

Examples of Good Manufacturing Practices

- Preventing people with communicable diseases or open wounds from handling food.
- Using microbe-resistant, easily cleaned surfaces such as stainless steel.
- Controlling rodents, birds, and insects with effective pest-management strategies.
- Following stringent personal hygiene requirements, including frequent hand washing and restrictions on jewelry.

The **Hazard Analysis and Critical Control Point** system is a management program designed to analyze food processing procedures from the raw material to the finished product. During the analysis, key production and contamination points are identified. Hazards are classified as biological, chemical, and physical. HACCP is designed to be used for all aspects of the food production system from growing, harvesting and processing to distributing, merchandising and preparing food for consumption.



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HACCP PRINCIPLES

HACCP is a systematic approach to the identification, evaluation, and control of food safety hazards based on the seven principles.

Principle 1:

Conduct a hazard analysis.

Principle 2:

Determine the critical control points (CCPs).

Principle 3

Establish critical limits.

Principle 4

Establish monitoring procedures.

Principle 5:

Establish corrective actions.

Principle 6:

Establish verification procedures.

Principle 7:

Establish record-keeping and documentation procedures.



ICE CREAM SCARE

In 2015, Blue Bell Creameries recalled all of its products on the market because their potential to be contaminated with the bacteria *Listeria monocytogenes*. Because of this contamination, 10 people from four states were hospitalized, with three deaths occurring. Listeriosis is a rare but serious illness caused by eating food contaminated with the bacteria. Symptoms include fever and muscle aches, sometimes preceded by diarrhea or other gastrointestinal symptoms.

Recalls can be devastating to a company. Blue Bell Creameries closed all of their production plants for over 5 months and slowly reintroduced ice cream flavors to grocery stores. This example shows the importance of following Good Manufacturing Practices and HACCP. Prevention is the best practice in producing a safe and healthy food supply.

Food Preparation and Safety

Once consumers purchase food, the steps needed to ensure food safety fall upon the consumer. Many people prepare foods and eat without giving it much thought—but food safety is essential in helping prevent foodborne illness. Foodborne illnesses not only make people sick, they can result in fatalities. To help address food safety and consumers, the Food Safe Families campaign was initiated. The Food Safe Families is a cooperative effort of the USDA, FDA, Centers for Disease Control and Prevention (CDC) and the Ad Council. The campaign emphasizes four steps to follow in every phase of food preparation: clean, separate, cook, and chill.

Consumers can take actions to help ensure their food is safe. Food safety starts when shopping.

- Purchasing refrigerated or frozen items after choosing non-perishables helps ensure food remains safe until it is put away.
- Consumers should not purchase food items in packaging that is torn, leaking, or past the expiration date.
- When placing items in the shopping cart, separate meat, seafood, eggs and poultry from other food items and keep them in separate bags at checkout.



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Once food is home, it should be stored properly.

- Promptly refrigerate perishable food items. The refrigerator and freezer should be set at the correct temperatures. Recommended guidelines for the refrigerator are between 32° F and 40° F, and the freezer to be set at 0° F or below.
- Consumers should be aware of when they purchased items and use foods before they spoil. **If there is any question as to the safety of a food item, do not risk it!**
- Meat and poultry should be securely packaged so they retain quality and do not leak, possibly contaminating other foods. If meat and poultry will not be used within a few days, freeze them.



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Consumers also need to be aware of the safety aspects of non-perishable items such as canned foods. While canned foods stored properly can remain viable for a long time, cans that are dented, rusted, or swollen should be discarded and never used.

Food preparation involves many different steps, each of which can provide an opportunity for contamination to occur. Properly washing hands, utensils, cutting boards, and dishes is vital to prevent spreading bacteria. It is important to wash hands with warm water and soap before and after handling food. Hands should be washed for at least 20 seconds. Fruits and vegetables should also be washed by rinsing under running water before using, even if you plan on peeling them as bacteria can spread as they are being peeled. Do not wash raw meat and poultry as this can spread

bacteria onto surfaces such as sinks or countertops.

A common mistake many people make in food preparation is thawing raw meats, poultry, or seafood on the counter. Bacteria can multiply rapidly at room temperature. Food should be thawed safely in the refrigerator. When using the refrigerator to thaw food, ensure that cross-contamination does not occur with juices from the thawed food. Microwaves can also be used to thaw foods safely, but they should be cooked immediately after being thawed. Foods can also be thawed by placing in cold water, but again, they must be cooked immediately.

Cross-contamination is a significant issue when cooking—always keep raw meats, poultry, fish, and seafood separate from other food. In addition, always wash cutting boards and utensils after use. Surfaces should also be washed properly. When marinating meats and poultry they should be placed in the refrigerator.

It is important when cooking foods such as meats and poultry to make sure they have been heated to a high enough temperature so that harmful bacteria are killed. The best way to ensure that food is properly cooked is to use a food thermometer. Consumers should refer to charts, such as those put out by the USDA, and follow minimum temperature guidelines.

For example, ground meats should be cooked to an internal temperature of 160° F, and poultry should be cooked to an internal temperature of 165° F.

A food thermometer should be cleaned with hot, soapy water after each use.

Consumers can help ensure the food they purchase and prepare at home is safe by paying attention to food safety. Restaurants and other food retailers are regularly inspected by local public health departments to ensure they are following safe food handling procedures.

Sources of Food

There are two main categories of food sources: plant and animal. The number of food products derived from these two categories is vast. Cereal grains, legumes, fruits and vegetables are all derived from plants. Milk, milk products, meat, poultry, fish and shellfish are products that come from animals. Fats and oils can be obtained from both plants and animals.



Cereal Grains and Legumes

Cereal grains are edible seeds produced by different types of grass plants. The food from cereal grains constitutes a major portion of most people's diet. There are many different types of cereal grains used around the world. Some of the most familiar grains are wheat, corn, rice, rye, oats and barley. These grains are processed into products like bread, breakfast cereals or pasta.

All cereal grains are an excellent source of complex **carbohydrates**, which provide the body with energy. In fact, the composition of cereal grains is approximately 75 to 80 percent carbohydrates. Whole grains are a good source of dietary fiber. Depending on the type and how they are processed, cereal grains can also be a good source of B vitamins, iron and other minerals.



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Legumes come from legume plants that grow seeds contained in pods. Edible legumes include peas, beans, peanuts and soybeans. Legumes are an excellent source of plant protein, carbohydrates, fats, minerals and vitamins, and are often used as ingredients in casseroles, salads, soups and stews.

Fruits and Vegetables

Fruits and vegetables are plant-based foods that are almost ready to eat when harvested. The processing of fruits and vegetables can be as simple as washing and eating, or as complex as canning. Depending on the type of processing, fruits and vegetables could potentially be stored for years.

SAE IDEA:
Placement
Work for an agricultural seed cleaning and bagging company.

Different types of fruits and vegetables offer different levels of nutrition. In general, fruits and vegetables are naturally low in fat, low in sodium, and have no cholesterol. They are usually high in fiber and water content and tend to be high in vitamins and minerals.

Milk and Milk Products

Most milk and milk products in the United States come from cow's milk. Fluid milk is consumed as a beverage. It is also manufactured into other products including concentrated and dried milk, butter, cultured products, ice cream and cheeses.

Milk and milk products are a source of both protein and carbohydrates. It is also a source of saturated fat and cholesterol, though milk products are commonly processed to reduce fat levels. Milk is also a good source of calcium. Fluid milk is usually fortified with vitamin D. **Fortified** food products have been enhanced with additional vitamins or minerals.

Meat and Poultry

Meat generally refers to the meat of cattle, hogs and sheep, though other types of animals such as goats and rabbits are also raised for meat. Meat has long been used as the centerpiece of most meals in the United States. It can be cooked in many ways, as well as processed into products such as sausages, frozen foods and cold cuts.

Most meat consists of approximately 70 percent water, 21 percent protein, 8 percent fat, and 1 percent mineral content. Meat is a **complete protein** source, meaning it provides all the essential amino acids that humans require in their diet. Meat is also a good source of iron, B vitamins, and zinc.

Poultry refers to the meat from chickens, turkeys and other birds such as geese and ducks. Poultry is also a source of high-quality complete protein and is lower in fat than the typical serving of beef or pork. Poultry is a good source of many minerals and B vitamins. Poultry has increased in popularity in the United States because it is perceived as a healthier meat alternative to beef or pork.



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Fish and Shellfish

Fish and shellfish are available across the United States thanks to modern processing techniques. They are popular because of the diversity and availability in many forms. Since fish and shellfish tend to spoil rapidly, they are marketed as fresh or frozen or are processed into precooked products.



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Fish and shellfish are a source of easily digestible, high-quality protein. They also provide a variety of vitamins and minerals. Fish is somewhat different from red meat and poultry as a protein source because of the fat composition it contains. Although some types of fish can be high in fat, most of the fat in fish is unsaturated, which makes it healthier.

Fats and Oils

Fats and oils are derived from both plants and animals. Fat is a necessary part of a healthy diet. It is also an important component of recipes and food products. Some common types of plant-based oils are olive oil, canola oil, corn oil and coconut oil. Some common types of animal-based fats are lard, tallow, and butter. As a food ingredient, fats and oils serve several useful purposes. Fats and oils enhance flavor, as well as contribute to the desired texture of the food product.

One of the most important facts to understand is the difference between unsaturated and saturated. A **saturated fat** is generally a solid at room temperature. Saturated fats are usually of animal origin. An **unsaturated fat** is usually liquid at room temperature and is of plant origin. Nutritionally, the difference between saturated and unsaturated fat is important because saturated fats in the diet contribute to higher levels of cholesterol.

SAE IDEA:

Exploratory

Prepare a food safety information kit covering safe handling of meat, eggs, and other fresh food products.

One of the most important facts to understand is the difference between unsaturated and saturated. A **saturated fat** is generally a solid at room temperature. Saturated fats are usually of animal origin. An **unsaturated fat** is usually liquid at room temperature and is of plant origin. Nutritionally, the difference between saturated and unsaturated fat is important because saturated fats in the diet contribute to higher levels of cholesterol.

World Food Customs

Food is essential to life. However, the type of food prepared and the way it is prepared is different from culture to culture. Many times, eating habits are determined by the food that is most readily available in that region or country. In Japan, fresh fish are available daily. It is customary in Japan to eat sashimi, or raw fish. Some Americans will enjoy this culture while others do not find raw fish appetizing. In Mexico and Latin America, it is common to have beans with each meal throughout the day. In the warm and wet climates of Asia, rice is consumed daily. In North Africa, couscous is more commonly served with meals. In Mediterranean countries, fresh squeezed orange juice is often served for breakfast.

Food availability is not the only factor that determines what people eat. Religious beliefs can also affect food consumption. In India, the cow is considered sacred; therefore, Hindus do not eat beef. Another example would be that Muslims do not eat pork. In the Jewish religion people eat Kosher food, which is food prepared according to Jewish dietary laws.

The way people eat also varies from culture to culture. In the United States, it is proper etiquette to use utensils while eating. In Ethiopia, it is common for people to eat with their hands. In Asian countries, chopsticks are used to eat. In many cultures, food is often served “family style” with food eaten from shared platters. The time spent eating



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also varies — in the United States, takeout food and fast food are very popular while in other countries, such as Italy or France, takeout is not as common, and meals are generally eaten more slowly.

Food types not only vary in different countries. Regional foods are influenced by ethnicities and food availability. In the U.S., fresh seafood is available and less expensive on the east or west coast. In the New England region, it is common to have

dishes such as chowder or clam bake. In the South, sweet tea is a common beverage. In the Southwest region, Tex-Mex is a cuisine of choice. The mild temperatures of the west coast allow for fruits and vegetables to be readily available.

Around the world, food is also much more than just sustenance — food is a part of the culture and a part of the celebrations of that culture. In the United States, Thanksgiving immediately conjures visions of turkey at the dinner table. At the end of Ramadan, the breaking of the fast is often a community event. Food helps to define a culture and a community. Around the world, food can also be viewed as a status symbol. Some foods are much more expensive. Beluga caviar, which is one of the most expensive foods in the world, can cost thousands of dollars per kilogram (2.2 pounds).

While every country has its unique food customs, globalization has made some food products more commonplace throughout the world. Restaurant chains can be found throughout the world in many countries. Manufacturers of food products often slightly change their products to meet demands in different areas of the world. Coca-Cola® is sold throughout the world but has slight variations in taste because of differences in bottling in countries. For example, cane sugar may be used instead of corn syrup in some countries. McDonald's varies its menus to reflect local cultural preferences and tastes. For example, in France McDonald's sells a variety of pastries, and in India they have veggie burgers on the menu.

Throughout the world, food is also used for its health benefits. Many modern pharmaceuticals have originated from plants. Different areas of the world use foods for their health benefits, depending upon what is available locally. While the food available in countries varies with the customs surrounding food, in every culture food plays an important role not only in providing sustenance but in helping to define a culture.



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UNIT SUMMARY

As you eat your next meal, think about the food products that were used to prepare it. Where did the products come from? Were they produced in your state or flown in from another country? Food is a part of our everyday lives, and we often do not consider all the steps needed to get food to consumers. Many different areas are included in the food industry such as production, harvesting, processing, transportation and marketing. We are dependent on agencies such as the USDA and FDA to ensure safety in the products purchased and consumed. Each step of food industry operations is vital to the profitability of the industry.

Once consumers purchase food, they must follow food preparation and safety guidelines. Foodborne illnesses can result when foods are not properly prepared or stored. The four steps to follow in food preparation are clean, separate, cook and chill. The two main categories of food are plant and animal. The food products that are derived from these two categories are vast. Cereal grains, legumes, fruits and vegetables are all derived from plants. Milk, milk products, meat, poultry, fish and shellfish are products that come from animals. Fats and oils can be obtained from both plants and animals. These two categories are found throughout the world, but the customs and types of food in different areas vary greatly. Food not only provides sustenance for a culture, but it also helps define a culture. The food industry is always changing. As technology advances, people will continue to enjoy new and innovative food products.

UNIT REVIEW

1. What are the five general operations in the food industry?
2. What is migratory labor?
3. Explain three benefits of food processing.
4. What is the main mode of transportation for food products?
5. What affects the type of transportation used to ship products?
6. Why is it important to understand food marketing?
7. Describe the difference between a wholesale and retail store.
8. List three types of retail food stores.
9. What two governmental agencies regulate food inspection?
10. What types of food are these two governmental agencies in charge of?
11. What is quality grading?
12. Explain the importance of GMP and HACCP.
13. What are the four steps that should be followed in every phase of food preparation?
14. How should foods be thawed?
15. What is the best way to ensure that food is properly cooked?
16. Name three plant-derived foods.
17. Name three animal-derived foods.

18. What provides the largest amount of carbohydrates to a diet?
19. Describe the difference between saturated and unsaturated fat.
20. Compare food customs in two different countries.

INTRODUCTION TO AGRISCIENCE

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