SNS COLLEGE OF TECHNOLOGY

An Autonomous Institution

Coimbatore – 35

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DEPARTMENT OF FOOD TECHNOLOGY

19FTE402 &
MEAT, FISH AND POULTRY PROCESS TECHNOLOGY

TOPIC - Post-mortem changes of meat.
Meat -Tenderization, Aging

Introduction

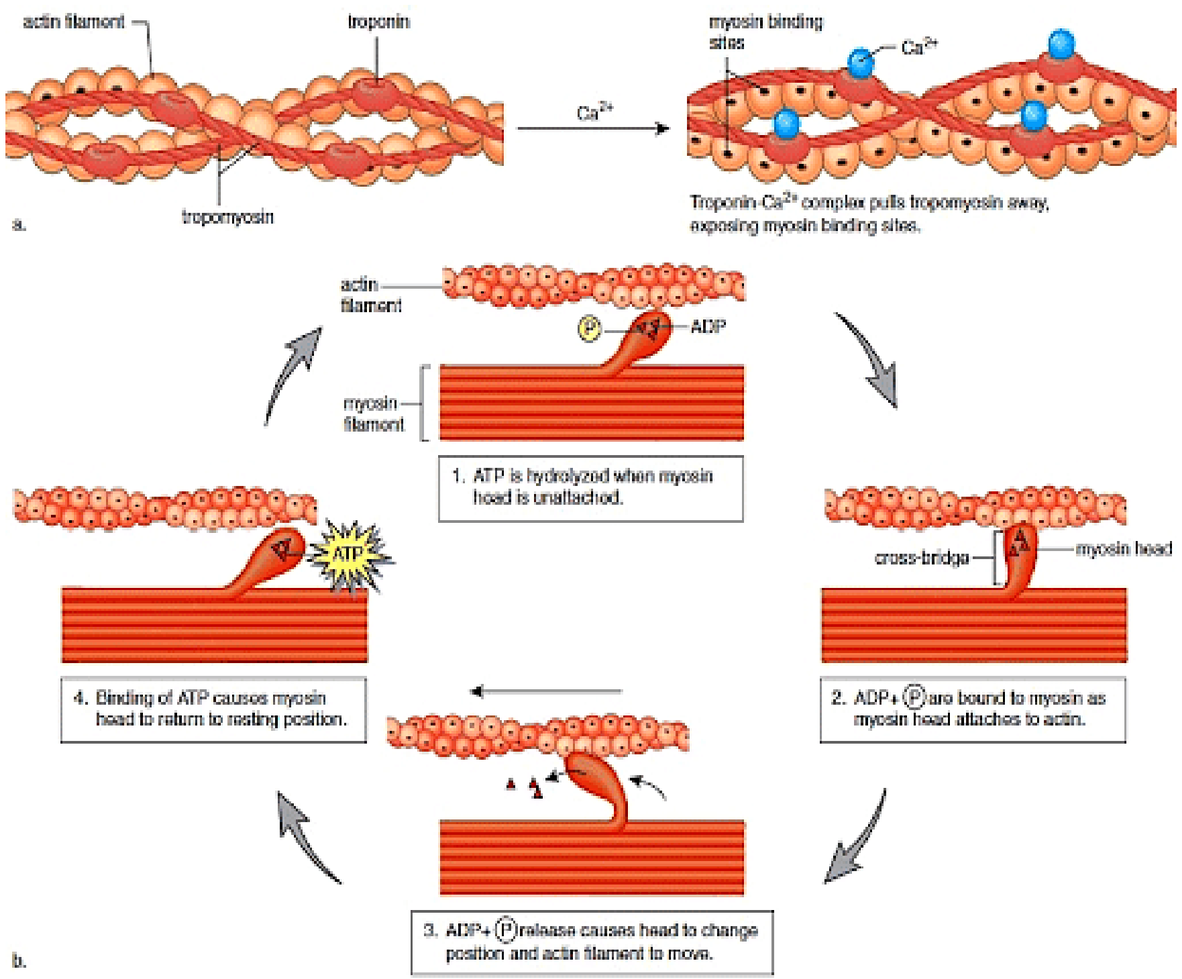
The changes taking place in meat after slaughter may be grouped under two heads

1. Onset of rigor mortis and
2. Development of tenderness in muscle

Onset of rigor mortis

Onset of rigor mortis: The first biochemical change occurring in muscle is rapid glycolysis of the glycogen represented by the presence of enhanced lactic acid content in muscle.

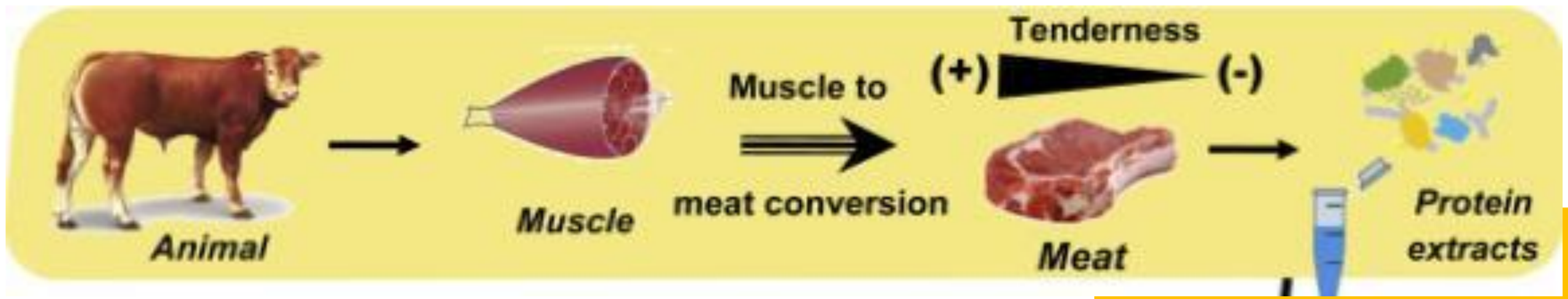
- The lactic acid content of muscle after rigor mortis is as high as 0.9 per cent. The muscle becomes stiff due to rigor mortis.
- Rigor mortis was correlated with the disappearance of ATP. In the absence of ATP, actin and myosin combine to form rigid chains of actinomyosin.
- Just before an animal is slaughtered, the muscles are soft and pliable. But immediately upon death, stiffening of the carcass known as rigor mortis occurs. It is 24-48 hours in beef.



Development of tenderness in muscle

Conditioning or tenderization of meat: When meat is stored at < 00C, biochemical changes take place in meat leading to the development of tenderness in meat. This process is called conditioning of meat. The tenderness is due to Denaturation of the meat proteins and Mild hydrolysis of denaturated meat proteins by the enzyme cathepsin present in meat

The increase in tenderness is followed by an increase in water soluble amino nitrogen indicating mild proteolysis of the muscle proteins. Contrary to the general belief, there is practically no change in the connective tissues and collagen. There is no increase in water soluble hydroxyl proline peptides indicating collagen has not been acted upon by proteolytic enzymes



Artificial tenderization of meat

Cold storage facilities are required for the natural tenderization of meat. Artificial tederization of meat has been developed by using proteolytic enzymes such as papain (from papaya), bromelin (from pineapple) or trypsin (from pancreas). The enzyme is usually injected into the animal, half an hour before slaughtering. The meat obtained from such animal becomes tender within 24 hours.

These post-mortem effects bring about changes in the quality attributes of meat, such as

- Texture
- Water-holding capacity
- Colour and
- Flavour

Nutritional quality is not that much affected.

Aging

- If meat is held cold for sometime for 1 or 2 days after it has completed rigor mortis, the muscles again becomes soft and pliable with improved flavour and juiciness which is called resolution of rigor. Some changes that take place during this period are known as ageing or ripening.
- During ageing there is progressive tenderisation of meat owing to the denaturation of the muscle proteins by the intracellular proteolytic enzymes, the cathepsins.
- Ageing or ripening is done by holding meat at 0.50 to 200C temperature in a cold room. Aging may take 1-4 weeks. The best flavour and the greatest tenderness develop in meat aged from 2 to 4 weeks.
- During ageing, humidity of the cold room is to be controlled and meat may also be affected by holding it at a higher temperature for as horter time usually 200 C for 48 hours.
- Ageing with even higher temperature for lesser time is practised commercially. In such cases, ultraviolet light is used to keep down surface bacterial growth.
- Beef is usually the only kind of meat that is commercially aged. Lamb and mutton are occasionally aged. Pork is never aged because of itshigh fat content

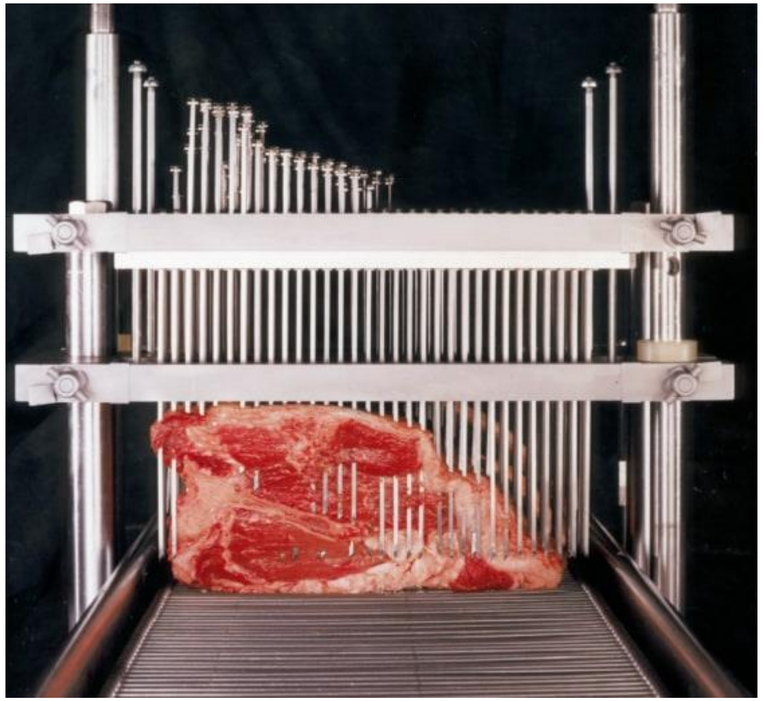
Tenderising

- Tenderness is the most desired characteristics in meat. The amount and distribution of connective tissues and the size of both muscle fibres and bundles of fibre determine the tenderness of meat.

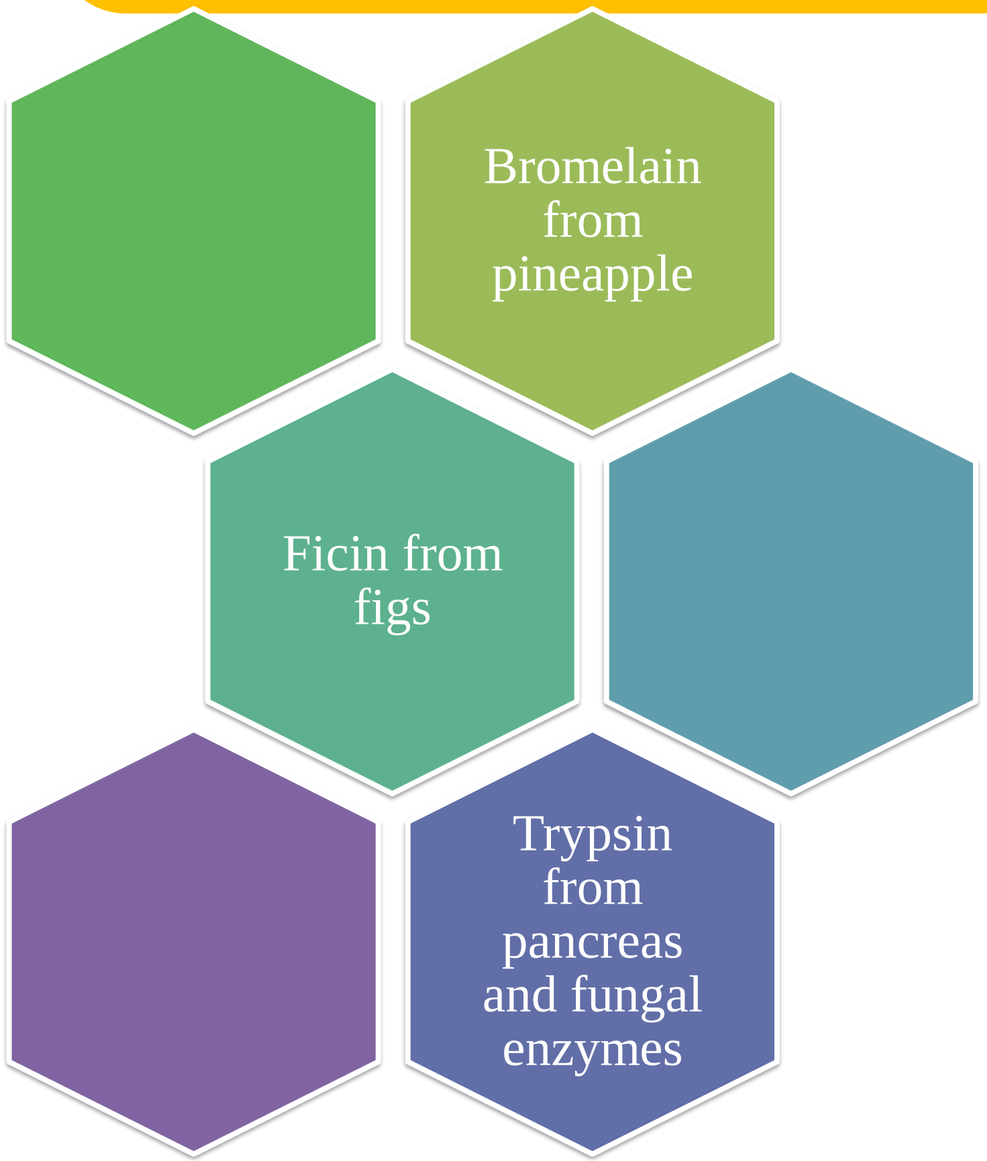
- The number and strength of cross linkages between the peptide chains of collagen increase with the age of the animal and this decreases the amount of collagen that may be solubilised during cooking thus contributing to decreased tenderness. There are different methods of tenderising meat. Exercise increases tenderness of meat.

Tenderising

- Cold-room storage results in the ripening of meat with tenderising from the natural enzymes of meat.
- The mechanical methods of tenderising meats include pounding, cutting, grinding, needling or pinning and the use of ultrasonic vibrations.
- Mechanical methods cut or break the muscle fibres and connective tissues.
- The art of using enzymes for tenderising meat is an old one.
- Wrapping of meat in papaya leaves before cooking results in tenderisation. This is the result of the action of the enzyme papain on meat proteins.



Tenderising



Tenderising

These proteolytic enzymes

- Catalyze the hydrolysis of one or more meat proteins.
- The enzymes also hydrolyze the elastin of the connective tissues.
- To achieve uniform tenderness, papain is injected into the veins of animals some 10 minutes before their slaughter.
- Tenderising enzymes remain active until the meat is heated. Papain is inactive at 55 C.
- Meat may be tenderised by the use of low levels of salts.

Tenderising

- Salts increase the water-holding capacity of muscle fibres resulting in tenderness and juiciness.
- Salt also solubilises the meat proteins.
- Tenderness of meat is improved when freezer dried meat is rehydrated in a weak salt solution instead of water.

❖ Salts used for tenderising are

❖ Sodium chloride

❖ Sodium bicarbonate and

❖ Sodium and potassium phosphate.

Tenderising

- Another method of increasing tenderness in meat is by change of pH.
  - ➢ Decreasing or increasing the pH of meat increases hydration and to its tenderness.
  - ➢ Soaking beef for 48hrs in concentrated vinegar increases its tenderness and juiciness.
  - ➢ Exercised animals give tender meat.

Pre rigor mortis

Vital functions stop

Deprivation of oxygen

Residual O_2 into haemoglobin and myoglobin

Presence of ATP and phosphocreatine

↓

Aerobic metabolism

Actomyosin and myosin dissociation

Rigor Mortis

Start of muscle to meat

↓

ATP and phosphocreatine reservoir exhausting

↓

Anearobic metabolism

No actomyosin and myosin dissociation

Highest toughness

Tenderization phase

Toughness deceases

Activation of proteolitic enzymes

↓

Calpains

Cathepsins

Caspeses

Proteosomes

Introducing proteolytic enzymes externally

THANK YOU