**UNIT.1  
1.Introduction to Veterinary Public Health**

* Veterinary Public Health is a component of Public Health devoted to the application of Veterinary skills, knowledge and resources to the protection and improvement of human health.
* Veterinary Public Health can thus be seen as the bridge between human medicine and the practice of Veterinary Medicine.
* It includes (***Components of Veterinary Public Health***):
  + Zoonoses.
  + Hygiene of food of animal origin.
  + Environmental hazards and protection**.**
  + Occupational hazards, trauma, allergies and control of animal population which may serve as disease reservoirs.

**Duties of VPH Veterinarian**

* Working out legislation, regulations, directives which assist the implementation of the objectives of VPH.
* Establishment of surveillance (observation) and information system.
* Production of vaccines and biological
* Control of import and export of livestock, their products and by products.
* Coordinate the activities of VPH.
* Advise investors on the construction of biilding, where animal are slaughtered or their product is processed

**UNIT2  
2. Food hygiene and principles of food preservation**

**Food Hygiene**

* Is the efforts made to safeguard food from becoming health hazard and to prevent early spoilage and contamination caused by handling of the foods.
* It include all the conditions and measures that are required to make of foods fit for human consumption.
  + In order for food to be classed as fit for human consumption, it must be **safe, wholesome** and **processed in a hygienic manner**
  + **Safe:** Food products must be free from any substance, which may be harmful to man. Such include both infectious agents and toxic substances or either endogenous or exogenous origin.
  + **Wholesome:** Food products must be free from defects, which may be either endogenous diseases or exogenous non-microbial contamination and adulterations/pollution.
  + **Hygienic processing:** Food products processed in the manner to ensure compliance with the above requirements
* Food of animal origin is a balanced diet containing all essential elements including protein, fat carbohydrates, vitamins and minerals, which the human body requires for growth reproduction and normal functioning of his/her body
* Food in terms of veterinary public health refers to food of animal origin and it including the following.
  + - Meat and Meat Products derived from beef, sheep, goats, Pigs, camels.
    - Poultry meat ( chicken, turkey, ducks, geese)
    - Milk and milk products (milk gained from the cow, goats, sheep, camel).
    - Egg and egg products
    - Fish and fish products

***Criteria for food of animal origin***

* Food of animal origin intended for human consumption should be
  + - Healthy,
    - Palatable/testy,
    - Free from decomposition (spoilage) and adulteration/contamination.
    - Must be nutritious.
    - Psychologically acceptable both by the consumer and vendor; appealing to sight and be pleasant.

**Food contamination and spoilage**

***Contamination*:**

* When the food became accessed to potentially dangerous, possibly invisible bacteria, viruses, parasites, toxins, chemicals, any adulterant, etc. it is called contaminated food
* The process of contamination of food is called as food contamination.

**The sources of contamination for food of animal origin includes**

* the *animal itself*
* *water*
* *sewage/manure/waste matter*
* *food contact surfaces*
* *air*
* *soil*
* *food handlers*
* *Insects*
* *Rodents etc*.

***Food animals as a source***

* + Animals carry large number of microorganisms on their hide/skin and feet.
  + Dirty hide and skin leads to contamination of carcasses during *dressing*.
  + Food animals also harbor microorganisms in their gastro intestinal tracts and contamination takes place during *evisceration*.

***Water as a source***

* + Water contaminated with human stool and animal feces serve as a source of contamination.
  + The most common bacterial water contaminants are fecal *colioforms, E.coli, Salmonella, Cholera*

***Food contact surfaces as a source***

* + Food contact surfaces (equipments such as knives, saws) used in meat industry, milk buckets, milk transportation cans, tanks and other equipments, which are not properly cleaned, washed and disinfected, can serve as source of contamination.

***Food handlers as a source***

* + Food handlers carry large number of microorganisms in their nasal tract (E.g. *Staphylococcus* spp) and GIT (*Salmonella, E.coli*) on their palms, clothes, fingernails, hairs
* There are three main ways in which food can become contaminated (Classification of food contaminating substances):

- Bacterial (Microbial) Contamination;

- Physical Contamination;

- Chemical Contamination.

**Bacterial Contamination**

* If food is consumed that has been contaminated by certain, harmful bacteria (pathogenic bacteria) or
* their toxins (poisons produced by some of these bacteria), food poisoning may result.
* It is important to remember that foods contaminated with pathogenic bacteria will look, taste and smell perfectly normal.

**Physical Contamination**

* Physical contamination can occur at any stage of the food chain and therefore all reasonable precautions must be taken to prevent this type of contamination.

Examples of physical contamination include-

* + Pieces of machinery which can fall into food during manufacture.
  + Stones, pips, bones, twigs, pieces of shell.
  + Foreign objects can enter food during handling so care must be taken to adhere to good food handling practices (e.g. do not wear jewellery or smoke in a food room).

**Chemical Contamination**

* Chemicals, including pesticides, bleach/dye and other cleaning materials can contaminate food if not used carefully.

**Food spoilage**

* Is a metabolic process that causes foods to be undesirable or unacceptable for human consumption due to changes in sensory/physical characteristics
* The kind of spoilage of foods by microorganisms (and enzymes) will depend upon the kinds and numbers of these agents present and upon their surrounding environment.

**Causes of Food Spoilage**

* Agents of food spoilage can be basically divided into microbial and non-microbial gents.

Microbial agents include

* bacteria
* yeast
* moulds
* parasites
* Non microbial factors include indigenous body enzymes, physiological pheromones and feeds.

**Effect on Protein**

* Bacterial proteolytic enzymes break down ***protein*** to ***amino acids*** through series of biochemical processes and the metabolization of amino acids results in the production of ammonia, sulphides and trimethyl amines, which impart the food unpleasant odor and flavor.

**Effect on fat**

* Lipolytic microorganisms split fat into glycerol and fatty acids.
* The further metabolism of fatty acids results in the production of metabolites leading to rancidity.

**Effect on Carbohydrates**

* The two most common carbohydrates found in food of animal source are glycogen in meat and lactose in milk.
* Bacterial enzymes break polysaccharides (lactose, glycogen) to disaccharides or monosaccharide.
* Metabolites produced from polysaccharides causing food spoilage include *ketones, aldehydes* and *lactic acid.*
* The production of lactic acid from glycogen does not cause meat spoilage; it rather prolongs the shelf life of meat.

**Detection of Food Spoilage**

* Examining the presence of foreign material, including parasites, organoleptic tests.
  + Organoleptic testing means testing the quality of food of animal source using the sense organs including
    - sight, Appearance, color, structure
    - smell (olfactory), Odors, Flavor changes
    - taste (gustatory), Flavor changes
    - Texture: Squishy, no longer firm
    - Conducting supportive tests (determination of PH and microbial load and applying rapid detection methods).

**Food borne infections and intoxications (Food borne illness)**

* Food borne illness has been defined by the WHO as a disease of infectious or toxic nature caused by, or thought to be caused by, the consumption of food or water

**Food borne infection**

* Any infection produced by ingesting food contaminated with specific infectious agents (such as bacteria, virus, fungi, or parasites) that can multiply in the intestine, break down and produce toxins, or penetrate the intestinal wall and spread to other organs or systems.

**Food borne intoxication (food poisoning)**

* any disease produced by ingesting toxins from
* plant or animal tissue,
* metabolic products of micro organisms in food,
* or chemicals that are added to foods accidentally, incidentally, or intentionally at any point of the food chain.
* In other words,Food borne intoxication is resulting from consumption of **preformed toxins** or **toxin precursors** in foods

***Factors Promoting Food- Borne Infections and Intoxication***

* + - Inadequate cooking of food
    - Inadequate cold holding
    - Preparing food ahead of time before serving
    - Poor personal hygiene
    - Inadequate heating of food
    - Use of left over
    - Inadequate cleaning and disinfection
    - Cross contamination
    - Contaminated raw materials and ingredients
    - Toxic containers
    - Intentional or incidental addition of additives

**Food safety and Principles of food preservation**

* Food safety: Definition
  + The ***assurance that food will not cause harm*** to the consumer, when it is prepared and /or eaten or is not spoiled.
  + All measures taken to prevent food borne infections and intoxications.
  + Is a goal, which food operators use, when designing and implementing their food safety management system.
  + Control measures, actions and activities set to prevent, eliminate or reduce food hazard to an acceptable level. (To make food safe)

**UNIT 3  
Meat Hygiene**

* ***Meat***: is defined as flesh of animal that used as a food/is the edible parts (muscle & offal) of the food animals.
* ***Carcase***: is meat with the two kidneys, but minus blood, feet, head, skin and viscera (internal organs).
* ***Offal***: also known as by-product refers to non-carcase material, which can be classified as edible and inedible.
  + *Edible offals*: includes liver, heart, kidneys, tongue (= red offals) and stomach and intestine are termed as green offals.
  + *Inedible offals*: includes feet, horn, hoof, hide, skin, ears, etc

**Meat hygiene**

* It refers to all the measures that are taken to provide a sound and wholesome meat for human consumption that is free from contamination of all types.
* The safeguarding of meat supply depends on the high standards of hygiene at all stages from the farm to the meat plant.

**Purposes of meat hygiene**

* To prevent the transmission of animal diseases to man
* To prevent the sale and consumption of meat that is inferior in value
* To provide safe, wholesome meat products for human consumption
* The reduction of loss of meat and its by-products
* The prevention of animal disease transmission to other domestic animals

**Qualitative changes in the meat**

* Immediately after animal slaughtered many changes such as rigor mortis, abnormal odor, adulteration and substitution may takes place in meat.
* Rigor mortis: is the stiffening and hardening of skeletal muscle after slaughter.
* Abnormal odor: is not acceptable as it disturbs the appetite of the consumer and it may rise from two sources: intrinsic and external factors.
* Adulteration and substitution:
  + - Adulteration is the case in which one makes meat and meat products impure by adding low quality meat into prime meat.
    - Substitution is presentation of unacceptable meat for sells as edible product.
* **Transportation of food animals and pre-slaughter care of food animals**

**Transportation of food animals**

* During the process of loading, the journey to the abattoir or market, the holding at the market, the off-loading, the detention in the abattoir lairage and the subsequent handling up to the point of slaughter, the animal is subjected to a wide variety of stressors.
* The adverse effect of stress results in deleterious change in the carcase and even death may occur.

**Transportation**:

* Animals may be transported by either of the following:

- By driving on hoof

- With a vehicle

- With a rail (train, ship) and by plane

**Adverse effect of transportation**

* Stress
* Change in meat quality
* Loss of body weight
* Bruise
* Suffocation
* Mortality

**Pre-slaughter care of food animals**

**Resting**:

* + It is important that animals arriving at the slaughterhouse are given an adequate period of rest before slaughter.
  + The actual duration of the resting period depends on the *species of animals, age, sex, class and condition, time of year, length of journey, method of transportation, degree of fatigue*, etc.
  + Without this rest period the keeping quality of the carcase may be lowered due to the incomplete development of acidity/lactic acid (PH) of the meat.
  + Also inadequate period of rest results in incomplete bleeding
  + During resting period in lairages, animals must be kept under conditions, which prevent any further contamination of feet, hides, fleeces or skins.

**Watering in the lairage*:***

* + Animals should receive ample drinking water during the rest period prior to slaughter.
  + This serves to lower the bacterial load in the intestine and facilitates removal of hide or pelt during dressing of the carcase

**Feeding in the lairage**

* + Animals, which have had long exhausting journeys, should be fed and rested near the slaughterhouse before they are slaughtered.
  + If slaughter takes place within 12hours of arrival at the slaughterhouse there is no need to feeding the animal

**Methods of slaughter and bleeding practices *Methods of slaughter***

* Slaughter – any procedure which causes the death of an animal by bleeding.
* Death – irreversible loss of brain activity as demonstrated by loss of brain stem reﬂexes
* The two essentials in the slaughter of food animals are that they shall be dispatched without unnecessary suffering and that bleeding shall be as complete as possible

**Method of slaughtering:**

* + All methods of slaughter aims at securing maximum bleeding of the animal and the humane method also aim to avoid unnecessary suffering.
  + The main method of slaughtering is:

1. Slaughtering with previous stunning (stunning prior to bleeding)

2. Slaughtering without previous stunning

* 1. **Slaughtering with previous stunning**

Stunning – refers to the act of making an animal unconscious by various techniques to achieve humane slaughtering.

***Stunning methods:*** The most commonly practiced method in stunning involves the application of the following:

* + - * Captive bolt
      * Electricity (electron narcosis)
      * Carbon dioxide.

**2. Slaughtering without previous stunning**

* Directly slaughtering without stunning the animal.

**Bleeding practices**

**Bleeding:**

* The main purpose of bleeding is to remove blood as much as possible from the animal so that bacteria may not decompose the carcase.
* Bleeding in ruminant is effected by severing the trachea, oesophagus, and jugular veins.
* Raising the carcase above the floor promotes bleeding.
* Bleeding in horizontal position is not acceptable while blood remains in the carcase

***Factors influencing the efficiency of bleeding:***

* + - The efficiency of bleeding has a direct influence on the keeping quality of meat and it is affected by factors such as
      * ***Stunning,***
      * ***Hauling and***
      * ***Elapse of time between stunning and bleeding***
    - ***Stunning***: stunning causes a rise in blood pressure. An increase in blood pressure in turn leads to increased heart beat, consequently to efficient bleeding.
    - ***Hauling*: -** Animals bleed well when their head is hung down rather than, when they are left on the killing floor.

**The efficiency of bleeding is judged by-**

* + ***Inspecting the blood vessels*.** In poorly bled carcass, the small blood vessels, particularly the inter-costal veins are distinctly seen. In a well-bled carcass, they are not visible.
  + ***Inspection of the heart***: in poorly bled carcass, the left ventricle is fully engorged with blood.
  + ***Incising internal organs& the muscle***. In poorly bled carcass, blood oozes out, when an incision is made in to organs or muscles.
  + ***Observing the color of the carcase***. In perfectly bled carcass, the meat is red in color and of firmer consistency, where as in poorly bled carcass, the meat is darkish red & flabby.

**Abattoir**

* Any establishment where specified animals are slaughtered and dressed for human consumption and that is approved, registered and/or listed by the competent authority for such purposes.
* It varies in size from the back yard of a local butcher to the great meat processing plants.
* In most countries slaughterhouses are either privately owned, depending on the local need, or are large premises capable of providing slaughtering accumulation for an entire city and are administered by the local authority.
* In Ethiopia this is the most common type of slaughterhouse

**Objectives of constructing abattoir**

* + To carry out meat inspection and provide wholesome and sound meat
  + To protect the public from zoonotic disease
  + To prevent out spread of epizootic disease
  + To generate revenue/income
  + To protect the environment from pollution
  + To utilize by product

**Points considered in building abattoir**

**Site selection**

* + The prime consideration in connection with the building of any slaughterhouse is the site.
  + The most important points to be considered in the choice of site are:
    - Accessibility by road and rail for the transportation of animals, meat and other products as well as staff workers.
    - Availability of a safe and abundant water supply system preferably with a public pipe connection and on-site water storage tanks
    - Proper and convenient final sewage and other waste disposal area and facilities
    - Accessibility to electrical power
    - The slaughterhouse should be freely exposed and if possible sited in the outskirts of town
    - A naturally sloping area assists both in the disposal of sewage and storm water
    - Availability of adequate space for future expansion possibilities
    - The immediate environment should be safeguarded from all possible alternatives that may endanger the health or safety of the inhabitants

**Abattoirs should not be constructed:**

* + In residential areas to avoid complaints about noise and smell
  + In industrial areas
  + In city expansion areas, (urban sites should be avoided).

**Structures included in ideal abattoir:**

* + Adequate lairage (the place where animals are kept before slaughter) or, climate permitting, waiting pens for the animals.
  + Slaughter premises large enough for work to be carried out satisfactorily.
  + A room for emergency slaughter
  + A room for slaughtering, stunning, bleeding
  + A room for emptying and cleansing stomach and intestine (eviscerating room)
  + A separate room for dressing, cleaning and treatment of hides and offals
  + Sufficiently large chilling or refrigerating rooms
  + Lockable rooms for the accommodation of sick or suspected animals, the slaughter of such animals, the storage of detained meat and the storage room for seized (condemned) meat or products
  + Adequate ventilation, natural or artificial lighting
  + Changing rooms, wash basins, showers and flush lavatories
  + Adequate supply of hot potable water
  + An appropriate protection against pests
  + Veterinary office: - should have an adequately equipped lockable room.
  + Veterinary laboratory.

**Meat inspection**

* It is an expert supervision of meat with the objective of providing sound and wholesome meat for human consumption.
* Meat inspection refers to examination of meat for some abnormalities and diseases.
* Meat inspection is commonly perceived as the sanitary control of slaughter animals and meat.
* The objectives of meat inspection programme are twofold:

**1**. To ensure that only apparently healthy, physiologically normal animals are slaughtered for human consumption and that abnormal animals are separated and dealt with accordingly

**2.** To ensure that meat from animals is free from disease, wholesome and of no risk to human health.

Inspection of meat has two aspects:

* Examination of the live animal on entry to the slaughter house (ante-mortem inspection), and
* Examination of the carcase and food products made from the meat after slaughter (post- mortem inspection).
* Without ante-mortem inspection, no adequate inspection of the carcase or meat is possible.

**Ante-mortem inspection**

* Reasons for ante-mortem examination of all livestock for slaughtering;
  + To screen all animals destined for slaughter
  + To isolate suspects and perform detailed clinical examination
  + To select and detain extremely dirty animals not to contaminate the killing floor
  + To prevent the contamination of the premises, equipments, and personnel by animals affected from communicable diseases.
  + To ensure emergency slaughter for injured/suffering animals
  + To separate fevered and excited animals
  + To identify those animals harbouring residues, e.g. Antibiotic residues.
  + To detect animals affected with disease, which otherwise difficult to detect during post-mortem inspection.

**Guidelines and principles**

* + No animal shall be slaughtered without undergoing ante-mortem inspection
  + All animals should be inspected within 24hrs of delivery
  + If 24hrs have elapsed after ante-mortem inspection, the ante-mortem inspection should be repeated.
  + Ante-mortem inspection should be made in well-lighted lairage pen and a crush for examination of individual animals.

**Procedures of ante-mortem inspection:**

* + Animals should be inspected
  + At rest (static position): to asses posture, detect lameness, to study their behaviour (excited or not)
  + In moving (motion) condition
* Generally when examining live animals attention must be given to the following;
  + Posture and movement
  + Condition of hide and skin
  + State of nutrition – fully developed or emaciated
  + Reaction to external influences (environment)
  + Feeding reaction – appetite, rumination, quality of droppings, etc,
  + Breathing mechanisms - condition of the muzzle, nasal mucosa, respiration, etc,
  + Anal opening, vagina or mammary gland.
* Abnormalities in respiration
* Abnormalities in behaviour
* Abnormal discharges or protrusions from body openings
* Abnormal colour
* Abnormal odour
* Abnormal heart rate and temp

**Judgement (decision) categories at ante-mortem inspection:**

* + The following decisions are passed during ante-mortem inspection
    - Approved for slaughter
    - Condemned for slaughter
    - Slaughter authorised under special precautions
    - Authorisation for slaughter delayed
    - Emergency slaughter ordered

**Post-mortem inspections**

* Refers to examination of the carcase and associated organs after slaughtering to detect and eliminate abnormalities including contamination to ensure only meat fit for human consumption is passed for food.

***The main objectives of post-mortem inspection are:***

* + To detect diseases and conditions which could not be detected during ante-mortem inspection
  + To pass carcases or organs which are fit for human consumption
  + To supervise and control the hygienic dressing of carcases

***Principles of post-mortem inspection:***

* + The meat inspector should always be present during post-mortem inspection and before beginning the slaughtering operations/he/she should ensure that
  + The slaughter hall and equipments are clean
  + The sewage system is functioning properly
  + The availability of adequate supply of potable water
  + Availability of adequate light
  + Presence of adequate personnel and their hygienic status.

***Facilities required:***

* + Washing and disinfection facilities
  + Towel and soap
  + Carcass and organ hanging facilities, etc

**Guidelines should be ensured (by the inspector) while post-mortem inspection is in progress:**

* + Evisceration is effected without delay
  + Incision are made without obliteration
  + Offals, carcases, and heart are labelled and bear the same number
  + No lesion is removed before judgement is passed
  + No lesions are modified or obliterated to disguise meat inspection
  + No removal of organs or carcase before final judgement is passed
  + No removal of identification marks
* Generally the method of postmortem examination recommended and adapted by most countries is as follows:
  + Visual examination
    - State of nutrition of the carcass
    - Evidence of bruising or discoloration
    - Efficiency of bleeding
    - Abnormalities or swelling of bones, joints or muscles
    - Signs of local and general edema
    - Condition of pleura and peritoneum
    - Check viscera as they are removed from the carcass
* Palpation, incision and detailed visual examination
  + Blood: color, clotting
  + Head: eyes, pharynx, tongue, lips, sub-maxillary and retro pharyngeal lymph nodes
  + Thoracic cavity: lungs, bronchial and medestinal lymph nodes, heart, diaphragm
  + Abdominal cavity: stomach, intestine, spleen, liver, and kidneys
  + Reproductive cavity: uterus and ovaries, testicles and penis, udder, supra mammary and inguinal glands
  + Connective tissue: fat, bones, joints, tendons
  + Muscles: mostly active muscles
  + Lymph nodes: at all sites of the carcass
  + Feet: internal condition
  + The final judgement as to the action to be taken with a carcass or parts of a carcass is based on the total evidence.
* Six categories judgment are passed :
  + - Approved for human consumption
    - Totally condemned for human consumption
    - Partially condemned for human consumption
    - Conditionally approved for human consumption
    - Inferior meat
    - Approved for human consumption with distribution restricted to limited areas and finally Detained

**UNIT.4  
Milk Hygiene**

* + Milk is the first natural food of all young mammals during the period immediately after birth.
  + “The lacteal secretion of the mammary glands of a mammal, practically free from cholesterol, obtained by the complete milking of one or more healthy cows.

**Contamination of milk**

* Milk is an excellent food for man but it is an **ideal medium for the growth of micro-organisms.**
* From the time milk leaves the udder of the animal, unless adequate safeguards are maintained, **it may receive bacteria and other micro-organisms from the surroundings**
* Most easily perishable and contaminated commodity
* Internal factors
  + - Udder infection – Mastitis
    - Foremilk – contains large no of bacteria
* External factors
  + - Cow/animal’s body
    - Udder and teats
    - Milker – hygiene and habits
    - Method of milking
    - Milking Utensils
    - Milk Storage utensils
    - Feed and water
    - Milking environment

**Sanitary practices to be observed in producing safe milk**

* Sources of contamination and Preventive Measures

1. **Contamination from human discharge and wastes:** 
   * + Construction of a proper waste disposal system
     + Prevention of human discharge and wastes from contacting animals and milk
     + Practices of good personal hygiene
     + Segregation of animals from human habitation.
2. **Contamination from air borne dust and droplets:** 
   * + Proper construction of the milking area
     + Sneezing or coughing away from milking containers during milking
     + Provision of clean surroundings and avoidance of dusty conditions during milking
3. **Contamination from animal bodies, hides, udder and teats:** 
   * + Clipping, brushing, cleansing and sanitizing before milking
4. **Milk containers (contamination from milking utensils and dirty water):** 
   * + Proper washing and storing of milking containers
     + Using proper and easily cleanable utensils
     + Using only safe water for washing and cleaning
5. **Milk handlers and contamination from milkers and their clothing:**
   * + Keeping the milker’s level of personal hygiene high
     + Washing of hands with detergents before milking
     + Should always wear clean garments while milking
6. **Cow and contamination from diseased animals:** 
   * + Detecting and isolating affected animals
     + Veterinary inspection and supervision of animals
     + Treatment and vaccination of animals.

**Hygienic production of milk:**

* + **The use of correct and sanitary milking methods is an important step in protecting clean milk.** 
    - Correct milking methods will reduce udder injuries and mastitis infections, increase milk production, result in cleaner milk and reduce milk contamination
    - There are two types of milking methods, namely manual (milking by hand) and mechanical (milking by milking machine).
  + **Boling** 
    - This is the easiest and most practicable method of making milk safe in every home.
    - As soon as raw milk is produced or delivered it should be boiled.
  + **Cooldening**
  + To preserve the keeping quality of milk, it should be cooled as soon as possible to a temp. below 5°C in a refrigerator
  + The sooner the milk is cooled after removal, the better is the quality
  + Bacterial growth is retarded by cooling the milk within 2 hours of milking
* **Pasteurization**
  + Method of rendering raw milk safe through controlled heat treatment
  + Can be defined as the process of heating every particle of milk and milk products to a predetermined temperature and holding this temperature for a predetermined time

**Methods of pasteurization of Milk**

* + - Basically pasteurization of milk involves three essential steps:
    - Heating raw milk to a predetermined temperature
    - Holding at this temperature for a predetermined time
    - Immediately cooling down to at least below 100C (500F).
  + **The low temperature- high time method** 
    - also known as the low temperature holding time process, is a method of holding the milk to a temperature of 63oc (145oF) for 30 minutes.
  + **The high temperature-short time method** 
    - This is a continuous process by which milk is rapidly brought to a temperature of 71oc (161oF) and heated continuously for 15 seconds.
  + **The ultra-high temperature (UHT) method** 
    - In this process the milk is heated to at least 88oC (191oF), held at this temperature for at least one second and then immediately cooled to at least below 10oC (50oF).

- **Sterilization**

* + - In this process milk is heated to destroy **all** micro-organisms including spore forming and can only be done by keeping the milk at a temperature above normal boiling point (100oc) for at least 20 minutes

- **Drying**

* + - This is a method where the entire water constituent is removed from the milk by evaporation.
    - The solids remaining form what is called milk powder (dry milk).
    - Milk powder can then be made into liquid milk by adding a proper amount of water

**HACCP concept**

* + - The introduction of specific HACCP concept involves the following:
  + Conduct a hazard analysis (Principle 1)
  + Determine critical control points (CCPs) (Principle 2)
  + Establish critical limits (Principle 3)
  + Establish monitoring procedures (Principle 4)
  + Establish corrective actions (Principle 5)
  + Establish verification procedures (Principle 6)
  + Establish record-keeping and documentation procedures (Principle 7)

**Conduct a hazard analysis (Principle 1)**

* Hazard analysis is the process used by the HACCP team to determine which potential hazards present a significant health risk to consumers.
* Only those hazards that pose significant risk to the health of consumers are included in a HACCP plan.
* When conducting a hazard analysis, safety concerns must be differentiated from quality concerns.
* A hazard is defined as a biological, chemical or physical agent that is reasonably likely to cause illness or injury in the absence of its control.
* Thus, the word hazard as used in this document is limited to safety.

**Determine critical control points (CCPs) (Principle 2)**

* A critical control point is defined as a step at which control can be applied and is essential to prevent or eliminate a food safety hazard or reduce it to an acceptable level.
* The potential hazards that are reasonably likely to cause illness or injury in the absence of their control must beaddressed in determining CCPs.
* Critical control points are located at any step where hazards can be either prevented, eliminated, or reduced to acceptable levels

**Establish critical limits (Principle 3)**

* A critical limit is a maximum and/or minimum value to which a biological, chemical or physical parameter must be controlled at a CCP to prevent, eliminate or reduce to an acceptable level the occurrence of a food safety hazard.
* A critical limit is used to distinguish between safe and unsafe operating conditions at a CCP.

***Establish monitoring procedures (Principle 4)***

* Monitoring is a planned sequence of observations or measurements to assess whether a CCP is under control and to produce an accurate record for future use in verification.
* An unsafe food may result if a process is not properly controlled and a deviation occurs.
* Because of the potentially serious consequences of a critical limit deviation, monitoring procedures must be effective.
* Ideally, monitoring should be continuous, which is possible with many types of physical and chemical methods

**Establish corrective actions (Principle 5)**

* + The HACCP system for food safety management is designed to identify health hazards and to establish strategies to prevent, eliminate, or reduce their occurrence.
  + However, ideal circumstances do not always prevail and deviations from established processes may occur.
  + An important purpose of corrective actions is to prevent foods which may be hazardous from reaching consumers.
  + Where there is a deviation from established critical limits, corrective actions are necessary.

**Establish verification procedures (Principle 6)**

* Verification is defined as those activities, other than monitoring, that determine the validity of the HACCP plan and that the system is operating according to the plan.
* One aspect of verification is evaluating whether the facility’s HACCP system is functioning according to the HACCP plan.
* An effective HACCP system requires little end-product testing, since sufficient validated safeguards are built in early in the process.
* Therefore, rather than relying on end-product testing, firms should rely on frequent reviews of their HACCP plan, verification that the HACCP plan is being correctly followed, and review of CCP monitoring and corrective action records.

**Establish record-keeping and documentation procedures (Principle 7)**

* Record is a written evidence that document some kind of action.
* Record keeping assures that this written evidence is available for review and is maintained for the required length of time.
* Records are an integral part of a working HACCP system.

**UNIT.5**

**Zoonoses**

* Zoonoses are those diseases and infections (the agents of), which are naturally transmitted from vertebrate animals to man and vice versa
* Zoonoses are primarily recognized as animal diseases and man acts as an accidental host.
* The zoonoses constitute an important component of veterinary public health activities.
* Almost all of the infections classified as Zoonoses can exist only where and when animals are present.
* According to the type of causative/etiological agents According to the reservoir host   
  According to maintenance cycle in nature

**Classification of zoonosis**

**A. According to the type of causative/etiological agents:**

* + Viral zoonosis
  + Rickettsial zoonosis
  + Chlamydial zoonosis
  + Bacterial zoonosis
  + Actinomycetic zoonosis
  + Myotic zoonosis
  + Fungal zoonosis
  + Protozoan zoonosis
  + Helminthic zoonosis
  + Ectoparasitic zoonosis

**B. According to the reservoir host:**

***Anthropozoonosis*:** Infection is transmitted from vertebrate animals to man, in this case the agents can all exits in nature independently of man

e.g. anthrax, brucellosis, cat scratch fever, contagious ecthyma, dermatophytosis, Q fever and rabies.

***Zooanthroponosis*:** Disease is transmitted from man to vertebrate animals, These are quite small groups of zoonotic diseases which normally pass from man to man but which may infect other vertebrate animals

e.g. infectious hepatitis, measles, poliomyelitis and tuberculosis (human).

***Amphixenosis*:** Infection is maintained in both man and vetebrate animals and may be transmitted in either direction. Man and vertebrates are equally suitable reservoir hosts and infections may be transmitted in either direction

e.g. salmonellosis and staphylococcosis.

**C. According to maintenance cycle in nature**

* + **Orthozoonosis/Direct zonoosis:** It is transmitted from an infected vertebrate host by contact, vehicle or mechanical vector,

e.g. chlamydiosis, glanders, leptospirosis, pasteurellosis, ringworm and scabies.

* + **Cyclozoonosis:** It requires more than one vertebrate host but, no invertebrate host for the completion of the life cycle of the agent,

e.g. echinococcosis and taeniasis.

* + **Metazoonosis:** It is transmitted biologically by invertebrate vector in which the agent develops, multiplies or both,

e.g., babesiosis, filariosis, leishmaniosis, plague, trypanosomiosis and yellow fever

* + **Saprozoonosis:** It requires a vertebrate host as well as a non-animal sites like soil, pigeon dropping, plant material for the development of an infectious agent,

e.g., aspergillosis, coccidioidomycosis, cryptococcosis and histoplasmosis

**Methods of transmission of zoonotic pathogen**

**1. Direct contact:**

Buffalo pox, contagious ecthyma, cow pox, dermatophytosis, goat pox, marburg disease, monkey pox, scabies.

**2. Ingestion:**

a) Milk: Brucellosis, campylobacteriosis, coxiellosis, tuberculosis.

b) Meat: Taenia saginata, T. solium, Trichinella spiralis.

c) Fish: Diphyllobothrium latum, vibrio parahaemolyticus.

d) Poultry: Arizona infection, Salmonella infection.

e) Water: Amoebiosis, giardiosis, infectious hepatitis, shigellosis.

**3. Inhalation:**

Anthrax, aspergillosis, bird flu, chlamydiosis, coxiellosis, cryptococcosis, histoplasmosis, SARS, tuberculosis.

**4. Bite of animals:**

Bat salivary gland fever, cat scratch disease, herpes simiae, pasteurellosis, sporotrichosis, rat bite fever, rabies.

**5. Bite of arthropods:**

Fillariosis, Japanese encephalitis, leishmaniosis, plague, scrub typhus, trypanosomiosis, yellow fever.

**6. Intrauterine/transplacental:**

Listeriosis, toxoplasmosis.

**7. Abraded skin/wound infection:**

Erysipelothricosis, melioidosis, necrobacillosis, tetanus.

* **Zoonotic Diseases**

**Bacterial zoonoses**

* Anthrax
* Zoonotic tuberculosis
* Brucellosis
* Salmonellosis
* Pathogenic E. coli
* Campylobacteriosis
* Leptospirosis
* Listeriosis
* Clostridial infections
* Botulism
* Lyme disease
* Melioidosis
* Glanders
* Shigellosis

**Parasitic zoonotic diseases**

* Group assignment
* Tuberculosis (TB)
* Anthrax
* Toxoplasmosis
* Leishmaniasis
* Salmonellosis
* Schistosomiasis