INTRODUCTION TO FOODS

Topic Objective:

At the end of the topic student will be able to understand:

- Standard specification
- Lot Mark or Batch Code
- Presentation
- Instruction for Use
- Place of Origin
- Business Name and Address
- Storage Conditions
- Date Tagging
- Ingredients
- Name
- Food Choices and Sensory Characteristics
- Federal-level regulation

Definition/Overview:

Agricultural economics originally applied the principles of economics to the production of crops and livestock a discipline known as agronomics. Agronomics was a branch of economics that specifically dealt with land usage. It focused on maximizing the yield of crops while maintaining a good soil ecosystem. Throughout the 20th century the discipline expanded and the current scope of the discipline is much broader. Agricultural economics today includes a variety of applied areas, having considerable overlap with conventional economics. Economics is the study of resource allocation under scarcity. Agronomics, or the application of economic methods to optimizing the decisions made by agricultural producers, grew to prominence around the turn of the 20th century. The field of agricultural economics can be traced out to works on land economics. Henry C. Taylor was the greatest contributor with the establishment of the Department of Agricultural Economics at Wisconsin. Another contributor, Theodore Schultz was among the first to examine development economics as a problem related directly to agriculture. Schultz was also instrumental in establishing econometrics as a tool for use in analyzing agricultural economics empirically; he noted in

his landmark 1956 article that agricultural supply analysis is rooted in "shifting sand", implying that it was and is simply not being done correctly. Food safety is a scientific discipline describing the handling, preparation, and storage of food in ways that prevent food borne illness. This includes a number of routines that should be followed to avoid potentially severe health hazards. Food can transmit disease from person to person as well as serve as a growth medium for bacteria that can cause food poisoning. Debates on genetic food safety include such issues as impact of genetically modified food on health of further generations and genetic pollution of environment, which can destroy natural biological diversity. In developed countries there are intricate standards for food preparation, whereas in lesser developed countries the main issue is simply the availability of adequate safe water, which is usually a critical item.

Key Points:

1. Federal-level regulation

In the United States, federal regulations governing food safety are fragmented and complicated, according to a February 2007 report from the Government Accountability Office. There are 15 agencies sharing oversight responsibilities in the food safety system, although the two primary agencies are the U.S. Department of Agriculture (USDA), which is responsible for the safety of meat, poultry, and processed egg products, and the Food and Drug Administration (FDA), which is responsible for virtually all other foods.

State and local regulation A number of states have their own meat inspection programs that substitute for USDA inspection for meats that are sold only in-state. Certain state programs have been criticized for undue leniency to bad practices. However, other state food safety programs supplement, rather than replace, Federal inspections, generally with the goal of increasing consumer confidence in the state's produce. For example, state health departments have a role in investigating outbreaks of food-borne disease bacteria, as in the case of the 2006 outbreak of E.coli O157:H7 from processed spinach. Health departments also promote better food processing practices to eliminate these threats. In addition to the US Food and Drug Administration, several states that are major producers of fresh fruits and vegetables (including California, Arizona and Florida) have their own state programs to test produce for pesticide residues. Restaurants and other retail food

establishments fall under state law and are regulated by state or local health departments. Typically these regulations require official inspections of specific design features, best food-handling practices, and certification of food handlers. In some places a letter grade or numerical score must be prominently posted following each inspection. In some localities inspection deficiencies and remedial action are posted on the Internet

2. **Food Choices and Sensory Characteristics**

Food stuffs in the UKhave one of two labels to indicate the nature of the deterioration of the product and any subsequent health issues:

Best before indicates a future date beyond which the food product may lose quality in terms of taste or texture amongst others, but does not imply any serious health problems if food is consumed beyond this date (within reasonable limits).

Use by indicates a legal date beyond which it is not permissible to sell a food product (usually one that deteriorates fairly rapidly after production) due to the potential serious nature of consumption of pathogens. Leeway is provided by producers in stating use by dates so that products are not at their limit of safe consumption on the actual date stated.

USlabels With the exception of infant formula and baby foods which must be withdrawn by their expiration date, Federal law does not require expiration dates. For all other foods, except dairy products in some states, freshness dating is strictly voluntary on the part of manufacturers. In response to consumer demand, perishable foods are typically labeled with a Sell by date. It is up to the consumer to decide how long after the Sell by date a package is usable. The law in the UKon food labeling is multifaceted and is spread over many reforms and parliamentary acts, making the subject complex. In the US, food labeling is mainly regulated by 21 CFR part 101 in accordance with 21 CFR 1.21, 74.705, Part 102, 104.20, 179.26 and FD&C. Codex Alimentarius also published a document on the food labeling which is supposed to be followed by the food industry internationally. Nevertheless, there are general laws which should be implied on any food product:

3. Name

This must also inform the customer the nature of the product. It may also be necessary to attach a description to the product name. However, there are certain generic names which must be only used for their conventional uses, for example: Muesli, Coffee, prawns.

4. Ingredients

All ingredients of the food must be stated under the heading 'Ingredients' and must be stated in descending order of weight. Moreover, certain ingredients such as preservatives must be identified as such by the label Preservatives, a specific name, e.g. "sodium nitrite", and the corresponding European registration number colloquially known as an "E number", e.g. "E250". Nutritional Information Although it is not a legal requirement to declare Nutritional Information on the product, if the manufacturer makes claims that the product is Low in Sugar, it must be supported with nutritional information (normally in tabulated form). However, as a rule it is recommended to declare nutritional information as consumers more than ever are investigating this information before making a purchase. Moreover, there are two European nutritional labeling standards which must be adhered to if nutritional information is shown. Medicinal or Nutritional Claims Medicinal and Nutritional claims are tightly regulated, some are only allowed under certain conditions while others are not authorized at all. For example, presenting claims the food product can treat, prevent or cure diseases or other adverse conditions are prohibited. While claiming the food is reduced in fat or rich in vitamins require the food to meet compulsory standards and grades, in addition, the terms must be used in a form specified in regulations.

5. Date Tagging

There are two types of date tagging:

Use by Date Use by Date must be followed by a day or/and month which the product must be consumed by.

Best Before Date 'Best Before Date is used as an indicator of when the product will begin to degrade from optimal quality: this includes when the food becomes stale, begins to

taste off or decays, rots or goes moldy. There are also regulations on which type of best before date must be applied:

- Best before + Day for foods with a shelf life of up to 3 months.
- Best before end + Month for foods with more than a 3 month shelf life.
- Best before end + Year for food with more than an 18 month shelf life.

6. Storage Conditions

If there are any particular storage conditions for the product to maintain its shelf life, these must be pointed out. However, as a rule it is recommended to always describe the necessary storage conditions for a food product.

7. Business Name and Address

In addition to the business name and address, it is necessary to indicate the manufacturer or packager, if independent to the main business and the seller established within the European Union.

8. Place of Origin

The food is required to specify its place of origin, especially if the name or trademark is misleading - such as if the product is called English Brie Cheese when it is produced in France.

9. Instruction for Use

This is only necessary if it is not obvious how to use or prepare the product, in which case the consumer's own initiative must be used.

10. Presentation

The label must be legible and easy to read, also it must be written in English, however, the manufacturer may also include other languages.

11. Lot Mark or Batch Code

It must be possible to identify individual batches with a lot mark or batch code - the code must be prefixed with the letter L if it can not be distinguish from other codes, however, the date mark can be used as a lot mark. Manufacturers must bear in mind that the smaller the size of a batch, the smaller financial consequences in the case of a product recall.

Sectioning All of the following must be in the same field of vision:

- Product name
- Date mark
- Weight
- Quantity
- Alcohol strength (if applicable).

12. Standard specification

Indicate the level of the standards compliance of the product manufactured and packaging completed against. However, there are many other Laws and European regulations for different types of food products.

Topic : Principles Of Cookery

Topic Objective:

At the end of the topic student will be able to understand:

- Back to Basics
- Application Of Scientific Knowledge
- Heat Transfer in Cooking

Definition/Overview:

Cooking is the act of preparing food for eating by the application of heat. It encompasses a vast range of methods, tools and combinations of ingredients to alter the flavor or digestibility of food. It is the general preparation process of selecting, measuring and combining of ingredients in an ordered procedure in an effort to achieve the desired result. Factors affecting the final outcome include the variability of ingredients, ambient conditions, tools, and the skill of the individual doing the actual cooking.

Key Points:

1. **Back to Basics**

The diversity of cooking worldwide is a reflection of the myriad nutritional, aesthetic, agricultural, economic, cultural, social and religious considerations that impact upon it. Applying heat to a food usually, though not always, chemically transforms it, thus changing its flavor, texture, consistency, appearance, and nutritional properties. There is archaeological evidence of roasted foodstuffs, both animal and vegetable, in human (Homo erectus) campsites dating from the earliest known use of fire, some 800,000 years ago. Other methods of cooking that involve the boiling of liquid in a receptacle have been practiced at least since the 10th millennium BC, with the introduction of pottery. Edible animal material, including muscle, offal, milk and egg white, contains substantial amounts of protein. Almost all vegetable matter (in particular legumes and seeds) also includes proteins, although generally in smaller amounts. These may also be a source of essential amino acids. When proteins are heated they become de-natured and change texture. In many cases, this causes the structure of the material to become softer or more friable - meat becomes cooked. In some cases, proteins can form more rigid structures, such as the coagulation of albumen in egg whites. The formation of a relatively rigid but flexible matrix from egg white provides an important component of much cake cookery, and also underpins many desserts based on meringue. Cooking often involves water which is frequently present as other liquids, both added in order to immerse the substances being cooked (typically water, stock or wine), and released from the foods themselves. Liquids are so important to cooking that the name of the cooking method used may be based on how the liquid is combined with the food, as in steaming, simmering, boiling, braising and blanching. Heating liquid in an open container results in

rapidly increased evaporation, which concentrates the remaining flavor and ingredients - this is a critical component of both stewing and sauce making.Fats and oils come from both animal and plant sources. In cooking, fats provide tastes and textures. When used as the principal cooking medium (rather than water), they also allow the cook access to a wide range of cooking temperatures. Common oil-cooking techniques include sauteing, stir-frying, and deep-frying. Commonly used fats and oils include butter; olive oil; vegetable oils such as sunflower oil, corn oil, and safflower oil; animal fats such as lard, schmaltz, and beef fat (both dripping and tallow); and seed oils such as rapeseed oil (Canola or mustard oil), sesame oil, soybean oil, and peanut oil. The inclusion of fats tends to add flavour to cooked food, even though the taste of the oil on its own is often unpleasant. This fact has encouraged the popularity of high fat foods, many of which are classified as junk food. Long-chain sugars such as starch tend to break down into more simple sugars when cooked, while simple sugars can form syrups. If sugars are heated so that all water of crystallisation is driven off, then caramelisation starts, with the sugar undergoing thermal decomposition with the formation of carbon, and other breakdown products producing caramel. Similarly, the heating of sugars and proteins elicits the Maillard reaction, a basic flavor-enhancing technique. An emulsion of starch with fat or water can, when gently heated, provide thickening to the dish being cooked. In European cooking, a mixture of butter and flour called a roux is used to thicken liquids to make stews or sauces. In Asian cooking, a similar effect is obtained from a mixture of rice or corn starch and water. These techniques rely on the properties of starches to create simpler mucilaginous saccharides during cooking, which causes the familiar thickening of sauces. This thickening will break down, however, under additional heat.

2. Application Of Scientific Knowledge

The application of scientific knowledge to cooking and gastronomy has become known as molecular gastronomy. This is a subdiscipline of food science. Important contributions have been made by scientists, chefs and authors such as Herve This (chemist), Nicholas Kurti (physicist), Peter Barham (physicist), Harold McGee (author), Shirley Corriher (biochemist, author), Heston Blumenthal (chef), Ferran Adria (chef), Robert Wolke (chemist, author) and Pierre Gagnaire (chef). The culinary triangle is a concept thought up by Claude Lvi-Strauss involving three types of cooking; these are boiling, roasting, and smoking, usually done to meats.The boiling of meat is looked at as a cultural way of

cooking because it uses a receptacle to hold water, therefore it is not completely natural. It is also the most preferred way to cook because neither any of the meat or its juices are lost. In most cultures, this form of cooking is most represented by women and is served domestically to small closed groups, such as families. Roasting of meat is a natural way of cooking because it uses no receptacle. It is done by directly exposing the meat to the fire. It is most commonly offered to guests and is associated with men in many cultures. As opposed to boiling, meat can lose some parts, thus it is also associated with destruction and loss.

3. **Heat Transfer in Cooking**

Smoking meat is also a natural way of cooking. It is also done without a receptacle and in the same way as roasting. It is a slower method of roasting, however, which makes it somewhat like boiling. High altitude cooking is the opposite of pressure cooking in that the boiling point of water will be lower at higher altitudes due to the decreased air pressure. This lower temperature results in a lowered boiling point of water and may require an increase in cooking times or temperature and alterations of recipe ingredients. For home cooking, this effect becomes relevant at altitudes above approximately 2000 feet (600 meters). At that altitude, water boils at approximately 208F (98C) and adjustments sometimes need to be made to compensate for the reduced air pressure/water boiling point. From pressure cooking: A pressure cooker is often used by mountain climbers to compensate for the low atmospheric pressure at a very high altitude. Under these circumstances water boils at temperatures significantly below 100 C and without the use of a pressure cooker, may leave boiled foods undercooked, as described in Charles Darwin's Voyage of the Beagle: At the place where we slept water necessarily boiled, from the diminished pressure of the atmosphere, at a lower temperature than it does in a less lofty country; the case being the converse of that of a Papin's digester. Hence the potatoes, after remaining for some hours in the boiling water, were nearly as hard as ever. The pot was left on the fire all night, and next morning it was boiled again, but yet the potatoes were not cooked. I found out this, by overhearing my two companions discussing the cause, they had come to the simple conclusion, "that the cursed pot [which was a new one] did not choose to boil potatoes."

Carry over cooking refers to the phenomenon that food retains heat and continues to cook after being removed from a source of heat. The larger and denser the object being heated,

the greater the degree of carry over cooking. Often after being removed from the oven the internal temperature can increase by as much as 25%. This means that when cooking large roasts one must often pull the item out of the oven when it is still a little raw on the inside in order to avoid overcooking. As well, it is for this reason that it is not recommended to cut a roast immediately after removing it from the oven, but instead to wait a half hour before cutting open the meat.

In Section 2 of this course you will cover these topics:

- Fats, Frying And Emulsions
- Sweeteners, Crystallization, Starch, And Cereal Grain

Topic : Fats, Frying And Emulsions

Topic Objective:

At the end of the topic student will be able to understand:

- Fats & Frying
- Emulsion
- Frying Techniques

Definition/Overview:

Frying is the cooking of food in oil or fat, a technique that originated in ancient Egypt around 2500BC. Chemically, oils and fats are the same, differing only in melting point, but the distinction is only made when needed. In commerce, many fats are called oils by custom, e.g. palm oil and coconut oil, which are solid at room temperature. Fats can reach much higher temperatures than water at normal atmospheric pressure. Through frying, one can sear or even carbonize the surface of foods while caramelizing sugars. The food is cooked much more quickly and has a characteristic crispness and texture. Depending on the food, the fat will penetrate it to varying degrees, contributing richness, lubricity, and its own flavour.

Key Points:

1. Frying Techniques

Frying techniques vary in the amount of fat required, the cooking time, the type of cooking vessel required, and the manipulation of the food. Sauting, stir frying, pan frying, shallow frying, and deep frying are all standard frying techniques.Sauting and stir-frying involve cooking foods in a thin layer of fat on a hot surface, such as a frying pan, griddle, wok, or sauteuse. Stir frying involves frying quickly at very high temperatures, requiring that the food be stirred continuously to prevent it from adhering to the cooking surface and burning.Shallow frying is a type of pan frying using only enough fat to immerse approximately one-third to one-half of each piece of food; fat used in this technique is typically only used once. Deep-frying, on the other hand, involves totally immersing the food in hot oil, which is normally topped up and used several times before being disposed. Deep-frying is typically a much more involved process, and may require specialized oils for optimal results. Deep frying is now the basis of a very large and expanding world-wide industry. Fried products have great consumer appeal in all age groups, and the process is quick, can easily be made continuous for mass production, and the food emerges sterile and dry, with a relatively long shelf life. The end products can then be easily packaged for storage and distribution. Examples are potato chips, french fries, nuts, doughnuts, instant noodles, etc. There is some criticism of fried foods for their low nutritional value. Frying, especially deep frying, imbues the food with fat from the oil, lowering their nutrient density. Emulsions tend to have a cloudy appearance, because the many phase interfaces (the boundary between the phases is called the interface) scatter light that passes through the emulsion. Emulsions are unstable and thus do not form spontaneously. Energy input through shaking, stirring, homogenizers, or spray processes are needed to form an emulsion. Over time, emulsions tend to revert to the stable state of oil separated from water. Surface active substances (surfactants) can increase the kinetic stability of emulsions greatly so that, once formed, the emulsion does not change significantly over years of storage. Homemade oil and vinegar salad dressing is an example of an unstable emulsion that will quickly separate unless shaken continuously. This phenomenon is called coalescence, and happens when small droplets recombine to form bigger ones. Fluid emulsions can also suffer from creaming, the

migration of one of the substances to the top of the emulsion under the influence of buoyancy or centripetal force when a centrifuge is used. Emulsions are part of a more general class of two-phase systems of matter called colloids. Although the terms colloid and emulsion are sometimes used interchangeably, emulsion tends to imply that both the dispersed and the continuous phase are liquid.There are three types of emulsion instability: flocculation, where the particles form clumps; creaming, where the particles concentrate towards the surface (or bottom, depending on the relative density of the two phases) of the mixture while staying separated; and breaking and coalescence where the particles coalesce and form a layer of liquid.

2. Emulsion

An emulsion is a mixture of two immiscible (unblendable) liquids. One liquid (the dispersed phase) is dispersed in the other (the continuous phase). Many emulsions are oil/water emulsions, with dietary fats being one common type of oil encountered in everyday life. Examples of emulsions include butter and margarine, milk and cream, and vinaigrettes; the photo-sensitive side of photographic film, magmas and cutting fluid for metal working. In butter and margarine, fat surrounds droplets of water (a water-in-oil emulsion). In milk and cream, water surrounds droplets of fat (an oil-in-water emulsion). In certain types of magma, globules of liquid NiFe may be dispersed within a continuous phase of liquid silicates. Emulsification is the process by which emulsions are prepared. Emulsion is also a term used in the oil field as untreated well production that consists primarily of crude oil and water. Emulsions tend to have a cloudy appearance, because the many phase interfaces (the boundary between the phases is called the interface) scatter light that passes through the emulsion. Emulsions are unstable and thus do not form spontaneously. Energy input through shaking, stirring, homogenizing, or spray processes are needed to form an emulsion. Over time, emulsions tend to revert to the stable state of the phases comprising the emulsion. Surface active substances (surfactants) can increase the kinetic stability of emulsions greatly so that, once formed, the emulsion does not change significantly over years of storage. Vinaigrette is an example of an unstable emulsion that will quickly separate unless shaken continuously. This phenomenon is called coalescence, and happens when small droplets recombine to form bigger ones. Emulsions can also suffer from creaming, the migration of one of the substances to the top of the emulsion under the influence of buoyancy or centripetal force

when a centrifuge is used. Emulsions are part of a more general class of two-phase systems of matter called colloids. Although the terms colloid and emulsion are sometimes used interchangeably, emulsion tends to imply that both the dispersed and the continuous phase are liquid. There are three types of emulsion instability: flocculation, where the particles form clumps; creaming, where the particles concentrate towards the surface (or bottom, depending on the relative density of the two phases) of the mixture while staying separated; and breaking and coalescence where the particles coalesce and form a layer of liquid. Whether an emulsion turns into a water-in-oil emulsion or an oil-in-water emulsion depends on the volume fraction of both phases and on the type of emulsifier. Generally, the Bancroft rule applies: emulsifiers and emulsifying particles tend to promote dispersion of the phase in which they do not dissolve very well; for example, proteins dissolve better in water than in oil and so tend to form oil-in-water emulsions (that is they promote the dispersion of oil droplets throughout a continuous phase of water). The basic color of emulsions is white. If the emulsion is dilute, the Tyndall effect will scatter the light and distort the color to blue; if it is concentrated, the color will be distorted towards yellow. This phenomenon is easily observable on comparing skimmed milk (with no or little fat) to cream (high concentration of milk fat). Microemulsions and nanoemulsions tend to appear clear due to the small size of the disperse phase.

3. Fats & Frying

A traditional round-bottom iron pan called a wok is heated to a high temperature. A small amount of cooking oil is then poured down the side of the wok (a traditional expression in Chinaregarding this is "hot wok, cold oil"), followed by dry seasonings (including ginger and garlic), then at the first moment the seasonings can be smelled, meats are added and agitated. Once the meat is seared, vegetables along with liquid ingredients (for example often including premixed combinations of some of soy sauce, vinegar, wine, salt, sugar, and cornstarch) are added. The wok then may be covered for a moment so the water in the liquid ingredients can warm up the new ingredients as it steams off. To keep the meat juicy, usually a cook would take the seared meat out before vegetables are added, and put the meat back right before vegetables are done. In some dishes, or if the cooking conditions are inadequate, different components may be stir fried separately before being combined in the final dish (if, for example, the chef desires the taste of the stir fried vegetables and meats to remain distinct).The food is stirred and tossed out very quickly

using wooden or metal cooking utensils. Some chefs will lift the wok to the side to let the flame light the oil or add a dash of wine spirit to give the food extra flavor. Using this method, many dishes can be cooked extremely quickly (within a minute).Some dishes that require more time are cooked by adding a few dashes of water after the stirring. Then the wok is covered with a lid. As soon as steam starts to come out from under the lid, the dish is ready. In this case, the food is stir fried on high heat for flavor and then steamed to ensure that it is fully cooked. The wok is heated to a dull red glow. With the wok hot, the oil, seasonings and meats are added in rapid succession with no pause in between. The food is continually tossed, stopping for several seconds only to add other ingredients such as various seasonings, broths or vegetables. When the food is deemed to be cooked it is poured and ladled out of the wok. The wok must then be quickly rinsed to prevent food residues from charring and burning to the wok bottom because of residual heat. The main ingredients are usually cut to smaller pieces to aid in cooking. As well, a larger amount of cooking oil with a high smoke point, such as lard and/or peanut oil, is often used in bao. Deep frying is a cooking method in which food is submerged in hot oil or fat. This is normally performed with a deep fryer or chip pan; industrially, a pressure fryer or vacuum fryer may be used. Deep frying is classified as a dry cooking method because no water is used. Due to the high temperature involved and the high heat conduction of oil, it cooks food extremely fast. If performed properly, deep-frying does not make food excessively greasy, because the moisture in the food repels the oil. The hot oil heats the water within the food, steaming it from the inside out; oil cannot go against the direction of this powerful flow because (due to its high temperature) the water vapor pushes the bubbles towards the surface. Long as the oil is hot enough and the food is not immersed in the oil for too long, oil penetration will be confined to the outer surface. However, if the food is cooked in the oil for too long, much of the water will be lost and the oil will begin to penetrate the food. The correct frying temperature depends on the thickness and type of food, but in most cases it lies between 175 and 190 C (345375 F). Some fried foods are given a coating of batter or breading prior to frying. The effect of these is that the outside of the food becomes crispy and browned, while the inside becomes tender, moist, and steamed. Some foods such as potatoes or whole, skin-on poultry have a natural coating and do not require breading or battering. Overheating or over-using the frying oil leads to formation of rancid-tasting products of oxidation, polymers, and other deleterious, unintended or even toxic compounds such as acrylamide (from starchy foods). Deep-frying under vacuum helps to significantly reduce acrylamide formation, but

this process is not widely used in the food industry due to the high investment cost involved. Some useful tests and indicators of excessive oil deterioration are the following:

- Sensory: Darkening, smoke, foaming, thickening, rancid taste.
- Laboratory: Acidity, anisidine value, viscosity, total polar compounds, polymeric triglycerides.
- Instruments that indicate total polar compounds, currently the best single gauge of how deep-fried an object is, are available with sufficient accuracy for restaurant and industry use.

Topic : Sweeteners, Crystallization, Starch, And Cereal Grain

Topic Objective:

At the end of the topic student will be able to understand:

- Iodine solution
- Common pasta
- Pasta
- Starch

Definition/Overview:

Frozen dessert is the generic name for desserts made by freezing liquids, semi-solids, and sometimes even solids. They may be based on flavored water (sorbet, snow cones, etc.), on fruit pures, on milk and cream (most ice creams), on custard (frozen custard and some ice creams), on mousse (semifreddo), etc. Starch, CAS# 9005-25-8, chemical formula $(C_6H_{10}O_5)_n$ is a polysaccharide carbohydrate consisting of a large number of glucose monosaccharide units joined together by glycosidic bonds. All plant seeds and tubers contain starch which is predominantly present as amylose and amylopectin. Depending on the plant, starch generally contains 20 to 25 percent amylose and 75 to 80 percent amylopectin. The word is derived from Middle English sterchen, meaning to stiffen, which is appropriate since it can be used as a thickening agent when dissolved in water and heated.

Key Points:

1. Starch

Starch is by far the most consumed polysaccharide in the human diet. Traditional staple foods such as cereals, roots and tubers are the main source of dietary starch. Starch (in particular cornstarch) is used in cooking for thickening foods such as sauces. In industry, it is used in the manufacturing of adhesives, paper, textiles and as a mold in the manufacture of sweets such as wine gums and jelly beans. It is a white powder, and depending on the source, may be tasteless and odorless.

Starch is often found in the fruit, seeds, rhizomes or tubers of plants and is the major source of energy in these food items. The major resources for starch production and consumption worldwide are rice, wheat, corn, and potatoes. Cooked foods containing starches include boiled rice, various forms of bread and noodles (including pasta).

As an additive for food processing, arrowroot and tapioca are commonly used as well. Commonly used starches around the world are: arracacha, buckwheat, banana, barley, cassava, kudzu, oca, sago, sorghum, regular household potatoes, sweet potato, taro and yams. Edible beans, such as favas, lentils and peas, are also rich in starch.

When a starch is pre-cooked, it can then be used to thicken cold foods. This is referred to as a pregelatinized starch. Otherwise starch requires heat to thicken, or "gelatinize." The actual temperature depends on the type of starch. A modified food starch undergoes one or more chemical modifications, which allow it to function properly under high heat and/or shear frequently encountered during food processing. Food starches are typically used as thickeners and stabilizers in foods such as puddings, custards, soups, sauces, gravies, pie fillings, and salad dressings, but have many other uses. The modified starches are coded according to the International Numbering System for Food Additives (INS) :

- 1401 Acid-treated starch
- 1402 Alkaline treated starch
- 1403 Bleached starch
- 1404 Oxidized starch

- 1405 Starches, enzyme-treated
- 1410 Monostarch phosphate
- 1411 Distarch glycerol
- 1412 Distarch phosphate esterified with sodium trimetaphosphate
- 1413 Phosphated distarch phosphate
- 1414 Acetylated distarch phosphate
- 1420 Starch acetate esterified with acetic anhydride
- 1421 Starch acetate esterified with vinyl acetate
- 1422 Acetylated distarch adipate
- 1423 Acetylated distarch glycerol
- 1440 Hydroxypropyl starch
- 1442 Hydroxypropyl distarch phosphate
- 1443 Hydroxypropyl distarch glycerol
- 1450 Starch sodium octenyl succinate

Resistant starch is starch that escapes digestion in the small intestine of healthy individuals. Plants use starch as a way to store excess glucose, and thus also use starch as food during mitochondrial oxidative phosphorylation.

2. Pasta

Pasta is an Italian food made from a dough using flour, water and/or eggs. There are approximately 350 different shapes of pasta. A few examples include spaghetti (solid, thin cylinders), maccheroni (tubes or hollow cylinders), fusilli (swirls), lasagne (sheets), and gnocchi (balls), although this is considered a separate dish by some. The two basic styles of pasta are dried and fresh. There are also variations in the ingredients used in pasta. The time for which pasta can be stored varies from days to years depending upon whether the pasta is made with egg or not, and whether it is dried or fresh. Pasta is boiled prior to consumption. The word, pasta, can also denote dishes in which pasta products are the primary ingredient, served with sauce or seasonings. There are many ingredients that can be used to make pasta dough. They range from a simple flour and water mixture, to those that call for the addition of eggs, spices and cheeses, or even squid ink to the dough.Under Italian law, dry pasta can only be made from durum wheat or semolina flour. Durum flour has a yellow tinge in color. Italian pasta is traditionally cooked al dente (Italian: "to the tooth", meaning not too soft). Abroad, dry pasta is frequently made

from other types of flour (such as farina), but this yields a softer product, which cannot be cooked al dente.Particular varieties of pasta may also use other grains and/or milling methods to make the flour. Some pasta varieties, such as Pizzoccheri, are made from buckwheat flour. Various types of fresh pasta include eggs (pasta all'uovo). Gnocchi are often listed among pasta dishes, although they are quite different in ingredients (mainly milled potatoes).

3. Common pasta

Common pasta sauces in Northern Italy include pesto and rag alla bolognese; in Central Italy, simple tomato sauce, amatriciana and carbonara, and in Southern Italy, spicy tomato, garlic, and olive oil based sauces, often paired with fresh vegetables or seafood. Varieties include puttanesca, pasta alla norma (tomatoes, eggplant and fresh or baked cheese), pasta con le sarde (fresh sardines, pine nuts, fennel and olive oil), spaghetti aglio, olio e peperoncino (literally with garlic, (olive) oil and hot chili peppers).Fettuccine alfredo, with butter and cheese, and spaghetti with tomato sauce with or without ground meat or meatballs are popular Italian-style dishes in the United States.As pasta is introduced elsewhere in the world, it has been incorporated into a number of local cuisines that may have significantly different ways of preparations from those of its country of origin. In Hong Kong, the local Chinese has adopted pasta, primarily spaghetti and macaroni, as an ingredient in the Hong Kong-style Western cuisine. In the territory's Cha chaan tengs, pasta, most commonly macaroni, is cooked in water, and served in broth with ham or frankfurter sausages, peas, black mushrooms, and optionally eggs reminiscent of noodle soup dishes. This is often a course for breakfast or light lunch fare. The method often involves cooking the pasta well beyond the al dente stage and washing the starches off the pasta after cooking, measures frowned upon in Italyor in Hong Kong's more authentic Italian eateries.

4. Iodine solution

Iodine solution is used to test for Starch. A bluish-black color indicates the presence of iodine in the starch solution. It is thought that the iodine fits inside the coils of amylose. A 0.3% w/w solution is the standard concentration for a dilute starch indicator solution. It is made by adding 4 grams of soluble starch to 1 litre of heated water; the solution is cooled before use (starch-iodine complex becomes unstable at temperatures above 35 C). This

complex is often used in redox titrations: in presence of an oxidizing agent the solution turns blue, in the presence of reducing agent, the blue color disappears because triiodide (I3−) ions break up into three iodide ions, disassembling the complex. Under the microscope, starch grains show a distinctive Maltese cross effect (also known as 'extinction cross' and birefringence) under polarized light.

In Section 3 of this course you will cover these topics:

- Bakery Products
- Vegetables, Fruits And Salads

Topic : Bakery Products

Topic Objective:

At the end of the topic student will be able to understand:

- Fats or shortenings
- Aeration
- Bacterial leavening
- Steam leavening
- Sourdough
- Yeast leavening
- Chemical leavening
- Leavening
- Liquids
- Flour
- White bread
- Pastry
- Batter

Definition/Overview:

Dough is a paste made out of any cereals (grains) or leguminous crops by mixing the flour with a small amount of water. This step is a precursor to making bread, pasta, noodles, pastry, cookies, and muffins. In many parts of central India, native people use the quick method of making an instant roasted dough ball or baati. Flat unleavened breads known as roti, lavash, yufka, matzo, lafa, and tortilla are used in many parts of the world today. Leavened or fermented dough, made from dry ground grain cereals or legumes mixed with water and yeast are in use all over the world. These includes all kinds of breads made from wheat, maize, rice and other cereals or similar crops used today in the world. Fried dough foods are common in many cultures. Dough is usually a non-Newtonian fluid, which is relevant for kneading and kneading machines. Salt dough, a variant consisting of 1 cup flour, 1 cup salt and 1/2 cup water, can be used as a toy for molding. Such a recipe is the basis for Play-Doh.

Key Points:

1. Batter

Batter is a liquid mixture, usually based on one or more flours combined with liquids such as water, milk or beer. Egg is also a common component. Often a leavening agent is included in the mixture to aerate and fluff up the batter as it cooks (or the mixture may be naturally fermented for this purpose as well as to add flavour).The viscosity of batter may range from very "stiff" (adhering to an upturned spoon), to very "thin" (similar to single cream). Heat is applied to the batter, usually by frying, baking or steaming, in order to cook the ingredients (thus rendering them palatable) and to "set" the batter into a solid form. Batters may be sweet or savoury, often with either sugar or salt being added (sometimes both). Many other flavourings such as herbs, spices, fruits and vegetables may also be added to the mixture.The word 'batter' comes from the old French word 'battre' which means 'to beat', as many batters require vigorous beating or whisking in their preparation. Bread is a staple food prepared by baking a dough of flour and water. It may be leavened or unleavened. Salt, fat and a leavening agent such as yeast are common ingredients, though breads may contain a range of other ingredients: milk, egg, sugar, spice, fruit (such as raisins), vegetables (such as onion), nuts (such as walnuts) or seeds (such as poppy seeds).Bread is one of the oldest prepared foods, dating back to the

Neolithic era. The development of leavened bread can probably also be traced to prehistoric times. Fresh bread is prized for its taste, aroma and texture. Retaining its freshness is important to keep it appetizing. Bread that has stiffened or dried past its prime is said to be stale. Modern bread is often wrapped in paper or plastic film, or stored in an airtight container such as a breadbox to keep it fresh longer. Bread that is kept in warm, moist environments is prone to the growth of mold. Bread kept at low temperatures, for example, in a refrigerator, will develop mold growth more slowly than bread kept at room temperature. However, unwrapped bread kept in the low-humidity air of the typical household refrigerator will turn stale quickly due to the low humidity. The inner, soft part of bread is known to bakers and other culinary professionals as the crumb, which is not to be confused with small bits of bread that often fall off, called crumbs. The outer hard portion of bread is the crust.

2. Pastry

Pastry is the name given to various kinds of baked goods made from ingredients such as flour, butter, shortening, baking powder or eggs. It may also refer to the dough from which such baked goods are made. Pastry dough is rolled out thinly and used as a base for baked goods. Common pastry dishes include pies, tarts and quiches..Pastry is distinguished from bread by having a higher fat content, which contributes to a flaky or crumbly texture. A good pastry is light and airy and fatty, but firm enough to support the weight of the filling. When making a shortcrust pastry, care must be taken to blend the fat and flour thoroughly before adding any liquid. This ensures that the flour granules are adequately coated with fat and less likely to develop gluten. On the other hand, overmixing results in long gluten strands that toughen the pastry. In other types of pastry, such as Danish pastry and croissants, the characteristic flaky texture is achieved by repeatedly rolling out a dough similar to that for yeast bread, spreading it with butter, and folding it to produce many thin layers.Many pie recipes involve blind-baking the pastry before the filling is added. Pastry dough may be sweetened or unsweetened. European traditions of pastry-making are often traced back to the short crust era flaky doughs that were in use throughout the Mediterranean in ancient times. These recipes were popularized in Western Europe by Crusaders returning home. However, the Romans, Greeks and Phoenicians all had filo-style pastries in their culinary traditions. There is also strong evidence that the ancient Egyptians produced pastry-like confections. These

recipes were adopted and adapted over time in various European countries, resulting in the myriad of pastry traditions known to the region, from Portuguese "pastis de nata" in the west to Russian "pirozhky" in the east. The use of chocolate in pastry-making in the West, so commonplace today, arose only after Spanish and Portuguese traders brought chocolate to Europe from the New Worldstarting in the 1500s. Many culinary historians consider French pastry chef Antonin Carme (1784-1833) to have been the first great master of pastry making in modern times. Small cakes, tarts and other sweet baked goods are called "pastries".Pastry-making also has a strong tradition in many parts ofAsia. Chinese pastry is made from rice, or different types of flour, with fruit, sweet bean paste or sesame-based fillings. Since the 19th century, the British brought western-style pastry to the Far East. Though it would be the French influenced Maxim in the 1950s that made western pastry popular in Chinese-speaking regions starting with Hong Kong. Still, the term "west cake" is used to differentiate between the automatically assumed Chinese pastry. Bread can be served at any temperature ranging from room temperature to hot. Once baked, it can subsequently be toasted. It is most commonly picked up and eaten with the hands, or sometimes with a knife and fork. It can be eaten by itself or as a carrier for another, usually less compact food. Bread may be dunked or dipped into a liquid (such as beef gravy, olive oil, or sardine pt), topped with various spreads, both sweet and savory, or serve as the enclosure for the ubiquitous sandwich with any number of meats, cheeses, vegetables or condiments inside. Bread is a popular food in Western and most other societies, although East Asian societies typically prefer rice or noodles. It is often made from a wheat-flour dough that is cultured with yeast, allowed to rise, and finally baked in an oven. Owing to its high levels of gluten (which give the dough sponginess and elasticity), common wheat (also known as bread wheat) is the most common grain used for the preparation of bread, but bread is also made from the flour of other wheat species (including durum, spelt and emmer), rye, barley, maize (or corn), and oats, usually, but not always, in combination with wheat flour. Although common wheat is best suited for making highly-risen white bread, other wheat species are capable of giving a good crumb. Spelt bread (Dinkelbrot) continues to be widely consumed in Germany, and emmer bread was a staple food in ancient Egypt. Canadian bread is known for its heartier consistency due to high protein levels in Canadian flour.

3. White bread

White bread is made from flour containing only the central core of the grain (endosperm).

Brown bread is made with endosperm and 10% bran. It can also refer to white bread with added colouring (often caramel colouring) to make it 'brown'; commonly labeled in America as "Wheat" bread (as opposed to "Whole Wheat" bread.)

Wholemeal bread contains the whole of the wheat grain (endosperm and bran). It is also referred to as 'whole grain' or 'whole wheat' bread, especially in North America.

Wheat germ bread has added wheat germ for flavouring. Whole grain bread can refer to the same as 'wholemeal bread', or to white bread with added whole grains to increase its fibre content (i.e. as in "60% whole grain bread"). Granary bread is bread made from granary flour. Trademarked to Hovis, it is made from malted white or brown flour, wheat germ and whole grains. Rye bread is made with flour from rye grain of variable levels. It is higher in fiber than many common types of bread and is often darker in color and stronger in flavor. In Finland, Estoniaand Russia, rye is the most popular type of bread.

The amount of water and flour are the most significant measurements in a bread recipe, as they affect texture and crumb the most. Professional bakers use a system of percentages known as Bakers' Percentage in their recipe formulations, and measure ingredients by weight instead of by volume. Measurement by weight is much more accurate and consistent than measurement by volume, especially for the dry ingredients.Flour is always 100%, and the rest of the ingredients are a percent of that amount by weight. Common table bread in the U.S. uses approximately 50% water, resulting in a finely-textured, light, bread. Most artisan bread formulas contain anywhere from 60 to 75% water. In yeast breads, the higher water percentages result in more CO2 bubbles, and a coarser bread crumb. One pound (500 g) of flour will yield a standard loaf of bread, or two French loaves.Calcium propionate is commonly added by commercial bakeries to retard the growth of molds.

4. Flour

Flour is a product made from grain that has been ground into a powdery consistency. It is flour that provides the primary structure to the final baked bread. Commonly available flours are made from rye, barley, maize, and other grains, but it is wheat flour that is most commonly used for breads. Each of these grains provides the starch and protein necessary for the production of bread. The quantity and quality of the proteins contained in the flour serve as the best indicator of the quality of the bread dough and the finished bread. While bread can be made from all-purpose wheat flour, for quality bread a specialty bread flour, containing more protein, is recommended. Wheat flour in addition to its starch contains three water-soluble protein groups, albumin, globulin, proteoses, and two non-water soluble protein groups, glutenin and gliadin. When flour is mixed with water the water-soluble proteins dissolve, leaving the glutenin and gliadin to form the structure of the resulting dough. When worked by kneading, the glutenin forms strands of long thin chainlike molecules while the shorter gliadin forms bridges between the strands of glutenin. The resulting networks of strands produced by these two proteins is known as gluten. Gluten development improves if the dough is allowed to autolyse.

5. Liquids

Water, or some other liquid, is used to form the flour into a paste or dough. The volume of liquid required varies between recipes, but a ratio of 1 part liquid to 3 parts flour is common for yeast breads while recipes that use steam as the primary leavening method may have a liquid content in excess of one part liquid to one part flour by volume. In addition to water, other types of liquids that may be used include dairy products, fruit juices, or beer. In addition to the water in each of these they also bring additional sweeteners, fats, and/or leavening components.

6. Leavening

Leavening is the process of adding gas to a dough before or during baking to produce a lighter, more easily chewed bread. Most bread consumed in the West is leavened. However, unleavened breads have symbolic importance in Judaism and Christianity. Jews consume unleavened bread called Matza during Passover. They are also used in the

Christian liturgy when they celebrate the Eucharist, a rite derived from the narrative of the Last Supper when Jesus broke bread with his disciples during a Passover Seder.

7. Chemical leavening

A simple technique for leavening bread is the use of gas-producing chemicals. There are two common methods. The first is to use baking powder or a self-rising flour that includes baking powder. The second is to have an acidic ingredient such as buttermilk and add baking soda. The reaction of the acid with the soda produces gas.

Chemically-leavened breads are called quick breads and soda breads. This technique is commonly used to make muffins, pancakes, American-style biscuits and sweet breads such as banana bread.

8. Yeast leavening

Many breads are leavened by yeast. The yeast used for leavening bread is Saccharomyces cerevisiae, the same species used for brewing alcoholic beverages. This yeast ferments carbohydrates in the flour, including any sugar, producing carbon dioxide. Most bakers in the U.S.leaven their dough with commercially produced baker's yeast. Baker's yeast has the advantage of producing uniform, quick, and reliable results, because it is obtained from a pure culture. Many artisan bakers produce their own yeast by preparing a 'growth culture' which they then use in the making of bread. This culture kept in the right conditions will continue to grow and provide leavening for many years.

Both the baker's yeast and the sourdough method of baking bread follow the same pattern. Water is mixed with flour, salt and the leavening agent (baker's yeast or sourdough starter). Other additions (spices, herbs, fats, seeds, fruit, etc.) are not necessary to bake bread, but often used. The mixed dough is then allowed to rise one or more times (a longer rising time results in more flavor, so bakers often punch down the dough and let it rise again), then loaves are formed and (after an optional final rising time) the bread is baked in an oven. Many breads are made from a straight dough, which means that all of the ingredients are combined in one step, and the dough baked after the rising time. Alternatively, dough can be made using a pre-ferment, when some of the flour, water, and the leavening are combined a day or so ahead of baking, and allowed to ferment

overnight. On the day of the baking, the rest of the ingredients are added, and the rest of the process is the same as that for straight dough. This produces a more flavorful bread with better texture. Many bakers see the starter method as a compromise between the highly reliable results of baker's yeast, and the flavor/complexity of a longer fermentation. It also allows the baker to use only a minimal amount of baker's yeast, which was scarce and expensive when it first became available. Most yeasted preferments fall into one of three categories: poolish or pouliche, a loose-textured mixture composed of roughly equal amounts of flour and water (by weight); biga a stiff mixture with a higher proportion of flour; and pte fermente, which is simply a portion of dough reserved from a previous batch. Sourdough (also known as levain or "natural leaven") takes it a step further, creating a pre-ferment with flour and water that propagates naturally occurring yeast and bacteria (usually Saccharomyces exiguus, which is more acid-tolerant than S. cerevisiae, and various species of Lactobacillus.)

9. Sourdough

The sour taste of sourdoughs actually comes not from the yeast, but from a lactobacillus, with which the yeast lives in symbiosis. The lactobacillus feeds on the byproducts of the yeast fermentation, and in turn makes the culture go sour by excreting lactic acid, which protects it from spoiling (since most microbes are unable to survive in an acid environment). All yeast-leavened breads used to be sourdoughs, and the leavening process was not understood until the 19th century, when with the advance of microscopes, scientists were able to discover the microbes that make the dough rise. Since then, strains of yeast have been selected and cultured mainly for reliability and quickness of fermentation. Billions of cells of these strains are then packaged and marketed as "Baker's Yeast". Bread made with baker's yeast is not sour because of the absence of the lactobacillus. Bakers around the world quickly embraced baker's yeast for it made baking simple and so allowed for more flexibility in the bakery's operations. It made baking quick as well, allowing bakeries to make fresh bread from scratch as often as three times a day. While European bakeries kept producing sourdough breads, in the U.S., sourdough baking was widely replaced by baker's yeast, and only recently has that country (or parts of it, at least) seen the rebirth of sour-vinegar dough in artisan bakeries. According to Alton Brown, host of Food Network's "Good Eats" television show, each

region of the world has different strains of lactobacillus, hence the flavor of the bread made from home starters is unique. The San Francisco Bay Area is especially famous for its sourdough breads. Sourdough breads are most often made with a sourdough starter (not to be confused with the starter method discussed above). A sourdough starter is a culture of yeast and lactobacillus. It is essentially a dough-like or pancake-like flour/water mixture in which the yeast and lactobacilli live. A starter can be maintained indefinitely by periodically discarding a part of it and refreshing it by adding fresh flour and water. (When refrigerated, a starter can go weeks without needing to be fed.) There are starters owned by bakeries and families that are several human generations old, much revered for creating a special taste or texture. Starters can be obtained by taking a piece of another starter and growing it, or they can be made from scratch. There are hobbyist groups on the web who will send their starter for a stamped, self-addressed envelope, and there are even mailorder companies that sell different starters from all over the world. An acquired starter has the advantage to be more proven and established (stable and reliable, resisting spoiling and behaving predictably) than from-scratch starters.

There are other ways of sourdough baking and culture maintenance. A more traditional one is the process that was followed by peasant families throughout Europein past centuries. The family (usually the woman was in charge of breadmaking) would bake on a fixed schedule, perhaps once a week. The starter was saved from the previous week's dough. The starter was mixed with the new ingredients, the dough was left to rise, then a piece of it was saved (to be the starter for next week's bread). The rest was formed into loaves which were marked with the family sign (this is where today's decorative slashing of bread loaves originates from), and taken to the communal oven to bake. These communal ovens over time evolved into what are known today as bakeries, when certain people specialized in bread baking, and with time enhanced the process so far as to be able to mass produce cheap bread for everyone in the village.

10. Steam leavening

The rapid expansion of steam produced during baking leavens the bread, which is as simple as it is unpredictable. The best known steam-leavened bread is the popover. Steam-leavening is unpredictable since the steam is not produced until the bread is baked. Steam leavening happens regardless of the rising agents (soda powder, yeast, baking-powder, sour dough, egg snow) The rising agent generates carbon dioxide - or already

contains air bubbles. The heat vaporises the water from the inner surface of the bubbles within the dough. The steam expands and makes the bread rise. It is actually the main factor in the rise of bread once it has been put in the oven. CO2 generation, on its own, is too small to account for the rise. Heat kills bacteria or yeast at an early stage, so the CO2 generation is stopped.

11. Bacterial leavening

Salt rising bread employs a form of bacterial leavening that does not require yeast. Although the leavening action is not always consistent, and requires close attention to the incubating conditions, this bread is making a comeback due to its unique cheese-like flavor and fine texture.

12. Aeration

Aerated bread is leavened by carbon dioxide being forced into dough under pressure. The technique is no longer in common use, but from the mid 19th to 20th centuries bread made this way was somewhat popular in the United Kingdom, made by the Aerated Bread Company and sold in its high-street tea rooms.

13. Fats or shortenings

Fats such as butter, vegetable oils, lard, or that contained in eggs affects the development of gluten in breads by coating and lubricating the individual strands of protein and also helping hold the structure together. If too much fat is included in a bread dough, the lubrication effect will cause the protein structures to divide. A fat content of approximately 3% by weight is the concentration that will produce the greatest leavening action. In addition to their effects on leavening, fats also serve to tenderize the breads they are used in and also help to keep the bread fresh longer after baking.

Topic : Vegetables, Fruits And Salads

Topic Objective:

At the end of the topic student will be able to understand:

- Fresh Vegetables
- Garnishes
- Popular types of garden salads
- Safety concerns
- Medicinal and nutritional properties
- Other uses
- Technical uses
- Uses
- Edible gelatins
- Recovery
- Extraction
- Pretreatments

Definition/Overview:

Gelatin is a translucent, colourless, brittle, nearly tasteless solid substance, extracted from the collagen inside animals' connective tissue. It has been commonly used as an emulsifier in food, pharmaceutical, photography, and cosmetic manufacturing. Substances containing gelatin or functioning in a similar way are called gelatinous. Gelatin is an irreversibly hydrolyzed form of collagen. Gelatin is classified as a foodstuff and has E number 441.Gelatin is a protein produced by partial hydrolysis of collagen extracted from the bones, connective tissues, organs, and some intestines of animals such as the domesticated cattle, and horses. The natural molecular bonds between individual collagen strands are broken down into a form that rearranges more easily. Gelatin melts when heated and solidifies when cooled again. Together with water, it forms a semi-solid colloid gel. Gelatin forms a solution of high viscosity in water, which sets to a gel on cooling, and its chemical composition is, in many respects, closely similar to that of its parent collagen. Gelatin solutions show viscoelastic flow and streaming birefringence. If gelatin is put into contact with cold water,

some of the material dissolves. The solubility of the gelatin is determined by the method of manufacture. Typically, gelatin can be dispersed in a relatively concentrated acid. Such dispersions are stable for 10-15 days with little or no chemical changes and are suitable for coating purposes or for extrusion into a precipitating bath. Gelatin is also soluble in most polar solvents. Gelatin gels exist over only a small temperature range, the upper limit being the melting point of the gel, which depends on gelatin grade and concentration and the lower limit, the ice point at which ice crystallizes. The mechanical properties are very sensitive to temperature variations, previous thermal history of the gel, and time. The viscosity of the gelatin/water mixture increases with concentration and when kept cool (≈40F).

Salad is a mixture of cold foods, usually including vegetables and/or fruits, often with a dressing, occasionally nuts or croutons, and sometimes with the addition of meat, fish, pasta, cheese, or whole grains. Salad is often served as an appetizer before a larger meal.The word "salad" comes from the French salade of the same meaning, which in turn is from the Latin salata, "salty", from sal, "salt. The "green salad" or "garden salad" is most often composed of some vegetables, built up on a base of leaf vegetables such as one or more lettuce varieties, spinach, or rocket (arugula) put together in a manner known as vegtabling. The salad leaves are cut or torn into bite-sized fragments and tossed together (called a tossed salad), or may be placed in a predetermined arrangement.Other common vegetables in a green salad include cucumbers, peppers, mushrooms, onions, spring onions, red onions, avocado, carrots, celery, and radishes. Other ingredients such as tomatoes, pasta, olives, hard boiled egg, artichoke hearts, heart of palm, roasted red peppers, cooked potatoes, rice, sweetcorn, green beans, black beans, croutons, cheeses, meat (e.g. bacon, chicken), or fish (e.g. tuna, shrimp) are sometimes added to salads. In a restaurant, a small salad without meat is called a dinner salad. The entree salads may contain chicken, either grilled or fried chicken fingers on top of the salad, or seafood in the form of grilled or fried shrimp, or a fish steak, such as tuna, mahi-mahi, or salmon. Steak such as sirloin can be grilled and sliced and placed upon the salad.

The worldwide production amount of gelatin is about 300,000 tons per year (roughly 600 million lbs.). On a commercial scale, gelatin is made from by-products of the meat and leather industry, mainly pork skins, pork and cattle bones, or split cattle hides. Recently, by-products of the fishery industry began to be considered as raw material for gelatin production because they eliminate most of the religious obstacles surrounding gelatin consumption. Contrary to popular belief, horns and hooves are not commonly used. The raw materials are

prepared by different curing, acid, and alkali processes which are employed to extract the dried collagen hydrolysate. These processes may take up to several weeks, and differences in such processes have great effects on the properties of the final gelatin products. Gelatin can also be prepared at home. Boiling certain cartilaginous cuts of meat or bones will result in gelatin being dissolved into the water. Depending on the concentration, the resulting broth, when cooled, will naturally form a jelly or gel. This process, for instance, may be used for the pot-au-feu dish.

While there are many processes whereby collagen can be converted to gelatin, they all have several factors in common. The intermolecular and intramolecular bonds which stabilize insoluble collagen rendering it insoluble must be broken, and the hydrogen bonds which stabilize the collagen helix must also be broken . The manufacturing processes of gelatin consists of three main stages: Pretreatments to make the raw materials ready for the main extraction step and to remove impurities which may have negative effects on physicochemical properties of the final gelatin product,

The main extraction step, which is usually done with hot water or dilute acid solutions as a multistage extraction to hydrolyze collagen into gelatin, and finally,

The refining and recovering treatments including filtration, clarification, evaporation, sterilization, drying, grinding, and sifting to remove the water from the gelatin solution, to blend the gelatin extracted, and to obtain dried, blended and ground final gelatin.

Key Points:

1. Pretreatments

If the physical material which will be used in production is bones, dilute acid solutions should be used to remove calcium and similar salts. Hot water or several solvents may be used for degreasing. Maximum fat content of the material should not exceed 1% before the main extraction step. If the raw material is hides and skin, size reduction, washing, removing hair from the hides, and degreasing are the most important pretreatments used to make the hides and skins ready for the main extraction step. Raw material preparation for extraction is done by three different methods: acid, alkali, and enzymatic treatments.

Acid treatment is especially suitable for less fully crosslinked materials such as pig skin collagen. Pig skin collagen is less complex than the collagen found in bovine hides. Acid treatment is faster than alkali treatment and requires normally 10 to 48 hours. Alkali treatment is suitable for more complex collagen as being in bovine hides. This process requires longer time, normally several weeks. The purpose of the alkali treatment is to destroy certain chemical crosslinkages still present in collagen. The gelatin obtained from acid treated raw material has been called type-A gelatin, and the gelatin obtained from alkali treated raw material is referred to as type-B gelatin. Enzymatic treatments used for preparing raw material for the main extraction step are relatively new. Enzymatic treatments have some advantages in contrast to alkali treatment. Time required for enzymatic treatment is short, the yield is almost 100% in enzymatic treatment, the purity is also higher, and the physical properties of the final gelatin product are better.

2. Extraction

After preparation of the raw material, i.e., reducing crosslinkages between collagen components and removing some of the impurities such as fat and salts, partially purified collagen is converted into gelatin by extraction with either water or acid solutions at appropriate temperatures. This extraction is one of the most important steps in gelatin production. All industrially used processes are based on neutral or acid pH values because alkali treatments speed up conversion, but, at the same time, degradation processes are promoted. Acid extract conditions are extensively used in the industry but the degree of acid varies with different processes. This extraction step is a multi stage process, and extraction temperature is usually increased in later extraction steps. This procedure ensures the minimum thermal degradation of the extracted gelatin.

3. Recovery

This process includes several steps such as filtration, evaporation, sterilization, drying, grinding, and sifting. These operations are concentration-dependent and also dependent on the particular gelatin used. Degradation must be avoided or minimized. For this purpose, limiting the temperature as much as possible would be helpful. Rapid processing is required for most of them. All of these processing steps should be done in several stages to avoid extensive deterioration of peptide structure. Otherwise, low gelling strength would be obtained that is not generally desired.

4. Edible gelatins

Household gelatin comes in the form of sheets, granules, or powder. Instant types can be added to the food as they are; others need to be soaked in water beforehand.

Special kinds of gelatin indicate the specific animal origin that was used for its production. For example, Jewish kosher or Muslim halal customs may require gelatin from fish. Vegetarians avoid gelatin and use other emulsifiers instead, such as agar, carrageenan, pectin, or konnyaku.

5. Uses

Probably best known as a gelling agent in cooking, different types and grades of gelatin are used in a wide range of food and non-food products: Common examples of foods that contain gelatin are gelatin desserts, jelly, trifles, aspic, marshmallows, and confectioneries such as Peeps and gummy bears. Gelatin may be used as a stabilizer, thickener, or texturizer in foods such as ice cream, jams, yogurt, cream cheese, and margarine; it is used, as well, in fat-reduced foods to simulate the mouthfeel of fat and to create volume without adding calories. Gelatin is used for the clarification of juices, such as apple juice, and of vinegar. Isinglass, from the swim bladders of fish, is still in use as a fining agent for wine and beer. Beside hartshorn jelly, from deer antlers (hence the name "hartshorn"), isinglass was one of the oldest sources of gelatin.

6. Technical uses

Gelatin typically constitutes the shells of pharmaceutical capsules in order to make them easier to swallow. Hypromellose is a vegan-acceptable alternative to gelatin, but is more expensive to produce. Animal glues such as hide glue are essentially unrefined gelatin.

It is used to hold silver halide crystals in an emulsion in virtually all photographic films and photographic papers. Despite some efforts, no suitable substitutes with the stability and low cost of gelatin have been found. Used as a carrier, coating or separating agent for other substances, it, for example, makes beta-carotene water-soluble, thus imparting a yellow colour to any soft drinks containing beta-carotene. Gelatin is closely related to

bone glue and is used as a binder in match heads and sandpaper. Cosmetics may contain a non-gelling variant of gelatin under the name hydrolyzed collagen. As a surface sizing, it smooths glossy printing papers or playing cards and maintains the wrinkles in crpe paper.

7. Other uses

Blocks of ballistic gelatin simulate muscle tissue as a standardized medium for testing firearms ammunition. Gelatin is used by synchronized swimmers to hold their hair in place during their routines as it will not dissolve in the cold water of the pool. It is frequently referred to as "knoxing", a reference to Knox brand gelatin.[citation needed] Though commonly used, the owners of the trademark object to the genericized use of the term.[citation needed] When added to boiling water and cooled, unflavored gelatin can make a home-made hair styling gel that is cheaper than many commercial hair styling products, but by comparison has a shorter shelf life (about a week) when stored in this form (usually in a refrigerator). After being applied to scalp hair, it can be removed with rinsing and some shampoo. It is commonly used as a biological substrate to culture adherent cells. Also used by those who are sensitive to tannins (which can irritate the stomach) in teas, soups or brews. It may be used as a medium with which to consume LSD. LSD in gelatin form is known as "windowpane" or "gel".

8. Medicinal and nutritional properties

Although gelatin is 98-99% protein by dry weight, it has less nutritional value than many other protein sources. Gelatin is unusually high in the non-essential amino acids glycine and proline, (i.e., those produced by the human body), while lacking certain essential amino acids (i.e., those not produced by the human body). It contains no tryptophan and is deficient in isoleucine, threonine, and methionine. The approximate amino acid composition of gelatin is: glycine 21%, proline 12%, hydroxyproline 12%, glutamic acid 10%, alanine 9%, arginine 8%, aspartic acid 6%, lysine 4%, serine 4%, leucine 3%, valine 2%, phenylalanine 2%, threonine 2%, isoleucine 1%,hydroxylysine 1%, methionine and histidine 1% and tyrosine 0.5%. These values vary, especially the minor constituents, depending on the source of the raw material and processing technique.

Gelatin is one of the few foods that cause a net loss of protein if eaten exclusively. In the 1970s, several people died of malnutrition while on popular liquid protein diets. For decades, gelatin has been touted as a good source of protein. It has also been said to strengthen nails and hair. However, there is little scientific evidence to support such an assertion, one which may be traced back to Knox's revolutionary marketing techniques of the 1890s, when it was advertised that gelatin contains protein and that lack of protein causes dry, deformed nails. In fact, the human body itself produces abundant amounts of the proteins found in gelatin. Furthermore, dry nails are usually due to a lack of moisture, not protein. Several Russian researchers offer the following opinion regarding certain peptides found in gelatin: "gelatin peptides reinforce resistance of the stomach mucous tunic to ethanol and stress action, decreasing the ulcer area by twice." Gelatin has also been claimed to promote general joint health. A study at BallState University, sponsored by Nabisco (the former parent company of Knox gelatin), found that gelatin supplementation relieved knee joint pain and stiffness in athletes. These results have not yet been replicated by other researchers.

9. Safety concerns

Due to bovine spongiform encephalopathy (BSE), also known as "mad cow disease", and its link to new variant Creutzfeldt-Jakob disease (vCJD), there has been much concern about using gelatin derived from possibly infected animal parts. One study released in 2004, however, demonstrated that the gelatin production process destroys most of the BSE prions that may be present in the raw material. However, more detailed recent studies regarding the safety of gelatin in respect to mad cow disease have prompted the U.S. Food and Drug Administration to re-issue a warning and stricter guidelines for the sourcing and processing of gelatin to reduce the potential risk posed by Bovine Spongiform Encephalopathy from 1997. An alternative source for gelatin could be fish gelatin from for example cat fish, Tilapia species or Trachurus species. Other advantages over gelatin from pigs or cows is the absence of issues for preparing food because of religious reasons.

10. Popular types of garden salads

- Caesar salad
- Chef salad

- Chinese chicken salad
- Cobb salad
- Greek salad
- Michigan salad
- Dressings

A green salad is often served with a dressing. Some examples include:

- Balsamic vinegar
- Caesar dressing
- Creamy mayonnaise or yoghurt-based dressings:
- Bleu cheese or blue cheddar dressing
- Louis dressing
- Ranch dressing
- Russian dressing
- Honey Dijon
- Thousand Island dressing
- Oil and vinegar, lemon, or soy sauce based dressings:
- French dressing
- Italian dressing
- Vinaigrette
- Wafu dressing
- Tahini
- Hummus

The concept of salad dressing varies across cultures. There are many commonly used salad dressings in North America. Traditional dressings in southern Europe are vinaigrettes, while mayonnaise is predominant in eastern European countries and Russia. In Denmarkdressings are often based on crme frache. In China, where Western salad is a recent adoption from Western cuisine, the term salad dressing (沙拉酱,shalajiang) tends to refer to mayonnaise or mayonnaise-based dressings. Many light edible oils are used as salad dressings, including olive oil, corn oil, soybean oil, safflower oil, etc.

11. Garnishes

There are various vegetables and other fare that are often added to garden salads. Some of them are:

A Green Salad

- anchovies
- bacon bits (real or imitation)
- beetroot
- bell peppers
- grated carrots
- cress
- croutons
- cucumbers
- fresh parsley
- mushrooms
- onions (often red onions)
- radishes
- sunflower seeds (shelled)
- surimi - artificial crab meat
- tomatoes

Again, individual taste usually governs the choice of salad garnishes. i like to have on my salad a nice fresh garnish and some vinegarette dressing YUM YUM pigs back side .

Other types of salad

12. Fresh Vegetables

Some salads are based on food items other than fresh vegetables:

- Antipasto salad
- Bean salad
- Blackford Salad
- Caesar salad
- Chef salad
- Chicken salad
- Chinese chicken salad
- Cobb salad
- Coleslaw
- Congealed salad
- Crab Louie salad
- Egg salad
- Eggplant salad
- Fattoush
- Fruit salad
- Greek salad
- Ham salad
- Israeli salad
- Larb, from Laos
- Milner salad
- Maritz salad
- Michigan salad
- Nioise salad
- Panzanella
- Pasta salad
- Pea salad
- Polish salad
- Potato salad
- Russian salad
- Pretzel salad

- Ivanov Salad
- Salmagundi

Sesame Noodle Salad

- Shopska salad from Bulgaria
- Somen salad from Japan
- Som tam (Thai □□□□□) or Green Papaya Salad from Thailand
- Gỏi ng sen - a Vietnamese salad
- Gỏi c sanh cầm - from Hue province,Vietnam
- Gỏi c trch - from Phu Quoc island, Kien Giang province, Vietnam
- Nộm rau muống - from northern Vietnam; made with Ipomoea aquatica
- Nộm hoa chuối - from northern Vietnam
- Thịt g x phay - from Vietnam
- Tabouli
- Taco salad
- Tuna salad
- Tuna salad nioise
- Waldorf salad
- Watergate salad
- History
- The diarist John Evelyn wrote a book on salads, Acetaria: A Discourse on Sallets (1699), that describes the new salad greens like "sellery" (celery), coming out of Italy and the Netherlands.

In Section 4 of this course you will cover these topics:

- Dairy Products And Eggs
- Meat, Poultry And Seafood

Topic : Dairy Products And Eggs

Topic Objective:

At the end of the topic student will be able to understand:

- History
- Preservation
- Substitutes
- Problems with cooking
- Flavour
- Chicken Eggs
- Egg
- Cream
- Milk

Definition/Overview:

Dairy products are generally defined as foodstuffs produced from milk. They are usually high-energy-yielding food products. A production plant for such processing is called a dairy or a dairy factory. Raw milk for processing generally comes from cows, but occasionally from other mammals such as goats, sheep, water buffalo, yaks, or horses. Dairy products are commonly found in European, Middle Eastern and Indian cuisine, whereas they are almost unknown in East Asian cuisine.

Key Points:

1. Milk

- Milk, after optional homogenization, pasteurization, in several grades of bacteria Streptococcus lactis and Leuconostoc citrovorum
- Crme frache, slightly fermented cream
- Smetana, Central and Eastern European variety of sour cream
- Clotted cream, thick spoonable cream made by heating

- Cultured buttermilk, fermented concentrated (water removed) milk using the same bacteria as sour cream
- Milk powder (or powdered milk), produced by removing the water from milk
- Whole milk & buttermilk
- Skim milk

2. Cream

Cultured and confectionery powders

- Condensed milk, milk which has been concentrated by evaporation, often with sugar added for longer life in an opened can
- Evaporated milk, (less concentrated than condensed) milk without added sugar
- Ricotta cheese, milk heated and reduced in volume, known in Indian cuisine as Khoa
- Infant formula, dried milk powder with specific additives for feeding human infants
- Baked milk, a variety of boiled milk that has been particularly popular in Russia
- Butter, mostly milk fat, produced by churning cream
- Buttermilk, the liquid left over after producing butter from cream, often dried as livestock food

3. Egg

An egg is a round or oval body laid by the female of many animals, consisting of an ovum surrounded by layers of membranes and an outer casing, which acts to nourish and protect a developing embryo and its nutrient reserves. Most edible eggs, including bird eggs and turtle eggs, consist of a protective, oval eggshell, the albumen (egg white), the vitellus (egg yolk), and various thin membranes. Every part is edible, although the eggshell is generally discarded. Nutritionally, eggs are considered a good source of protein and choline. Bird eggs are a common food and one of the most versatile ingredients used in cooking. They are important in many branches of the modern food industry. The most commonly used bird eggs are those from the chicken. Duck and goose eggs, and smaller eggs such as quail eggs are occasionally used as a gourmet ingredient, as are the largest bird eggs, from ostriches. Gull eggs are considered a delicacy in England, as well as in Scandinavian countries, particularly in Norway. In some African countries, guineafowl eggs are commonly seen in marketplaces, especially in the spring

of each year. Pheasant eggs and emu eggs are perfectly edible but less widely available. Sometimes they are obtainable from farmers, poulterers, or luxury grocery stores. Most wild bird's eggs are protected by laws in many countries, which prohibit collecting or selling them, or only permit these during specific periods of the year.

4. Chicken Eggs

Most commercially produced chicken eggs intended for human consumption are unfertilized, since the laying hens are kept without roosters. Fertile eggs can be purchased and eaten as well, with little nutritional difference. Fertile eggs will not contain a developed embryo, as refrigeration prohibits cellular growth for an extended amount of time. Chicken eggs are widely used in many types of dishes, both sweet and savory. Eggs can be pickled, hard-boiled, scrambled, fried and refrigerated. They can also be eaten raw, though this is not recommended for people who may be especially susceptible to salmonella, such as the elderly, the infirm, or pregnant women. In addition, the protein in raw eggs is only 51% bio-available, whereas that of a cooked egg is nearer 91% bio-available, meaning the protein of cooked eggs is nearly twice as absorbable as the protein from raw eggs.As an ingredient egg yolks are important emulsifier in the kitchen, and the proteins in eggs white makes all kinds of foams and aerated dishespossible.

Quail eggs are considered a delicacy in many countries. They are used raw or cooked as tamago in sushi. In Colombia, quail eggs are considered less exotic than in other countries, and a single hard-boiled quail egg is a common topping on hot dogs and hamburgers, often fixed into place with a toothpick. A boiled egg can be distinguished from a raw egg without breaking the shell by spinning it. A hard-boiled egg's contents are solid due to the denaturation of the protein, allowing it to spin freely, while viscous dissipation in the liquid contents of a raw egg causes it to stop spinning within approximately three rotations. The albumen, or egg white contains protein but little or no fat. It is used in cooking separately from the yolk, and can be aerated or whipped to a light, fluffy consistency. The albumen is the healthiest bit of the egg. Beaten egg whites are used in desserts such as meringues and mousse. Ground egg shells are sometimes used as a food additive to deliver calcium. Boiled eggs that are difficult to peel are usually too fresh. Fresh eggs have a lower pH, and this does not allow the shell to

separate easily from the underlying albumen. When put into vinegar the shell will dissolve slowly.

5. Flavour

Although the age of egg and the conditions of its storage have a greater influence, the bird's diet does affect the flavor of egg. For example, when a brown-egg chicken breed eats rapeseed or soy meals, its intestinal microbes metabolize them into fishy-smelling triethylamine, which ends up in the egg. The unpredictable diet of free-range hens will produce unpredictable eggs.

6. Problems with cooking

If a boiled egg is overcooked, a greenish ring sometimes appears around egg yolk. This is a manifestation of the iron and sulfur compounds in the egg. It can also occur when there is an abundance of iron in the cooking water. The green ring does not affect the egg's taste; overcooking, however, harms the quality of the protein (chilling the egg for a few minutes in cold water until the egg is completely cooled prevents the greenish "ring from forming on the surface of the yolk).

Cooking also increases the risk of atherosclerosis due to increased oxidization of the cholesterol contained in the egg yolk.

7. Substitutes

For those who do not consume eggs, alternatives used in baking include other rising agents or binding materials, such as ground flax seeds or potato flour. Tofu can also act as a partial binding agent, since it is high in lecithin due to its soy content. Applesauce can be used as well as arrowroot and banana. Extracted soybean lecithin, in turn, is often used in packaged foods as an inexpensive substitute for egg-derived lecithin.

Other egg substitutes are made from just the white of the egg for those who worry about the high cholesterol and fat content in eggs. These products usually have added vitamins and minerals as well as vegetable-based emulsifiers and thickeners such as xantham gum or guar gum. These allow the product to maintain the nutrition found in an egg as well as several culinary properties of real eggs. This makes it possible for food like Hollandaise

sauce, custard, mayonnaise, as well as most baked goods to be prepared using these substitutes.

8. Preservation

The simplest method to preserve an egg is to treat it with salt. Salt draws water out of bacteria and molds, which prevents their growth. The Chinese salted duck egg is made by immersing duck eggs in brine, or coating them individually with a paste of salt and mud or clay. The eggs stop absorbing salt after about a month, having reached chemical equilibrium. Their yolks become an orange-red colored solid, but the white remains liquid. They are boiled before consumption and often served with rice congee.

Another method is to make pickled eggs, by boiling them first and immersing them in a mixture of vinegar, salt, and spices like ginger or allspice. Frequently, beetroot juice is added to impart a red color to the eggs. If the eggs are immersed in it for a few hours, the distinct red, white, and yellow colors can be seen when the eggs are sliced. If marinated for several days or more, the red color will reach to the yolk.If the eggs are marinated in the mixture for several weeks or more, vinegar's acetic acid will dissolve much of the shell's calcium carbonate and penetrate the egg, making it acidic enough to inhibit the growth of bacteria and molds. Pickled eggs made this way will generally keep for a year or more without refrigeration.

A century egg or thousand-year-old egg is preserved by fermenting an egg in a mixture of clay, wood ash, salt, lime, and rice straw for several weeks to several months, depending on the method of processing. After the process is completed, the yolk becomes a dark green, cream-like substance with a strong odor of sulfur and ammonia, while the white becomes a dark brown, transparent jelly with a comparatively mild, distinct flavor. The transforming agent in a century egg is its alkaline material, which gradually raises the pH of the egg from around 9 to 12 or more. This chemical process causes an "inorganic

version" of fermentation, which breaks down some of the complex, flavorless proteins and fats of the yolk into simpler, flavorful ones.

9. History

Bird eggs have been valuable foodstuff since prehistory, in both hunting societies and more recent cultures where birds were domesticated. In Thebes, Egypt, the tomb of Haremhab, built about 1420 BCE, shows a depiction of a man carrying bowls of ostrich eggs and other large eggs, presumably those of the pelican, as offerings. In ancient Rome, eggs were preserved using a number of methods, and meals often started with an egg course. The Romans crushed the shell in their plate to prevent evil spirits from hiding there. In the Middle Ages, eggs were forbidden during Lent because of their richness. It is possible that the word mayonnaise was derived from moyeu, the medieval French word for the yolk meaning center or hub. Egg scrambled with acidic fruit juices were popular in France in the 17th century; this may have been the origin of lemon curd.

The dried egg industry developed in the 19th century, before the rise of the frozen egg industry. In 1878, a company in St. Louis, Missouristarted to transform egg yolk and white into a light-brown, meal-like substance by using a drying process. The production of dried eggs significantly expanded during World War II, for use by the United States Armed Forces and its allies. The egg carton was invented by Joseph Coyle in Smithers, British Columbia, to solve a dispute about broken eggs between a farmer inBulkley Valley and the owner of the Aldermere Hotel. Early egg cartons were made of paper.

Topic : Meat, Poultry And Seafood

Topic Objective:

At the end of the topic student will be able to understand:

- Examples of types of poultry
- Poultry

- Meat
- Seafood

Definition/Overview:

Meat is prepared in many ways, as steaks, in stews, fondue, or as dried meat. It may be ground then formed into patties (as hamburgers or croquettes), loaves, or sausages, or used in loose form (as in "sloppy joe" or Bolognese sauce). Some meat is cured, by smoking, pickling, preserving in salt or brine (see salted meat and curing). Other kinds of meat are marinated and barbecued, or simply boiled, roasted, or fried. Meat is generally eaten cooked, but there are many traditional recipes that call for raw beef, veal or fish. Meat is often spiced or seasoned, as in most sausages. Meat dishes are usually described by their source (animal and part of body) and method of preparation. Meat is a typical base for making sandwiches. Popular varieties of sandwich meat include ham, pork, salami and other sausages, and beef, such as steak, roast beef, corned beef, and pastrami. Meat can also be molded or pressed (common for products that include offal, such as haggis and scrapple) and canned. All muscle tissue is very high in protein, containing all of the essential amino acids, and in most cases, is a good source of zinc, vitamin B12, selenium, phosphorus, niacin, vitamin B6, iron and riboflavin. However, meat tends to be high in fat (red meat in particular), low in carbohydrates, and contains no fiber. The fat content of meat can vary widely depending on the species and breed of animal, the way in which the animal was raised, including what it was fed, the anatomical part of the body, and the methods of butchering and cooking. Wild animals such as deer are typically leaner than farm animals, leading those concerned about fat content to choose game such as venison. However, centuries of breeding meat animals for size and fatness is being reversed by consumer demand for meat with less fat.In recent years, the health benefits of meat as a regular part of the human diet have come into question. In a large-scale study, the consumption of red meat over a lifetime was found to raise the risk of cancer by 20 to 60 percent, while causing adverse mutations in DNA. In particular, red meat and processed meat were found to be associated with higher risk of cancers of the lung, esophagus, liver, and colon, among others. Animal fat is one of the only dietary sources of saturated fat, which have been linked to various health problems, including heart disease, bowel cancer, prostate cancer, breast cancer, osteoporosis, and arteriosclerosis. One famous study, the Nurses' Health Study, followed about 100,000 female nurses and their eating habits. Nurses who ate the largest amount of animal fat were twice as likely to develop colon

cancer as the nurses who ate the least amount of animal fat.In response to changing prices as well as health concerns about saturated fat and cholesterol, consumers have altered their consumption of various meats. A USDA report points out that consumption of beef in the United States between 19701974 and 19901994 dropped by 21%, while consumption of chicken increased by 90%. During the same period of time, the price of chicken dropped by 14% relative to the price of beef. In 1995 and 1996, beef consumption increased due to higher supplies and lower prices.Meat, like any food, can also transmit certain diseases, but undercooked meat is especially susceptible. Undercooked pork sometimes contains the parasites that cause trichinosis or cysticercosis. Chicken is often contaminated with Salmonella enterica disease-causing bacteria. Minced beef can be contaminated during slaughter with disease-causing Escherichia coli O157:H7 deriving from the intestinal tract if proper precautions are not taken.Poultry is the category of domesticated birds kept for meat, eggs, and feathers. These most typically are members of the superorder Galloanserae (fowl), especially the order Galliformes (which includes chickens and turkeys) and the family Anatidae (in order Anseriformes), commonly known as "waterfowl" (e.g. domestic ducks and domestic geese). Poultry also include other meat birds such as pigeons or doves or game birds like pheasants. The term also refers to the flesh of such birds.

Key Points:

1. Seafood

Seafood is any sea animal or seaweed that is served as food or is suitable for eating, particularly seawater animals, such as fish and shellfish (including mollusks and crustaceans). By extension, in North America although not generally in the United Kingdom, the term seafood is also applied to similar animals from fresh water and all edible aquatic animals are collectively referred to as seafood. Edible seaweeds are also seafood, and are widely eaten around the world. See the category of sea vegetables. The harvesting of seafood is known as fishing and the cultivation of seafood is known as aquaculture, Mari culture, or simply fish farming. Seafood is a source of protein in many diets around the world. Research into population trends of various species of seafood is pointing to a global collapse of seafood species by 2048. Such a collapse would occur due to pollution and over fishing, threatening oceanic ecosystems, according to some researchers. A major international scientific study released in November 2006 in the

journal Science found that about one-third of all fishing stocks worldwide have collapsed (with a collapse being defined as a decline to less than 10% of their maximum observed abundance), and that if current trends continue all fish stocks worldwide will collapse within fifty years.The FAO State of World Fisheries and Aquaculture 2004 report estimates that in 2003, of the main fish stocks or groups of resources for which assessment information is available, "approximately one-quarter were overexploited, depleted or recovering from depletion (16%, 7% and 1% respectively) and needed rebuilding."Advocacy organizations such as the National Fisheries Institute, however, disagree with such findings and assert that currently observed declines in fish population are due to natural fluctuations and that enhanced technologies will eventually alleviate whatever impact humanity is having on oceanic life. The use of large industrial monoculture that is common in industrialised agriculture, typically for feed crops such as corn and soy is more damaging to ecosystems than more sustainable farming practices such as organic farming, permaculture, arable, pastoral, and rain-fed agriculture.Animals fed on grain and those which rely on grazing need more water than grain crops. According to the USDA, growing crops for farm animals requires nearly half of the U.S.water supply and 80% of its agricultural land. Animals raised for food in the U.S. consume 90% of the soy crop, 80% of the corn crop, and 70% of its grain. In tracking food animal production from the feed through to the dinner table, the inefficiencies of meat, milk and egg production range from a 4:1 energy input to protein output ratio up to 54:1. The result is that producing animal-based food is typically much less efficient than the harvesting of grains, vegetables, legumes, seeds and fruits, though this might not be largely true for animal husbandry in parts of the developing world where factory farming is almost non existent, making animal based food much more sustainable.

2. Meat

In modern English usage, meat most often refers to animal tissue used as food, mostly skeletal muscle and associated fat, but it may also refer to organs, including livers, skin, brains, bone marrow, kidneys, in some countries lungs, and a variety of other internal organs as well as blood. The word meat is also used by the meat packing and butchering industry in a more restrictive sensethe flesh of mammalian species (pigs, cattle, etc.) raised and prepared for human consumption, to the exclusion of fish, poultry, and eggs. Eggs and seafood are rarely referred to as meat even though they consist of animal tissue.

3. **Poultry**

Poultry is the category of domesticated birds which some people keep for the purpose of collecting their eggs, or kill for their meat and/or feathers. These most typically are members of the superorder Galloanserae (fowl), especially the order Galliformes (which includes chickens and turkeys) and the family Anatidae (in order Anseriformes), commonly known as "waterfowl" (e.g. domestic ducks and domestic geese). Poultry also include other birds which are killed for their meat, such as pigeons or doves or birds considered to be game, like pheasants. The term also refers to the flesh of such birds.

4. **Examples of types of poultry**

Bird	**Wild ancestor**	**Domestication**	**Killed or used for**
Chicken	Red Junglefowl	India, c. 3000 BC	meat, feathers, eggs, ornamentation
Duck	Mallard/Muscovy Duck	various	meat, feathers, eggs
Goose	Greylag Goose/Swan Goose	various	meat, feathers, eggs
Indian peafowl	Indian Peafowl	various	meat, feathers, ornamentation, landscaping
Mute swan	Mute Swan	various	feathers, eggs, landscaping
Turkey	Wild Turkey	Mexico	meat, feathers
Domesticated guineafowl	Helmeted guineafowl	Africa	meat, pest consumption, and alarm calling
Common pheasant	Common pheasant	Eurasia	meat, mainly ornamental
Golden pheasant	Golden pheasant	Eurasia	meat, mainly ornamental

[Figure 2]

In Section 5 of this course you will cover these topics:

- Beverages
- Food Preservation

Topic : Beverages

Topic Objective:

At the end of the topic student will be able to understand:

- Distilled beverages
- Chemical Analysis
- Beverages

Definition/Overview:

An alcoholic beverage is a drink containing ethanol, commonly known as alcohol although in chemistry the definition of alcohol includes many other compounds. Alcoholic beverages are divided into three general classes: beers, wines, and spirits. Ethanol is a psychoactive drug that has a depressant effect. Most countries restrict and regulate its sale and consumption; for example, they place legal drinking-age restrictions upon the sale of alcoholic drinks to young people. The manufacture and consumption of alcohol is found to some degree in most cultures and societies around the world, from hunter-gatherer peoples to nation-states. The drinking of alcoholic beverages is very often an important part of social events in such societies, and it can be an important aspect of a communitys culture. Ethanol is only slightly toxic compared to other alcohols, but has significant psychoactive effects. Significant blood alcohol content may be considered legal drunkenness as it reduces attention and slows reaction speed. Alcoholic beverages can be addictive and the state of addiction to ethanol is known as alcoholism. Ethanol (CH3CH2OH), the active ingredient in alcoholic drinks, for consumption purposes is always produced by fermentationthe metabolism of carbohydrates by certain species of yeast in the absence of oxygen. The process of culturing yeast under alcohol-producing conditions is referred to as brewing. The same process produces carbon dioxide in situ, and may be used to carbonate the drink. However, this method leaves yeast

residues and on the industrial scale, carbonation usually is done separately. Drinks with a concentration of more than 50% ethanol by volume (100 US proof) are flammable liquids and easily ignited. Some exotic drinks gain their distinctive flavors through intentional ignition, such as the Flaming Dr Pepper. Spirits with a higher proof (ABV in UK is roughly half of proof number) can be ignited with ease by heating slightly, e.g. adding the spirit to a warmed shot glass.In chemistry, alcohol is a general term for any organic compound in which a hydroxyl group (-OH) is bound to a carbon atom, which in turn may be bound to other carbon atoms and further hydrogens. Other alcohols such as propylene glycol and the sugar alcohols may appear in food or beverages regularly, but these alcohols do not make them "alcoholic". Methanol (one carbon), the propanols (three carbons giving two isomers), and the butanols (four carbons, four isomers) are all commonly found alcohols, and none of these three should ever be consumed in any form. Alcohols are toxicated into the corresponding aldehydes and then into the corresponding carboxylic acids. These metabolic products cause a poisoning and acidosis. In the case of other alcohols than ethanol, the aldehydes and carboxylic acids are poisonous and the acidosis can be lethal. In contrast, fatalities from ethanol are mainly found in extreme doses and related to induction of unconsciousness or chronic addiction (alcoholism).Humans can metabolize ethanol as an energy-providing nutrient. Ethanol is metabolized into acetaldehyde and then into acetic acid. Acetic acid is esterified with coenzyme A to produce acetyl CoA. Acetyl CoA carries the acetyl moiety into the citric acid cycle, which produces energy by oxidizing the acetyl moiety into carbon dioxide. Acetyl CoA can also be used for biosynthesis. Acetyl CoA is an intermediate common with the metabolism of sugars and fats, and it is the product of glycolysis, the breakdown of glucose.When compared to other alcohols, ethanol is only slightly toxic, with a lowest known lethal dose in humans of 1400 mg/kg, and a LD50 of 9000 mg/kg (oral, rat). Nevertheless, accidental overdosing of alcoholic drinks, especially those of concentrated variety, is a risk for women, lightweight persons and children. These people have a smaller quantity of water in their bodies, so that alcohol is diluted less. A blood alcohol concentration of 50 to 100 mg/dL may be considered legal drunkenness (laws vary by jurisdiction). The threshold of effects is at 22 mg/dL. Alcohol affects the gamma-aminobutyric acid (GABA) receptors, to produce a depressant (neurochemical inhibitory) effect. Other psychoactives affecting the GABA receptor include gamma-hydroxybutyric acid, barbiturates and benzodiazepines. "GABA has been implicated, both directly and indirectly, in the pathogenesis of Huntington's disease, Parkinsonism, epilepsy, schizophrenia, tardive dyskinesias, and senile dementia, as well as several other behavioral disorders." Excessive consumption of alcohol leads to a

toxication-induced delayed poisoning called hangover (in Latin, crapula refers to intoxication and hangover) and represents the inhibited state of the brain in the initial phases of addiction. Various factors contribute, including the toxication of ethanol itself to acetaldehyde, the direct toxic effects and toxication of impurities called congeners, and dehydration. Hangover starts after the euphoric effects of alcohol itself have subsided, typically in the night and morning after alcoholic drinks were consumed. However, the blood alcohol concentration may still be substantial and above the limits imposed for drivers and operators of other dangerous equipment. Hangover subsides during the day. Various treatments, many of them pseudoscientific, are presented to "cure hangover". However, activities such as driving are still dangerous. The concentration of alcohol in a drink may be specified in percent alcohol by volume (ABV), in percentage by weight (sometimes abbreviated w/w for weight for weight), or in proof. In the USA, the 'proof' measurement is twice the percentage of alcohol by volume at 60 degrees Fahrenheit (e.g., 80 proof = 40% ABV). Degrees proof were formerly used in the UKwhere 100 degrees proof was 57.1% ABV (historically, the most dilute spirit which would sustain the combustion of gunpowder). Common distillation cannot exceed 191.2 proof (USA) because at that point ethanol is an azeotrope with water. Alcohols of this purity are commonly referred to as grain alcohol and are not meant for human consumption, with the notable exception of neutral grain spirits.Most yeasts cannot grow when the concentration of alcohol is higher than about 18% by volume, so that is a practical limit for the strength of fermented beverages such as wine, beer, and sake. Strains of yeast have been developed that can survive in solutions of up to 25% alcohol by volume, but these were bred for ethanol fuel production, not beverage production. Spirits are produced by distillation of a fermented product, concentrating the alcohol and eliminating some of the by-products. Fortified wines are produced by adding brandy or other distilled spirits to achieve higher ABV than is easily reached using fermentation alone. Unsweetened alcoholic beverages based on distilled alcohol with a percentage of alcohol greater than perhaps 30% are referred to as spirits. Sweet beverages with high alcohol content are usually called liqueurs. Spirits are sometimes added to wines (port, sherry), creating fortified wines.

Key Points:

1. Beverages

Ethanol is a moderately good solvent for many fatty substances and essential oils, and thus facilitates the inclusion of several coloring, flavoring and/or aromatic compounds to alcoholic beverages, especially to distilled ones. These flavoring ingredients may be naturally present in the starting material, or may be added before fermentation, before distillation, during distillation (gin) or before bottling the distilled product. Sometimes the flavor is obtained by allowing the beverage to stand for months or years in oak barrels, normally American or French oak, sometimes charred (bourbon), sometimes already used for aging a different spirit, wine or fortified wine. Occasionally, in the bottle herbs or fruits have been inserted to flavor the final product.

2. Chemical Analysis

Chemical analysis of traces absorbed and preserved in pottery jars from the Neolithic village of Jiahu, in Henan province, Northern China, have revealed that a mixed fermented beverage of rice, honey, and fruit was being produced as early as 9,000 years ago. This is approximately the same time that barley beer and grape wine were beginning to be made in the Middle East. Recipes have been found on clay tablets and art in Mesopotamiathat show individuals using straws to drink beer from large vats and pots. The Hindu Ayurvedic texts describe both the beneficent uses of alcoholic beverages and the consequences of intoxication and alcoholic diseases. Most of the peoples in India and China, have continued, throughout, to ferment a portion of their crops and nourish themselves with the alcoholic product. However, devout adherents of Buddhism, which arose in India in the 5th and 6th centuries BC and spread over southern and eastern Asia, abstain to this day, as do devout Hindus and Sikhs. In Mesopotamia and Egypt, the birthplace of beer and wine, Islam is now the predominant religion, and it also prohibits the drinking and even the handling of alcoholic beverages. Wine was consumed in Classical Greece at breakfast or at symposia, and in the 1st century BC it was part of the diet of most Roman citizens. However, both Greeks and Romans generally consumed diluted wine (with strengths varying from 1 part wine and 1 part water to 1 part wine and 4 parts water). The transformation of water into wine at the wedding at Cana is the first of the miracles attributed to Jesus in the New Testament, and his use of wine in the Last

Supper led to it becoming an essential part of the Eucharist rite in most Christian traditions (see Christianity and alcohol).In Europe during the Middle Ages, beer was consumed by the whole family, thanks to a triple fermentation process the men had the strongest, then women, then children. A document of the times mentions nuns having an allowance of six pints of ale a day. Cider and pomace wine were also widely available, while grape wine was the prerogative of the higher classes.By the time the Europeans reached the Americas in the 15th century, several native civilizations had developed alcoholic beverages. According to a post-Conquest Aztec document, consumption of the local "wine" (pulque) was generally restricted to religious ceremonies, but freely allowed to those over 70 years old. The natives of South Americamanufactured a beer-like product from cassava or maize (cauim, chicha), which had to be chewed before fermentation in order to turn the starch into sugars. This chewing technique was also used in ancient Japan to make sake from rice and other starchy crops.The medicinal use of alcohol was mentioned in Sumerian and Egyptian texts dated from 2100 BC or earlier. The Hebrew Bible recommends giving alcoholic drinks to those who are dying or depressed, so that they can forget their misery (Proverbs 31:6-7).

3. Distilled beverages

The distillation of alcohol can be traced back to China, Central Asia and the Middle East. In particular, Muslim chemists were the first to produce fully purified distilled alcohol. It later spread to Europe in the mid-12th century, and by the early 14th century it had spread throughout the continent. It also spread eastward, mainly due to the Mongols, and began in China no later than the 14th century. However, recent archaeological evidence suggests that inChinathe practice of distillation may date back to 5000 BC. Paracelsus gave alcohol its modern name, taking it from the Arabic word which means "finely divided", a reference to distillation. In many countries, alcoholic beverages are commonly consumed at the major daily meals (lunch and dinner).In places and areas with poor public sanitation, such as Medieval Europe, consumption of alcoholic drinks (particularly weak or "small" beer) was one method of avoiding water-borne diseases such as cholera. Though alcohol kills bacteria, the low concentration in beer or even wine will have only a limited effect. Probably the boiling of water, which is required for the brewing of beer, and the growth of yeast, which would tend to crowd out other micro-organisms, were more important than the alcohol itself. Additionally, the ethanol (and possibly other

ingredients) of alcoholic beverages allows them to be stored for months or years in simple wood or clay containers without spoiling; for this reason they were commonly utilized onboard sailing vessels as a key (or even the sole) source of hydration for the crew, especially during the long voyages of the early modern period.In colder climates, strong alcoholic beverages such as vodka are popularly seen as a way to "warm up" the body, possibly because ethanol is a quickly absorbed source of food energy and because it dilates peripheral blood vessels (Peripherovascular dilation) a dangerous misconception, as the perception of warmth is actually caused by the transfer of heat from the body's core to its extremities where it is quickly lost to the environment.In many cultures, both contemporary and historical, alcoholic beverages mostly because of their neurological effects have also played an important role in various kinds of social interaction, providing a form of "liquid courage" (those who consume it typically gain confidence and lose discretion). While other psychoactive drugs (such as opium, coca, khat, cannabis, kava-kava, etc.) also have millennial traditions of social use, only coffee, tea, betel, and tobacco are currently as universally used and accepted as ethanol.

In many countries, production of alcoholic beverages requires a license, and alcohol production is taxed.In the United States, the sale of alcoholic beverages is controlled by the individual States, the counties or parishes within each State, and then by local jurisdictions within counties. For example: in most of North Carolina, beer and wine may be purchased in retail stores, but distilled spirits are only available at State ABC (Alcohol Beverage Control) stores. In Maryland, distilled spirits are available in liquor stores except in Montgomery Country where the County runs the ABC stores. A county that prohibits the sale of alcohol is known as a dry county.In most States, individuals may freely produce wine and beer usually up to 100 gallons per adult, but no more than 200 gallons per household for personal consumption (but not for sale). However, in St. Mary's County, Maryland a 'bono fide' resident may sell beer and native wines from their home.The production of distilled beverages is regulated and taxed. The Bureau of Alcohol, Tobacco, Firearms, and Explosives and the Alcohol and Tobacco Tax and Trade Bureau (formerly one organization known as the Bureau of Alcohol, Tobacco and Firearms) enforce federal laws and regulations related to alcohol. Illegal manufacture of distilled liquor is often referred to as "moonshining", and the product, which is not aged and contains a high percentage of alcohol, is often called "white lightning".All alcoholic product packaging must contain a health warning from the Surgeon General.In the UK,

the Customs and Excise department issues distilling licenses.In New Zealand it is legal to produce any form of alcohol for personal use, including spirits. This has made the sale and use of home distillation equipment popular. The same is true of many U.S. states, including Missouri.

Topic : Food Preservation

Topic Objective:

At the end of the topic student will be able to understand:

- High pressure food preservation
- Burial in the ground
- Modified atmosphere
- Irradiation
- Jugging
- Canning
- Canning and bottling
- Lye
- Pickling
- Sugar
- Salt
- Vacuum packing
- Freezing
- Smoking
- Drying
- Preservation processes
- Food preservation

Definition/Overview:

Canning is a method of preserving food in which the food is processed and sealed in an airtight container. The process was first developed as a French military discovery. The container prevents microorganisms from entering and proliferating inside.To prevent the food from being spoiled before and during containment, quite a number of methods are used: pasteurization, boiling, other means of high temperature applied over a period of time, refrigeration, outright freezing, drying, vacuum treatment, antimicrobial agents that are natural to the indegenous recipe of the foodstuff being preserved, or otherwise are applied to the contents of the can, a sufficient dose of ionizing radiation, submersion in a strongly saline, acid, base, osmotically extreme (e.g. very sugary) or otherwise microbially challenging environments.No such countermeasure is perfectly dependable as a preservative. E.g. spore-forming thermo-resistant microorganisms, such as Clostridium botulinum (the causative agent of botulism) can still survive.From a public safety point of view, foods with low acidity, i.e. pH more than 4.6 need sterilization under high temperature (116-130C). Foods that must be pressure canned include most vegetables, meats, seafood, poultry, and dairy products. The only foods that may be safely canned in an ordinary boiling water bath are highly acidic ones with a pH below 4.6, such as fruits, pickled vegetables, or other foods to which acidic additives have been added.

Modern double seams provide an airtight seal to the tin can. This airtight nature is crucial to keeping bacteria out of the can and keeping its contents sealed inside. Thus, double seamed cans are also known as Sanitary Cans. Developed in 1900 in Europe, this sort of can was made of the traditional cylindrical body made with tin plate; however, the two ends (lids) were attached using what is now called a double seam. A can thus sealed is impervious to the outside world by creating two tight continuous folds between the cans cylindrical body and the lid at each end. This eliminated the need for solder and allowed improvements in the speed of manufacturing, thereby lowering the cost. Double seams make extensive use of rollers in shaping the can, lid and the final double seam. To make a sanitary can and lid suitable for double seaming, manufacture begins with a sheet of coated tin plate. To create the can body rectangles are cut and curled around a die and welded together creating a cylinder with a side seam. Rollers are then used to flare out one or both ends of the cylinder to create a quarter circle flange around the circumference. Great care and precision are required to ensure that the welded sides are perfectly aligned; as any misalignment will mean

that the shape of the flange is inconsistent, compromising its integrity. A circle is then cut from the sheet using a die cutter. The circle is shaped in a stamping press to create a downward countersink to fit snugly in to the can body. The result can be compared to an upside down and very flat top hat. The outer edge is then curled down and around approximately 140 degrees using rollers creating the end curl. The final result is a steel tube with a flanged edge, and a countersunk steel disc with a curled edge. A rubber compound is put inside the curl.

Most liquids freeze by crystallization, formation of crystalline solid from the uniform liquid. This is a first-order thermodynamic phase transition, which means that as long as solid and liquid coexist, the equilibrium temperature of the system remains constant and equal to the melting point. Crystallization consists of two major events, nucleation and crystal growth. Nucleation is the step where the molecules start to gather into clusters, on the nanometer scale, arranging in a defined and periodic manner that defines the crystal structure. The crystal growth is the subsequent growth of the nuclei that succeed in achieving the critical cluster size.

Key Points:

1. Food preservation

Food preservation is the process of treating and handling food in a way that preserves its value as food. The main effort is to stop or greatly slow down spoilage to prevent foodborne illness (e.g. salting, cooling, cooking). However some methods utilise benign bacteria, yeasts or fungi to add specific qualities and to preserve food (e.g. cheese, wine). While maintaining or creating nutritional value, texture and flavour is important in preserving its value as food; this is a culturally dependent determinant as what qualifies as food fit for humans in one culture may not qualify in another culture. Preservation usually involves preventing the growth of bacteria, fungi and other micro-organisms, as well as retarding the oxidation of fats which cause rancidity. It also includes processes to inhibit natural ageing and discolouration that can occur during food preparation such as the enzymatic browning reaction in apples which causes browning when apples are cut. Some preservation methods require the food to be sealed after treatment to prevent re-contamination with microbes; others, such as drying, allow food to be stored without any

special containment for long periods. Common methods of applying these processes include drying, spray drying, freeze drying, freezing, vacuum-packing, canning, preserving in syrup, sugar crystallization, food irradiation, adding preservatives or inert gases such as carbon dioxide. Other methods that not only help to preserve food, but also add flavour, include pickling, salting, smoking, preserving in syrup or alcohol, sugar crystallisation and curing.

2. Preservation processes

Preservation processes include:

- Heating to kill or denature organisms (e.g. boiling)
- Oxidation (e.g use of sulphur dioxide)
- Toxic inhibition (e.g. smoking, use of carbon dioxide, vinegar, alcohol etc)
- Dehydration (drying)
- Osmotic inhibition (e.g use of syrups)
- Low temperature inactivation (e.g. freezing)
- Ultra high water pressure (e.g. fresherized, a kind of cold pasteurization, the pressure kills naturally occurring pathogens, which cause food deterioration and affect food safety.)

3. Drying

One of the oldest methods of food preservation is by drying, which reduces water activity sufficiently to delay or prevent bacterial growth. Most types of meat can be dried. This is especially valuable in the case of pork, 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, mangoes, papaya, apricot, and coconut. Zante currants, sultanas and raisins are all forms of dried grapes. Drying is also the normal means of preservation for cereal grains such as wheat, maize, oats, barley, rice, millet and rye.

4. Smoking

Meat, fish and some other foods may be both preserved and flavoured through the use of smoke, typically in a smoke-house. The combination of heat to dry the food without cooking it, and the addition of the aromatic hydrocarbons from the smoke preserves the food.

5. Freezing

Freezing is also one of the most commonly used processes commercially and domestically for preserving a very wide range of food stuffs including prepared food stuffs which would not have required freezing in their unprepared state. For example, potato waffles are stored in the freezer, but potatoes themselves require only a cool dark place to ensure many months' storage. Cold stores provide large volume, long-term storage for strategic food stocks held in case of national emergency in many countries.

6. Vacuum packing

Vacuum-packing stores food in a vacuum environment, usually in an air-tight bag or bottle. The vacuum environment strips bacteria of oxygen needed for survival, preventing the food from spoiling. Vacuum-packing is commonly used for storing nuts.

7. Salt

Salting or curing draws moisture from the meat through a process of osmosis. Meat is cured with salt or sugar, or a combination of the two. Nitrates and nitrites are also often used to cure meat.

8. Sugar

Sugar is used to preserve fruits, either in syrup with fruit such as apples, pears, peaches, apricots, plums or in crystallized form where the preserved material is cooked in sugar to the point of crystallisation and the resultant product is then stored dry. This method is used for the skins of citrus fruit (candied peel), angelica and ginger. A modification of this process produces glac fruit such as glac cherries where the fruit is preserved in sugar but is then extracted from the syrup and sold, the preservation being maintained by the sugar content of the fruit and the superficial coating of syrup. The use of sugar is often combined with alcohol for preservation of luxury products such as fruit in brandy or other spirits. These should not be confused with fruit flavored spirits such as Cherry Brandy or Sloe gin.

9. Pickling

Pickling is a method of preserving food in an edible anti-microbial liquid. Pickling can be broadly categorized as chemical pickling (for example, brining) and fermentation pickling (for example, making sauerkraut). In chemical pickling, the food is placed it in an edible liquid that inhibits or kills bacteria and other micro-organisms. Typical pickling agents include brine (high in salt), vinegar, alcohol, and vegetable oil, especially olive oil but also many other oils. Many chemical pickling processes also involve heating or boiling so that the food being preserved becomes saturated with the pickling agent. Common chemically pickled foods include cucumbers, peppers, corned beef, herring, and eggs, as well mixed vegetables such as piccalilli, chow-chow, giardiniera, and achar.

In fermentation pickling, the food itself produces the preservation agent, typically by a process that produces lactic acid. Fermented pickles include sauerkraut, nukazuke, kimchi, surstrmming, and curtido. Some chemically pickled cucumbers are also fermented. In commercial pickles, a preservative like sodium benzoate or EDTA may also be added to enhance shelf life.

10. Lye

Sodium hydroxide (lye) makes food too alkaline for bacterial growth. Lye will saponify fats in the food, which will change its flavor and texture. Lutefisk and hominy use lye in their preparation, as do some olive recipes. Modern recipes for century eggs also call for lye.

11. Canning and bottling

12. Canning

Canning involves 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. Various foods have varying degrees of natural protection against spoilage and may require that the final step occur in a pressure cooker. High-acid fruits like strawberries require no preservatives to can and 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. Most such failures are rapidly detected as decomposition within the can causes gas production and the can will swell or burst. However, there have been examples of poor manufacture and poor hygiene allowing contamination of canned food by the obligate , Clostridium botulinum which produces an acute toxin within the food leading 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 has included Mushrooms, Corned beef and Tuna.

Fruit preserved by jellying is known as jelly, marmalade, or fruit preserves. In this case, the jellying agent is usually pectin, either added during cooking or arising naturally from the fruit. Most preserved fruit is also sugared.

13. Jugging

Meat can be preserved by jugging, the process of stewing the meat (commonly game or fish) in a covered earthenware jug or casserole. The animal to be jugged is usually cut into pieces, placed into a tightly-sealed jug with brine or gravy, and stewed. Red wine and/or the animal's own blood is sometimes added to the cooking liquid. Jugging was a popular method of preserving meat up until the middle of the 20th century.

14. Irradiation

Irradiation of food is the exposure of food to ionizing radiation; either high-energy electrons or X-rays from accelerators, or by gamma rays (emitted from radioactive sources as Cobalt-60 or Caesium-137). The treatment has a range of effects, including killing bacteria, molds and insect pests, reducing the ripening and spoiling of fruits, and at higher doses inducing sterility. The technology may be compared to pasteurization; it is sometimes called 'cold pasteurization', as the product is not heated. Irradiation is not effective against viruses or prions, it cannot eliminate toxins already formed by microorganisms, and is only useful for food of high initial quality.

The radiation process is unrelated to nuclear energy, but it may use the radiation emitted from radioactive nuclides produced in nuclear reactors. Ionizing radiation is hazardous to life; for this reason irradiation facilities have a heavily shielded irradiation room where the process takes place. Radiation safety procedures ensure that neither the workers in such facility nor the environment receive any radiation dose from the facility. Irradiated food does not become radioactive, and national and international expert bodies have declared food irradiation as wholesome. However, the wholesomeness of consuming such food is disputed by opponents and consumer organizations. National and international expert bodies have declared food irradiation as 'wholesome'; UN-organizations as WHO and FAO are endorsing to utilize food irradiation. International legislature on whether food may be irradiated or not varies worldwide from no regulation to full banning.

It is estimated that about 500,000 tons of food items are irradiated per year world-wide in over 40 countries. These are mainly spices and condiments with an increasing segment of fresh fruit irradiated for fruit fly quarantine.

15. Modified atmosphere

Modified atmosphere is a way to preserve food by operating on the atmosphere around it. Salad crops which are notoriously difficult to preserve are now being packaged in sealed bags with an atmosphere modified to reduce the oxygen (O2) concentration and increase the carbon dioxide (CO2) concentration. There is concern that although salad vegetables retain their appearance and texture in such conditions, this method of preservation may not retain nutrients, especially vitamins. Grains may be preserved using carbon dioxide. A block of dry ice is placed in the bottom and the can is filled with grain. The can is then "burped" of excess gas. The carbon dioxide from the sublimation of the dry ice prevents insects, mold, and oxidation from damaging the grain. Grain stored in this way can remain edible for five years.

Nitrogen gas (N2) at concentrations of 98% or higher is also used effectively to kill insects in grain through hypoxia. However, carbon dioxide has an advantage in this respect as it kills organisms through both hypoxia and hypercarbia, requiring concentrations of only 80%, or so. This makes carbon dioxide preferable for fumigation in situations where an hermetic seal cannot be maintained.

16. Burial in the ground

Burial of food can preserve it due to a variety of factors: lack of light, lack of oxygen, cool temperatures, pH level, or desiccants in the soil. Burial may be combined with other methods such as fermentation. Many root vegetables are very resistant to spoilage and require no other preservation other than storage in cool dark conditions, for example by burial in the ground, such as in a storage clamp.

Century eggs are created by placing eggs in alkaline mud (or other alkaline substance) resulting in their "inorganic" fermentation through raised pH instead of spoiling. The fermentation preserves them and breaks down some of the complex, less flavorful proteins and fats into simpler more flavorful ones.

Most foods can be preserved in soil that is very dry and salty (thus a desiccant), or soil that is frozen.

Cabbage was traditionally buried in the fall in northern farms in the USA for preservation. Some methods keep it crispy while other methods produce sauerkraut. A similar process is used in the traditional production of kimchi.

Sometimes meat is buried under conditions which cause preservation. If buried on hot coals or ashes, the heat can kill pathogens, the dry ash can desiccate, and the earth can block oxygen and further contamination. If buried where the earth is very cold, the earth acts like a refrigerator. Fish (e.g. Gravlax) has been buried to preserve by fermentation. Some foods, such as many cheeses, wines, and beers will keep for a long time because their production uses specific micro-organisms that combat spoilage from other less benign organisms. These micro-organisms keep pathogens in check by creating an environment toxic for themselves and other micro-organisms by producing acid or alcohol. Starter micro-organisms, salt, hops, controlled (usually cool) temperatures, controlled (usually low) levels of oxygen and/or other methods are used to create the specific controlled conditions that will support the desirable organisms that produce food fit for human consumption.

17. High pressure food preservation

High pressure food preservation refers to high pressure used for food preservation. "Pressed inside a vessel exerting 70,000 pounds per square inch or more, food can be processed so that it retains its fresh appearance, flavour, texture and nutrients while disabling harmful microorganisms and slowing spoilage." By 2001, adequate commercial equipment was developed so that by 2005 the process was being used for products ranging from orange juice to guacamole to deli meats and widely sold.