**ALABI FUNMILOLA GRACE**

**16/SMS06/001**

**TEM 418**

**FOOD AND CATERING STUDIES**

ANSWER TO QUESTION 1

A caterer provides hot or cold food to clients at a remote location. The food offer could be anything from hot gourmet meals prepared on-site to buffet food served in chafing dishes or party platters of cheese, meats and snacks.

Catering companies send servers, chefs and other employees to the site for black tie parties, conventions and other events. A small office party may only require cold food, beverages and furniture or equipment rental without catering employees on premises — caterers tend to be very flexible with service.

**Catering Service Employees and Procedure**

A catering service may have its own cooks to prepare food, or it may obtain food from a contractor or third party to deliver to the client. For sit-down dining events, the service usually sends waiters, waitresses and busboys to prepare tables and serve meals. For buffets and informal parties, the caterer may send employees to set up chafing dishes, bowls and platters full of food, replenish them and serve food to attendees.

For banquet hall events and wedding receptions, a manager will generally direct the wait staff and supporting employees, such as coat check persons. Prior to the event, a sales representative helps the client choose food, venue and decorations within his price range and sets up the billing method. The client reviews an event proposal package with projected costs. Catering services usually require a de posit before the event.

**Using Full-Service Catering Services**

A full-service caterer handles all aspects of an event, such as a graduation party, wedding reception or corporate business dinner. A sales representative helps the client plan the menu, decorations and theme. The caterer hires cooks to prepare food according to the client’s wishes, sets up catering tables, decorations and lighting, and employs servers and bartenders. Full-service caterers can also provide entertainment for the event.

Full-service caterers work in banquet halls, hotel ballrooms, schools, cruise ships, casinos and other venues at the client’s request. They charge per person fees for food and other services.

**Considering Mobile Catering Services**

Mobile caterers, which can include taco trucks or food carts, travel from place to place and serve sandwiches, drinks, burgers and other fare to customers in various neighborhoods. They must be licensed and inspected for health issues just like a restaurant. The type of food offered and hours of operation depend on the mobile caterer’s client base.

Mobile catering trucks serve a variety of lunches and snacks to office and construction employees during daylight hours, while food carts cater to the public at large in high traffic areas, or station themselves outside concerts and other events.

**Exploring Industrial Catering Services**

The least glamorous but most common type of caterer serves schools, prisons, employee cafeterias, commercial airlines and other everyday settings. Industrial caterers sell snacks, beverages and prepare simple meals. They hire food service employees to oversee and maintain supplies and equipment and serve food on the client’s property, usually on a regular schedule.

Nutritional knowledge is important, particularly in the light of the rapidly expanding work population and threat of food population imbalance. The world we live in is changing constantly. People prefer to eat out day-by-day as they have taken it to be a part of life. Everyone is getting busier in order to find ends meet for survival and so hardly have time to prepare nutrition meals with appropriate calories.

For many people, eateries have become their kitchen where all they need is to order something

from the menu, which is very 'fast' and convenient. Nutritionally, fast food is the main source

of obesity epidemic around the globe today. Puff-puff, buns, burgers, sandwiches etc are fall products fast foods business and these have the adverse effects of obesity.

For some, all they need is not the nutrient in food but just to fill the empty and hungry stomach, which can lead to malnutrition. It is important to acquaint consumers with nutrition issues, problems of malnutrition, nutrient content of meal etc. What to take at right time. The absence of Nutrition Education or adequate information about fast food Nutrition in the past was what prevented people from knowing how much fat or calories they were consuming with each bite that was taken from a burger as an example. As a result of good education on nutrition on how certain foods can cause obesity and other ill-effects, nobody wants to die, so they want to know how much saturated fat, cholesterol, carbohydrate, sugar etc they are consuming in the fast foods they eat. Hence, there is the need to educate consumers of products from catering and fast food business.

Since there is rapid advancement and development of catering and fast food industry in the society today, it is important to provide general awareness of the role of Nutrition Education in catering and fast food business; Olatunji (2013) ascribes the role of Nutrition -Education as to acquainting the consumers of fast food and catering products to the benefit of eating healthy and balanced diet. He further stated that it is the enlightenment of consumer and people food therapy and the explanation of danger in mal-nutrition. Nutrition Education Stresses the need for people to take nutrition into consideration when planning menu and making menu choices

(Iyiola, 2014).

Importantly, people are educated on the fact that fast food eating, impacts so much on individual`s health (Olaoluwa, 2010). Eziogwu (2012) explained that the role nutrition plays in the eradication of chronic diseases cannot be underemphasized, hence the need to sensitize the public, the benefit in making healthy selections when eating.

**IMPORTANCE OF FOOD AND CATERING STUDIES IN EVENTS MANAGEMENT**

A catering department can complement your business and expand on its success if the quality of food and the service meet or exceed customer expectations. When the catering department is part of other establishments, such as restaurants ,hotels or event planning businesses, it is well positioned to provide food and refreshments for weddings and other celebratory events. At its best, the catering department can provide lasting memories for the guests it serves and create a viable income base for the affiliated business.

1. **Increased Revenue**

The addition of a catering department has the potential to dramatically increase your bottom line. A 2011 industry trend report by the Food Service Director website indicated that 29 percent of total revenue could be attributed to the catering component of 92 percent of participating businesses, representing an increase in revenue over the previous year. The possibility of broadening this percentage may depend, in part, on the extent to which businesses invest in promoting their catering departments and the quality of food and service offered.

1. **All-Inclusive Entity**

Your business may require constant supervision and involvement, leaving little time for you or your managers to attend to the myriad details associated with catering. These specifics include menu planning, food purchasing and preparation, event decor, renting equipment such as tables and the procurement of glasses, utensils and plates. If such tasks can be executed by your catering department staff, it frees you to attend to the rest of your business. As your company develops a reputation for offering catered events boasting fine food and service, you may consider fine-tuning your catering operation. For example, you may decide to exclusively cater weddings or themed events.

1. **Visibility**

After your catering department has earned a reputation for producing delicious meals, quality service and enjoyable events, other businesses in your community might turn to your establishment for chamber mixers, retirement parties or other social gatherings. When regional businesses advertise that their events will be held at your site, it further raises community awareness of your company. You can also market your catering department by writing a press release announcing the addition of your catering operation, or invite the local media or a food critic to sample your catering efforts.

1. **Catering Demand**

As growing companies have less time to produce events on their own, the field of catering might experience increased demand. To take advantage of this, you can incorporate a catering department into your business on a conservative level to start and gradually increase your event production. You might begin by offering to cater manageable events such as school graduation or birthday parties and then increase your catering department's efforts to include larger events, such as extravagant family reunions or corporate conferences.

1. **Accommodations for Dietary Restrictions**

Your business partner may make a great crab cake, but what about your employees with shellfish allergies? When you go through a catering company, you can specify which, if any, dietary restrictions there are in the crowd.

A catering expert can accommodate food allergies and intolerances, without making the planning process more stressful or significantly more expensive.

1. **Classic Food Options**

Some foods are simply tried-and-true with most groups. Most catering companies build their menu options around classic favorites. This step ensures that all your attendees find something to eat that they'll love.

1. **Cost-Effective Meal Planning**

Unless you have experience with event and meal planning, you likely don't have the knowledge needed to effectively execute a large-scale meal. Your caterer knows exactly how much food to bring for each estimated guest to make sure each person leaves satisfied.

Some catering professionals can even help you pin down your estimated number of guests.

1. **Expert Help with Permits and Handling**

Food handling requires specific knowledge that may be overlooked when not handled by professionals. When you work with a caterer, you know you've hired a professional who helps reduce the risk of undercooked food, cross contamination, and other food issues.

Additionally, if you plan to serve any alcohol at your event, your caterer can help you determine if you need any permits, licensing, or space at a particular venue.

1. **Positive Impressions of Your Company**

When you get dressed for the day and meet with clients, your appearance and demeanor create an image of your company that can make or break any deal. The same theory applies to the food served at company events.

Professionally prepared, served, and presented food gives clients and employees the impression that your company is both confident and capable.

1. **Reduced Stress and Responsibility**

If you have ever organized a corporate event, you know how hectic the process can be from inception until the end of clean-up. Delegating the responsibility for food to a catering company lets you mark one task off your list.

Catering companies even provide wait staff and servers so that you don't have to worry about messes or even disproportionate portions.

1. **Set Event Tone and Atmosphere**

The food items and style you choose can set the tone for your entire event. For example, hors d'oeuvres circulating on trays provide an air of sophistication and promote mingling, friendly conversation and a spirit of fun. On the other hand, a formal sit-down dinner lends a gravity to your event and encourages important conversations over the meal.

Most catering companies offer many different styles so that you can craft the perfect atmosphere for your event.

1. **Varying Menu Options**

When you handle food on your own, you're limited to what you can prepare and buy. After two or three events, chances are your employees would love a little something new.

Take advantage of these benefits when you have your next corporate event catered by a reputable company.

Why quality catering is so important at events

Catering is an important element of any conference or event and it is also one of the biggest expenses, so how do you ensure that you are getting an amazing caterer and menu? Here’s what you need to look for in a caterer:

1. Responsiveness and an ability to work with you
2. Good recommendations
3. Experience working with your type of event and/or venue
4. Sharing your vision
5. Willingness to do a tasting

**WHAT DOES A QUALITY CATERER BRING TO THE TABLE?**The answer is simple …… a quality constructed culinary experience for everyone! To be more specific a quality caterer will provide you with the following:

**Food Expertise**Your caterer should be a food expert, transforming your vision, requirements and expectations into a carefully constructed menu for your conference or event showcasing creativity and locally sourced ingredients.

**Flexibility and Improvisation**Quality caterers are innovative, offering creative menu suggestions whilst being flexible with regards to navigating dietary preferences, requirements and allergies. A good caterer can improvise when the unexpected happens such as increased guest numbers, surprise dietary requirements etc.

**Attention to Detail**  
Successful caterers are detailed oriented resulting in perfection on the plate, immaculate food stations and practical food solutions tailored to your conference or event. Think creative conference lunch boxes, exciting canapes, innovative dinner menus – no more alternate drop!

**ANSWER TO QUESTION 2**

Heat kills microorganisms by changing the physical and chemi­cal properties of their proteins. When **heat**is used to preserve foods, the number of microorganisms present, the **microbial load**, is an important consideration. Various types of microorganisms must also be considered because different levels of resistance exist. For example, bacterial spores are much more difficult to kill than vegetative bacilli. In addition, increasing acidity enhances the killing process in food preservation.

**High Temperature**

Three basic heat treatments are used in food preservation: **pasteurization**, in which foods are treated at about 62°C for 30 minutes or 72°C for 15 to 17 s; **hot filling**, in which liquid foods and juices are boiled before being placed into containers; and **steam treatment**under pressure, such as used in the canning method. The heat resistance of microorganisms is usually expressed as the **thermal death time**, the time necessary at a certain temperature to kill a stated number of particular microorganisms under specified conditions.

**Pasteurization**

It is the process of heating a food-usually a liquid-to or below its boiling point for a defined period of time. The purpose is to destroy all pathogens, reduce the number of bacteria, inactivate enzymes and extend the shelf life of a food product. Pasteurization treatment is able to kill most heat resistant non spore forming organisms like *Mycobacterium tuberculosis* and*Coxiella burnetti.*Foods with a pH of less than 12.6, such as milk and spaghetti sauce, can be pasteurized. Permanent stabilitythat is, shelf life of about two years is obtained with foods that can withstand prolonged heating, such as bottled juices. There is a greater loss of flavor from foods that are exposed to a longer time-temperature relationship. Therefore, temporary stability (that is, limited shelf life) is only obtained with some foods where prolonged heating would destroy its quality. These foods, such as milk, usually require subsequent refrigeration. "High Temperature Short Time" (HTST) and "Ultra High Temperature" (UHT) processes have been developed to retain a food's texture and flavor quality parameters. Pasteurization is not intended to kill all microorganisms in the food. Instead pasteurization aims to reduce the number of viable pathogens so that they are unlikely to cause disease. Pasteurization involves a comparatively low order of heat treatment, generally at temperature below the boiling point of water. eating may be done by means of steam , hot water, dry heat or electric currents . Products are immediately cooled. Desired pasteurization can be achieved by a combination of time and temperature such as heating food to a low temperature and maintain for a long time i.e. LTLT -62.8°C for 30 minutes (Figure 12.1), or by heating food to a high temp and maintain for a short time: HTST-71.7°C for 15 second.

Pasteurization is used when more rigorous heat treatment might harm the quality of the food product, as the market milk and for the main spoilage organisms which are not heat resistant, such as yeast in fruit juice. It also kills the pathogens .

**Ultra-heat pasteurization**

In this process milk is heated to 120-138°C for 2-4 seconds and followed by rapid cooling. This treatment kills all the spoilage microorganisms. UHT pasteurized milk is packaged aseptically resulting in a shelf stable product that does not require refrigeration until opened.

**Heat Resistance of Microorganisms and Their Spores**

It is expressed in terms of their thermal death time (TDT).

**Thermal death time** (**TDT)**

It is the time taken to kill a given number of microorganisms or spores at a certain temperature under specified conditions.

**Thermal death point**

It is the temperature necessary to kill all the organisms in ten minutes.

Heat resistance of different microorganisms is different. Microorganisms are more heat resistant than their spores. Heat resistance of vegetative yeast is 50-58°C in 10-15 min and the ascospores is 60°C for 10-15 min. However, yeast and spores are killed by pasteurization.

**Heat Resistance of Microorganisms**

Heat resistance of mold is 60°C in 5 to 10 min and asexual spores are more heat resistance than the ordinary mycelium and require a temperature 5-10°C higher for their destruction. *Aspergillus, Muco, ,Penicillium*are more resistant than yeast. Heat resistance of bacteria and bacterial spores is different. Cells high in lipid content and capsule containing bacteria are harder to kill. Higher the optimal and maximal temperature for growth , the greater the resistance to killing.

**Heat Resistance of Enzymes**

Most of the food and microbial enzymes are destroyed at 79.4°C . Some hydrolases will retain a substantial level of activity after an ultra-high temperature treatment. Bovine phosphatase, if present, in processed milk indicates that the milk was not properly pasteurized.

**D Value**

It is the decimal reduction time, or the time required to destroy 90% of the organisms. Mathematically, it is equal to reciprocal of the slop of the survivor curve and is a measure of the death rate of a microorganism. When D is determined at 250°F, it is expressed as Dr.

**Z Value**

It refers to the degree F required to reduce TDT tenfold. Mathematically, this value is equal to the reciprocal of the slope of the TDT curve.

**1F Value**

This value is the equivalent time, in min at 250°F, of all heat considered, with respect to its capacity to destroy spores or vegetative cells of a particular organisms or F is the time in minute required to destroy the microorganisms in a specified medium at 250°F.

**Thermal Death Time Curve**

Mean viable counts determined at intervals of 5 minute are as follows-

**Time Mean viable count**5 3120.0 10 65.015 19.0

Time of heating in min is plotted on semi-log paper along the linear axis and the number of survivors is plotted along the log scale to produce the TDT curve .

**12-D concept:**It is the time temperature process that will reduce the most heat resistant *Cl. botulinum* spores by 12 log cycles. Processing of food for 2.52 min at 250°C reduces *Cl. botulinum* spores to 1 spore in 1012 containers.

**Effect of Pasteurization**

The positive effects of pasteurization are the destruction of pathogenic microorganisms to increase the safety of market milk for human consumption, improved keeping quality and inactivation of certain naturally occurring enzymes. The negative effects are: certain preformed products of microbial origin are not inactivated during pasteurization, e.g. Staphylococcal toxins and aflatoxins. There is small loss of native aroma particularly in case of fruit juices. In case of milk, it destroys the natural microbicidal property of milk by inactivating different natural occurring antimicrobial substances and the rennet coagulation time also increases.

**Blanching**

It is a kind of pasteurization generally applied to fruits and vegetables , primarily to inactive natural food enzymes. It is a common practice when such food products are to be frozen, since frozen storage itself would not completely arrest enzyme activity. Peroxidase and catalase are the most heat resistant enzymes; the activity of these enzymes is used to evaluate the effectiveness of a blanching treatment. If both are inactivated then it can be assumed that other significant enzymes also are inactivated. The heating time depends on the type of fruit or vegetable, method of heating, the size of fruits or vegetable or the temperature of the heating medium.

Rapid changes in color, flavor and nutritive value occur as a result of enzyme activity. Blanching is a slight heat treatment, using hot water or steam, that is applied mostly to vegetables before canning or freezing. The main objectives of blanching are to inactivate enzymes, to remove the tissue gases, to clean the tissue, to increase the temperature of the food. Blanching is also used before canning for different reasons, because enzymes will inevitably be destroyed during canning. Blanching induces a vacuum in canned goods, and it is also used to control the fill into containers (for example, spinach).

**12.13 Sterilization (Retorting)**

Sterilization destroys all pathogenic and spoilage microorganisms in foods and inactivates enzymes by heating. All canned foods are sterilized in a retort (a large pressure cooker) and called commercial sterilization which indicates that no viable organisms are present. This process enables food to have a shelf life of more than two years. Foods that have a pH of more than 4.6, such as meat and most vegetables must undergo severe heating conditions to destroy all pathogens. These foods are heated under pressure to 121°C for varying times. Severe conditions are applied primary to ensure that *Clostridium botulinum* spores are destroyed during processing. These spores produce the deadly botulinum toxin under anaerobic conditions (that is, where there's no oxygen). The spores are destroyed by heat or are inhibited at pH values of less than 4.6 Therefore, a food with a pH of less than 4.6 that is packaged anaerobically, such as spaghetti sauce, doesn't need to undergo such a severe heat treatment. The destruction of vegetative and spore forming organism and pathogens is secondary objective of commercially sterilized foods.

Nicolas Appert , a Parisian confectioner by trade, established the heat processing of foods as an industry in 1810. The food product is washed, sorted, and graded and then subjected to steam for three to five minutes. This last process called blanching, destroys many enzymes in the food product and prevents further cellular metabolism. The food is then peeled and cored, and diseased portions are removed. For canning, containers are evacuated and placed in a pressurized steam sterilizer, similar to an autoclave at 121°C. This removes especially *Bacillus*and *Clostridium* spores. If canning is defective, foods may become contaminated by anaerobic, bacteria which produce gas. These are species of *Clostridium*, and coliform bacteria (a group of Gram-negative non spore-forming rods which ferment lactose to acid and gas at 32°C in 48 hours).

Canning cooking fruits or vegetables, sealing them in sterile cans or jars, and boiling the containers to kill or weaken any remaining bacteria as a form of pasteurization. High-acid fruits like strawberries require no preservatives to can and holding for only a short boiling cycle, whereas marginal fruits such as tomatoes require longer boiling and addition of other acidic elements. Many vegetables require pressure canning. Food preserved by canning or bottling is at immediate risk of spoilage once the can or bottle has been opened. Lack of quality control in the canning process may allow ingress of water or micro-organisms. *Clostridium botulinum* produces an acute toxin within the food and may lead to severe illness or death. This organism produces no gas or obvious taste and remains undetected by taste or smell. Food contaminated in this way include Corn, beef and Tuna.

In canning process heat is applied to food that is sealed in a jar in order to destroy any microorganisms that can cause food spoilage. Proper canning techniques stop this spoilage by heating the food for a specific period of time and killing these unwanted microorganisms. During the canning process, air is driven from the jar and a vacuum is formed as the jar cools and seals.

Water-bath canning and pressure canning are two approved methods of canning.

**12.14 Water-Bath Canning**

This method sometimes referred to as *hot water canning,* uses a large kettle of boiling water. Filled jars are submerged in the water and heated to an internal temperature of 212°F for a specific period of time. This method is used for processing high-acid foods, such as fruit, items made from fruit, pickles, pickled food, and tomatoes.

**Pressure Canning**

Pressure canning uses a large kettle that produces steam in a locked compartment (Figure 12.5). The filled jars in the kettle reach an internal temperature of -240 °C under a specific pressure (stated in pounds) that is measured with a dial gauge or weighted gauge on the pressure-canner cover. A pressure canner should be used for processing vegetables and other low-acid foods, such as meat, poultry and fish.

**Drying**

One of the oldest methods of food preservation is by drying, which reduces water activity sufficiently to delay or prevent bacterial growth. Drying is done to produce concentrated form of foods, inhibits microbial growth and autolytic enzymes, retains most nutrients. Drying can cause loss of some nutrients, particularly thiamine and vitamin C. Sulphur dioxide is sometimes added to dried fruits to retain vitamin C, but some individuals are sensitive to this substance.

Most types of meat can be dried. This is especially valuable in the case of pig meat, since it is difficult to keep without preservation. Many fruits can also be dried; for example, the process is often applied to apples, pears, bananas, mangos, papaya, and coconut and grapes . Drying is also the normal means of preservation for cereal grains such as wheat, maize, oats, barley, rice, millet and rye. Drying is an excellent way of preserving several of the seasonal fruits for use during the off season. There are several types of dryers which are used. These include: drum dryer, cabinet dryer, tunnel dryer, rotary dryer, spray dryer and solar dryer. The basic methods of drying involve ai r and contact drying under atmospheric pressure . In this case e the heat is transferred through the food either from heated air or heated surfaces, and the resulting water vapor is removed with the air current . Solar drying, sun drying, drum and spray drying all use this technique.

**Advantages of drying are many**

**i)**Long Shelf Life – Since most microorganisms responsible for food spoilage are unable to grow and multiply in the absence of moisture, spoilage due to microbial degradation is limited in dried foods. Furthermore, enzymes which catalyze undesirable changes in foods need moisture to be effective.

**ii)** Reduced Weight – This results in reduced transportation, storage and shipping costs.  
  
**iii)**Convenience – The production of convenience items with novelty appeal for niche markets makes drying an attractive option.  
  
**iv)** Concentration of nutrients – The removal of most of the water from a food results in a highly concentrated source of nutrients.  
  
**v)** No refrigeration is required for dried products – Savings in energy and storage costs together with the long shelf life provide a lucrative processing alternative for tropical countries.  
Disadvantages of Drying

Disadvantages of Drying are few and mainly relate to oxidation, which usually accompanies drying. This results in losses of micronutrients such as carotene and ascorbic acid and minimal loss in protein as a result of browning reactions. Reduced consumer appeal is often linked with the latter. There might also be changes in flavor and texture if drying is not properly controlled, particularly with regard to maximum temperatures.

**12.17 Microwave Sterilization**

Microwave sterilization is a thermal process. A microwave oven (Figure 12.6) works by passing non ionizing microwave radiation, usually at a frequency of 2.125 GHz (a wavelength of 12.212 cm), through the food. Microwave radiation is between common radio and infrared frequencies. Microwave heating takes place due to the polarization effect of electromagnetic radiation at frequencies between 300 MHz and 300 GHz. It delivers energy to the food package under pressure and controlled temperature to achieve inactivation of bacteria harmful for humans. Most processed foods today are heat treated to kill bacteria. Prolong exposure to high heat often diminishes product quality. Microwaves interact with polar water molecules and charged ions. The friction resulting from molecules aligning in rapidly alternating electromagnetic field generates the heat within food. Since the heat is produced directly in the food, the thermal processing time is sharply reduced. The color, texture and other sensory attributes of foods processed by microwave sterilization are often better compared with those of conventionally retorted foods while meeting microbial safety requirements. US Federal Communication Commission (FCC) allocates 915 MHz and 21250 MHz bands for industrial and domestic microwave heating applications. The microwave sterilization technology using the combination of 915 MHz microwave and conventional heating to improve heating uniformity. Microwave ovens use electromagnetic radiation to excite water molecules in food. The actual waves penetrate only about 10 inches from the source of the radiation. Within the food, the waves only penetrate 3/12 to 1 inch on all sides. As a result, the actual ovens must be limited in size. Heat is produced within the food by the friction of water molecules, which spreads to the center of the food by conduction. Small portions are cooked rapidly in microwave ovens. As the quantity of food increases, however, the efficiency is lost.

Microwave heating has also found applications in the food industry, including tempering of frozen foods for further processing, pre-cooking of bacon for institutional use and final drying of pasta products. In those applications, microwave heating demonstrates significant advantages over conventional methods in reducing process time and improving food quality.

The shelf life of a product is determined by its microbiological safety and sensory attributes. In general, microwave sterilization can achieve the same reduction of bacterial population as conventional retorting. Products intended for microwave sterilization are usually packaged in plastic trays or pouches. The ability of plastics to withstand oxygen permeation will affect the organoleptic or sensory acceptance of the product during storage. Normal shelf life expectancy of microwave-sterilized products pre-packaged in plastic containers or pouches is 2-3 years or longer. With innovative plastic technologies coming to the market, the new generations of plastics may increase the expected shelf life even longer.

**ANSWER TO QUESTION 3**

**Food preservation**

**Food preservation** includes a variety of techniques that allow food to be kept for extended periods of time without losing nutritional quality and avoiding the growth of unwanted microorganisms. There are three basic objectives for the preservation of foods:

* Prevention of contamination of food from damaging agents.
* Delay or prevention of growth of microorganisms in the food.
* Delay of enzymic spoilage, i.e. self-decomposition of the food by naturally occurring enzymes within it.

For storing or preserving food, one or several of the living conditions needed for the growth of microorganisms have to be removed. Like humans, microorganisms need a source of food and water, and they also need a suitable pH and temperature to grow, so food preservation techniques aim to target these requirements. Food preservation depends on procedures which effectively manage the microbial content of foods and on processes that alter or delay the activities of enzymes in the food. The techniques may be applied separately or in combination. Their aims are to prevent contamination in the first place, to remove or reduce the numbers of contaminants, and to prevent microbial growth. We describe them below.

**Prevention of contamination (aseptic technique)**

This technique simply means to prevent contamination of the food by spoilage agents or by contact with them. The word ‘aseptic’ means free from harmful bacteria, viruses etc.

The technique requires either using an artificial covering for the food, or keeping its natural protective covering if there is one. Examples of natural coverings are the shells of eggs, fat or skins in animals, and/or the skin or peel of fruits. Leaving the natural covering of the food intact, or applying a clean artificial cover, can prevent microorganisms from entering or dropping on to the food.

**Removal or reduction of microorganisms**

Microorganisms can be physically removed from food, or their numbers reduced, by techniques like washing, trimming, sieving and filtration. For example, vegetables and fruit should be washed in clean water; any damaged or dirty parts of vegetables should be trimmed off with a clean knife; flour can be sieved to remove any unwanted contaminants.

**The use of high temperature**

Heat is one of the oldest methods of destroying microorganisms in food processing and preservation. The greatest advance in food hygiene was inadvertently made when humans discovered the advantage of boiling, roasting, baking and other heat treatments of food, hence preserving the food for longer periods. Food is also rendered safe by the application of heat because most pathogenic microorganisms are comparatively heat-sensitive. Some of the methods of heat treatment used for food preservation are discussed below.

* **Cooking/boiling**

**Boiling** is the process of applying heat to water until the temperature reaches about 100°C. Boiling foods in water cannot completely destroy all microorganisms, but the vegetative cells of bacteria, yeasts and molds are generally quickly destroyed at temperatures of 100°C or above. Spores of some bacteria are extremely resistant to heat and are not killed at this temperature, although their growth is prevented. For this reason, boiling food can rarely be relied upon to ensure complete destruction of all organisms. However, most pathogens are killed, provided that sufficient exposure time is maintained. Although the spores of *Clostridium botulinum*, which causes botulism, are extremely heat-resistant, the toxin produced by this organism is readily destroyed by boiling. However, some toxins produced by other bacteria such as staphylococci are not easily inactivated. Thermophilic (heat-loving) organisms may survive the effects of boiling and can cause food spoilage if environmental conditions are favorable for them.

Bacterial destruction by heat is affected by time and temperature variation. The higher the temperature, the more rapid is the destruction. On the other hand, as the temperature is lowered, the time of exposure (**holding time**) needs to be longer.

Cooking can have some disadvantages. It can damage the food’s appearance, texture and flavor, and may also destroy some important vitamins. Nevertheless, the advantages of cooking outweigh the disadvantages because it inhibits spoilage and possible disease transmission.

* **Pasteurization**

is named after its inventor, Louis Pasteur, a French chemist. It is a process of heat treatment of milk, beer and some other beverages. It requires sufficient holding time to assure the thermal destruction of pathogens and organisms responsible for spoilage, without altering the nutritional value. It involves heating the food to a specific temperature for a specific time and then cooling rapidly.

Pasteurization kills most but not all of the microorganisms present. It is a very useful method when more rigorous heat treatment could harm the quality of the product, as in the case of milk, and when the aim is to kill only the pathogens that are not very heat-resistant.

The temperature applied and the holding time of pasteurization vary with the equipment available and the type of food product. In milk pasteurization, the time-temperature combination is selected on the basis of the thermal death time of the most resistant pathogens (TB bacilli) that may be present in raw milk, and the maximum temperature and time at which the taste, palatability and nutritive value of milk are maintained. Normally milk is pasteurized at 62.8°C for at least 30 minutes or at 71.7°C for at least 15 seconds, or, if using ultra-high temperature (UHT), at 135°C for 1–2 seconds. UHT milk is sterilized, meaning all forms of life are destroyed. This extends its storage time but does affect the taste.

* **Blanching**

**Blanching** is a mild pre-cooking operation which can reduce the bacterial load on vegetables by 90%. It means the application of boiling water or steam for a short time. It wilts some bulky vegetables and prevents discoloring of others. It cleans peas of the moist and sticky material around them. Blanching vegetables prior to canning, freezing or drying helps to remove soil, insects and microorganisms, and destroys or slows the action of enzymes. It sets the green color and generally facilitates dicing, peeling and packing.

* **Canning**

**Canning** is one of the most widely used modern methods of processing and preserving food. It involves the careful preparation of food packed into a sealed tin, glass or plastic container which is subjected to defined high temperatures (above 100ºC) for an appropriate period of time, and then cooled. Following the thermal (heat) processing, the sealed container must be cooled immediately to a temperature of about 38ºC to prevent unnecessary adverse effects of heat on the texture, flavor or color of the food.

The canning method involves the following steps: sterilizing the food to be canned, packing it in sterile, air-tight stainless metal, glass or plastic containers, and then hermetically sealing (i.e. with a complete, airtight seal) the containers to prevent contamination during handling and storage. In the heat process, all vegetative bacteria are destroyed and spores cannot grow. Any can that is damaged or swollen should not be used. A swollen, bulging can indicates that gas is being produced on the inside and demonstrates there is microbial activity in the food, so it would not be safe to eat.

**The use of low temperature**

Unlike high temperature, cold is not an effective means of destroying pathogenic bacteria, viruses and toxins in foods, but it can retard their multiplication and metabolic activities.

No food or food product is rendered free from microorganisms by low temperature (by freezing or refrigeration). This explains the generally accepted danger of refreezing any kind of thawed foods. Certain parasites, such as *Taenia* cysts in beef and all stages of *Trichinella spiralis,* can be completely destroyed by storage of infected food at -18ºC for periods of 20 to 30 days, depending upon the rate of cold penetration. The most important prerequisite for successful preservation by cold is that the food must be clean to start with.

* **Chilling**

**Chilling** involves reducing food temperatures, but only to approximately -1ºC. Refrigerators for cold storage/chilling are normally used at 0ºC to +8ºC for preservation of a wide variety of food products.

* **Freezing**

**Freezing** of food, when carried out properly, is one of the best methods of preserving foodstuffs in as nearly natural a state as possible. Freezing preserves the storage life of foods by slowing down enzyme reactions and the growth of microorganisms. A low storage temperature of at least -12°C is important if prolonged storage life is desired without losing flavor. Needless to say, freezing foods to preserve them is only possible with a freezer and reliable power supply.

Vegetables with a high moisture content do not freeze well because cellulose (in plant cell walls) tends to be broken down by enzymes regardless of the rate of freezing, making the vegetables soft. Therefore, for such food items, blanching to destroy enzyme activity is required prior to freezing.

**Drying**

This is a dehydration process by which the water/moisture content of the food is removed or decreased. Pathogenic and other bacteria cannot multiply in the absence of water. Most tend to die in foods that have been dehydrated to a moisture content of 10–20% of weight. Drying, however, may not kill spores. Drying also achieves food preservation by inactivating enzymes.

Drying or evaporation methods have been applied to nearly every kind of watery food, including milk. Although the loss in vitamins and nutritional value is usually minor, some foods change physically and chemically, and are sometimes altered in natural color and flavor. Other dried products do not compare favorably with their fresh counterparts due to difficulties in reconstitution, i.e. adding water to return the food to its original form. One traditional form of dried food is *quanta*. *Quanta* is made from sliced meat which is hung in the air to dry.

**Fermentation and pickling**

Not all microorganisms are bad. Certain microorganisms are necessary in the preparation and preservation of many foods and beverages. Essentially, **fermentation** (a controlled microbial action) is a process of anaerobic or partially anaerobic oxidation of carbohydrates that produces acids and alcohol. It is one of the oldest methods of food preservation. In fermentation, food preservation is achieved by the presence of acid or alcohol, which creates unfavorable environmental conditions for decomposing and other undesirable bacteria.

Foods commonly processed and preserved by fermentation methods are milk and milk products, beef, vinegar, drinks like beer and wine, and pickled fruits and vegetables. Pickling is the process of preserving food by anaerobic fermentation either in brine (salt solution) or in an acid solution, usually vinegar. The concentrations of the pickling agents and the time needed for pickling are determined by the type of food. Fermented and/or pickled food products are semi-perishable and must be protected from molds, which are able to attack the acids and permit the invasion of spoilage organisms.

**Chemical preservation**

It has been customary to classify chemicals incorporated into food for preservation purposes as ‘intentional additives. Additives used at food industry level include vitamins, mold inhibitors, bactericides, emulsifiers, minerals, food coloring, synthetic flavors and sweeteners. Chemicals that get into food accidentally are referred to as ‘unintentional additives. They include the unavoidable residues of agricultural chemicals, pesticides or antibiotics.

There are several traditional methods of food preservation used at the household level that can be classed as chemical methods. Substances such a sugar, salt, vinegar, spices and wood-smoke are generally regarded as safe and natural preservatives. Salting, sugaring and smoking are all methods of **curing** foods. Curing is a general term that covers all these types of food preservation.

**Salting** is the addition of salt (sodium chloride or NaCl) to food for the purpose of preservation. The growth of microorganisms is inhibited by the salt, which has the effect of drawing water out of the bacterial cells so they become dehydrated and die. In this manner, salt, in combination with other measures, acts as a preservative in many foods such as butter, cabbage, cheese, cucumber, meat and fish. It also gives a desired flavor to the food. Salting can be done by rubbing adequate quantities of dry salt into foods, or by immersion, where the food item is soaked in a concentrated salt solution (i.e. brine). For effective preservation, the concentration of the brine solution has to be maintained above 18%. This is approximately one cupful of salt to five cups of water.

**Sugaring**refers to the action of sugar in food preservation. It is similar to the action of salt in that it depends on the removal of water. In concentrations of at least 65%, sugar solution is widely used as a sweetening and preserving agent. However, care is needed because at low concentrations, sugar solution can support the growth of microorganisms. It has been found that microorganisms rarely survive in solutions above 20–25% sugar concentration.

**Smoking** is one of the oldest methods used to improve the quality of food and is commonly used to preserve meat and fish. The smoking process involves exposing food to smoke from burning or smoldering wood or other plant material. It partially preserves the food by surface drying, i.e. removing moisture from the surface of the food, but it is not a reliable method of preservation unless combined with some other method such as salting or drying.

Spices also have some uses in food preservation because they tend to inhibit the growth of staphylococci and other bacteria. However, they have a very limited application because they often get contaminated themselves by a number of bacteria.

10.2.8  Other methods of food preservation

There are some other methods of food preservation that are used in the food industry and require special equipment, for example, irradiation and vacuum packing. Irradiation is the process of exposing food to ionizing radiation in order to destroy microorganisms. Vacuum packing depends on the removal of oxygen from food packaging to prevent the growth of aerobic bacteria that will decompose the food.