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COIMBATORE-641 035, TAMIL NADU

DEPARTMENT OF FOOD TECHNOLOGY

19FTE402 &

MEAT, FISH AND POULTRY PROCESS TECHNOLOGY

UNIT IV – EGG PROCESSING

Topic: Structure, composition, nutritive value of egg

The three main components of the egg are:

i) Shell 10%

ii) Yolk 28%

iii) Albumen 62%

The albumen consists of different layers:

Chalaziferous layer - 2.7%

Inner thin layer 16.8%

Middle dense or thick layer - 57.3%

Outer thin layer 23.2%

As usual egg is also composed of water and solids. There are two types of solid materials viz., organic and inorganic. Proteins, lipids and carbohydrates compose the organic part. All these are presented in the following table.

Constituents	Entire egg (%)	Egg Content (%)	Yolk (%)	Albumin (%)	Shell (%)	Shell Membrane (%)
Water	65.6	73.6	48.7	87.9	1.6	20.0
Solids	34.4	26.4	51.3	12.1	98.4	80.0
Organic matter	23.5	25.6	50.2	11.3	3.3	70.00
Proteins	12.1	12.8	16.4	10.6	3.3	70.00
Lipids	10.5	11.87	32.8	Trace	Trace	Trace
Carbohydrates	0.9	1.0	1.0	0.9	-	-
Inorganic	10.9	0.8	1.1	0.6	95.1	10.00

Prepared by Ms. Mohana Priya R AP/FT

Inorganic matter (i.e. in shell):

Calcium Carbonate 98.43%

Magnesium Carbonate 0.84%

Tri calcium Phosphate 0.73%

The values given in the table show that eggs can act as an important source of protein, fat and minerals by providing a well-balanced source of nutrients for persons of all ages. Its rich protein content and low caloric value are mostly sought for in this modem days to curb obesity and other health problems. Species of bird, diet, age of bird, season of laying, storage and processing influence the composition of egg.

NUTRITIVE VALUE

Eggs are considered as a delicacy and recognized as an important protective food from ancient times. Eggs are rich in easily digestible fat, high quality protein, good source of vitamins and valuable source of minerals. Eggs are palatable and useful in special diets and indispensable in cookery practices. Traces of carbohydrates (1.0 per cent) is present in egg content which reacts with Nutritive Value and egg protein during cooking causing maillard reaction (browning) specifically in egg powder manufacture. Types of lipids are phospholipids (32.8 per cent). sterols (4.9 per cent) and neutral fats (62.3 per cent). Fatty acids are palmitic, stearic, linolenic, linoleic and arachidonic acids. Egg is a rich source of quality protein, important source of unsaturated fatty acids (oleic), iron, phosphorus, trace minerals, vitamin A, E, K and B complex vitamins, especially vitamin B. As a source of vitamin D, egg ranks second to fish liver oils. Eggs are low in calcium (present in shell) and have no vitamin C. Due to low caloric value and easy digestibility, egg is included in the diet of older people. Egg protein and emulsified egg fat - (egg yolk) are most suitable for babies and growing children. Eggs find place in all diets including infertile eggs for vegetarian people. In the egg, all the essential amino acids are present. As you know that essential 'amino acids are required for the body and have to be provided in the diet, it cannot be synthesized in the human body. The amino acids which are essential to human being are given below:

1. Tryptophan	6. Leucine
2. Threonine	7. Isoleucine
3. Histidine	8. Methionine
4.Arginine	9. Valine
5. Lysine	10. Phenylalanine

Amino acid requirements for man

Amino Acids	Daily Minimum Requirement for an Average Man (in mg.)	Quantity in Two Eggs (in mg.)
Arginine	6	756
Histidine	-	260
Threonine	500	605
Valine	800	853
Leucine	1100	1096
Isoleucine	700	756
Lysine	800	745
Methionine	1100	390
Phenylalanine	1100	690
Tryptophane	250	140

Role of egg as good nutrient

	Recommended daily allowance for a moderately active man	Quantity in two eggs	% of daily requirement supplied by two eggs
Energy , Calories	3000	180	6
Proteins, gm	70.0	13.2– 14.0	20
Fat, gm	50.0	11.0	22
Carbohydrate, gm	570.0	-	-
Calcium, gm	0.8	0.06	8
Phosphorus, gm	0.9	0.24	30
Iron, mg	12.0	3.20	26
Iodine, mg	0.1	0.01	10
Vitamin A, I.U.	5000	1000 – 1500	20 – 30
Vitamin D, I.U	400	100	25
Vitamin C, mg.	75.0	-	-
Vitamin B_1, mg.	1.5	0.12	8
Vitamin B_2, mg.	2.0	0.32	16
Niacin, mg	20.0	1.20	6

Biological Value and Protein Efficiency Ratio

	Digestibility	Biological Value	Protein Efficiency Ratio
Egg	98	92	4.0
Milk	95.6	93.4	2.0
Beef	98	84	3.8
Mutton	98	78	3.2
Pork	98	76	3.2
Chicken	98	80	3.3
Fresh water fish	97	88.5	2.0
Rice	96.5	85.1	2.0
Wheat	93	68.0	1.8

Thus, findings in different tables reveal that egg can act as a good source of protein, vitamin A, vitamin D, riboflavin, folic acid, vitamin B,, and various essential amino acids (threonine, valine, leucine, isoleucine, lysine, methionine, phenylalanine and tryptophan). Two medium sized eggs can meet upto 50 % to 100% dietary requirement of these amino acids. Minerals obtained from two medium sized eggs also fulfill around 10% of our daily requirement of calcium and iron. So, at the existing situation, egg can be considered as the cheapest source of pure quality protein available in the market.

Egg white proteins (Albumen proteins):

All egg white proteins are globular. Globular proteins are important for foaming properties of egg white. Different egg white proteins are as follows:

1) Ovalbumin: It is the main protein constituent. It is 55 per cent of the protein of egg white and is a phosphoglycoprotein.

The carbohydrate components of albumen are mannose and glucosamine. Ovalbumin in solution denatures by mechanical agitation but is resistant to thermal denaturation.

2) Conalbumin: It constitutes 13 per cent protein of egg albumen. Conalbumin complexes with iron making iron unavailable to the system. Conalbumin is easily heat coagulated.

3) Ovomucoid: It constitutes 10 per cent of the egg white protein. Ovomucoid is a trypsin inhibitor.

4) Ovomucin: It is responsible for thickness of albumen and largely present in thick albumen and is insoluble in water but soluble in dilute salt solution.

5) Lysozyme: It acts as antibacterial by dissolving the cells of bacteria (lysis). Lysozyme is heat resistant.

6) Avidin: It binds biotin and makes the vitamin (biotin) unavailable to the system.

Egg Yolk proteins

Phosvitin: It is rich in phosphorus. This accounts for 80 per cent of the protein of yolk. It binds tightly ferric iron, and forms a soluble complex and thus is the iron carrier of yolk.

Lipovitellins: These are high density proteins separated into two fractions. The a and p lipovitellins, contain 40 per cent neutral lipid and 60 per cent phospholipids.

Livetin: It has three components – alpha, beta and gamma. These differ in their molecular weight

Low density lipoprotein (LDL): Egg yolk consists of 74 per cent neutral lipids and 25 per cent phospholipids. It can be separated to tow components LDL and

Yolk pigments are yellow or dark depending upon amount and type of pigment present in the feed. Colour of yolk is due to carotenoid and xanthophyll pigments. Carotenoids are converted to vitamin A in the body. Egg shell is the major source of calcium present in the egg. Calcium is present significantly in egg yolk but less in albumen. Other minerals present in yolk and albumen are sodium, potassium, magnesium, sulphur and chlorine. The mineral content of eggs depends on mineral content of the feed of chicken.

Minerals	Quantity in Yolk (in mg)	Quantity in Albumen (in mg)	Quantity in Shell (in mg)
Phosphorus	110	6	20
Calcium	27	4	2210
Magnesium	24	3	20
Chlorine	23	51	-
Potassium	21	55	-
Sodium	13	53	-
Sulfur	3	64	Trace
Iron	2	0.3	Trace
Copper	0.05 – 0.13	0.02	Present
Iodine	0.003 – 0.008	0.008 – 0.002	0.001 – 0.003
Manganese	0.004 – 0.018	0.0014	0.000012
Zinc	0.70 – 1.00	0.007	Occasionally Present

Minerals in Hen's Egg

Vitamins

The yolk is a good source of Vitamin A and Vitamin D. Egg is also a good source of Vitamin B complex.

Vitamins	Quantity in Yolk	Quantity in Albumen
Vitamin A, (I.U.)	600.27	--
Vitamin D, (I.U.)	25.70	--
Thiamine, (mg)	0.05	...
Riboflavin, (mg)	0.066	...
Niacin, (mg)	Traces	0.033
Pantothenic acid, (mg)	0.875 – 1.220	0.025 – 0.890
Choline chloride (mg)	320	--