Lec: 1 (the food animals):
first semester:

Meat is the flesh of animals used as food. It is often widened to include as well as the muscle, organs such as liver and kidney, brain and other edible tissues. The bulk of the meat consumed in Iraq is derived from cattle, buffaloes, camels, sheep, goats and poultry. Meat is not only an essential and easily digestible food, but its provides an excellent source of protein in human nutrition. Meat hygiene can be considered as a public health function as it prevents transmission of diseases to human and provides a safe and wholesome product for his consumption. It also includes the reduction in losses of meat and the prevention of disease transmission to other food animals .meat is highly susceptible to spoilage and also frequently implicated in spreading of food-borne disease.

Consequently knowledge of the microbiology of meat is of important in the development of methods which are satisfactory to prevent as retard the spoilage of this most valuable nourishment food article, in addition to protection of consumers against food- borne microbial, viral, parasitic and fungal disease by proper meat inspection services which consists of a veterinary examination of carcasses and offal's and where necessary laboratory tests of body tissue and fluids.

Meat hygiene is not limited to study of tissues it includes all facts of the meat industry, beginning with animal production and ending with final preparation for consumption.

Breeding, feeding and management are extremely important parts of the food chain, because quality control actually starts on the farm.

Along with the increasing demand for production of meat of high quality, there is also an increasing demand for differentiated control system whether. It is a private or governmental control. The basis of any control system would be the "ante – mortem "and "post – mortem " inspection, there should be laboratory meat inspection. In this connection meat inspection as well as meat hygiene always has been and always will be a matter of economy. The task of **"meat hygienist"** is to secure, therefore that the following items are fulfilled to the largest possible extent.

1- Meat and meat products should be sound and not constitute any public health hazards.

2-meat and meat products should be wholesome and valuable to the consumer; the meat hygienist should have a basic knowledge in the origin of ordinary spoilage bacteria. The fate of bacteria in food chain and its effect on consumers.

Meat : is normally regarded as the edible parts including muscle & offal's of food grassing animals such as cattle , sheep , buffalos , camels, goats , deer , llama , horse and pigs . In addition to poultry meat (broiler, duck, geese, turkey and pigeons).

Meat: is defined as those animal tissues, which are suitable for use as food. All processed or manufactured products that might be prepared from these tissues are included in this definition.

Meat can be subdivided into 4 categories:

1- red meat (including beef, sheep , veal , buffalo , camel , pork , rabbit , ostrich) .

2- White meat (including domestic birds (guinea fowl, turkey, duck, geese, pigeons).

3- Sea meat (Including flesh aquatic organisms like (fish, shrimps, lobster, oyster).

4- Game meat (including non-domesticated animals (kangaroo, snakes, crocodile, rodents, wild rabbit and birds).

Histological structure of muscle:

Skeletal muscle comprise the bulk of carcass weight (35 – 85%)with an average of (50-65%) skeletal muscles are divided from one another by connective tissue covering **"epimysium"** the individual muscles are divided into separate several muscle bundles by another connective tissue sheath **"perimysium"** . each muscle bundle contain varying number (30-80) of muscle fibers , that are individually wrapped with a thin connective tissue sheath **"endomysium"** which is made up from basic proteins (collagen , elastin , reticulin) . the epimysium , perimysium and endomysium extend beyond the fleshy part of the muscle to form a thick tendon . the tendons form indirect attachments from muscles to the periosteum of bones or to the connective tissue of other muscles .

Myofibers are the basic cellular units of muscles and meat. They are single cylindrical, long and multinucleated cells, and constitute 75-92 % of the structure of skeletal muscle. Each muscle fiber is surrounded by a cell membrane**" sarcolemma ".within the sarcoplasm of each individual muscle fiber are** so many myofibrils. About 70% of the muscle cells consist of thousands of myofibrils, which are solid protein chains, which account for the major and nutritionally most valuable part of the muscle cell proteins. Myofibrils are made up of long protein molecules called myofilaments. There are two types of myofilaments in myofibrils: thick filaments (myosin) which encircled by thin filaments (actin). Overlapping of the contractile proteins (actin and myosin) in certain regions, along the longitudinal axis, accounts for the banding or the striated appearance of muscle. These myofilaments are arranged in interdigitating matrix capable of sliding across each other.

Chemical composition of meat:

In general, meat is composed of 60-72% water, 10-20% protein, 4-20% fat and 1% ash. There will be some exceptions to the above compositional ranges, in that moisture content could be as low as 40% in raw materials that are high in fat. Likewise, the fat content could be as high as 50% in fatter meat cuts.

Water is inversely related to fat content. The fat content is higher in entire carcasses than in lean carcass cuts. The most valuable components and values define the quality of the raw meat material and its suitability for further processing. Protein content is also the criterion for the quality and value of the finished processed meat products.

Moisture:

Water is the largest components, comprising 70% of lean tissue. There is a relatively consistent relationship between the moisture and the protein content of muscle. This means that one part of muscle protein can typically bind or hold about 3.5 to 3.7 parts water (moisture: protein ratio 3.5 to 3.7:1). As fat content of muscle increases or decreases, the content of moisture and protein combined will shift in the opposite direction .there are 3 forms of water in meat. **The first** is the bound which is a small amount (5-10 g/100 g protein =4-5 % of total water) and is held very tightly by the charged hydrophilic groups on the muscle protein even during application of severe mechanical or physical force. **The second** form is the immobilized water which forms 2-3 molecule layer attracted to the bound water molecules around protein groups (50-60 g/ 100 g protein) , and become successively weaker as the distance from the reactive group on the protein becomes greater . **The third** is the free water (300 g /100 g protein) which is loosely held and very dependent upon capillary space between and within muscle proteins.

Muscle proteins:

Meat is an excellent source of high quality protein which is the most important component of meat products. Product costs are largely based upon the quantity of meat protein in their formulations. On the basis of its location, meat proteins can be divided into the sarcoplasmic, myofibrillar and connective tissue protein.

Sarcoplasmic (plasma) protein:

The sarcoplasmic (soluble) proteins make about 25 – 35 % of the total muscle protein .they are soluble in water , and easily lost through improper processing procedures e.g. thawing frozen meat through normal commercial practice (commonly observed as drip ,seen in the bottom of bins or tanks of thawing meat). These proteins are often discarded in the meat industry, because of the assumption that they are blood. They contain albumins as myoglobin (1% of the total muscle protein) which is responsible for meat color.

Meat color is largely due to the water – soluble protein "myoglobin". The difference in myoglobin concentration is the reason why there is often one muscle group lighter or darker than another in the same carcass. The concentration of myoglobin in meat is

affected by species and age of the animal as well as the type of muscle fibers. Beef has more myoglobin than pork, veal or lamb, thus giving beef a more intense color. The maturity of the animal also influences pigments intensity, with older animals having darker pigmentation.

Myofibrillar (structural / contractile) protein:

Myofibrillar proteins constitute about 55% of the total muscle protein. They are responsible for muscle rigidity. Myofibrillar proteins are composed of myosin (55%), actin, troponin, and tropomyosin (40-45%).

Connective tissue (stromal) protein:

The connective tissue of muscle comprises 10 – 15 % of total muscle proteins, and composed mainly of collagen and elastin. Collagen is the most common connective tissue protein in meat, it forms a fibrous network.

Fat:

Fat is the most variable component in meat in terms of compositions (8-30%). fats accumulate in and around the muscles (70% of fat is subcutaneous or inter-muscular). About 90% of adipose tissue is triglycerides. Triglycerides consist of one molecule of glycerol and several types of fatty acids.

In the animal body, there are subcutaneous fat deposit (under the skin) and fat (intramuscular fat). Fat deposit between the fibers of a muscle bundles are called intramuscular fat and lead in higher accumulations to marbling. Marbling of muscle meat contributes to tenderness and flavor of meat. For processed meat products, fat are added to make products softer and also for taste and flavor improvement. Buffalo fat has a whiter color than beef fat and is therefore well suited for processing. the limiting factors for utilization of beef / buffalo fat is its limited availability ,as beef/buffalo carcasses do not provide high quantities of body fats suitable for the manufacture of meat products.

The main value of chemical composition of meat of different food animals:

Species	Protein %	Water %	Fat %	Ash %
Beef	16.5- 21.9	55.7-74.0	4.6-27.0	0.8 -1.1
Veal	19.5-20.0	69.0-73.6	5.5-10.0	1.0-1.1
Sheep	14.5-18.5	74.5-76.0	5.8-36.15	0.8-1.2
pork	12.7-20.1	45.3-72.0	6.3-41.4	0.7-1.0

Proteins:

1- Myofibrillar (actin, myosin, actinomyosine).

2- Sarcoplasmic (myoglobin, hemoglobin, enzymes).

3- Connective tissue and organelles (collagen, elastin, reticulin, mitochondria).

Lipid:

Nature lipid, fatty acid, phospholipid.

Carbohydrate:

Glucose, glycogen, lactic acid, formic acid.

Vitamins:

Fat soluble (a, e, d, k)

Water soluble (c, B complex)

Note: large quantities of vit. Destroyed during cooking or processing.

Soluble non-protein substances:

1- nitrogenous substance (free amino acid) which responsible of flavor, creatinin, nucleotides, adenosine mono phosphate).

2- Inorganic mineral (soluble phosphor, zinc, calcium, sodium, magnesium) with trace elements.

Nutritional value of meat:

1- High protein which require for growth & rebuilding & production or energy & heat.

2- Meat contains nitrogenous substance rich with amino acid essential for human life.

3- Contain important vitamins such as thymine, niacin, B complex and B6.

4- Meat contain or rich of iron & phosphorus.

Slaughter animals:

Its means animal brought into an abattoir for slaughter & used for public human consumption. theoretically human needs animal for supplying meat fit for human consumption , in practice only a relatively small numbers of species are used today . In many parts of the world, horse flesh forms an important article of human diets, and slaughter in Denmark, Belgium, Holland, England and Germany.

Nowadays, the production and consumption of the poultry meat and rabbits has extremely increased after the recent improvement in feed conversion rate and their quick turnover rabbits from subsidiary, but important source of meat because of their quick turnover and feed conversion rate 2:1.

A great advantage of rabbits as meat producer is its high muscle/bone ratio due to 70% of the carcasses is composed of edible meat as compared with about 50% in the chicken.

The future demand for meat and products will depend mainly on several factors such as …

1- Cost of production. 2- Feed conversion efficiency. 3- And use and availability. 4- Consumer taste. 5- Price of consumer. 6- Diet. 7- attitude of people to meat production methods .8- use of protein from non-animal source.

Definition types of products:

The different definitions are based on the proportion of meat or meat flesh or meat protein in the product …

Meat: any part of carcass including offal and fat.

Meat flesh: skeletal muscle with any attached animal fat, blood, c.t, nerve, blood vessel and skin in case of poultry.

Offal : this mean a parts of carcass such as blood , brain ,heart , kidney , liver , spleen , thymus ,tongue & tripe , but exclude meat flesh , bone and bone marrow .

Manufactured meat: these products must contain at least 66% meat, where meat includes all parts of the carcass including offal & fat.

Sausage: it's one of the processed meats which is must contain at least 50& fat – free meat flesh. Fat content (measured analytically) must be no more than 50& of the meat flesh content. Sausages are commonly made from unprocessed meat.

Carcass : the portion of body that remain after slaughter & removal of blood ,head , hide , feet , intestine , liver , spleen , lung, kidney & fatty tissues also removal tarsus & corpus from limbs . Whereas some country allow the kidney still with carcass.

Viscera: mean offal found in thoracic, abdominal & pelvic cavity such as trachea, lung esophagus.

Meat hygiene……

Lec: 2 (meat plant construction & equipment):

First semester

In most countries abattoirs are either privately owned or provided by the local authority .the local authority owns the buildings and also responsible for certain essential services such as sanitation, feeding of animals in the lairage, provision of meat inspection services. In some instances the slaughtering is carried out by contractors' staff and in others by municipal employees and their methods. Construction, layout and equipment must all be geared to promote efficient and hygienic operations. The first step in planning an abattoir is to ascertain the ultimate maximum daily kill of each class of animal –proposed disposal treatment of the edible and inedible by products.

The actual system of operation must be determined, bearing in mind local conditions. It may comprise a complete meat plant including full processing facilities on one or more floors or an abattoir adapted only for slaughter and dressing.

Abattoir (slaughterhouse or meat plant):

Abattoir is the only specialized official place in which food animals should be slaughtered, inspected and prepared for direct human consumption. The first step in planning an abattoir is to ascertain the ultimate maximum daily slaughter of each class of food animal and the proposed disposal and treatment of the edible and inedible by-products.

Sites:

A/ suitable site for an abattoir should have the following facilities …
1- main water and electricity supply (1000L/ton) dressed carcass weight daily.
2- Mains sewerage.
3- Contiguity with uncongested road and rail system.
4- Proximity with public transport.
5- Proximity to supply of varied labour.
6- freedom from pollution from other industries , odors , dust , smoke and a 7- ability to separate clean and dirty area . 8- Freedom from local housing and other development to avoid complaints about noise and smell. 9- Good availability of stock nearby. 10- Ground suitable for good foundations, including piling and freedom from fl 11- sufficient size for possible future expansion. In general, urban sites should be avoided, rural and nominated industrial sites are preferred.

Water:

Mains water supply usually provides an ample supply of potable water, hot and cold water are very necessary, the hot from a central heating system, at not less than 82C˚.

On- site water storage tanks holding at least one day consumption are usual 272 L/day/bovine, 45 L /day/ovine.

Electricity:

Industrial three phase power should be supplied and stand – by generator installed.

Area size:

Careful consideration must be given to the size of the site, with allowance for various building and traffic circulation. Completely separate routes for stock and meat vehicle must be provided approach roads should be at least 6:10 m wide.

Small abattoir (up to 30000 unit / year) 1-2 acre.

Medium abattoir (50000 unit / year) 2-4 acre.

Large abattoir (100000 unit / year) 4-6 acre.

Acre = 4000 m ².

Overall layout:

There must be adequate partition between the clean and polluted section, with completely separate entrance and exits for traffic involved. Lairage accommodation should be sited away from main roads. The direction of prevailing winds should be taken into account in the siting of any inedible by-products department in relation to fresh meat areas. It is recommended that inedible rendering is restricted to large factories located outside the meat plant, and that all material is conveyed to them under approved security conditions.

Lighting:

Adequate natural or artificial lighting must be provided throughout the meat plant , type of lighting must not distort colors . It is recommended that overall intensity should not be less than.

540 lux (50 foot – candles) at all inspection points.

220 lux (20 foot – candles) in work rooms.

110 lux (10 foot – candles) in other areas.

Ventilation:

Adequate ventilation must be provided to prevent excessive heat, steam and condensation.

Ventilation prevent the accumulation of odors, dust etc. but it should not cause draughts and lead problems to staff. Opening ventilators and windows should be screened and internal window still sloped.

Floor and wall finishes:

All part of meat plant must be easily cleaned, this means that all floors and walls should be non- toxic and non-absorbent, the floor also non-slip. The floors of slaughterhouse should have gradients of 50 mm in 3 m and be coved at wall junctions. It is generally recommended that walls should be faced with a smooth, hard, impervious material up to a height of not less than 3 m from the floor.

Equipment design: the design and location of equipment should be such as to allow for ease and efficiency of cleaning and disinfection.

Pest control:

The ingress of birds, rats, mice and insects such as flies and cockroaches can cause serious problem, in addition to dirt, they carry food poisoning organisms, even those responsible for zoonoses .an effective final means of birds control is the use of narcotic baits Control is effected by ensuring cleanliness, absence of food scraps and use of specialist pest control firms. Plant location and design are important factors in prevention of fly infestation e.g. the manure bay must be sited away from meat areas.

Building:

There is various form of abattoir design, but the following are considered necessary in a modern meat plant dealing with a throughput in excess of 100000 unit/ year.

Lairage:

Lairage space sufficient for three days supply of cattle and two days' supply for sheep , it provided by roof to protect animal and staff particularly during identification , handling and sorting of stock , off-loading dock should about 1.2 m high to permit careful off-loading . The pen size for cattle (loose) 2.3 -2.8 m^2 and 3.3. M^2 for tied cattle, for sheep and calves 0.7 m^2.

Ante-mortem care of the food animals:

1- resting:

It is necessary to rest animals before slaughter, an adequate rest period may reduce the keeping quality of the meat due to incomplete development of acidity of the muscles and the early invasion of the system by putrefactive bacteria from the intestinal tract .these bacteria are the essential cause of bone taint in cattle. The meat animals slaughtered while exhausted appear dark in color due to incomplete bleeding. A period of 12-24 hours with a maximum of 36 hours detention and rest in a lairage is therefore essential before slaughter. Cattle that subjected to stress for short period may recover rapidly, and those subjected for a long period may take several days to regain physiological normality. In general it has been found that rest before slaughter is essential for the production of meat of good keeping quality.

2- Watering:

Animals should receive ample of drinking water during their detention as this serves to lower the bacterial load in the intestine and facilities removal of the hide during dressing.

Fasting:

Beside the need for physiological normality in animals before slaughter, there is also a duty to insure that they are not slaughtered with full stomach.

These requirements serve to prevent carcass contamination. Remembering that the fasting period begins at the animal leaves the farm .don't fasting for long period may be because loss of the body weight, moreover it has been recorded that the fasted animals bled better, easier to dress and have brighter color.

Slaughter hall:

The transference of animals from lairage to slaughter hall is easy if the abattoir is well designed. Many abattoirs spray the cattle from above as they move along race connecting the mustering pen and stunning pen and by horizontally directed water sprays fitted on both sides of race to clean the bellies, legs and feet. The size and type of slaughter hall for cattle depended on which of slaughtering system is adopted, but in all cases it should be an open hall with good floor space and well ventilated and lighted. There are two area in slaughter hall, stunning area and bleeding area.

Stunning prior to bleeding:

Most countries have legislation requiring that animals are rendered unconscious (stunned) by a human method prior to bleeding. Exceptions are made for religions which require that ritual slaughter without prior stunning is practiced, provided the slaughter method is humane. Stunning also makes sticking (throat- slitting) less hazardous for the operator. The animal must be unconscious long enough for sticking to be carried out, and for brain death to result from the lack of blood supply.

Methods of stunning:

Direct blow to skull using a club or poleaxe: the blow must be dealt with precision and force, so that the skull is immediately smashed, causing instantaneous unconsciousness. In cattle the aiming point is in the middle of the forehead in line with the ears, where the skull is thinnest. Horses have thinner skull and are therefore easier to stun by this method. In sheep and goat the brain is more easily reached from the back of the neck. A bolt held in the correct position by the mask is driven into the animals' brain by a hammer blow. The device is usually fitted with a spring which returns the bolt to its original position.

Free bullet: fired from a pistol into the skull is effective but unsafe .this method has been used on horses and cattle.

Captive –bolt pistols: fitted with a blank cartridge are effective on cattle and sheep but not pigs whose skulls are thicker. After firing, the bolt returns to its original position in pistol. The bolt may or may not be designed to penetrate the skull, with penetrating types the brain becomes contaminated with hair, dirt and bone fragments. If brains are to be saved as edible tissue then the non-penetrating type with a mushroom-shaped head should be used.

Electrical stunning: an electric current of high frequency, low voltage (60 – 80 v) is passed the brain of an animal for a few second to produce unconsciousness. Head tongs are suitable for pigs and sheep but not for cattle, the electrodes carried on the ends of the tongs must be accurately placed. Places where the skull is thick must be avoided .electrical contact is impeded by hair and caked mud. Water and brine will improve contact but the head must not be completely wet otherwise the current will have a short – circuit path avoiding the brain. The electrodes must be applied with strong pressure.

Carbon dioxide stunning: it is used only in large pig abattoirs .pigs are induced into a chamber and exposed to a concentration of 85 percent CO2 for about 45 seconds. Although effective for anaesthetizing sheep, it is impractical because of large amounts of CO2 collecting in the wool and affecting operators on the killing line.

Bleeding after stunning:

The objectives of bleeding are to kill the animal with minimal damage to the carcass and to remove quickly as much blood as possible as blood is an ideal medium for the growth of bacteria. Sticking, severing the major arteries of the neck should immediately follow stunning .care must be taken not to puncture the chest cavity or it will fill with blood.

Bleeding on a rail:

The most hygienic system of bleeding and dressing is to shackle the animal immediately after stunning, then hoist it on to a moving rail. The animal is stuck while being hoisted to minimize the delay after stunning. Bleeding continues until the blood flow is negligible when carcass dressing should begin without further delay.

Horizontal bleeding:

Horizontal bleeding is claimed to give faster bleeding rates and a greater recovery of blood. This may be due to certain organs and blood vessels being put under pressure when animals are hoisted, thus trapping blood and restricting the flow. Bleeding on the floor is very unhygienic.

Bleeding without stunning:

The Jewish and Muslim religions forbid the consumption of meat which was killed by any method other than bleeding. Since it is difficult to guarantee that all animals will recover consciousness after being stunned by any particular method, stunning is not generally allowed. There are exceptions; however some communities do accept low-voltage electrical stunning. Ritual slaughter may be less humane than sticking after stunning, because animals are fully conscious at the time of sticking. To reduce the suffering operators must be a successful cut or severing all the veins and arteries is made quickly at the first attempt.

Emergency slaughter hall:

This is actually a small abattoir with a lairage for up to four cattle , a slaughter hall and hanging room .it should be situated near to the suspect meat detention room and should also be in direct communication with the by-products department if one is provided .diseased or suspected animals must segregated and lairage apart from other animals .

Refrigeration accommodation:

The slaughterhouse provided with sufficient large chilling or refrigerating rooms, fresh meat must be chilled immediately after the post-mortem inspection and kept at a constant temperature of not more than 7C˚ for carcasses and cuts or 3C˚ for offal. The carcasses must be hung in such a way as to allow free movement of cold air around them; rail spacing should be 0.9 m for beef 0.5 m for sheep. The minimum space between carcasses on rail should be 0.3 – 0.4 m. it is vital that chill and freezer doors be close-fitting and that they be provided with an internal opening device to avoid personal being closed in the rooms.

Detained meat room:

Carcasses detained for further examination should be routed by a special rail to the detained meat room which should located adjacent to the main slaughter hall inspection point in order to identified and diagnosed the disease , from this detained meat room the overhead rail must reconnect with the main slaughter line for direction of carcasses either to the chill room or to the condemned meat room .it is important that there should be ample space for the examination of carcasses which ,being hot at this stage , should not be allowed to touch each other .

Condemned meat room:

In order to arrange for proper sorting and holding of material unfit for human consumption prior to dispatch, adequate space, refrigeration and drainage with durable and lockable container and weighing facilities are essential.

Hide and skin store:

As for by-product handling, gravity feeding of hides and skin is easier if the slaughter hall floor is on the higher level, and connected with various by-products departments by stainless steel chutes.

Gut and tripe store:

The initial separation and emptying of stomachs and intestine is normally carried out in the gut and tripe room, subsequent processing of stomachs and intestine should take place in a separate unit.

Offal room:

Offal should be trimmed and then placed in a chill or freezing room depending on the system of disposal .offal for edible purpose must be held at a temperature not exceeding 3 C˚.

Edible fat room:

This is a completely separate holding room, usually situated near the gut room and where edible fat is held pending dispatch.

Cutting room:

The hygienic procedure undertaken with initial carcass dressing are continued in the cutting room .during the cutting process the temperature of the building must not exceed 10 C˚ and the room must have sufficient refrigeration accommodation to keep meat at an internal temperature of not more than 7C˚ . There must also be a thermometer installed in the cutting room. Adequate facilities are necessary in the form of suitable equipment, an adequate supply of hot potable water to keep the whole area hygienic and waste disposal system that meets hygienic requirements.

Inedible area:

All material unfit for human consumption with exception of hide or skin should be sited away from edible areas. One of the difficulties associated with the inedible area is the arrangement for handling items such as omasums after separation from cattle paunches since improper handling of these organs can result in unhygienic conditions.

Fresh meat dispatch area:

The fresh meat dispatch area be sited away from the dirty part and access to it restricted to vehicle associated with meat and offal for human consumption. A system

whereby the meat plant rails coordinate with those of the meat transport vehicle is of great value efficiently and hygienically loading meat for delivery. There must be protection against pests of various kinds as well as stops to prevent damage to plant wall.

Manure bay:

This should be sited near the lairage on the dirty side of the plant, in some cases stomach and intestinal material is handled along with manure or it may be processed. Size and design depend mainly on throughput. Disposal of waste material must be carried out without greeting objectionable conditions.

Laboratory:

In the larger premises a well equipped laboratory is essential not only for the preliminary diagnosis of animal disease but also to maintain the overall hygienic standards. These premises are very often also utilized for the training of meat inspectors and other employees.

Meat hygiene……

Lec: 3 (preservation of meat):

first semester:

Successful feeding in countries unable to rise all their own food has been possible only by the improvements in methods of food preservation and transportation .as a result of the improved methods of preservation and transportation our diet has become more varied and better balanced , perishable foods have been made available the year round instead of only seasonally , the preparation of meals has been made easier , and foods in general are being produced in a cleaner and more sanitary manner than previously .

The primary purpose of food preservation is to retard spoilage. It is customary to use the term preservation to include the retardation or prevention of changes in flavor, odor, texture, appearance and nutritive value of the food. Whether food spoilage is mild to extreme, the primary cause is the action of microorganisms (bacteria, moulds or yeast) that can survive and developed under particular environmental conditions. Moreover, food spoilage can also occur due to autolytic changes including enzymatic, chemical and physical actions.

The main principles of all food preservation methods is to create unfavorable conditions (e.g. extreme heat or cold , deprivation of water , and sometimes oxygen , excess of saltiness or increased acidity) to the growth or survival of spoilage organism or destruction of such organisms .

The methods of food preservation are classified into two main categories.

The first one include methods for preservation of microbial decomposition (bactericidal methods) as canning and irradiation , as well as methods of hindering the growth and activity of microorganism (bacteriostatic methods) as chilling , freezing ,drying ,curing, smoking and use of chemicals .

The second category depends on the prevention or delay of self-decomposition of food, by destruction or inactivation of enzymes (blanching), prevention or delay chemical relations (antioxidants), and prevention of damage because of insects, animals, and mechanical causes.

For successful preservation of meat, it is essential to manage all animals correctly on the farm, during transportation and in the lairage to ensure the supply of clean healthy animals to the meat plant and that the operations in the meat processing plants are carried out in a good manner. The meat from animals properly handled and processed will have a low PH value which will aid in the preservation process.

With any method of preservation, it is essential to evaluate the effect on product quality, any health hazards involved for food handlers and consumers, the methods possible misuse, distribution and marketing problems, as well as engineering and economic evaluation of the methods commercial applications.

Growth curve of microbial culture:

Whenever microorganisms are added to a food and the conditions are favorable, the organisms will begin to multiply and pass through a succession of phases, which include, the initial "lag" phase (during which there is no growth). Logarithmic "exponential" phase (during which the rate of multiplication is rapid and constant). Stationary phase (during which the number of bacteria remains constant). And decline "death" phase (during which the number of microorganisms decrease).

Lengthening, as much as possible of the lag phase is of special importance in food preservation. this can be accomplished by reducing the contamination (the fewer organisms present , the longer will be the lag phase) , avoiding the addition of actively growing organisms from the logarithmic growth phase , applying one or more unfavorable environmental conditions (the greater the number of these conditions that are unfavorable , the longer will be the delay of the initiation of growth), and actual damage to organisms by processing methods such as heating or irradiation .

The generation time of microorganisms vary with the environmental conditions e.g. type of food, ph., temperature, oxidation-reduction potential, available moisture and presence of inhibitors. The generation time shortens as conditions become more favorable and lengthens as they become less favorable. any change in the environmental conditions that will extend the generation time will lengthen the keeping time of the food .if we start with a single cell, and if it divides every 10 minutes, there will be about a million cell in 3 hours, but only about 1000 cells if the generation time is 20 minutes, and only 32 cells if it is 40 minutes. This emphasizes the importance of avoiding contamination of food with microorganisms that are in the logarithmic phase of growth because their generation time is the shortest.

Physical changes in stored meat:

Meat undergoes certain superficial changes as a result of storage, chief of which are shrinkage, sweating and loss of bloom.

Shrinkage: or loss of weight occurs as a result of evaporation of water from the meat surface carcass cut into quarters dissipate water vapor rapidly and continuously, and retail joints even more. A freshly killed carcass dissipates body weight slowly, losing 1.5-2 % of water by evaporation during the first 24 hours of hanging.

Sweating: this denotes the condensation of water vapor on meat brought from a cold store into ordinary room temperature. The condensation occurs because the cold refrigerated carcass lowers the temp. Of air to below the dewpoint.

Loss of bloom : bloom is defined as the color and general appearance of a carcass surface when viewed through the semitransparent layers of connective tissue , muscle and fat which from the carcass surface .

Chemical changes in meat stored:

The chemical changes that take place after slaughter are indicative of a slight degree of breakdown in protein , due either to endogenous enzymes or to those of microorganisms , the odor of meat becomes progressively more marked but never disagreeable . The storage life of meat is more dependent on the chemical changes that take place in fat rather than in muscle, for fat rancidity, even in slight degree, is objectionable.

Drying: drying as such plays only a minor role in preservation today, the whole vast process of refrigeration is largely based on the principles of drying, e.g. the removal of water available for microbial growth .again, salting largely owes its preservatives action to the extraction of water by osmosis. Drying is not a commercial preservation method but is chiefly used by those who require a protein diet of great durability and lightness.

Meat curing: while curing may be applied to all kinds of meat, it is best adapted to those with a high fat content e.g. pork or fine –fibred beef intermixed with fat. And it is for this reason that brisket and flank of beef make high-quality pickled meat .on the other hand, lean beef, veal or mutton become dry and unpalatable on pickling. Salt is the principle preserving material used in curing on a commercial scale, though it appears to have a little directly harmful effect on bacteria.

Distinction must be made between salted meats (beef, pork) and cured meats (bacon, ham, corned beef). In salted meats the dry salt first dissolves in the surface fluid and then passes slowly inward until it is evenly distributed throughout the meat substances.

Curing may be defined as the addition of salt (NaCl) and nitrate or nitrite or nitric oxide to the meat. Which results in conversion of the meat pigments, predominantly myoglobin to the nitroso or cured form? myoglobin in freshly cut uncured meat is in the reduced form (purple) which in contact with air is rapidly oxygenated to oxymyoglobin , which is bright red and responsible for the bloom on meat .

Smoking : the purpose of smoking bacon is to preserve color and flavor for meat .the bacon is dusted with pea meal prior of smoking , which enhance the smoked appearance ,the smoke is produced in rooms so constructed as to emit a cool smoke .

Cold : the cold method , the basis of the great industry of refrigeration , is the simplest for the preservation of food efficient refrigeration can preserve meat in a condition approaching its natural state for periods adequate for commercial requirements, its appearance , weight and flavor are little altered and no substances is added to the meat nor any extracted .

Abattoirs should have sufficiently large chilling or refrigerating rooms lay down that …..

1- Meat must be chilled immediately after post-mortem inspection and kept at a constant tem. Of not more than 7C˚ for carcass and cuts and 3C˚ for offal's.

2- Cutting plants must have cooling equipment in the cutting rooms to keep meat at a constant internal temp. Of not more than 7C˚.

3- Cutting plants must have a thermometer in the cutting rooms.

4- during cutting the temp. Of building must not exceed 10C˚. In recent years, emphasis has been placed on shorter chilling cycles and lower temp.

(Quick chilling) for the following reasons ……

1- Both time and building space are saved and higher rates of product handling are achieved overhead in labour are reduced and capital investment in building minimized.

2- The meat is said to have a better keeping quality because lower air temp. (Usually below -3C˚initially) retard the rate of bacterial growth on the surface of carcass where their concentration is most pronounced.

3- Shrinkage of meat is reduced substantially an important economic factors.

4- The bloom is said to be enhanced by quick chilling.

Effect of freezing on pathogenic microorganisms and parasites:

Some bacteria are destroyed by freezing, but in others low temp. Merely inhibit their growth and multiplication until conditions favorable to their growth appear. Freezing is therefore of no great value in rendering a carcass affected with pathogenic bacteria safe for human consumption, nor are the bacteria commonly found on beef carcass destroyed by slow or sharp freezing.

Anthrax bacilli can withstand a temp. of -13C˚ while salmonella can withstand exposure to -175C˚ for 3 days , and tubercle bacilli have been found alive after 2 years in carcass frozen at -10C˚ . the virus of FMD can remain viable for 76 days if carcass of animals slaughtered during the incubative stage of the disease are chilled or frozen immediately afterwards . Under similar conditions the virus of swine fever may remain infective in the bone marrow for at least 73 days, and the virus has been shown to be viable in frozen pork for 1500 days.

Canning of meat:

Corned beef is perhaps the best known of the canned meat products; though considerable quantities of canned ham, ox, sheep and pig tongues and special hams are now manufactured .the preparation of corned beef will illustrate the procedure normally adopted in the preparation of canned meats.

Bacteria in canned beef:

It was at one time thought that the keeping qualities of canned goods depended upon the complete exclusion of air. Later it was suggested that the heating destroyed all microorganisms. While the sealing of the can prevented the entry of others, and that decomposition, when it occurred, was due to faulty sterilization or to entry of bacteria through a fault in the can.

Types of spoilage:

Canned goods are classified as spoiled when the food has undergone a deleterious change, or when the condition of the container renders such changes possible. Spoilage of canned goods may be of microbial or chemical origin or due to deleterious influences such as rust or damage.

1- Microbial spoilage: - bacteria of the decomposing or fermenting types are the most important as regards canned foods, while spore-forming bacteria are the most resistant.

There are 3 main types of spore-forming organisms which can resist normal processing and may cause spoilage in canned foods ……

*gas –producing anaerobic & aerobic organisms with an optimum growth temp.of 37C˚.

*gas –producing anaerobic organisms growing at an optimum temp. Of 55C˚.

*non-gas-producing aerobic or facultative anaerobic spore-forming organisms with an optimum growth temp. Of about 55 C˚.

2- Chemical spoilage: - hydrogen swell may occur quite independently of fermentation or bacterial decomposition, and is associated with the formation of hydrogen gas in the can. Purple staining on the inner surface of cans in which sulphur-contianing foods are packed may occur with all fish and meat products, especially liver, kidney and tongue.

3- Rust of damage: - cans showing external rust require careful consideration, and it is a condition particularly liable to occur beneath can labels when the adhesive contains hygroscopic substances.

Public health aspect of canned foods:

Improvement in the canning industry recent years , together with greater appreciation of its hygienic requirements , have done much to remove the public prejudice against canned foods , which were thought to cause food poisoning .food poisoning is usually the result of improper handling of good during preparation or storage .,and, with exception of botulism . Food poisoning outbreaks are nearly always caused by bacteria which would be destroyed during processing. Salmonella are destroyed with certainly by the temp. Attained in commercial processing. The minimum standards of processing now universally recognized by reputable canners ensure the destruction of CL. Botulism spores in low and medium acids foods. Staphylococci and more rarely Streptococci are now recognized as a cause of food poisoning mainly in prepared or unheated foods, such as cheese, salad, milk or ice cream.

Meat hygiene……

Lec: 4 (animal by-products):

first semester:

Animal by-products are everything from the meat that may not be sold directly as food. There is a variety of by-product obtained from the meat animals. Although animal by-product is valuable sources of proteins and other nutrients, it generally has less nutritive value than "meat". Generally, animal by-product is divided into two classes, edible and inedible. In the scientific terminology, offal means slaughter by-products, and includes the entire animal which is not a part of the carcass. The terms drop or viscera are also used. The terms principal and secondary may also used in classification of animal by-products. Secondary by-products are items manufactured from the principal one. In our country edible offal are considered as nutritive and attractive food especially in rural areas probably due to its cheap price and palatable taste and finally the public habits.

Purchasing power of the consumers, food habits and customs are the basic factors in division of by-products into edible and inedible. Moreover traditions culture and religion are often important when a meat by-product is being utilized for food. Regulatory requirements are also important, because many countries restrict the use of meat by-products for reasons of food safety and quality.

Eficient utilization of meat by-products in important for the profitability of the meat +industry. It has been estimated that 11.4% of the gross income from beef, and 7.5% of the income from pork, come from the by-products. It is of many countries restrict the use of meat by-products for reasons of food safety and quality.

In the past by-products were a favorite food in many places in the world, but health concerns have led to an increased focus on non-food uses, and consequently the traditional markets for edible meat by-products have gradually been disappearing. In response to these problems, meat processors have directed their marketing and research efforts toward non-food uses, such as pet food, pharmaceuticals, cosmetics and animal feed.

Animal by-products including organs (fat, skin, feet, abdominal and intestinal contents, bone and blood) of cattle, pigs and lambs represents 66, 52 and 68 % of the live weight respectively. More than half the animal by-products are not suitable for normal consumption, because of their unusual physical and chemical characteristics. As a result, a valuable source of potential revenue is lost, and the cost of disposing of these products is increasing.

Benefits derived from by-products:

1- Improved environmental sanitation: all unused offal attracts flies, rats, stray dogs and other vermin, thus causing public nuisance and even danger of spreading

diseases .meat slaughtered and kept under bad sanitary conditions created by this offal result in a product not only of inferior keeping quality but also it serving as a vehicle for transmission of disease. So the better method is produce sterilized, concentrated products suitable for stock feed through reduction of moisture content to the point where bacterial multiplication is inhibit.

2- Healthier and more productive livestock: bone meal in the form of powder or bricks is the first step in the production of mineral supplements. Addition of salt and trace elements such as copper, iodine, cobalt and iron to bone meal convert it into complete mineral supplements.

3- development of secondary rural industries : the manufacture of by-products of animal origin leads to establishment of secondary rural industries ,a- hides and skin provides a sound base for tailing industry .b- hides , skin and tendons are sources for glue manufacturing .c- hair and bristles are suitable for brushes .d- tallow is used for ufacturing of soap .

4- Price structure: by-products influence the price of meat. The return derived from by-products may be used to lower the price of meat to the consumer.

Edible by-products:

Variety meats are the wholesale edible by-products .they are segregated, chilled and processed under sanitary conditions, and inspected. Edible by-products constitute 8.4 % of live weight of cattle and 14.5% of sheep. it include , liver , heart , tongue , tripe , ox-tail , kidney, sweetbread , brain , fat and sausage casings . In some parts of the world, blood is also utilized as an edible product for human consumption. Almost all of the edible by-products are more perishable than the carcass; therefore these items must be chilled quickly after slaughter and be processed or moved quickly into the retail trade.

Edible meat by-product contains many essential nutrients .some is used as medicines because they contain special nutrients such as amino acids, hormones, minerals, vitamins and fatty acids. Several meat by-products have a higher level of moisture than meat e.g. lung, kidney, brains, spleen and tripe.

Inedible by-product:

Inedible by-products are not generally eaten by humans , and some can be fed to animals .they include dead animals , condemned carcasses ,skin,hide,bones,wool,hair,bristles,hoofs,horns,claw,ear,ilps,snout,teeth,gall bladder and bile stone .according to the aforementioned regulations some organs may be considered edible or inedible e.g. uterus , lung , spleen , feet , head , blood and testicles .

Pharmaceutical preparation of animal origin:

Livestock population and the services of the meat industry play an important part in the treatment of the diseased human. For out of the meat industry comes many important medications which can be derived from animal sources. Such as lifesaving insulin for diabetic, liver extract for perinaceous anemia, thyroid extract, other

hormones and glandular products, enzymes aid digestion, bile salts and many others.

The following specifications allowing the products to be used for human pharmaceuticals:

1- All animals should be certified (BSE) free nation bovine spongiform encephalopathy.

2- Animals are between 12 and 24 months of age.

3- Cattle are fed nutritionally balanced rations.

4- Animals have never been fed ruminant meat or bone meal.

5- Animals must feed in selected feed yards for a minimum of 110 days.

6- A complete health history is documented on each animal,

7- Safety and wholesomeness are assured through constant monitoring and careful management of critical control points.

Utilization of blood:

Animal blood has a high level of protein and heme iron, and is an important edible by-product. In Europe, animal blood has long been used to make blood sausages, blood pudding, biscuits and bread. In Asia, it is used in blood curd, blood cake and blood pudding. Blood is usually sterile in a healthy animal. It has a high protein content (%17), with a reasonably good balance of amino acids .blood is a significant part of the animals body mass (2.4 -8.0 % of the animals live weight).

Medicinal and pharmaceutical uses of blood:

Blood can be separated into several fractions that have therapeutic properties. Liquid plasma is the largest fraction (63 %). it consists of albumin (3.5%), globulin and fibrinogen (4 %). in the laboratory, many blood products are used as a nutrient for tissue culture media, as a necessary ingredient in blood agar, and as peptones for microbial use. Glycerophosphates, albumins, globulins, sphingomylins and catalase are also used for biological assay. Many blood components such as fibrinogen, fibrinolysis and serotonin.

Utilization of hides and skins:

Animal hides have been used for shelters, clothing and a container by human beings since prehistoric times. The hides represent a remarkable portion of the weight of live weight in live animal.

Stacking of hides and skins:

After the hide is removed from the animal, it should be cured quickly to avoid decomposition by bacteria and enzymes. There are four basic treatments. **One** is air-drying, **second** is curing with salt, **third** and **fourth** is curing by mixer and raceway respectively.

Salt curing is often used for the raw hides. The quality of cured hides and skins is usually based on their moisture and salt content. The moisture of hides should be in the range 40 – 48 %, if they are to remain in good condition during storage or shipping. Some chemicals or insecticides are often used to help protect the hides from insect damage or for short –term preservation before tanning.

Gelatin from hides and skins:

Gelatin is produced by the controlled hydrolysis of water –insoluble collagen derived from protein. it is made from fresh raw materials (hides or bones) that are in an edible condition .both hides and bones contain large quantities of collagen .the processing of gelatin from hide consists of three major steps . The first step is the elimination of non-collagenous material from the raw material. This is followed by controlled hydrolysis of collagen to gelatin. The final step is recovery and drying of the final product.

Uses of gelatin in the food and pharmaceutical industries:

Gelatin is added to a wide range of foods, as well as forming a major ingredient in jellies and aspic .it is main use in the production of jellied desserts, because of its "melt in the mouth" but is also added to a range of meat products, in particular to meat pies. Gelatin is also widely used as a stabilizer for ice cream and other desserts. Approximately 6.5% of the total production of gelatin is used in the pharmaceutical industry, most of it used to make the outer covering of capsules.

Hides and skins for food and sausage casings:

Gelatin extracted from animal skins and hides can be used for food. The raw material can also be rendered into lard .collagen from hides and a skin also has a role as an emulsifier in meat products because it can bind large quantities of fat.

Medicinal and pharmaceutical uses of hides and skins:

A product made from extracted collagen can stimulate blood clotting during surgery. Pork skin is similar to human skin, and can be converted into a dressing for burns or skin-ulcers. Pork skin used as a dressing needs to be cut into strips or into a patch.

Utilization of bone:

Eleven percentages of pork carcasses, 15% of beef carcasses and 16% of lamb carcasses is bone. These values are higher if they include the meat clinging to the bone. For centuries, bones have been used to make soup and gelatin, in recent years, the meat industry has been trying to get more meat from bones, and new techniques have been used for these purposes.

Gelatin from bone:

Ossein is normally produced from bone for gelatin extraction. The bones must first be pretreated by cooking them at 80-95C˚ to remove the adhering meat, gristle and fat. Then washed several times to get the bones clean. Next, the bones are washed in dilute hydrochloric acid to remove the minerals.

Bones used to flavor liquid concentrate:

Chicken bones are often used to flavor a concentrate used in cooking. In this process, crushed bones are cooked with water for 8-12 hours. the product is cooled and the fat skimmed off .the liquid remaining contains approximately 5% solids .currently , the time of processing has been reduced to one or two hours by using a high-pressure extraction system.

Utilization of edible tallow and lard:

Animal fats are important by-products of the meat packing industry. The major edible animal fats are lard and tallow. Lard is the fat rendered from the clean tissues of healthy pigs. tallow is hard fat rendered from the fatty tissues of cattle or sheep .Lard and edible tallow are obtained by dry or wet rendering .in the wet rendering process ,the fatty tissues are heated in the presence of water , generally at a low temperature . The quality of the lard or tallow from this process is better than that of products from dry rendering. Traditionally, tallow and lard are used for deep frying .however; this use is declining in the fast –food industry, due to consumer health concern. An alternative liquid tallow product has been developed for the preparation of French fries and other fast foods, since less fat is absorbed.

Meat hygiene……..

Lec: 5 (plant sanitation):

first semester:

It cost less to be clean than to be dirty. **Sanitation** is one of the most important functions in the meat plant and involves a technology no less detailed than that of slaughter and carcass dressing. It demands well-trained and responsible operatives whose influence on meat quality, product shelf-life and working conditions should not be underestimated.

The contamination occurring in an abattoir is largely derived from the animals entering it as well as from the procedures of slaughter and carcass dressing. The accumulation of animals in lairage further increases the possibility of carcass contamination by salmonella unless strict attention is paid to cleanliness and the avoidance of overcrowding.

Inside the meat plant bacteria are spread by contact with personal, clothing, surface and equipment, vermin, birds, insects and animals are other means of spread of bacteria. Microorganisms can also be brought into the premises by visitors and by other personal and their vehicle employed in the ancillary trade's .it is important, therefore, to keep the initial contamination on the animals to a minimum and to supplement this with strict hygiene at all stages in the abattoir itself.

Building and equipment:

Most countries in which meat hygiene is of a high caliber possess regulations which set standards for meat premises in relation to overall layout , type of construction , materials used , lighting , drainage , etc . All buildings must be vermin –proof and kept free from flies. The surrounding area must be well maintained so that there is no risk to the plant from vermin or insects .floor and walls should be of smooth impervious material, with corners covered. Maintenance should be of a high standard whether this is related to equipment or to operations such as plastering, painting, etc. all paints used should be have a lead-free type stainless steel is an ideal material when used in the proper place. The type of equipment to be used must be of good quality, durable, easily cleaned and non-toxic to meat and meat products.

Cleaning components:

Before discussing the actual measures designed to reduce the amount of bacterial contamination in the meat plant it will be useful to define the meaning of certain terms sterilization refers to any process, chemical or physical, which destroys all living microorganisms. It is an absolute term, sterility meaning the absence of all forms of life .a disinfectant is an agent usually a chemical one, which destroys bacteria. An antiseptic is a substance which prevents or arrests the growth of organisms either by inhibiting their activity or destroying them. A germicide is a substance which will destroy vegetative bacterial cells but not necessarily bacterial spores and is thus it's

a kind of disinfectant; it is usually applied in relation to disease –producing bacteria. A sanitizer is a chemical agent which reduces to acceptable bacteriological standards the number of bacterial contaminants on surfaces in contact with food. Most sanitizers on sale are made up of combined detergent – sanitizing compounds.

Detergent:

A detergent is a cleansing substance which acting with water, can remove soil or dirt from surfaces. It may be natural or artificial and may be in the form of tablet, powder, flake or liquid. The most effective natural detergent is water. However is not a very good wetting agent because of its high interfacial tension which is inhibits close contact with other surfaces. Artificial detergents may be simple inorganic chemical compounds such as washing soda (sodium carbonate) or more complex organic substances such as soap or mixtures of synthetic cleansing materials and lather-producing chemicals as in modern washing powders and liquids.

Detergents consist of two main categories:

1- Soapy detergents (made by heating animal and/or vegetable oils with an alkali, usually caustic soda).

2- Soap less detergent, usually in the form of powders or liquids, are manufactured mainly from mineral oils.

There are four main groups of detergents or surface – active agents ……..

1- Anionic detergents produce electrically negative ions in solution e.g. soap and most modern synthetic detergents.

2- Cationic detergents produce electrically positive ions in solutions. It's a weak detergent.

3- Non-ionic detergents do not produce an electrical charge in solution.

4- Amphoteric detergents act as anionic or cationic detergents depending on the ph. of the solution. (They are not used extensively in food industry).

Sanitizing (disinfecting) agents:

The sanitizing agents commonly used in the food industry belong to four main groups, halogen – based formulations, quaternary ammonium compounds, amphoteric compounds and acids and alkalis.

Halogens:

Chlorine is used today in many food industries for sanitizing or disinfecting purposes as well as for the treatment of water (process and potable) and sewage (algae and odor control) , and for the treatment of equipment in the drug and pharmaceutical field and hospitals .

Objectives of sanitation:

1- Visual hygiene – freedom from obvious dirt.

2- Chemical hygiene – no residues of cleaning compounds.

3- Microbiological hygiene – freedom from potential pathogens. The use of an HACCP system will be of value in determining possible hazards.

Pre-slaughter inspection:

Operations must not begin until a satisfactory report is received from the inspectors. Operation must also cease if unsatisfactory hygiene conditions occur and not recommence until defects are remedied. The pre-slaughter inspection is a most important function for which the inspector requires the following essentials, sanitation reports, torch, and surface sampling swabs/spatula/containers.

Cleaning facilities:

Recently two methods of detergency-foam and gel cleaning have been introduced which greatly reduce the need for manual work. These compounds contain chemicals appropriate to the soil and surface being cleansed.

There are four advantages of foam cleansing are …..

1- It is labour –saving. Large surface areas can be covered in a relatively short time. It can penetrate inaccessible areas, often eliminating the need for the dismantling of equipment.

2- It is economical since the foam clings to surface and does not turn to waste.

3- It is biodegradable and does not give rise to effluent problems.

4- Foam does not splash and is comparatively safe to use.

Good food plant sanitation is a critical part for ensuring food safety. The core of any sanitation plan knows how to effectively clean a plant in terms of what types of soils are encountered. This information pamphlet explains some common principles that will help processors first understand sanitation and second, how to help to build a functional sanitation plan for their plants.

Knowing your soils:

Knowing what kind of soiling or dirt you are facing is very important since different types of chemicals and applications. Soiling itself refers to the waste products that are left over on equipment and the facility as a result of food processing. There are two main types of soils, organic and inorganic. Examples of organic include large chunks of animal flesh, fur, feces, horns, blood, cuttings, food particles and other materials that are left over after processing. This material is a food source for

microbes. Organic can be broken down to bulk debris, fats and protein –type materials. Bulk debris is best removed manually, fats with caustics and protein materials with caustics fortified with chlorine.

The second type of soil is inorganic examples include scale and mineral buildup .scale is not a good food source for microbes but rather provides a good hiding spot which can prevent adequate meat plants usually deal with primarily organic soils , while dairy usually have both types . The types of food you produce are usually the deciding factor on how you will plan to clean the plant.

Five steps to effective sanitation:

1- The first step is removal of bulk debris. Bulk debris includes large pieces of waste material, spills and left-over material occurring from processing. The best way to remove this material is manually .this means that all the bulk pieces must be collected first and disposed of in the garbage. This must always be performed first for any sanitation program.

2- The second step is the rinse. After the bulk material has been removed, the equipment and area should be rinsed with potable water to further remove debris and prepare the surface for the cleaner. Generally speaking warm water will be more effective than cold when applying the initial rinse.

3- The third step is to apply the cleaner .all cleaners will have instructions for use on the label which will determine the amount used.

4- Once the area and equipment has been cleaned according to manufacturer recommendations, a rinse will be required to remove the cleaner. A warm rinse will be most effective unless specified otherwise by manufacturer instructions.

5-- The fifth and final step is to apply a sanitizer .some sanitizers are required to be rinsed off after a certain time, and others do not require rinsing. The sanitizers' job is to reduce the bacterial load to low levels.

There are several kinds of sanitizers including iodine – based, chlorine- based and hydrogen peroxide / peracetic acid.

Meat hygiene……

Lec: 6 (microbiology of meat & meat products):

first semester:

Presence of microorganisms even if saprophytic in meat or its products is extremely undesirable as during their enzymatic activities. Certain objectives unfit for human consumption are produced. The harm will be increased if pathogens find in the product.

Sources of contamination:

1- Animal condition prior to slaughter …a- pre-slaughter handling. b- Stresses .c- health condition.

2- During slaughter … a- action of slaughtering. b- Contamination of knives with blood.

3- Surface contamination of meat … a- exterior of the animal 50% skin heavy contamination, dirty animal should not be slaughter. b- during preparation of carcasses: such as ….. 1- Evisceration should close the rectum and esophagus, also fasting of the animal help in decreasing of the contamination. 2- During preparation of the carcass, by contaminated water and cloths used for cleaning of the carcass may spread the contamination.

4- Handling of meat … excess of contamination from hands or other cloths.

5- In retail market … a- at butchers shop, the meat should be transmitted by child vehicle .b- at refrigerators, if not cleaned or disinfected.

Reduction of contamination of meat (produce high quality meat):

1- Careful selection of slaughtering animal.

2- Rest of animal before slaughtering.

3- Fatigued animal kept not less than 72 hours with food and water.

4- Fasting for 12 hours before slaughtering.

5- Watering of animal before slaughtering.

6- Do not slaughter animal with high temperature.

7- Diseased animal (T.B, brucella, salmonella …etc.) slaughtered at isolated part.

8- Cleaning and disinfection of premises and equipment's.

9- Stomach and intestine should be freed in separated places.

10- Clean water should clean and bacterial examination.

11- Good hygiene of workers … a- healthy and medically certified .b- well trained and educated. c- Have hygienic facilities.

12- Prevent air contamination … a- plantation of trees around. b- Setup air filters .c- bacterial examination of air once per week.

13- Flies and rodents must be avoided.

14- hygienic of transport of meat in special cold trucks.

15- Butchers shop should be hygienically constructed.

16- Meat should be kept at 1-2 C˚until used.

Spoilage of meat:

Meat is perishable food, sooner or later will show undesirable changes depending on their bacterial load and environmental condition.

Therefore keeping quality of the product depends on:

1- Rate of contaminates.

2- Growth of contaminates, **their depends on …**

A- Associative growth … if conditions are favorable for all types of microorganisms, bacterial grow faster than yeast and yeast faster than mold.

Meat should be stored at low temperature not far above freezing where only molds, yeast and psychrotrophic bacteria can grow slowly and produce characteristic defects. The putrefaction is rare at these low temperatures, but is likely at room temperature.

At chilling temperature, psychrophiles are favored and proteolysis occurs. At atmospheric temperature, mesophiles (confirm, bacilli and clostridium) grow with production of acid from glycogen.

B- environmental conditions …the environmental conditions determine which of existing contaminates will outgrow others and cause its type of change or spoilage.

The factors influences the growths of microorganisms are ……

1- Physical property of meat, exposed surface of meat has the greatest load of microorganisms.

2- Chemical property of meat, meat is a good medium for microorganisms as it contains different nutrients (protein, fat .etc.).

Meat putrefaction:

It means breaking up or hydrolysis of protein into simpler undesirable substances through the action of proteolytic enzymes liberated by putrefactive microorganisms. During this process, protein molecules are broken up into peptones, polypeptides, amino acid .etc. Putrefaction depends on the number of microorganisms, the PH of

meat, holding temp. Usually putrefaction begins after rigor-mortis but it may begin immediately after slaughter or death, blood is subjected to putrefaction. the signs of putrefaction includes ,changes in color to grey , yellow or green , the texture become soft in consistency , the odor becomes repulsive and reaction become alkaline .

Forms of meat putrefaction:

1- Meat sliming: it appears on the surface of cooled meat which is kept in chilling room at humidity more than 90% and a temperature above 2C˚. It has the appearance of continuous coating on the meat surface due to the growth of various bacteria and yeasts .at first; it appears as tiny small drop colonies of psychrophilic microorganisms such as pseudomonas.

2- Sour side (acid fermentation): it occurs within carcasses which are hanged too close to each other .it is caused by lactic acid bacteria. The meat gets grayish white color, soften in consistency.

3- Bone taint: it is caused by growth of anaerobic putrefactive microorganisms in deep sitting muscle with very offensive **odor caused by predisposing factor …….** A – Un-rested and un-fasted animal .leading to migrate microorganisms from intestine to deep tissues- fatigued animal the muscle has an alkaline PH which will allow microbial growth. C- Suitable temperature in summer without chilling (mainly anaerobic bacteria).

4- Phosphorescence: it caused by some bacteria which produce fluorescence pigments e.g. pseudomonas fluorescence which produces toxins and fast decomposition of fat especially in imported animal. The organism may infect chilling rooms by storage of fish. The chilled meat may show luminous area scattered over its surface in dark.

5- Decomposition of fat: it result in change in odor, **taste and flavor of fat the cause may be …….**

A – Absorption of foreign odor. If meat is stored in a chamber previously used for fruits, fish or any other substances having a strong odor.

B – Rancidity which may be due to: first – oxidation of fat / this is the most common through oxidation of unsaturated fatty acids of fat .therefore the meat must be well wrapped in green red or in cellophane casing. Second – hydrolysis by bacterial enzymes / this occurs by the action of lipolytic microorganisms, so the lipase enzyme acts on the fat and hydrolyses it into fatty acids and glycerol. Unsaturated fatty acids cause rancidity.

6- Moulds: the growth of mold on meat causes a problem to those exporting meat .as moulds are aerobic organisms, therefore they develop only on the surface of meat.

Food poisoning:

Food poisoning causes gastro-intestinal disturbances, arises from variety of causes including …..

1- Food allergy: this is due to hypersensitivity of some persons to certain food stuffs which are rich in protein .e.g. meat, milk, eggs, cheese, fish. It occurs in a form of diarrhea, vomiting, itching and sweating.

2- Chemical contamination: it is not common, it occurs as a result of accidental contamination or due to chemical action between food stuff and its container.

3- Poisonous plants and animals: this includes some poisonous plants, fish shellfish and certain fungi.

4- Contamination by microorganisms and their products: it is a disturbance of the gastrointestinal tract with abdominal pain and diarrhea with or without vomiting; the onset may be in less than one hour or more than 48 hours after eating contaminated food.

Food infection:

The microorganisms can grow and multiply in the food, sometimes will elapse before their multiplication in the body to produce the symptoms .such as …..

Salmonella food poisoning:

Salmonella are gram negative small rod, non spore forming .and ferment glucose with gas production but not ferment lactose or sucrose. They are not destroy in carcass or offal held at freezing temperature or in pickling solution but destroyed in heat treatment.

Source of infection: the organism may reach food directly or indirectly from animal excreta at time of slaughter or from human or water or tools .incubation periods 12-36 hours after consumption of contaminated food. Symptoms, fever, headache, diarrhea, vomiting.

Methods to prevention:

1- Ensure animal feeding stuffs are salmonella free.

2 -prevent contamination of food by hygienic production.

3- Destruction of organism in food by heating.

4- Avoid cross contamination.

5- Personal hygiene.

Food intoxication:

Food intoxication, caused by ready formed toxins presence in food when it is consumed.

Staphylococcus aureus:

Gram positive, aerobic, non-spore former cocci which grow at 37-44C˚, destroyed by heating but the toxin is heat stable even at 100C˚. Source of infection, the main reservoir was nasal discharge of person, suppurative lesion in food handler, throat and then they found their way to air, dust and cloths then contaminates food .incubation period, rapid onset 2-6 hours. Symptoms, nausea, sever vomiting, diarrhea, abdominal pain, sweating, headache and finally no fever .duration of illness 24-48 hours.

Methods of prevention:

1- Personal hygiene.

2- Care in handling food.

3- Heat treatment of food to kill staph. Before their multiplication.

4- Prevention of growth of staph. By cold storage.

Clostridium botulinum:

Gram positive, anaerobic spore forming, found in soil, dust and water. The poisoning occurs by the ingestion of food containing the toxin produced by the organism. The toxin is nerve poisoning and lethal in small amount. Source of infection, fruits, vegetable which are contaminated with mud. Food associated with anaerobic condition as fish, meat and its products, canned food. Incubation period 18 – 36 hours. Symptoms, fatigue, headache, strong constipation central nerve system is affected, disturbance of vision and paralysis of throat muscle. (Death occurs by paralysis of the respiratory centers).

Methods of prevention:

1- Spores destroyed by heating food to 120 C˚for 20 minutes.

2- Pickled food become safe in brine solution used is not less than 10%.

3- In smoked fish, the heat must be not less than 82C˚for 30 minutes.

Meat hygiene……

Lec: 7 (chemical residues in meat):

first semester:

Chemical means an agricultural or veterinary substance of toxicological or environmental effect. NO chemical is safe under all conditions of use. It is therefore important to evaluate the safety of all chemicals including its parent compounds and/or metabolites to determine its acceptability.

Chemical residues are those chemicals not intended to be present and which are left over from some processes in the production of the food. chemical are broadly used for controlling weeds , insects and other pests , treating or preventing animal diseases and infestations and growth promoters .

Veterinary chemical residues can result from the use of veterinary drugs for growth promotion and disease control in animal production (direct route due to application of an agricultural and veterinary chemical and/or an incidental contaminant entering the production system) or because there has been chemical treatment of some other material that is then taken in by the animal (consumption of animal feed crops contains herbicides and pesticides).

For example, residues in meat could result from indirect chemical contamination if animals are fed grain or forage that has been treated with pesticide.

A large number of drugs used to control or prevent infections or to promote growth. Additional chemicals may be added to food to ensure maximum utilization and to delay deterioration. Even when chemicals are used according to recognized doses and route of administration and when pre-slaughter withholding times are observed, tissue residues can result.

While the use of agricultural and veterinary chemicals provides many benefits, there is also some risk that residues of these chemicals may be found in agricultural products .residues adversely affecting both the environmental and human health. Also, residues, even in minute amount can affect quality of product demanded by consumers. American institute for cancer research estimated the exposure to all manufactured chemicals in air, water, soil and food is believed to cause less than 1% of all cancers.

Antimicrobial:

In mammals, the most frequently used drugs in this group are the antibiotics. An antibiotic is a chemical substance produced wholly or partly by fungus or a bacterium, which has the capacity to inhibit the growth or to kill bacteria. Antibiotics can be used therapeutically in short courses of treatment to control diseases of animals or at lower concentrations but over a longer time, to promote growth. When used therapeutically, antibiotics can reduce the symptoms of diseases and may result in unhealthy animals being accepted at ante-mortem inspection.

Antimicrobial are a difficult group of drugs to detect chemically because of they are diverse and show great variation in their chemical structure. They are also used in a wide range of formulations and are administrated by many routes.

Not all antibiotics residues retain activity after metabolism in animal tissues; the target tissue is (muscle, liver, kidney, fat).

Commonly used antimicrobial agents include the penicillin's, streptomycin, neomycin, tetracycline, chlortetracycline and oxytetracycline. The use of chloramphenicol in farm animals is now prevented.

The most frequently used tests for detection of antimicrobial agents are based on the detection of residual antimicrobial activity. The basic microbiological methods are the four-plate test (FPT). Meat samples are applied to four plates of agar medium, three of which are inoculated with Bacillus subtilis spores at ph. 6, 7.2 and 8 .the diffusion of the active antibiotics is detected by the formation of clear zones in one or more plates after overnight incubation. The reliability and sensitivity of the test is monitored by applying 6 mm diameter filter-paper discs containing standard quantities of known antibiotics.

Hormones:

Hormones are naturally present in very small amounts in all meats, whether from implanted animals or not. The human body produces hormones in quantities much greater than would ever be consumed by eating beef or other foods.

Hormones have been used for a variety of therapeutic and growth-promoting purposes in animals. in general , use of hormones as growth promoters has resulted in 10-15% increases in daily gains , similar improvements in feed conversion efficiency (FCE) and improvement of carcass quality increased (lean/fat ratio) and improves overall quality and healthfulness of beef . There has been a substantial reduction in the amount of energy required per unit weight of protein produced and the economic implications of this have been great. An estimated 70 to 90 % of feedlot cattle are implanted. Although, the use of hormonally active substances in animal production rose, opposition to their use also increased, because of the theoretical possibility that residues in edible tissues might endanger consumers.

FDA approved the use of five hormones (estradiol ,testosterone ,progesterone ,trenbolone acetate and zeranol) .the first three are produced naturally by livestock as well as humans ,the last two are synthetically made and are not found physiologically in animals or humans . Such hormones proved to be not harmful to consumers eating meat from hormone-treated livestock provided that the implants are used according to accepted husbandry practices.

Post-mortem examinations need to detect abnormally high concentration for extended to include specific examinations for the sex or physiological status of the animal.

Animals that are suspected of have been implanted with growth promoting hormones must be tested when these are presented for slaughter .in the live animal , which is tested on-farm , blood or feaces are the most convenient samples to collect , sometimes urine may also be used , at slaughter , blood , rectal feaces , liver ,kidney and muscle can be obtained from all animals , bile is usually available but the quantity may vary .

Pesticides:

Pesticides is a term encompassing a wide variety of substances used in food production to control undesirable plant , insect and other animal populations .pesticides must be toxic to some living organisms to fulfill their role . Depending on the pest being controlled, they may be termed insecticides, fungicides, herbicides, bactericides; nematicide and growth regulators .the insecticides that are directly applied to food animals and the anthelmintics are regarded as the most important subgroup.

Pesticides used to remove internal parasites such as liver fluke and nematodes are important in animal production systems.

Detecting of pesticides using spectrographic methods which depends on color producing reactions were the first to reach sensitivities at the ppm level, but these methods have been replaced by chromatographic techniques.

Heavy metals:

Excessive intakes of heavy metals in food have caused intoxications in human. Such as …..(arsenic , mercury , cadmium , copper , selenium , mycotoxin , aflatoxins).

Meat hygiene……

Lec: 8 (veterinary ante mortem examination of food animals):

first semester:

Ante mortem inspection means examination of food animals prior to slaughtering. The objectives of such inspection are:

1. To screen all food animals destined to slaughter.

2. To ensure that food animals are properly rested and that proper clinical information, which will assist in the disease diagnosis and judgment, is obtained.

3. To reduce contamination on the slaughtering floor by separating the dirty animals and condemning the diseased animals if required by regulation.

4. To ensure that injured animals or those with pain and suffering receive emergency slaughter and that animals are treated humanely.

5. To identify reportable animal diseases to prevent slaughtering floor contamination.

6. To identify sick animals and those treated with antibiotics, chemotherapeutic agents, insecticides, pesticides.

7. To require and ensure the cleaning and disinfection of trucks used to transport livestock.

Ante – mortem inspection is carried out in lairages. Both sides of an animal should be examined at rest and in motion on the day of their arrival and every 24 hours during holding the animal in the lairages. The inspection must be repeated immediately before slaughter.

Procedures or technique of ante-mortem inspection:

1. Owners name.

2. The number of animals in the lot and arrival time.

3. Definition of the animal species, age, sex .aim of definition for economic state.

*male cattle not slaughtered before 2 years old or 300 kg live weight. *male buffalo slaughtered at weight not less than 120 kg live weight.

4. Clinical signs (temperature, pulse and mucous membrane).

5. Pregnancy conditions.

6. General conditions of the animal (clean, dirty, fatigue).

7. Nutritive state (poor, emaciated).

Ante – mortem inspection is carried out in adequate lighting where the animal can be observed both collectively and individually at rest and motion. Some of the abnormalities, **which are checked on ante-mortem inspection, include:**

1. Abnormalities in respiration: commonly refer to frequency of respiration. If the breathing pattern is different from the normal animal should be segregated as a suspect.

2. Abnormalities in behavior: manifested by one or more of the following signs. The animal may be ….
*walking in circles or show an abnormal gait or posture. *
pushing its head against wall. *
charging at various objects and acting aggressively. *
showing a dull and anxious expression in the eyes.

3. Abnormalities in gait: an abnormal gait in an animal is associated with pain in the legs, chest or abdomen or is an indication of nervous disease.

4. Abnormalities in posture: abnormal posture in an animal is observed as tucked up abdomen or the animal may stand with an extended head and stretched out feet. The animal may also be lying and have its head turned along its side. When it is unable to rise, it is often called a "downer" Downer animal should be handled with caution in order to prevent further suffering.

5. Abnormalities in structure (confirmation) are manifested by:

1. Swelling abscesses seen commonly in swine.

2. enlarged joints.

3. Umbilical swelling (hernia).

4. Enlarged sensitive udder indicative of mastitis.

5. Enlarged in jaw "lumpy jaw".

6. bloated abdomen.

6. Abnormal discharges or protrusions from body openings e.g.:

1. Discharges from the nose, excessive saliva from the mouth, afterbirth.

2. Protruding from the vulva, intestine.

3. Protruding from the rectum (prolapsed rectum) or uterus.

4. Protruding from vagina (prolapsed uterus).

5. Growths on the eye and bloody diarrhea.

7. Abnormal colors: such as red areas on light colored skin (inflammation), dark blue areas on the skin or udder (gangrene).

8. Abnormal odors: are difficult to be detected on routine ante-mortem inspection. The odor of an abscess, a medical odor, an acetone odor of ketosis may be observed.

Decision of ante-mortem inspection:

1. Approved for normal slaughter: ante-mortem inspection has revealed no evidence of any abnormal condition or disease and the animal is adequately rested.

2. Animal should not enter the plant (condemnation of the animal):
* animal show evidence of septicemia or other conditions, which on post-mortem requires total condemnation (Rabies).
* Animal disease that represents a hazards for meat handlers (Anthrax).

3. Slaughter under special precautions (in separate department or at the end of the working day or in special day). If at ante-mortem inspection, the animals diseased, which at post-mortem, require condemnation (Brucellosis).

4. Delayed slaughter: if the animal affected by condition, which temporally limits its fitness for human consumption (stress, fatigue) animal still in the holding period of drug, immaturity, excited animal and drug treatment.

5. Emergency slaughter: the animal suffers from acute pain (sever accident, acute respiratory disease and traumatic pericarditis.

Importance or significance of Ante-mortem inspection:

1. To safeguard the health of consumer as there are certain diseases not intended with gross lesions in the carcass, although they are harmful (salmonellosis).

2. Facilitates post –mortem examination and direct attention of inspector to particular part or organ to be examined (coenurus cerebrals).

3. Prevent infection of butcher with contagious diseases (Anthrax).

4. Immediate detection and isolation of animals affected with notifiable disease (FMD, swine fever).

5. Detection of diseases, which cannot be detected in post-mortem inspection (Rabies, Tetanus, Listeriosis Poisoning).

Methods of slaughter process of food animals:

Slaughter is defined in the meat hygiene regulations as "killing by blood removal"

Classification of slaughter methods: (Ritual slaughter) …

Islamic method (Halal slaughter): derived from verses of the holy Quran and the saying of profit "hadith" .animal species from Islamic legal position.

A. indisputably forbidden foods:

1. Pork.
2. Carrion.
3. Shed blood.
4. Animal dedicated to any other than ***Allah***.
5. strangled animals.
6. Fatally beaten animals.
7. dead through falling from height.
8. Horn butted animals.
9. Devoured by wild beats.
10. Scarified to idols.
11. Slaughtered animals of all non-kitabis.

B. Animals indisputably permissible:

1. Sheep.
2. Goats.
3. Cows.
4. Buffalos.
5. Poultry.
6. Fish and locust (crustacean and Mollusca).

Procedures of Halal slaughter:

1. Pre –slaughter rest.

2. Forbid cruel treatment of the animals before slaughter (mercy and kindness).

3. Knife should be very sharp and forbids sharpening of the knife in front of the animals or slaughtering in the sight of other animals.

Halal slaughter includes three methods:

1. Slaughter (Dabh): severing the animals trachea, esophagus and jugular veins. Used in sheep, cows and birds.

2. Slaying (Nahr): cutting the vessels at the base of the neck (upper part of chest). Used in camels and similar animals, but in special circumstances may use in cow.

3. Stabbing (Aqar): fatally wounding an unmanageable animal. Used for wild animals which are lawful for hunt?

In Halal slaughter the cut must be:

1. Continuous and uninterrupted.

2. The knife must be depressed down vertically but drawn horizontally across the neck.

3. The cut free and must not be stap.

4. Not be so closed to the chest or too near to the head.

5. No laceration or tearing of tissues.

6. Further preparation and dressing of well-bled carcass must be delayed until all signs of life and cerebral reflex disappear.

Jewish method "kosher slaughter":

1. according to "tow rah" and other Jewish religious tests.

2. Animal species which may be slaughtered according to the Jewish faith are …
* cattle, calves, sheep, goats, deer and all kind of poultry. *
Animal should be conscious and healthy.

3. Forbidden animals ….
* Pigs, camel, blood, flesh of death animals and the meat of the animals which has not fulfill the kosher requirements.

Procedure of Jewish method:

1. Jewish method is known as "Shechita".

2. Carried out by special trained Jew slaughter "shochet" assisted by "shomer" who stamps the kosher seal on each part of the carcass.

3. The animal is thrown down or hoisted and shackled.

4. The rapid very sharp strokes in continuous backward and forward motions across the neck using a sharp steel knife free from nicks "chalaf" which severs (skin, muscle, esophagus, trachea, carotid arteries and jugular veins).

5. carcasses found to be fit for Jewish consumption (kosher) must have "meat porged" by removing the blood vessels prior to retail sale of the meat .for this reason the fore quarter of kosher beef are consumed by the jewish ,while the hind quarter are rarely eaten .

6. It is further forbidden to eat the meat of animals which show any sign of disease or which exhibit no movement (struggling) during or after the process of slaughter "Terepha".

Method of slaughter of food animals while being unconscious "human slaughter":

Using pre-slaughter stunning. Stunning means immediate disappearance of cerebral activity of consciousness.

Methods of pre-slaughter stunning:

1. Mechanical devices "percussion" stunning:

#. Non penetrative percussion stunning: by means of sudden heavy blow on the forehead using blunt instrument. They are …..

* . Pole-axe: iron pick, fixed to a wooden handle. One side of its head was an axe and the other was a hummer.

* . Hammer: it produce immediate and permanent insensibility in small animals.

* . non- penetrative firearm bolt : non-penetrating mushroom headed bolt is shot into the head of the animal , its power is deviced from a cartridge of explosive charge or from compressed air .

 # . Penetrative percussion stunning: occur due to the cerebral herniation of the brain and vascular brain stem lesions (hemorrhages).

A – Free bullet "human killer".

* By which discharge a free bullet.

* A pistol discharging free bullet.

* This method is associated with hazards when used in abattoirs.

* It used for killing horses.

B – Captive bolt pistol:

*in the muzzle end a heavy pistol – like device is found.

*firing is done by pressing the trigger with the same hand that holds and directs the instrument.

*the bolt moves back and forth in the barrel of the pistol and is motivated by the discharge of a blank cartridge which produces immediate unconsciousness , after firing the bolt returns back to its original position either by the exhausted gas or a spring .

2. Non-mechanical devices:

A – Penetrative methods:

1. Neck stabbing:

*this method produces insensibility by the severance of the spinal cord with a short, broad bladed knife.

*cutting of spinal cord produce paralysis of the animal body.

*the animal does not become unconscious until anemia of the brain follows slaughtering.

*puntilla stunning affects the quality of meat and considered as inhuman method.

2. Pithing:

*by inserting a cane or metal spike through a hole in the skull into the brain to the spinal cord to break down the brain and renders the animal insensitive to pain .

*the use of long pithing can causes destruction of splenic nerve which affects through bleeding , this will lead to dilatation of the abdominal blood vessels which will become filled with blood .

B – Electrical method:

*widely used for inducing insensibility in pig, sheep and poultry.

*it depends on the passage of a high frequency alternating current with comparatively low voltage (75 – 90 v) across the brain by the use of electrodes applied to the animal head .

Meat hygiene……

Lec: 9 (meat inspection):

First semester:

The objectives of meat inspection programmed are:

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

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

These objectives are achieved by **ante**-mortem and **post**-mortem inspection procedures and by hygienic dressing with minimum contamination. whenever appropriate the hazard analysis critical control point (**HACCP**) principles should be used .the inspection procedures should be appropriate to the spectrum and prevalence of diseases and defects present in the particular class of livestock being inspected using the principles of risk assessment .

Post-mortem examination:

The aim of post-mortem inspection is to ensure that only the meat fit for human consumption is passed for food.

Significance"

1. Protect consumers against zoonotic diseases.

2. Protect consumers against food-borne infections and intoxications and hazards associated with residues (drug, pesticides, hormones, etc.).

3. Protect consumers from falsification.

4. Protect livestock against spread of diseases (notifiable).

Post-mortem inspection includes:

1. Macroscopic examination "abattoir inspection".

2. Laboratory examination.

General directions before post-mortem examination:

1. post-mortem inspection should be carried out in the slaughter hall and directly after slaughter.

2. post-mortem inspection carried out by the same inspector who done ante-mortem inspection.

3. The inspector should be supervising the dressing of each carcass to prevent substitution of diseased organ with healthy one.

4. The inspector should have 2 knives to prevent cross contamination and facilitate post-mortem examination.

5. Head and viscera should be hanged to their carcass.

6 .every organs should be examined by inspection, palpation, olfaction and incision.

7. Avoid carcass contamination with floor and hide.

8. Suspected carcass must be detained in the detention room for further examination.

Inspection of emergency slaughtered animals:

Carcasses of emergency slaughtered animals must be subjected to a careful inspection because most causes of food poisoning are associated with the consumption of such flesh. Therefore, bacteriological examination of such carcass should be including, **injured or ill animals arrive to the slaughterhouse in one of the following three conditions:**

1. The animal may arrive alive but in a moribund state:

Injured should be made to identify the nature of the disease, accident or medicine .such animals in a moribund state bleed badly and stiffen immediately after slaughter. Judgment depends upon ……

A – Bleeding.

B – Setting.

C – The color of fat and serous membranes.

D – Causes of conditions.

E – The condition of the meat.

2. The animal may arrive slaughter and uneviscerated:

All animals slaughter outside the abattoir, no matter what explanation is offered by the owners as to the cause of the death, it is necessary to examine a blood smear from the ear or tail, only when it is proved that the animal slaughter is not due to anthrax should the unless slaughter has occurred less than an hour or two previously coldness .in cattle evidence of tympanitis in the left flank are indication that slaughter has not been recent. In sheep which have been dead for some hours the wool is easily pulled out and tympanitis will be observed in the left flank.

3. The animal may arrive slaughtered but bleed and eviscerated:

These carcasses are very difficult to judge specially if they are not accompanied by the internal organs. It is advisable to condemn the carcass if it is not accompanied by some of the organs but an important one is missing. The carcass must bacteriologically examine, or otherwise condemned. Especially attention should be made to the examination of the carcass lymph nodes for enlargement, hemorrhages or tuberculosis and to the kidneys for degree of bleeding.

In emergency slaughtered animals, only in cases where the animal has been a short slaughtered, shows no evidence of disease (result of bacteriological examination is satisfactory) and in which the carcass sets and looks normal in every way, should been considered fit for human consumption.

International decisions at post-mortem examination:

The final judgment is based on the total evidence produced by observation, palpation, incision, smell, ante-mortem signs and the result of any laboratory tests.

A Approved for human consumption.

I approved as inferior quality.

L Approved for distribution in restricted areas.

K Conditionally approved for human consumption.

Kh means that meat treated with heat.

Kf means that meat treated with freezing.

D Partial condemnation.

T Total condemnation.

1. Approved for human consumption (A):

When the post-mortem examination revealed no evidence of any abnormal condition or disease, the carcass including the edible offal's should be approved for human consumption without any restriction.

2. Totally condemned (T):

The carcass and offal's should be condemned in one or more of the following conditions:

a- if they are hazardous to food handlers, consumers and /or livestock.

b- If they contain chemical or radioactive residues which exceed the permissible limits.

c- There is severing organoleptic deviations from normal meat.

3. Partially approved for human consumption (D):

In case of localized defects resulting from disease or other abnormalities, affecting only part of the carcass or offal's the affected parts shall be condemned, while the remaining parts shall be approved for human consumption.

4. Conditionally approved for human consumption (K):

Carcass that are hygienically unsatisfactory or that hazardous to human or animal health, but may be treated under official supervision and judged as conditionally approved for human consumption. The organs should be treated in the same manner as carcass.

5. Inferior quality meat (I):

Meat is safe from the hygienic point of view, but shows minor deviation from the generally accepted quality standard (slight abnormal odor, taste or color, poor carcass) it may be approved for human consumption on condition that the consumer is aware of its inferior quality, therefore such meat should be sold only in special shops under the supervision of the authority (low price or used for manufacturing purposes).

6. Approved for human consumption, with distribution in restricted to limited areas (L):

Meat obtained from animals coming from area kept under quarantine because of an outbreak of a dangerous contagious animal disease may be approved for distribution in restricted area, providing no hazard to human health is involved. Such meat should not be distributed or marketed outside the infected and strictly controlled area, in order to avoid a possible spread of the animal disease concerned e.g. FMD.

Meat derived from animals coming from restricted area that have been vaccinated and may be carriers of a disease agent should not be marketed and distributed outside this restricted area, especially when such vaccination is not being practiced in neighboring area.

Meat hygiene…….

Lec: 10 (meat quality):

First semester:

Meat is derived from skeleton muscle whose function in life is to provide movement by its ability to expand and contract its length, after death chemical and physical changes occurs which changes muscle into "meat".

There are two overall types of quality can be distinguished:

1. Functional quality (refers to desirable attributes in a product).

2. Conformance quality (is producing a product that meets the consumer's specifications exactly).

In general, quality is the totality of characteristics of an entity that bears on its ability to satisfy stated and implied needs. Meat quality is the composite of characteristics that have significance and make for acceptability; it is the degree of excellence. Meat quality refers to the physical or chemical properties that relate to its processing and palatability characteristics.

Ante-mortem factors: (Age) …

Meat from older animals, have a darker color due to the deposition of myoglobin and tend to the tougher due to change in the structure of connective tissue. Very young lambs show the pale exudates condition as a result of reduced adrenocorticotrophic hormone activity of them that affects the quality meat.

Slaughter stress:

Transport stress and its effects on the yield of carcass and edible offal's. Cattle tend to keep more on their, own, while sheep usually in flocks and their separation is considered as stress.

Post-mortem factors: (slaughter technique) …

Pre-mortem handling (slaughter technique) acts as a stress factor which influences the muscle temperature that affects meat quality.

Pre-slaughter stunning:

1. Imperfect bleeding.

2. Muscular splash.

3. Loss of bloom.

4. Contamination of the bloom.

5. Rapid muscular contraction.

6. Fracture.

Bleeding:

Position of animals at the times of bleeding (on ground or hanged) may affect the residual blood content.

Storage:

1. High storage temperature enhances onset of rigor mortis.

2. Contamination, effects on keeping quality of meat.

Rigor mortis or setting "post-mortem glycolysis":

Rigor mortis is a state of reaction occurs after slaughter "death" as a result of excessive muscular contraction and exhaustion of oxidative enzymatic system and accumulation of metabolic products "lactic acid" resulting in coagulation of the muscle protein action myosin where the muscles and joints become stiff known as post-mortem rigidity or setting of the carcass.

Rigor mortis start in normal cases 2-3 hours P.M. and stays for 1-6 days then disappears due to softening of coagulated actinomyosine. By the autolytic enzyme when actins becomes soluble. Muscles in rigor mortis show Harding, stiffing, shortening, loss in elasticity and loss in transparency. The time of onset of rigor mortis dependent upon the speed of breakdown of ATP and the development of glycolysis.

Factors influencing rigor mortis:

1. Degree of muscular activity before slaughter: the stronger the activity of the muscle during lives the sooner rigor mortis sets in.

2. The health of the animal: glycogen may be lowered as a result of ante-mortem starvation, disease or physical stress.

3. The atmospheric temperature: high temp. Accelerates the appearance of rigor mortis, while low temp. Cold retards it.

Significance of rigor mortis:

1. It plays an important role in the keeping quality of meat as the acid reaction reduces the multiplication of bacteria, thus retards the putrefaction of meat.

2. It renders the meat more tender and palatable, the reaction of muscle after slaughter is slightly alkaline, (after 3-6 hours it becomes acidic due to the formation of lactic acid, formic acid which cause swelling and loosening of connective tissues.

3. Rigor mortis is one of the keeping quality parameters.

4. Rigor mortis can determine the degree of keeping quality of meat through measuring "rigor – value".

Comparison between fresh and set meat ….

Subject	Fresh	Set
Ph.	6.9-7.1	5.8
Muscle fiber	Swollen	Shrine
Inter fiber space	Small	Large
Pickling ability	Bad	Good
Loose H2O	Small	Large
Ability to take H2O	Good	Bad
Aroma	Not developed (unpalatable)	Developed
Color	Dark red	Light red
Appearance	Glistening	Turbid
Consistency	Course , tough , gummy	Tender and juicy

Meat hygiene……

Lec: 11 (lymphatic system):

First semester:-

Lymph is the medium by which oxygen and nutritive matter are transferred from the blood to the body tissues and waste-products are removed. The presence of lymph around the tissue cells is maintained by a slow exudation of fluid through the capillary walls and into the surrounding tissue, this fluid is similar to the plasma of the blood but is thinner, more watery and poor in protein, which can't pass readily through the capillary walls .after lymph has fulfilled its function of feeding the tissue cells it is forced by animals muscular movements into the fine walled lymphatic, which arise as blinded vessels in the tissues. All lymph vessels discharge their content into lymph nodes and, with are exception, all the lymph throughout the system pass through at least one lymph node before it returns into the blood circulation.

In every case the direction of flow of lymph in an organ is from the central of the organ toward its surface. Lymph nodes consist of a reticular framework of elastic and smooth muscle fibers enclosing lymphatic tissue, which contains lymphocytes.

Lymphatic vessels conveying lymph node are known "afferent lymphatic " and the area drained by the particular lymph node known as " drainage area " .

An appreciation of the drainage system of lymph node is of particular value in the judgment of septic infection especially T.B. after passing through one or more lymph is conveyed by afferent lymphatic to discharge into larger lymph collecting vessels, which all flow towards the heart.

The largest of this lymph – collecting vessels is the "thoracic duct "which +Commences as a thin-walled dilation about 19 mm in width and known as the "receptaculum chyli ". This dilation is situated in the abdomen, lying above the aorta at the level of the dorsal vertebra, and receives lymph from the lumbar and intestinal trunks, "it is the main receptacle for lymph from the posterior part of the body ". the thoracic duct is about 6.3 mm in width , passes forward through the diaphragm , traverses the thorax and opens into the *anterior Vena Cava ,* lymph from the anterior part of the body is carried towards the heat by two tracheal lymph ducts , which commence at the lateral retro pharyngeal lymph nodes , and pass down the neck on each side of the trachea and esophagus , each duct discharges into the jugular vein the size of lymph nodes varies from that of a pinhead to that of a walnut , the mediastinal lymph nodes of the OX may reach a length of 20 cm . Lymph nodes are generally round or oval and somewhat compressed, in the ruminant they are large and few in number. The size of lymph nodes is relatively greater in the young growing animal then in the adult. The color of lymph nodes shows considerable variation, and may be white, greyish, blue or black. The mesenteric lymph nodes of OX black and may be yellowish "fatty infiltration ", greenish "parasitic infestication".

But in pig the lymph nodes are lobulated and white, with the exception of those of the head and neck which are reddish. The superficial lymph nodes of camels are superficially lobulated.

The consistency of lymph nodes varies in different parts of the body, the nodes of the abdomen softer than these of the thorax.

Lymph nodes of cattle:-

Lymph nodes of head and neck ….

1. Sub maxillary.

2. Parotid.

3. Retro pharyngeal.

4. Middle cervical.

P – Position, D – drainage area, E – destination of efferent lymph vessels of nodes.

Middle cervical:-

P: situated in the middle of the neck on each side of the trachea and often absent in cattle.

D: lateral retro pharyngeal nodes.

E: prepectoral nodes.

Lymph nodes of the chest and forequarter:

1. Prepectoral (lower cervical).

2. cost cervical.

3. Pre scapular.

4. Intercostal (dorsa-costal).

5. Sub dorsal.

6. Suprasternal (stern-costal).

7. Bronchial.

Bronchial:

P:

- Left bronchial: situated close to the left bronchus embedded in fat & partly covered by the aorta.

- Right bronchial: is related to the right bronchus and partly hidden by the right lung , it is abscent in 25% of the cases .

- Middle bronchial: situated in the middle line dorsal to the bifurcation of the trachea and abscent in 50% of the cases.

- Apical: is placed on the accessory bronchus where it enters the apical lobe of the right lung.

D: lung.

E: the left bronchial node discharges into the thoracic duct, the right bronchial node into the posterior mediastinal node or thoracic duct.

** A node known as the inspector's node or reissman lymph nodes is present in 75 % of cases and is situated at the junction of the two cardiac lobes of the right lung.

Lymph nodes of the abdomen and hindquarter:

1. Lumbar.
2. Portal (hepatic).
3. Renal.
4. Mesenteric.
5. Splenic.
6. Gastric.
7. Iliac.
8. Superficial inguinal (male).
9. Super mammary (female).
10. Deep inguinal……..
11. Sciatic.

Sciatic:

P: lies on the outer aspect of the sacrosciatic ligament, and is exposed by a deep incision on a vertical line midway between the posterior part of the ischium and the sacrum.

D: posterior pelvic organs and receives efferent from popliteal node.

E: internal iliac.

Meat hygiene……

Lec: 12 (over-view of fish):

First semester:

Chemical composition, spoilage & health hazards:

Introduction: there are 22000 species of fish worldwide comprising more than 50% of all vertebra species, fish are found in both fresh and salt water, and constitute a very important food source for many nations.

From a nutritional point of view, fish meat can be favorably compared to other animal food such as livestock meat, poultry and milk. But as to harvesting, storing and processing fish products have a condition which differs greatly from those of livestock meat. For instance, compared to livestock its production can be controlled, fish products bear many problems a side from difficulty of distribution due to the higher perishability.

Proximate composition of fish, beef, poultry and milk…..

	Moisture %	**Protein %**	**Fat %**
Fish	66-84	14-24	0.2 - 22
Beef	70-75	18-22	1.5 - 13
Poultry	70-74	20-23	3 - 6
Milk	87	3.6	4

Fish is low in saturated fat and sodium, rich in polyunsaturated fatty acids PUFA, vitamins , minerals and protein .fish especially marine species are rich on omega – 3 fatty acids such as DHA (docosahexaenoic acid) and EPA (eicosapentaenoic acid) which are essential elements in human nutrition .

The primary source of DHA and EPA is fatty fish and oils from the tissues of such fish . they play an important role in preventing coronary heart disease and sudden death from cardiac arrest . Fish oil supplementation also significantly lowers overall triglyceride and cholesterol levels without affecting the level of HDL “good cholesterol “the anatomy of fish muscle is different from the anatomy of terrestrial mammals in that fish lacks the tendinous system connecting muscle bundles to the skeleton. Instead fish muscle is composed of striated muscle fibers running in parallel and connected to sheaths of c.t, which are anchored to the skeleton and skin. Most of fish muscle is white but depending on the species, many fish have a certain amount of dark tissue of brown or reddish color. The dark muscle is located just under the skin along the side of the body. There are many differences in the chemical composition of the two muscle types, some of the more noteworthy being higher level of lipid, myoglobin, NPN compound in dark muscle.

Chemical composition:

The composition of a particular species often appears to vary from one fishing ground to another. And from season to season, but the basic cause of change in composition is usually variation in the amount and quality of food that the fish eats and the amounts of movements it makes. for example fish usually stop feeding before they spawn , and draw on their reserves of fat and protein , also when fish are overcrowded , there may not be enough food to go round , intake will be low and composition will change accordingly .

Fish lipids:

Fish species may be categorized as lean or fatty fish depending on how they store lipids for energy. Lean fish use the liver as their energy depot, which fatty species store lipids in far cells throughout the body (subcutaneous tissue, belly flat, muscles and belly cavity).

Depending on the amount of PUFA, most fish fats are more or less liquid at low temperature. Lipids content in the different tissues of fish varies considerably through different seasons (food, maturity, spawning and migration).

The lipids present in telosts may be divided into two major groups:

Phospholipids.

Triglycerides.

The phospholipids make up the integral structure of the unit membrane in the cells so termed structural lipids , while triglyceride are lipids used for storage of energy in fat depot so termed depot fat . Fish lipids contain up to 40% long chain fatty acids which are highly unsaturated, and depot fats contain several fatty acids with five or six double bonds.

Postmortem changes in fish:

Rigor mortis: it is a sequence of enzymatic reactions lead to stiffness of muscle, occur after several hours of capture and persist for a day or more then resolve and the fish muscle become soft and relax.

Mechanism of onset and resolution of rigor mortis:

The mechanism and pattern of rigor mortis occurrence in fish is the same as that of large animals. At the point of death O2 supply to muscles is interrupted because the blood is no longer pumped by the heart and isn't circulated through the gills. Since no oxygen is available for normal respiration the production of energy from ingested nutrients is generally restricted. Glycogen or fat is oxidized by tissue enzymes in a serious of reactions which ultimately produce CO2, H2O and ATP. Under anaerobic condition ATP may be synthesized by important pathway from certain phosphate. But

ATP production ceases when creatine phosphate is depleted. Thus after death muscles can't continue maintaining its normal levels of ATP, in that case the muscle enter rigor mortis.

The resolution of rigor mortis is a process still not completely understand but always results in subsequent softening (relaxation) of the muscle tissue is thought to be related to activation of one or more of the naturally occurring muscle enzymes .

Rigor mortis follows the descending pattern where stiffness starts from lower Jaws. It starts 1 – 7 hours after capture and extends 30 – 120 hours in well rest & fed fish. In general R.M in fish extends for shorts duration & never shows lower PH as large animals. The rate in the onset and resolution of R.M varies from species to another and influenced by temperature, handling, size, physical condition of fish and the method used for stunning and killing of the fish.

The technological significance of R.M.:

Major important when fish is filleted before or after rigor. In rigor the fish body will be completely stiff, the filleting yield will be very poor and rough handling can cause gaping. If fillets are removed from the bone pre-rigor the muscle can be contracted freely and the fillets will shorten following the onset of rigor. If the fish is cooked pre-rigor the texture will be very soft and pasty. In contrast the texture is tough but not dry when the fish is cooked in rigor, while cooking during post-rigor the flesh will be firm succulent and elastic. Both whole fish and fillets frozen pre-rigor can give good products if they are carefully thawed at a low temperature in order to give R.M. time to pass while muscle is still frozen.

Spoilage:

To understood the mechanism of fish spoilage. The bacteriology of fish should be briefly discussed. Bacterial flora in fish is affected by species, water temp. , water salinity and harvesting location. Bacterial flora of fish from temp. Water is differed from that of tropical and subtropical water, where gram negative psychrotrophic and psychrophilic rods shaped bacteria belong to the genera.

Spoilage … refers to any change in the condition of food in which become less palatable, or even toxic. These changes may be accompanied by alternative in taste, smell, appearance or texture. In raw fish spoilage takes two forms: microbiological and non-microbiological (enzymatic and non-enzymatic)...

Micro – organisms are present on external surface (slim & gills) and in the gut of the fish but during life are kept from invading the sterile flesh by the fish defense system. On-death … the microorganisms or the enzymes they secret are free to invade or diffuse into the flesh where they react with the complex mixture of natural substance percentage. The numbers of microorganism in the flesh grow slowly initially but then increase rapidly. Their microbial enzymatic action results in a well- defined sequence of changes in odoriferous and flavors compounds. Initially, compound have sour grassy fruity or acidic odor, later bitterness and sulphiding appear, and finally in the putrid state the character is ammoniacal and fecal.

In many marine species that contain the odorless compound TMAO, one prominent reaction is its reduction to TMA. Which is possibly in conjunction with fatty substances is alleged to smell fishy but on its own is always recognized as being ammoniacal. The gradual reduction in the concentration of TMAO has been used as chemical measure of spoilage.

In addition to change in odor and flavor the continued action of microorganisms affects the appearance and physical properties of several components of the body. The slime on the skin and gills, initially watery and clear, becomes cloudy and clotted and discolored. The skin loses its bright iridescent appearance, bloom and smooth feel and becomes dull.

Microorganisms are the most important agents of deterioration in raw fish since they give rise to the particular undesirable odor and flavor associated with spoilage. Thus the control of deterioration is largely control of microorganism.

Non-microorganism deterioration id of two kinds (enzymatic and non-enzymatic) the former arises in the first place from the large number of the different enzymes naturally present in the flesh. In these are engaged in normal process such as tissue building and muscular contraction and relaxation but on death they become involved in predominantly degradation reactions. One of these reactions is gradual hydrolysis during the first few hours of glycogen to lactic acid. Resulting when the process is complete in a fall of PH from about 7 to 6 – 6.8 depending on the species and condition of the fish. The decline in a PH affects quality in so far as the texture of the flesh is rendered somewhat firmer and its tendency to lose water when pressed is enhanced.

Development of rancidity is the most prominent non-enzymatic deterioration. Fish in general have lipid of higher of unsaturation than most other foods and are therefore particularly prone to oxidative rancidity. The deterioration takes the form of the development of linsed oil-like odor and flavor.

Control of spoilage: all proteinaceous food spoils sooner or later, but a number of measures can be taken to reduce spoilage rate- greatest effect can be obtained by control of storage temperature. The major cause of spoilage is bacterial, and in the chill temperature range the growth pattern of psychrotrophic spoilage organisms can be decreased. Chemical spoilage or development of rancidity can be prevented by rapid catch handling on board and storage of products under anoxic conditions (vacuum packed or modified atmosphere packed). Use of antioxidant may be considered.

Assessment of fish quality:

1. Sensory methods.

2. Biochemical and chemical methods.

3. Physical methods.

4. Microbiological methods.

The methods for evaluation of fresh fish quality may be conveniently divided into two categories: sensory and instrumental. Since the consumer is the ultimate judge of quality, most chemical or instrumental methods must be correlated with sensory evaluation before being used in the laboratory. However, sensory methods must be performed scientifically under carefully controlled conditions so that the effects of test environment. Personal bias, etc. may be reduced.

1. Sensory methods:

It is defined as the scientific discipline used to evoke , measure , analyze and interpret to characteristics of food as perceived through the senses of sight , smell, taste , touch and hearing .

Most sensory characteristics can only be measured meaning –fully by humans. However, advances are being made in the development of instruments that can measure individual quality changes. Instruments capable of measuring parameters included in the sensory profile are: the instron, bohlin rheometer for measuring texture and other rheologic properties and the artificial nose to evaluate odor.

Sensory process:

In sensory analysis appearance, odor, flavor and texture are evaluated using the human senses. Scientifically the process can be divided into three steps …

1. Detection of a stimulus by the human sense organs.

2. Evaluation and interpretation by a mental process.

3. Response of the assessor to the stimuli.

Variations among individuals in the response of the same level of stimuli can vary and can contribute to a non- conclusion answer of the test. So it is very important to be aware of these differences when selecting and training judges for sensory analysis.

2. Biochemical and chemical methods:

1. This methods used for evaluation of seafood quality.

2. Set quantitative standards.

3. Establish tolerance levels of chemical spoilage indicators which eliminate the need to base decisions regarding product quality on personal opinions.

4. Resolving issues regarding products of marginal quality.

5. Replace more time consuming microbiological methods.

Such objective methods should however correlate with sensory quality evaluation and the chemical compound to be measured should increase or decrease with the level of microbial spoilage or autolysis. It is also important that the compound to be measured must not be affected by processing (e.g. breakdowns of amines or nucleotides in the canning products as a result of high temp.)

The following is of the applied tests used for the objective measurements of seafood quality.

1. Total volatile basic nitrogen .TVBN.

2. Ammonia.

3. trimethylamine TMA .

4. Dimethylamine DMA.

5. Biogenic amines.

6. Nucleotides catabolite's K-value.

7. Ethanol.

8. Measurement of oxidative rancidity TBA.

3. Physical methods:

It has long been known that the electrical properties of skin and tissue change after death, and this has been expected to provide a means of measuring post mortem changes or degree of spoilage. however , many difficulties have been encountered in developing an instruments : for example species variation , variation within a batch of fish , different instrument readings when fish are damaged , frozen , filleted , bled or not bled , and a poor correlation between instrument reading and sensory analysis .

1. PH.

Knowledge about the ph. of fish meat may give valuable information about its conditions. Measurements are carried out with a ph.-meter by placing the electrodes either directly into the flesh or into a suspension of fish flesh in distilled water.

Measuring texture:

Texture is an extremely important property of fish muscle, whether raw or cooked. fish muscle may become tough as a result of frozen storage or soft and mushy as a result of autolytic degradation .the most used methods is measuring of sheer force of fish flesh , has been concluded that a thin – bladed shear force cell of the karmer type can be applied .

4. Microbiological methods:

The aim of microbiological examination of fish products is to evaluate the possible of bacteria or organisms of public health significance and to give an impression of the hygienic quality of the fish including temp. Abuse and hygiene during handling and processing. Microbiological data will in general not give any information about eating quality and freshness. However, the number of specific spoilage bacteria will be related to the remaining shelf life and this can be predicted from such numbers.

Chemical hazards:

Environmental contamination:

Heavy metals: it is naturally occur in varying amounts such as iron, copper, cobalt and zinc are essential in small quantities for the healthy growth of human and animals. Others, such as mercury, lead and cadmium have no known biological role. All of these metals are toxic if present in excess but the most important contaminates are generally considered to be those non-essential heavy metals. Of all of the heavy metals, most attention is currently paid to mercury.

Pesticides: pesticides such as cyclodienes, toxaphene, hexachlorbenzene and others are substances used for protection of plants or plant products against all harmful organisms. Pesticides in fish pose a potential human health hazards because these contaminants may accumulate in fish tissues (in particular in fatty tissue) at levels that can cause toxicity mainly chronic one. The hazard is most commonly associated with long-time (term) exposure to these contaminants. Fish and shellfish harvested from water subject to waste water discharges (fresh water estuaries and near –shore coastal waters) are exposed to varying amounts of pesticides rather than that from the open ocean.

Chemical used in aquaculture:

A lot of drugs are used in fish farms for many purposes such as diseases treatment, growth and reproduction improving or sedative during transportation. These substances may constitute hazards for humans. It could be carcinogenic, allergenic or lead to antibiotics resistance. That why all drugs used in the aquacultures must be permitted by an authorized organization. These drugs can be grouped into …..

1. Treat and prevent diseases: chloramphenicol, oxytetracycline and nitrofuran.

2. Control of parasites: formalin solution, acetic acid, hydrogen peroxide, magnesium sulfate and sodium chloride.

3. Enhance reproduction and growth: gonadotropin.

4. Osmoregulation & relives stress: potassium chloride.

5. Tranquillization: sodium bicarbonate.

6. Enhance egg hatchability: urea and tannic acid.

7. Improve of color in salmon fish.

Astaxanthin and canthaxanthin:

Control of aquaculture drugs used in aquaculture operations can include:

1. Each received batch of fish must be supported with a certificate of proper drug usage.

2. Periodical examination for drug residues.

3. The producer should conduct HACCP plan or any other quality assurance system for drug usage in aquaculture.

4. on-farm visit to review drug usage before receipt of the product, to ensure that the producer used approved drugs in the correct concentration.

Meat hygiene……

Lec: 13 (abnormal conditions and diseases of food producing animals): first semester:

The most common abnormalities which usually met during routine ante-mortem and post-mortem inspection could be classified according to their proposed causative agent into ….

1 . abnormal conditions within physiological limits (imperfect bleeding , exhausted animal , fetuses , immaturity , pregnancy , malformation , pale muscular tissues , poorness , abnormal colors , abnormal odors and dead animals) .

-+*-**2 . abnormal conditions with retrogressive changes and infiltration of the tissues (cloudy swelling , amyloid degeneration , caseation fatty infiltration , fatty degeneration , necrosis , gangrene , atrophy and hypertrophy and pigmentation) .

3 . abnormal conditions with general pathological changes (inflammation , suppuration , injury , edema , fever and tumors) .

4 . abnormal conditions with constitutional disorders and blood diseases (rickets , osteomalacia anemia , hydraemia , jaundice , uremia , leukemia and haemoglbinaemia) .

5 . abnormal conditions with generalized systemic infection (bacteremia and septicemia) .

Imperfect bleeding :

It is important to distinguish between the congestion of a carcass due to active hyperemia and that due to imperfect bleeding . the former is associated with pyrexia and systemic changes in the parenchymatous organs . conversely , imperfect bleeding due to mechanical causes is unaccompanied by systemic changes and is seen in animals slaughtered at the point of death on account of injury , suffocation , heart failure and in cases of sever indigestion .

In imperfectly bled animals the left ventricle usually contains blood , the subcutaneous blood vessels appear injected , and the flesh is dark and the organs congested , flappy and watery .

Since ill bled or badly bled carcasses undergo rapid decomposition (as blood act as an excellent medium for the growth of microorganisms) , these must be condemned.

Exhausted animals:

Exhaustion represents a sort of stress on the animals which may affect dramatically the quality of the yield meat (PSE, DFD conditions). Exhausted animals, on slaughter, often insufficiently bled and set badly. Exhaustion could be overcome by allowing a suitable pre-slaughter rest and care to the animals to regain its conditions.

Carcass of well-nourished animals, showing no sign of systemic reaction, bled and set ell on slaughter is fit for human consumption otherwise, total condemnation is recommended.

Foetal flesh:

This is the flesh of unborn or stillborn animals. Some of the unscrupulous butchers try to market the calves; Foetal flesh as retail joints of meat but it is rare and most commonly subjected it for sale as minced meat or incorporated with comminuted meat products.

The undressed stillborn calf may be recognized by the following signs …….

1. Skin presents a sudden appearance.

2. Claws are soft and yellowish with unwalked upon convex sole pad (golden slippers).

3. The umbilical cord remains hanging from the open naval ring.

The dressed carcass shows the following …

1. Stomach and intestines are free of coagulated milk.

2. The lungs are purple in color, and sink in water.

3. The muscles are loose, flabby, watery greyish white in color and easily periorated by finger.

4. The fatty tissue is undeveloped and gelatinous especially around the kidneys.

5. Kidneys and liver are small in size and dark in color.

6. Bone marrow is red.

7. Umbilical veins are open.

The meat of fetuses should be condemned and unfit for human consumption for the following reasons:

A) The meat would make a feeling of repulsive.

B) Transmission of infectious disease (Brucella abortus and congenital tuberculosis).

Immaturity:

Calves are considered mature and ready for slaughter when their meat and fat has attained certain degree of development. The estimation of the age of a calf may be of value in judging veal carcass for immaturity and may be deduced from the hoofs, teeth and umbilicus.

Post-mortem finding:

1. Muscles are loose, flabby, watery, tears easily and can be perforated with the finger.

2. The fat capsule of the kidneys is edematous, dirty yellow or greyish yellow in color.

Signs of maturity:

1. Horny and hoofs, with slightly convex solar surface.

2. All incisor teeth have emerged from the gum and show their pink appearance.

3. The umbilical cord is no more present and is replaced by a scar.

4. Start of horn development which is either felt as callosity in the place of the horns or a horn tip may be seen.

Judgment of immaturity:

1. Immature carcasses are considered unfit for human consumption for the following reasons (repulsive , development of the musculature , predominance of bones , less or no fat and a high percentage of water) .

Advanced pregnancy “recent parturition “abortion:

Female food animals may subjected to slaughter while being pregnant especially if it is in the early stages and not detected at ante mortem inspection . in advanced pregnancy , it is unusual for farmer to sale such animal and prevent the birth of valuable calf and also illogic for butchers to pay more money for useless weight (in cow , the foetus and foetal material reach about 36 kg.) .

Pregnant animals may reach abattoir in moribund state while suffering from dystocia and cesarean section could not be done and emergency slaughter is the right decision to save the meat . special attention should be paid for cases of abortion to exclude the risk of venereal diseases .

During pregnancy , there is a series of physiological and hormonal changes which reflect on meat quality . this is quite clear in the muscles of the hind quarter which becomes moisten . loose in consistency and does not keep well . moreover , odor of acetone can be defected in cases of advanced stage of pregnancy , animal showing signs of parturition or within two days of birth .

Judgment :

1 . carcasses of animals at the early stage of pregnancy are fit for human consumption if they are in good condition (set and bled well) .

2 . cases of extra-uterine pregnancy are treated as a local condition necessitates removal of the mummified embedded foetus and its surrounding tissues ,with releasing the rest of the carcass .

3 . cases of advanced pregnancy and recent parturition , especially in cattle , should not be sent for slaughter until 10-14 days after parturition or abortion . if such animals emergency slaughtered , the following should be done .

a)hygienic disposal of foetus , placenta and discharges .

b) detain the carcass for 12 hours .

c) boilig and roasting test to exclude abnormal odors .

d) bacteriological examination with special references to brucellosis , Listeriosis , toxoplasmosis and campylobacteriosis .

emaciation :