

## **Conversion of muscle to meat**

- Slaughter of food animal is followed by a series of physical and chemical changes over a period of several hours or even days resulting in the conversion of muscle to meat.
- There is immediate loss of oxygen supply to the muscle due to exsanguination (bleeding). As the stored oxygen in myoglobin gets depleted, there is inhibition of aerobic pathway ( Citrate cycle).
- Energy metabolism is then shifted to anaerobic pathway resulting in the breakdown of glycogen to lactic acid.

The important changes that take place during postmortem period are as follows:

### **Loss of homeostasis**

Homeostasis mechanism, a system for the physiologically balanced internal environment which helps the body to cope up with the stresses of oxygen deficiency, extreme variation in temperature, energy supply, etc. is lost.

The homeostasis is controlled by nervous system which ceases within 4 to 6 minutes after bleeding.

In the absence of blood supply, there is loss of body heat and temperature starts declining.

### **Postmortem glycolysis and pH decline**

In the absence of oxygen, anaerobic glycolysis leads to the formation of lactic acid from the glycogen reserves. The accumulation of lactic acid lowers down the muscle pH which is an important postmortem change during the conversion of muscle to meat. The rate and extent of pH decline are variable, being influenced by the species of food animal, various preslaughter factors, environmental temperature, etc. In most species, a gradual decline continues from approximately pH 7 in the living muscle during first few hours (5 to 6 hours) and then there is a little drop in the next 15 to 20 hours, giving an ultimate pH in the range of 5.5 to 5.7. The rate of pH decline is enhanced at high environmental temperature.

A sharp decline in postmortem pH even before the dissipation of body heat through carcass chilling may cause denaturation of muscle proteins. So, the muscles depict pale, soft and exudative (PSE) condition. Contrary to this, muscles which maintain a consistently high pH during postmortem conversion to meat depict a dark, firm and dry (DFD) condition. Both the conditions are undesirable.

## **Rigor mortis**

It refers to stiffening of muscles after death and is another important postmortem change in the process of conversion of muscle to meat.

It is now well known that a particular level or concentration of ATP complexed with  $Mg^{++}$  is required for breaking the actomyosin bond and bringing the muscle to a relaxed state and as it drops, permanent actomyosin cross bridge begin to form and muscle gradually becomes less and less extensible under an externally applied force.

During the period immediately following exsanguination, the actomyosin formation proceeds very slowly at first and the muscle is relatively extensible and elastic. This period is called the delay phase of rigor mortis. Then actomyosin formation picks up and the muscle begins to loose extensibility. This phase is called the fast or onset phase of rigor mortis. When all the creatine phosphate is depleted, ADP can no longer be phosphorylated to ATP, muscle becomes quite inextensible and still. This stage marks the completion of rigor mortis.

## **Loss of protection from invading microorganisms**

During postmortem period, body defense mechanism stops operating and membrane properties are altered. So, during conversion to meat, muscle is quite susceptible to invading microorganisms. Except for low pH, most of the other postmortem changes favor bacterial growth.

## **Degradation due to proteolytic enzymes**

Several autolytic enzymes called cathepsins which remain inactive in a living muscle tissue, are activated as the muscle pH decline. These enzymes initiate the degradation of muscle protein structure. In fact, catheptic enzymes are capable of breaking down even collagenous connective tissue of the muscle and cause tenderization of meat during aging.