UNIT 12: MEAT, FISH AND THEIR PRODUCTS

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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. Myoblogin 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 nonprotein 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

Line

Line

Line

Sacromere _____ I I ____Sacrornere

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 acide 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 oxymoglobin 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

Myogblobin, 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,
oxymoglobin (bright red) is converted to globin — haemochrome (brown) during cooking.

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