

lec.1 (the food animals)

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). -----فاصل القسم (استمرار)-----

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 .

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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 -----فاصل القسم (استمرار)----- 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. -----فاصل القسم (استمرار)-----

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

| 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. -----فاصل القسم (استمرار)-----

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 diet.

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