

Composition of Muscle Tissue

Composition is defined as the aggregate of ingredients, their arrangement, and the integrated interrelationship that forms a unified, harmonious whole.

Muscle tissue contains approximately 75% water and 25% solids of which 19% are protein. Lipids constitute about 2.5 to 5% of muscle.

Water

- This is the largest component of the muscle tissue.
- Due to polar behavior water molecules are attached with muscle proteins.
- About 4.5% of the total water in muscle is so tightly bound that it is almost impossible to dislocate it.
- Most of the water exists in immobilized and free forms.
- Increases water holding capacity is associated with juiciness and tenderness of cooked meat.

Proteins

Muscle proteins have been broadly classified into three categories:

1. Myofibrillar proteins- soluble in dilute salt solution.
2. Sarcoplasmic proteins- soluble in water or very dilute salt solution.
3. Stroma or connective protein- almost insoluble tissue proteins.

Myofibrillar Proteins

- These proteins constitute contractile part of muscle and make up about 60% of the total protein in the skeletal muscle.
- These proteins include myosin, actin, tropomyosin, troponin and actinin.
- These proteins contribute approximately 95% of the water holding capacity, 75% of the emulsifying capacity and to a large extent the tenderness of meat.

Sarcoplasmic proteins

- These proteins make up about 30 to 35% of the total protein in the skeletal muscles.
- They contain hundreds of enzyme for the normal functioning of muscle cells.

- In general, these proteins are very susceptible to heat.
- Myoglobin is a sarcoplasmic protein, provide red color to the muscle and serve as carrier of oxygen to the muscle fiber.

Stroma or connective tissue proteins

- The connective tissue is composed of an amorphous ground substance or matrix which formed elements mostly fibers and few cells are embedded.

Lipids

- Lipid is a major component of the carcass of meat animal.
- It is highly variable and is inversely proportional to the moisture content.
- Animal lipids are mainly true lipids (mostly triglycerides and some mono and di glycerides) and phospholipids.
- The composition and distribution of meat lipids depend on the diet of meat animal.
- Phospholipids are found in muscle tissue in small percentage (0.5 to 1%).
- These are principal structural and functional constituents of cell membranes and have a key role in the flavor and shelf stability of meat and meat production.
- Meat phospholipids are more susceptible to oxidation than triglycerides.
- Cholesterol is a minor but important component of animal tissue.

Carbohydrates

- Immediately after slaughter, muscle normally contains a very small amount (nearly 1%) of glycogen.
- However, it gets worked up before the completion of rigor mortis and play a key role in attaining the ultimate muscle pH.
- Both the rate and amount of glycolysis influence the color, tenderness and water holding capacity of meat.

Minerals

- About 3.5% of the total body weight is inorganic matter.
- Most of the total body inorganic material is located in skeletal tissue primarily as salt of calcium and phosphorus and some other minerals especially magnesium.
- In living meat animal, essential minerals serve a variety of important function.

- In the conversion of muscle to meat, inorganic elements play an important role.
- Their main function relates to development of rigor mortis.
- Several inorganic ion acts as catalyst during oxidation of meat fat, enhancing the process of rancidity development.

Vitamins

- The vitamin content of meat is variable, depending on the specie and age of the animal, the degree of fatness and type of feed received by the animal.
- Water soluble vitamins are localized in lean tissues, whereas fat soluble vitamins in fatty tissues.
- Most of vitamins in meat are relatively stable during processing or cooking. However, thiamine or to some extent vitamin B₆ are susceptible to heat treatment.

Nutritive value of meat tissues

Meat is a very nutritious food. It is almost fully digestible. The nutritive value of meat is attributed to its abundant high quality proteins, essential fatty acids, some important minerals and B-complex group of vitamins.

Meat Proteins

- Meat is a concentrated source of proteins which are far superior to the plant proteins due to very high biological value.
- This protein is rich in essential amino acid.

- Among proteins, myofibrillar and sarcoplasmic proteins are of high quality because they contain enough of essential amino acids.
- Connective tissue proteins have lower levels of tryptophan and sulphur containing amino acids.
- Collagen is especially poor in lysine content.

Meat Fats

- Meat fats contain ample amount of essential fatty acids and the nutritional demand of the body is easily met by intramuscular fat itself.
- The most abundant fatty acid in meat fat is oleic acid (an unsaturated FA) followed by palmitic and stearic acids (saturated FA).
- The essential fatty acids in human diets are linoleic, linolenic and arachidonic acids.
- It may be noted that excess dietary linoleic acid is converted to archidonic acid in human body to meet its demand.
- Meat fat also contain some quantity of cholesterol and blood cholesterol level increases after ingestion of cholesterol in food.
- However, it is now well known that our body is capable of synthesizing more cholesterol than is normally ingested.
- Organ meat have remarkably high cholesterol content as compared to skeletal meat.

Minerals

- In general, meat is a good source of all minerals except calcium.
- Of these minerals, quantitatively potassium is most abundant followed by phosphorus.
- Meat is good source of iron, which is required for the synthesis of hemoglobin, myoglobin and certain enzymes and thus plays a vital role in maintaining good health.

Vitamins

- Lean meat is an excellent source of B-complex group of vitamins.
- Meat has only traces of fat soluble vitamins.
- Vitamin C is almost absent in lean meat, although certain organs contain it in minor quantities.
- Among the B-complex, thiamin, riboflavin and niacin concentrations are quite high.

Liver is a very rich source of iron, riboflavin, niacin and vitamin A.

