

## UNIT 13: EGGS AND EGG PRODUCTS

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### 1.0 Introduction

Eggs have been described as nature's convenient food since they come in hygienic pack, are easily stored and readily opened and cooked (Davidson et al 1975). Eggs have high nutritive value. They are used in many catering preparations. In view of these, there is a need to study eggs, its structure, composition, storage, uses spoilage and preservation.

This unit therefore treats egg under the headings stated.

### 2.0 Objectives

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

- Describe the structure of an *egg*
- Describe the composition of eggs
- List the uses of eggs in food preparation
- Discuss storage of eggs
- Describe quality tests for eggs
- Explain spoilage of eggs

- Discuss preservation of eggs

### 3.0 Main Content

#### 3.1 Structure and Composition of Egg

Eggs come from different birds such as domestic fowl, ducks, goose, turkeys, wildbirds such as plover, gull and heron and also from fish such as herring. For the purpose of this unit, we will discuss only eggs from hens. This is because, hen is the chief supplier of eggs for human consumption. An egg is a living organism with an embryo and its store of food is contained in a protective shell. The oval shape of egg prevents the egg from rolling when it is laid and helps the packing of the eggs. The shape also increases the resistance of the shell against external pressure.

The shell is composed of calcium carbonate and some small quantities of calcium phosphate and organic materials. The porosity of the shell allows passage of air in and out of the egg through the pores. With this, the developing embryo is able to obtain oxygen for respiration and to discharge carbon dioxide. The porosity of the egg shell also allows the entry of putrifying bacteria into the egg. Fortunately a freshly laid egg has mucous covering which covers the pores and prevents the entry of the bacteria. In view of this, it is advisable not to wash eggs when they are laid.

Below the shell is a thin membrane called keratene membrane which divides into two layers to form an air chamber at the broad end of the eggs. Inside the shell membrane, we have the egg white and the egg yolk. The egg white consists of three layers; the thin white, the thick white and the thin white. The thick white is more viscous than the thin white. The egg yolk, a golden yellow fluid mass is enclosed in a thin elastic membrane. It is spherical in shape. The egg yolk contains the living embryo which can be seen in a fertile egg as a small circular speck underneath the yolk membrane called viteline membrane (Lake and Waterworth 1980). Two thick fibrous bands, the chalazae or balancers join the viteline membrane of the egg yolk with the thick white. When an egg becomes old, the thick white loses its carbon dioxide and becomes thinner, thereby unable to hold the egg yolk in position. The egg yolk therefore flows upward and rests against the keratene membrane. As a result of osmosis, water moves from the thick white to the egg yolk thereby increasing the volume of the yolk. The increase in the volume of the yolk, causes the viteline membrane to stretch to the extent that it tends to break. The implications of this are :

- a. Old eggs are impossible to break without breaking the yolk

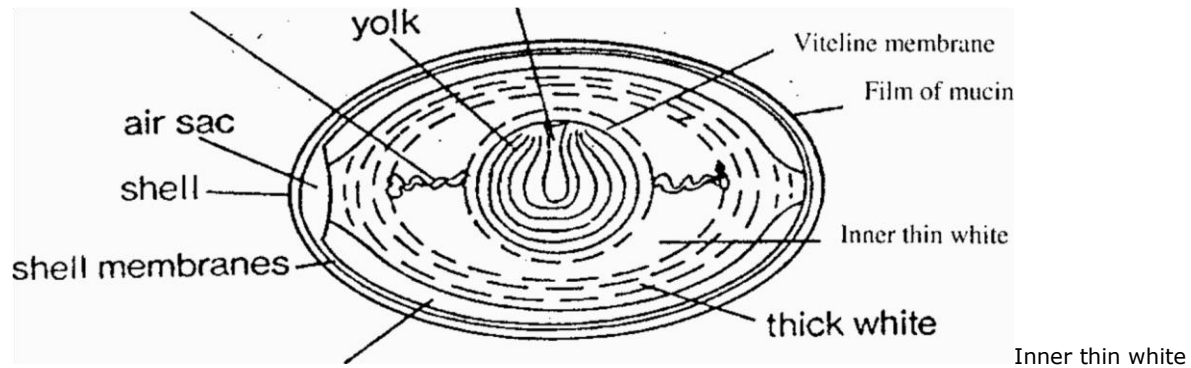
b. This accounts for the spread of an old egg during frying and poaching.

Figure 13.1 Structure of an Egg of Hen

germinal disc and white yolk

outer thin white

chalaza



air sac

shell

shell membranes

thick white

vitelline membrane

film of mucin

Source: Lake B and Waterworth M (1980) Foods and Nutrition 13<sup>th</sup> ed. Mills and Boon Ltd, Brook's Mews London Pg. 290

The average weight of egg is about 50g. This consists of shell and membrane 10%, egg white about 60%, yolk about 30%. The ratio of the egg white to egg yolk is about 2-1.

Table 13.1 Shows the composition of the egg of a hen.

	Water	Protein	Fat	Ash	Undetermined	Kg (per 100gm)
Whole egg (without Shell)	73.7	12.3	11.26	1.1	1.64	662
White	87.2	10.7	0.10	0.6	1.4	155
Yolk	47.1	15.5	33.3	2.0	2.1	1470

Source: Lake B and Waterworth M. (1980) Foods and Nutrition  
13<sup>th</sup> ed. Mills and Boon Ltd., Brook's Mews London, pg. 291

From the table, we can see that the egg yolk is superior in food value to egg white.

The egg white contains essentially proteins with about 70% of its protein as "Ovalbumin". The egg yolk is richer than the egg white since it contains less water more protein and a

greater proportion of fat. In addition to the ovalbumin contents, egg yolk contains phosphorus containing protein (vitellin), phospholipids, (lecithin and cholesterol. The lecithin is an emulsifying agent and it is very useful in the manufacture of mayonnaise. Lecithin is also used in baking to soften the crumbs. Olein, stearin and small amount of palmitin constitute the fat in egg yolk. There are also valuable calcium and iron compounds. Egg yolk is rich in thiamin, riboflavin, vitamins A and D but deficient in nicotinic acid and vitamin C. Despite all these quality attributes of egg-yolk, it is still not as expensive as egg-white

because egg-white has foaming property which is deficient in egg-yolk.

### 3.2 Cooking and Uses of Egg in Food Production

Eggs are consumed raw, in lightly boiled form and in the hard boiled form. Raw eggs are digested in the stomach and in the small intestine. Freshly laid eggs are more digested than the older ones. Of the three forms of consuming egg, lightly boiled egg is most digested and the hard boiled one is the least digested. This also applies to fried, scrambled and poached egg.

Heat treatment during cooking causes the denaturation of egg like in any other protein.

Egg yolk is a valuable ingredient in baked goods since it imparts rich colour on the baked goods. It is also used to flavour and enrich baked goods. This is apart from the emulsifying effect it has on these goods: Eggs are used as raising agent in baking to the extent that a flour low in gluten may be used. Eggs are used in Omelette, custard and other puddings. The egg-white is also used in meringues, macarons royal icing and certain types of biscuits. Because of the lecithin content of egg, it is used in the production of mayonnaise.

### 3.3 Tests of Quality of Eggs

You have learned that egg is very nutritive and in view of this, it can support growth of micro-organisms. You have also learned that the shell of the egg is porous and allows the entry of bacteria into the egg. This can lead to putrefaction of eggs resulting in pungent smell. Eggs can have another problem apart from putrefaction. This is the problem of partial development of embryo resulting from irregular collection of egg and accidental incubation of eggs. These two problems mentioned make this type of egg unwholesome for consumption. Mere visual examination of the egg may not

reveal this problem, since the egg is enclosed in a protective shell. Two test used for measuring the quality of eggs are the brine test and the candling test.

### 3.3.1 Brine Test

To conduct brine test, we prepare 10% solution of brine by adding 100g of sodium chloride per a litre of the solution. We take the egg one by one and put them into the solution. A freshly laikd *egg* sinks into the solutions and lie flat at the bottom of the container containing the solution. In older eggs, there is less of water and there is shrinkage in the egg, which leads to the enlargement of the air chamber. This makes the egg lighter. As a result of this two-day egg floats near the bottom of the solution with its broad end upward. A three-day old *egg* will float half the way up of the solution while a five-day old *egg* will flow at the surface of the solution. From this it can be seen that the older the *egg*, the nearer to the surface of the solution it floats.

It should be noted that the solution should be put in a long measuring cylindrical jar that will allow *egg* to be dropped into the solution.

### 3.3.2 Candling Test

Candling test involves the observation of egg when it is exposed to a source of light. The apparatus may consist of lamp surrounded a metal shade, bored with a whole in a sheet of hard card board, placing the egg against the hole and holding the card board to some source of light. Any source of light that will cause the transparency of the egg for the necessary observation may be adequate for this test. With this test, the egg-white of a freshly laid egg appears dense and homogenous, the air chamber is small and the yolk is seen slightly at the middle of the egg. In the older egg, the airspace is enlarged egg-white appears cloudy and the yolk displayed to the top of the *egg*. A rotten egg becomes opaque when observed with the candling test.

#### *Students' Assessment Exercise 13.1*

*Describe the two tests f measuring the quality of eggs.*

## 3.4 Spoilage of Eggs

As a result of the porosity of the shell of the *egg* and without the mucous covering of the shell, there can be entry of bacteria into the shell through its pores. This bacteria can act on protein to cause putrefaction which leads to spoilage of *egg* and causes rotten *egg* smell. The spots on egg are due to bacteria, blood and mould growth. When the embryo of the egg is dead and

decomposing, we have spot rot. Bacteria cause decomposition in egg too and this is known as white rot. We also have mixed rot and blackrot due to decomposition in eggs. Fishy and musty flavour in eggs are caused by micro-organisms.

### 3.5 Treatment of Egg

Before treatment is given to egg and even after the treatment, egg is stored. In storing egg, the egg should be placed in trays with the blunt end containing the space kept uppermost so that the air space does not bear the weight of the egg. With this type of arrangement, the yolk is kept in its proper position. The egg-white containing the egg-yolk has bacteriacid action and this causes the disappearance of putrefactory bacteria during incubation. Egg stored properly at the temperature of 10°C and they should be kept away from other strong smelling food and household goods, so that the eggs do not tend to absorb the odour of these other food and goods.

We always subject eggs to some treatments so as to preserve them. These treatments are freezing, drying and pickling.

- 3.5.1 Freezing: Since whole eggs and cooked eggs do not freeze successfully, separated eggs are always frozen. Before freezing, egg may be pasteurized at a temperature of 63°C for about a minute.

Indeed, frozen eggs can be stored in some considerable length of time and can be transported in some refrigerated devices.

- 3.5.2 Dried Egg: Another way of preserving egg is by drying it. Fresh egg are mixed properly to form a homogenous liquid, pasteurized and sprayed-dried. The moisture content of the dried egg limits the growth of undesirable micro-organisms.

The temperature of the drying chamber must be controlled since too high temperature during drying has adverse effect on the flavour of the egg. The water content of the dried egg should not be more than 5%.

- 3.5.3 Picking: This is another method of preserving egg by placing in a solution of sodium silicate or lime water. This process hermetically seals the pores of the shell of the eggs, thereby preventing the entry of bacteria into the eggs. A pickled egg can have a shelf life of 9 -12 months. Since the pore of the shell of the egg is sealed, some cracking of the shell may occur when a pickled egg is boiled.

*Students' Assessment Exercise 13.2**Discuss the methods of preserving eggs*

#### 4.0 Conclusion

This unit treats egg, the structure and the composition, the effect of cooking of eggs, uses of eggs in food preparation. Test for quality of eggs, spoilage and preservation of eggs.

The next unit will treat food and vegetable to conclude discussion of classes of food.

#### 5.0 Summary

Egg has been described as the nature's convenient food packed in a hygienic form, stored and readily opened and cooked.

It has high nutritive value and high biological value. Indeed, the amino acid composition of eggs from hen is sometimes used as a standard to which we compare the chemical score of other protein.

The eggs are enclosed in a protective shell made up of calcium carbonate and some quantity of calcium phosphate. The porosity of the shell allows passage in and out of oxygen and carbondioxide and of bacteria.

The eggs consist of egg-white, yolk and germ or embryo. Though the egg yolk has been found to have higher biological value than egg-white, the eggwhite is still more high priced than the egg yolk because of its foamy properties.

Eggs are rich sources of all vitamins except nicotinic acid and ascorbic acid. Eggs are also rich in protein of high quality. Eggs also contain phospholipids, lecithin which is a good emulsifying agent.

Eggs are used to impart colour and flavour in baked goods. It is also used as raising agent in confectionary and it is used as enriching agent in cake mixture and sponge.

Slightly boiled egg has been found to be more digestible than the raw egg. Hard cooked egg, fried egg and poached egg are also less digestible than raw egg.

The quality of egg to reveal deterioration, the amount of air spaces and age could be assessed by the use of brine test and candling.



Spoilage of egg is been due to microbial action of moulds and bacteria and contamination from blood.

Storage of eggs should be done in such a way that the end containing the airspace is allowed to be uppermost when the egg is placed in a suitable tray at a temperature of about 10°C.

Preservation of eggs is achieved by freezing separated eggs, spray drying the eggs in such a way the moisture content does not exceed 5% and by pickling the egg in a solution of sodium silicate or lime water to hermetically seal the pore of the shell so as to prevent bacteria entry into the egg.

## 6.0 Tutor Marked Assignment

Discuss the composition of eggs and the various uses of egg in food preparation.

Answers to Students' Assessment Exercises

13.1 See answers in section 3.5 of this unit 13.2 See answers in section 3.5 of this unit.

## 7.0 Reference and Other Sources

Davidson S. et al (1975) Human Nutrition and dietetic.  
6th ed. Longman Group Ltd

Lake B and Waterworth M. (1980) Foods and Nutrition 13<sup>th</sup> ed  
Richard Clay Ltd Bingay Suffolk.