

UNIT 12: MEAT, FISH AND THEIR PRODUCTS

TABLE OF CONTENT

1.0	Introduction
2.0	Objectives
3.0	Main content
3.1	Meat, Structure and Composition
3.2	Meat Quality, Digestibility and Nutritive Properties
3.3	Changes in Meat During Cooking
3.4	Offal
3.5	Fish and Other Sea Foods
3.5.1	Shell Fish
3.5.2	Fish Meal and Fish Flour
4.0	Conclusion
5.0	Summary
6.0	Tutor Marked Assignment
7.0	References and Other Sources

1.0 Introduction

Meat is an important type of food that majority of people have natural appetite for. As soon as the income of the household increase, the demand for meat and meat products also increases. In poor economies of the world, consumption meat has implication for status. This unit therefore treats meat and meat products.

2.0 Objective

At the end of this unit, you should be able to

- Describe meat structure and composition
- Describe meat quality, digestibility and nutritive properties
- Describe changes in meat during cooking
- Discuss offal and sausages
- Discuss fish and sea foods

3.0 Main Content

3.1 Meat Structure and Composition

Meat consists of muscle fibres and fatty tissue from the adipose tissue. The meat therefore contains the lean meat and the fatty tissue. The fat content of

the meat varies with the animal, the species, the age, the feed and cut or joints even from the same animal.

There are also connective tissues that bind the muscle fibres together. Dispersed through the flesh are the nerves, blood vessels, capillaries, veins and arteries.

Chemical Composition of Meat

The lean muscle contains about 20% of protein, 5% Of fat and another .1% of minerals. The rest is water.

The most abundant proteins in meat are myosin and actin. There are also the water soluble proteins, albumins and globulins. The colour of meat is influenced by another protein called myoglobin which is either purple red or bright red in raw meat. You should recall that myoglobin is used to transport oxygen to the cells where it combines with oxygen to form oxy-myoglobin. Myoglobin therefore plays important role in aerobic respiration (oxidation of glucose in the cells to release energy necessary by the body).

Connective tissue proteins, collagen and elatin form the fibrous structure of the meat. Collagen fibres are tough, while inextensible fibres. The elatin fibres are elastic and branching. Collagen fibres are more distributed in meat than the elatin fibres Older animals have greater connective tissues than the younger ones of the same specie.

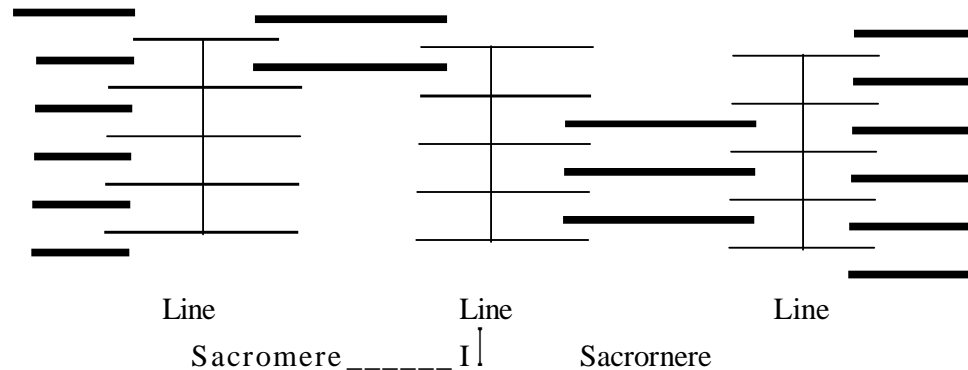
Some of the other constituents of the meat around the muscle are the non-protein water soluble materials such as lactic acid, creatin, and ions of minerals. Some of these substances are implicated as contributing to the flavour of the meat.

The adipose tissue of the meat contains mostly fats and these are mainly triglycerides with residues of stearic, oleic and palmitic acids. Some fat soluble vitamins, not in significant amounts, are also contained in the dispose tissue.

A muscle fibre is a long cylindrical structure consisting of myofibrils. A myofibril contains dark band of myosin filaments and light band of actin filament with a sort of overlap between the myosin and actin filaments. Between two bands of myosin filaments and in the light actin filament, we have the z line. The distance between two z lines forms sarcomere.

With contraction, the overlapping between the myosin and actin increases.

Figure 12.1: Muscle Fibre



Source: Lake B. and Waterworth M. (1980) Foods and Nutrition 13th edition, Mills and Boons Mews, London, pg. 275

Let us use this opportunity of the structure of muscle fibre to explain muscle contraction.

In the body, there is the metabolism of ADP, Adenosine DI — Phosphate to Adenosine tri-phosphate (ATP). This formation of ATP cause the relaxation of the muscle. With some nervous stimulation to muscle contraction, calciu, ions are released leading to activating of myosin to become enzyme called ATP — ase. This enzyme breaks down ATP to release energy needed for mechanical work of contraction. With the breakdown of ATP, there is greater overlap of the dark band of myosin and the light band of actin leading to muscle contraction.

The distance between z-z lines reduces. When there is the replenishment of ATP, the muscle relaxes by the breaking of the cross link between myosin and actin. This reaction just described is also importance in meat after slaughtering. It is important when we discuss the tenderization of meat.

When an animal is slaughtered, the circulation of blood ceases. The aerobic respiration also ceases. The temperature of the meat starts to fall. Since aerobic respiration ceases, ATP will not be replenished when it is broken down. The little glycogen in the likver is sued for anaerobic respiration for the production of lactic acid that in turns reduces the PH of meat to about 5.5.

As a result of the breakdown of ATP and without replacement of it, actin forms actinmyosin with myosin. Formation of actinmoyosin from myosin

and actin causes the stiffness of the muscle and this is called rigor mortis. If the meat is cooked at this stage, the meat will be very tough. For the tenderization of the meat, the meat should be allowed to pass the stage of rigor mortis. In view of this, carcasses are hung until rigor has passed and the muscles have become tender. Enzymes cathepsins are implicated the tenderization of meat.

The lactic acid produced during the anaerobic respiration also reduces the bacterial spoilage of the meat.

3.2 Meat Quality, Digestibility and Nutritive Properties

Man eats the flesh of more than one hundred species of animals with varying qualities as revealed by the prices of the meat. The reputation acquired by some meats at time sin not related to the nutritive value of the meats. For instance, the reputation acquired by cow legs or skin in Nigeria is not related to the quality of this joint.

You have learned in this unit that the meat consists of the lean meat and the fatty tissue or adipose tissue. You have also learned that generally, the lean muscle of most species contains about 20% protein, 5% fat, 1% minerals and the rest is water. It should be noted that there are great variations in the fat content of various joints of an animal. The fat content of meat varies with the animals, the specie, the age the feed given to the animal and the joint of the meat.

The presence of high content of fat in meat is know to cause the delay in emptying the stomach when some meats are consumed. Cuts of porks always contain large amount of fat, hence people refer to pork as indigestible. Proteins in lean meat are readily digestible and absorbed with only small amount discarded in faeces. However, the collagen in the fibrous connective tissue is not easily digested. The muscle of the older animals contains more fibrous tissue than those of the younger ones, hence the muscles of the older ones are tougher.

Meat is of particular value because it contains protein of high biological value. The meat proteins contain essential amino acids in proportions that can support growth and maintenance of body tissue. As you have learned, the protein in the meat is readily digestible and almost completely absorbed in the intestine.

Meat is an important source of energy if we consider the large amount of fat it contains. The flavouring extractives from meat have a lot of influence on the palatability of cooked meat and soup. Meat is a rich source of iron and

phosphorus. It has a little content of calcium. Meat is also an important source of nicotinic acid and riboflavin. Meat, especially pork contains some thiamin. Meat contains little vitamin a and ascorbic acid.

3.3 Changes in Meat During Cooking

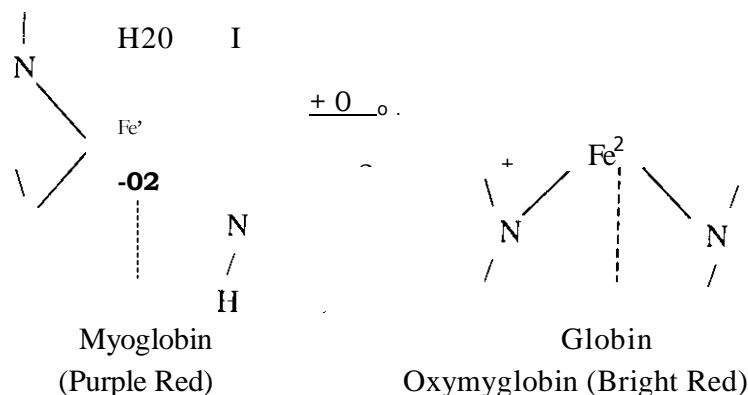
Meat must be cooked so that it can be palatable, properly chewed and digested. Some changes occur during cooking. These are changes in texture, colour and food value.

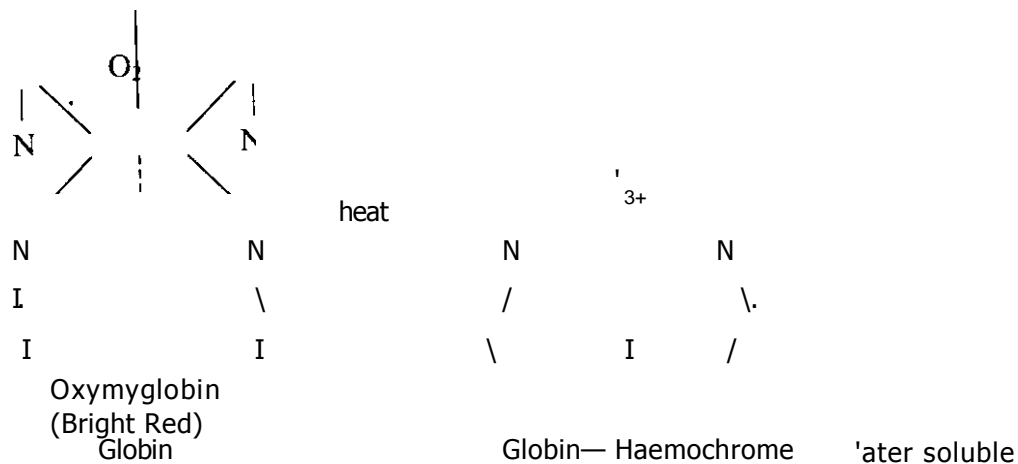
Textural Change: Cooking denatures the meat protein and causes shrinkage of the meat. The connective tissues are also softened by cooking . Collagen is converted to gelatin. The fat cells break and there is the release of fat, fat soluble substances and some water soluble substance into the stock. This is known as "cooking loss" in meat.

Colour Change: The purple red colour of meat is conferred on it by myoglobin when it forms oxymyoglobin with oxygen, the colour becomes bright red. You should recall that myoglobin, like haemoglobin, is used to carry oxygen to the cells during aerobic respiration in living organisms. During cooking, the globin part of the

Myoglobin, that is the protein part undergoes denaturation and the ferrous state of iron is oxidized to ferric state. This leads to the formation of globin-haemochrome, this gives a brown colour to meat. In other words, oxymyoglobin (bright red) is converted to globin — haemochrome (brown) during cooking.

Oxidation of myoglobin in stale meat in which ferrous state of iron is oxidized to ferric state produced met myoglobin (brownish red)





constituents of meat and even some of the fat soluble components of meat are drained into the stock leading to cooking loss. Some thiamin is lost in the meat during cooking.

3.4 Offal

Some of the offals are liver, kidney, heart and tongue. These are foods of repute food on the menus of some restaurants. Other offals are given by Davidson et al (1975) as sweet breads (pancreas and thymes), tripe (dressed stomach of horse or sheep), feet (pigs' and cow's) brains, chitterlings (pigs intestines), maws (pigs' stomach), lambs' fries and hudders. The offals have good nutritional value and contribute to the nutritional value of the diet. For instance, liver contributes vitamin and absorbable iron to the diet. Brain contains large amount of lipids especially phospholipids.

Student Assessment Exercise 12.1

Of what nutritive importance is meat in the diet?

3.5 Fish and Other Sea Foods

Fish provides an important source of animal protein lean fish contains about 10% protein and 1% fat and the common lean fish are cod, haddock, lemon sole, brill, ling etc. The fish is easily digested and the fat fish contains 8-15% of fish oil.

Fat fish therefore have higher energy level than lean fish. Examples of fat fish herring, salmon and sardines. Fish protein is of high biological value. Though fish can be very delicious, they are generally less tasty than meat.

Fish contain less protein than meat. Fat oils in fish are good sources of fat soluble vitamins.

3.5.1 Shellfish

Examples are lobsters, crayfish, crabs, shrimps and other crustacea. They have little fat and energy value of 50kcal per 100g. They are very tasty and in some communities they have become expensive (prestige) food. Oysters contain more protein than most fish and about 5% of glycogen and little fat. This is an expensive luxury food.

Shell fish live on sea shores and they have been found to easily abhor bacteria particularly salmonella group.

3.5.2 Fish Meal and Fish Flour

These products are used as feeds for dairy animals and poultry. In essence, they contribute to the supply of protein rich food. They are also consumed by man. They are prepared from small whole fish and they are noted for their excellent nutritional value.

Student Assessment Exercise 12.2

Discuss fish and sea foods in relation to their nutritional compositions.

4.0 Conclusion

This unit discusses the structure and composition of meat, the quality, digestibility and nutritive value of meat, changes in meat during cooking and fish and other sea foods.

Subsequent units will still build on this unit by discussion of other classes of food.

5.0 Summary

Meat is defined as containing muscle fibre and fat from the adipose tissue of flesh of animals. Most people of the world have natural appetite for meat. Meat has protein the lean part and the fatty part. The lean part consists about 20% protein, 5% fat, 1% minerals and the rest water.

There are great variations in the fat content of different meat. The fat content varies in meat with the type of animal, the species of animal, the age and the joint of the cut of the animal.

Meat protein is of high biological value since it contains most of the essential amino acids in the proportion that can support growth and maintenance of body tissue. Most of the fats are triglycerides. Meat is a good source of iron and phosphorus. It also has little content of calcium.

When meat is slaughtered, aerobic respiration ceases, hence production of ATP, Adenosine Triphosphate is limited to the small amount produced by anaerobic respiration involving glycogen. The lactic acid produced lowers the PH of the meat to about 5.5..

This reduces the bacterial spoilage of meat. As a result of the breaking down of the ATP without replenishment, actin and myosin fuse together to form a stiff structure actinomyosin. This condition is known as "rigourmortis". When the rigour is passed, enzyme cathepsin acts on the meat to cause the tenderization of the meat.

Cooking softens the meat, makes it more digestible and palatable and causes loss of nutrient into the stock. Cooking also changes the bright red colour of oxymyoglobin in meat to brown colour of globin-haemochrome.

The unit also discusses offal, fish, shell fish and fish meal and fish flour.

6.0 Tutor Marked Assignment

Discuss the various changes in meat after slaughtering and during cooking.

Answers to students' assessment exercises.

12.1 Answers are contained in section 3.2 of this unit

12.1 Answers are contained in section 3.5, 3.5.1 and 3.5.2 of this unit

7.0 References and other Sources

Davidson S et al (1975) Human Nutrition and Dietetics.
e^h ed. Longman Group Ltd

Lake B. and Waterworth M.(1980) Food and Nutrition
13¹¹¹ ed. Mills and Boons Ltd Brook's Mews, London