

The eggs and its chemical composition

The Egg :

The egg is formed in the mature hen by a reproductive system composed of an ovary and oviduct. Most females have two functional ovaries, but chickens and most other birds have only one ovary and one oviduct. In this oviduct, all parts of the egg, except the yolk, are formed. The developing embryo, protected from drying out, can survive outside of water and in a variety of habitats. The yolk provides it with food, and the albumin supplies water and nutrients. Wastes are released to the allantois an extension of the embryonic gut. Oxygen diffuses easily through the thin outer shell of the egg; its passage to the embryo is regulated by the chorion. The yolk is formed in the follicular sac by the deposition of continuous layers of yolk material. Ninety-nine percent of the yolk material is formed within the 7-9 days before the laying of the egg. When the yolk matures, the follicular sac ruptures or splits along a line with few, if any, blood vessels called stigma. If any blood vessels cross the stigma, a small drop of blood may be deposited on the yolk as it is released from the follicle called blood spots in eggs. The shell is added in the uterus or shell gland portion of the oviduct. The shell is composed mainly of calcium carbonate. It takes about 20 hours for the egg shell to form. If the hen lays brown eggs, the brown pigments are added to the shell in the last hours of shell formation. When an egg is laid, it fills the shell. As it cools, the inner portion of the egg contracts and forms an air cell between the two shell membranes. A high quality egg has a tiny air cell, indicating the egg was collected soon after being laid and was stored properly. The air cell is usually located in the large end of the egg where the shell is most porous and air can enter easily. After fertilization, the embryo develops and the egg consists of the following :

1. albumin .
2. chorios.
3. yolk sac.
4. allantois.

Chemical Composition Of Eggs :

Egg consists of three main parts, the shell, the egg white and the egg yolk. The shell consists of calcite crystals embedded in a matrix of proteins and polysaccharide complex. Inside the shell the viscous colourless liquid called the egg white accounts for about 58 percent of the total egg weight. The composition of egg white and yolk is given in the following table.

Percentage composition of egg white and yolk

Nutrients	Egg White	Egg yolk
Water	88.0	48.0
Protein	11.0	17.5
Fat	0.2	32.5
Minerals	0.8	2.0

Egg White

Egg white is composed of thin and thick portions. 20-25% of the total white of fresh eggs (1-5 days old) is thin white. The chief constituents of egg white besides water are proteins. Different types of proteins are present in egg white.

Ovalbumin

This constitutes 55% of the proteins of egg white. This is a phospho glycoprotein and is composed of three components A1, A2, and A3, which differ only in phosphorus content.

Conalbumin

This constitutes 13% protein of the egg albumin. It consists of two forms neither of which contains phosphorus nor sulphur.

Ovamucoïd

It is a glycoprotein. This constitutes about 10% of the egg white proteins.

Ovomucin

This protein is responsible for the jelly like character of egg white and the thickness of the thick albumen. It contains 2% of the egg white. Its content in the thick layers of albumin is about 4 times more than in thin layers. It is insoluble in water but soluble in dilute salt solution.

Lysozyme

Lysozyme content of egg is 3.5%. This is an enzyme capable of lysing or dissolving the cell wall of bacteria. It is composed of 3 components A, B and C. It binds biotin and makes the vitamin unavailable.

Avidin

Avidin is 0.05% of the egg white protein. It is denatured by heat and cooked eggs and do not affect the availability of biotin.

Ovoglobulin

It is a protein consisting of two components G1 and G2 and both are excellent foaming agents.

Ovoinhibitor

% of egg protein is made up of ovoinhibitor. It is another protein capable of inhibiting trypsin and chymotrypsin.

Egg yolk : Solid content of yolk is about 50%.

Percentage composition of egg yolk on dry weight basis is given below

Nutrient	Granules	Plasma
Lipid	34	77-81
Protein	60	18
Ash	66	2

The major proteins in egg yolk are lipoproteins, which include lipovitellins and lipovitellinin. The lipoproteins are responsible for the excellent emulsifying properties of egg yolk, when it is used in such products as mayonnaise.

Chemical composition of egg contents

- 1.The weight and composition of a table egg is dependent on heredity, age, season, diet, and other factors. A typical White Leghorn egg usually weighs from 53 to 63 gm with an average of 55 gm.
- 2.In addition to water (74%), the main chemical compositions of hen egg are 11.8% lipids, 12.8% proteins, and small amounts of carbohydrates and minerals.
- 3.Most of the proteins are present in the egg white and the egg yolk, amounting to 50% and 44%, respectively; the eggshell contains the rest of the proteins. The yolk accounts for slightly over one-third of the edible portion, but it yields three-fourths of the calories and provides all or most of the fat in whole eggs.
- 4.The yolk comprises 48% water, 16% protein, 32.6% fat, and some minerals and vitamins. The white consists of 88% water, 10% protein, and some minerals. The amount of lipid in the egg white is negligible (0.01%) compared with the amount present in the yolk.
- 5.The shell makes up 11% of the weight of an egg, and approximately 98% of the shell consists of calcium. Carbohydrates are a minor component of hen eggs. Their average content is about 0.5 g per egg, 40% of which is present in the yolk.

6. Carbohydrates are present as free and conjugated forms which are attached to proteins and lipids. Glucose accounts for about 98% of the total free carbohydrate in the egg white.

7. The content of carbohydrate in egg yolk is about 0.7-1.0 % and it consists of oligosaccharides bound to protein, composed of mannose and glucosamine; the remaining 0.3% is free carbohydrate in the form of glucose.

8. About 94% of the minerals are in the egg shell fraction; the rest are distributed in egg white and egg yolk. Most of the minerals are in conjugated form, and only a small portion is present as inorganic compounds or ions.

9. Calcium represents over 98% of total mineral in the shell; other inorganic components include phosphorus, magnesium, and trace contents of iron and sulfur. Egg yolk contains 2% minerals, phosphorus being the most abundant.

10. More than 61% of the total phosphorus of egg yolk is contained in phospholipids. The major inorganic components of egg white are sulfur, potassium, sodium, and chlorine.

- Consumption of eggs :

The eggs contain high nutritional value, the digestible protein coefficient of yolk is about 100% while the digestible protein coefficient of albumin is 97% and usually percent of albumin to yolk is 2 : 1 .The gross thermal energy generated from whole egg are very high value because it is contain fat and protein on 155-180 calories/gm, and the ratio of crude protein in egg is about 12% also contain all kinds of vitamins except ascorbic acid and it is rich in mineral elements such as calcium, phosphorus, copper and zinc.

Table (1) : chemical analysis of an egg .

Portion	Percentage * (%)	Moisture (%)	Protein (%)	Fat (%)	Ash (%)
Whole egg	100	75.2	12.6	10.5	1.0
albumin	66	87.6	10.9	0.2	0.7
yolk	34	51.1	16.0	30.6	1.7

* the proportion including shell : albumin=58%, yolk=30% and shell=12% .(Forest Muir et al ,2005).

- composition of an eggshell :

1- Calcium carbonate 94.0% . 2-magnesium carbonate 1.0%. 3- calcium phosphate 1.0%. 4- organic matter 4.0%

- Consumption of poultry meat :

The poultry is considered a white meat source and the it is high nutritional value and it is easy digest.

Table (2):Chemical composition of poultry meat .

Water (%)	Ash (%)	Fat (%)	Protein (%)	Gross energy (Kcal/kg)
60-70	0.9-1.2	3-17	18-23	1180-2250