

THE S I S  
ON  
EGGS AND THEIR USES  
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## EGGS AND THEIR USES.

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## EGGS AND THEIR USES.

There is no article of food more commonly used in all parts of the world than the egg. It can be served in so many ways and has such a high nutritive value that it is universally used as a food, by the uncivilized native as well as the most scientific cook. Because of its concentrated food value and its cheapness the egg is adapted to uses where other foods would not be practical.

An egg may be defined as a form of a cell containing an embryo and all the required nourishment for the development of the young individual until it has reached such a stage that life is possible outside the narrow limits of a shell. Since the egg furnishes the sole source of material for the growth and development of the individual for some considerable time it must necessarily follow that it contains all the elements required, i.e., it must be a perfect food for the purpose intended. Eggs have veritably been called,

"Treasure houses wherein lie

Locked by Angeles alchemy,

Milk and hair and blood and bone."

It does not follow however that eggs are a perfect food

for the adult, but they are very nutritive and form a very important item in man's food.

Hen's eggs are most commonly used although the eggs of geese, ducks, and guinea fowls are used to a certain extent. In England and Germany Plover eggs are regarded as a very great delicacy. In our country the eggs of certain sea birds such as the gull, tern, and heron are gathered in great quantities. Considering both wild and domestic birds the sizes of eggs vary from the tiny egg of the humming bird, no larger than a pea to the immense egg of the ostrich which weighs several pounds. In color they vary through many tints and mottlings. Those of the hen vary from white to a light brown; those of ducks are usually bluish white; geese white; guinea fowls light brown mottled with dark brown; white turkey eggs are usually white, speckled with a yellowish brown. The development of colors in the shells of eggs has been explained as a protective measure to render the eggs less conspicuous in their normal surroundings. The color of the egg has some effect upon the market of the hen egg although not on its food value. Some people believe the brown shelled egg to be the richest in nutriment but this is proved to be an error by chemical analysis.

The hen's egg on the average is 2.27 inches in length and 1.72 inches in diameter. These sizes vary a great deal with the different breeds and it is generally



found that the egg of the pullet is smaller than the egg of the more mature hen. The average egg weighs about 50 grammes(2 ounces), the weight being distributed as follows:

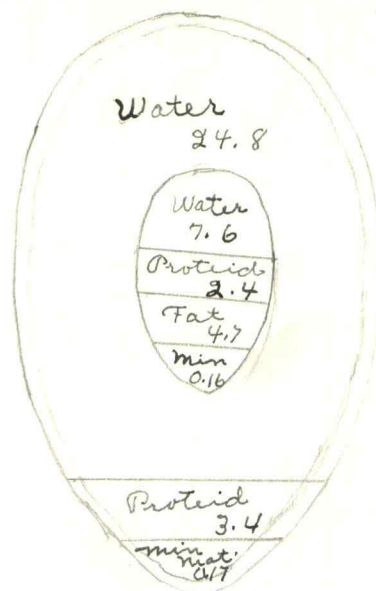
Shell weight being 12% or 6 grammes.

White       "       "       58%   " 29   "

Yolk       "       "       30%   " 15   "

The egg may be divided into three distinct parts, the shell, the yolk, and the white. Chemically they differ very widely. The shell consists almost entirely of carbonate of lime. The white consists of a solution of proteids shut up in the interior of millions of minute cells. This proteid is called albumin and upon chemical analysis it is shown to consist of a mixture of various proteids. The yolk of the egg contains much of the nourishing part. It has a very different composition from the white, containing less water and more solid matter. In the yolk is found a great deal of fat.

The actual composition of an egg is graphically illustrated in the accompanying diagram.



Shell  
carbonate of lime  
6 grms.

"Actual composition of an average egg, weighing  
50 grammes." Hutchison.

#### COMPOSITION OF EGG

Hen's egg 60 parts by weight.

White ---- 36 " " "

Albumen--- 5 " " "

Ovalbumin

Ovomucin

Conalbumin ----- 13.3 %

Ovomucoid

Water---31 parts by weight-----86.7 %

Yolk---- 18 " " "

Fats----- 6 " " "

Olein

Palmatin

Stearing

Lethicin ----- 32.7 %

Cerebrin

Cholestrin

Protein--3 parts by weight.

Vitelin-----	15.8 %
Nuclein-----	1.5 %
Water -----	50.0 %

Shell--6 parts by weight.

Mineral matter:

Calcium carbonate-----	93.0 %
Magnesium       "       -----	1.0 %
Calcium phosphate-----	3.0 %
Magnesium       "       -----	3.0 %
Organic matter -----	3.0 %

The preceeding table is a diagram taken from a phamphlet treating of eggs and shows the exact composition of an egg as it has been carefully worked out by chemists. This shows the great number of different substances which combineto make up an egg. Several of them differ only a very little when analyzed by chemists.

The yolk is seen to be very complex. Besides the proteid, vitellin, it contains three parts, palmatin, stearin, and olean, coloring matter, nuclein, lecithin and salts of iron, calcium, magnesium and potassium. The yolk contains the bulk of the nutriment of the egg. The lecthin has come to be regarded as one



of the important food constituents as it furnishes the body with a form of phosphorus which can be assimilated very readily. The total phosphorus in the yolk is equivalent to a little over one percent of phosphoric acid. The yellow coloring matter has been separated and studied to a certain extent but as yet its exact character is not known. It is a pigment and thought to be the coloring matter of animal origin called lutein.

The white of the egg as it appears to the eye is a clear, sticky, pale straw colored liquid and is commonly called albumin. It consists of a solution of proteids shut up in minute cells. The Connecticut Experiment station, after very careful and extended investigations, found it to consist in almost pure protein. The protein was found to consist of four bodies, ovalbumin, conalbumin, ovomucoid, and ovomucin. The ovalbumin makes up the greater part of the egg white. The conalbumin has much the same chemical properties as ovalbumin. The last two constituents are a form of proteid and are found in very small proportions. In addition to the albumins, the white contains a little carbohydrate material, about three percent phosphoric acid and an ash constituent, sodium chloride. Sulphur is a chief constituent of egg albumin and it is due to this fact that eggs are so readily decomposed. By the

action of micro-organisms, chemical changes take place and hydrogen sulphide is liberated. The most disagreeable odor of decomposed eggs is due to the presence of this gas.

The eggs of different types of fowls differ to a certain extent, not in their chemical composition but in their percentage composition. They vary in their size and appearance more widely. At one time it was thought that there was a difference in the composition of brown and white shelled eggs but this has been proved to be a fallacy.

The following table taken from C.F. Langworthy has eggs of our most common domestic fowls nicely compared.

Hen	Refuse	Water	Protein	Fat	Chyde	Ash	Realvalue
Whole egg as purchased--	11.2	65.5	11.9	9.3	- -	0.9	635
Edible--	-	73.7	13.4	10.5	- -	1.0	720
Duck							
-----	13.7	60.8	12.1	12.5	- -	.8	750
-----	-	70.5	13.3	14.5	- -	1.0	860
Goose							
-----	14.2	59.7	12.9	12.3	- -	0.9	760
-----	-	69.5	13.8	14.4	- -	1.0	865
Turkey							
-----	13.8	63.5	12.2	9.7	- -	0.8	635
-----	-	73.7	13.4	11.2	- -	.9	720
Guinea							
-----	16.9	60.5	11.9	9.9	- -	.8	640
-----	-	72.8	13.5	12.0	- -	.9	755

In composition eggs resemble such animal foods

as meat, milk and cheese, and vegetable foods such as flour and potatoes. As shown by the above table eggs of the different species of fowls do not differ to any great extent in composition. The yolk and white differ widely in composition, the yolk containing much fat and ash, while the white is practically free from fat and ash. There is little protein in the white but very much water, in fact about twice as much as in the yolk. About one third as much carbohydrates occurs in the yolk as is found in the white.

Taken as a whole the egg contains the most valuable food principles and is of very great use to man in his dietary. The egg is very nutritious and when raw or properly cooked, very easily digested. They give a variety to the diet and furnish a light, digestible, nitrogenous food for breakfast or other light meals. In the diet of the sedentary person they can almost wholly take the place of meat. Combined with other foods they are used to make many appetizing and delightful additions to the menu. Compared with other foods eggs at 12 cents a dozen are a cheaper source of nutrients, but when they come higher as they quite commonly do in this part of the country, they cannot be recommended on the merits of cheapness alone.

It has been shown that the nutritive value of eggs is due almost entirely to proteids and fats. Hutchison says, "One egg contains enough of these to



~~yield~~ 70 calories of energy. Half a tumblerfull of milk or 1 1/2 ounces of fat meat would ~~yield~~ as much. Fifteen to twenty eggs may be taken as the equizalent of two pounds of medium fat meat. Owing to the absence of charbohydrates, eggs are not a complete food, nor can they benregarded a cheap source of proteid, although the many forms in which they can be combined make them a very valuable and useful form of food. Also the fact that the yolk contains valuable salts, such as phosphorous, lime and iron, gives eggs a place in the dietary which cannot easily be filled by any other one article of food.

Langworthy has nicely calculated and compared the price of eggs and their food value with several other foods, an extract of which is given below. "When eggs are at 15 cents per dozen, 10 cents expended for this food will furnish one pound of total food material contains 0.13 pound protein and 0.09 pound fat, the whole having a fuel of 635 calories. At 25 cents per dozen, 10 cents worth ofleggswill furnish 0.60 pound total food material, supplying 0.08 pound protein and 0.05 pound fat, giving 380 calories.

Ten cents expended for beef at 8 cents a pound will furnish 1.25 pounds total food material, containing 0.24 pound protein, 0.16 pound fat and 1120 calories. Expended for beef sirloin at 20 cents per pound it will furnish 0.5 pound protein, 0.09 pound fat and 520 calories. If wheat bread is purchased at 5 cents per pound, 10 cents will pay

for 2 pounds total food material containing 0.18 pound protein, 0.13 pound fat, 1.06 pounds carbohydrates and 2,430 calories.

It is sometimes stated that eggs at 25 cents per dozen are cheaper than meat. This is true in a sense, not in reference to the total amount of nutrients received for the money expended but because a smaller amount of money will furnish the meal. Langworthy says where 1 1/4 pounds of beef steak at 20 cents per pound would serve five people, in many families 5 eggs costing 10 cents at 25 cents per dozen will serve the same number of people and satisfy them equally as well. If the appetites of the family demand 2 eggs the cost is still 20 cents less than the steak. Many people eat more than two eggs at a meal but it is stated on good authority that the average number per person does not exceed two. Where eggs are served in omelets, souffles, and other similar dishes less than one is served.

The following table from Langworthy compares eggs with some of our similar foods in composition and food value.

Egg as purchased	Refuse	Water	Protein	Fat	Chyde	Ash	Full value.
11.2		65.5	11.9	9.3	--	0.9	635
Cheese----	-	34.2	25.9	33.7	2.4	3.8	1950
Serloin							
Steak-12.8		54.0	16.5	16.1	- -	.9	985
Milk -----	-	87.0	3.3	4.0	5.0	.7	325
Oysters --81.4		16.1	1.2	12	.7	.4	45
Potatoes--20.0		62.6	1.8	.1	14.7	.8	310



Because of the ease with which eggs are prepared they have found great favor with the house wife. Eggs are combined with other foods into many palatable made dishes and judging from the composition and digestibility they are worthy the high opinion in which they are held. They please the aesthetic sense as well as satisfy the hunger ~~ss~~ may be highly recommended in the dietary even where the question of economy is to be considered.

Eggs are very easily digested especially in the raw state. It is shown that the digestibility depends on the method and manner of cooking. Some German investigators show that eggs eaten raw or poached or in the form of <sup>an</sup> omelet left the stomach in two or three hours, thus falling in the class with milk, oysters, and white bread. The ordinary kinds of fresh meat leave the stomach in three or four hours, while smoked meats and salt fish require a longer time. Another investigator had divided common foods into four classes including raw or soft cooked eggs in the most digestible class along with beef tea, milk etc. Stern concludes that raw or half raw yolks are very readily digested. Two to four raw yolks leave the stomach in 70 to 100 minutes. One to two raw yolks taken in a cup of hot coffee with some sugar and milk leaves the stomach in 60 or 70 minutes. Experiments also show that eggs cooked at a low temperature (180° F) where the albumin is just coagulated will digest much more quickly and thoroughly than when cooked at a higher temperature.

Investigations also show that eggs are very thoroughly digested. One investigator proved that 95 % of the dry matter and 97 % of the protein was digested.

To the cook the egg offers the greatest possibilities. There is hardly any class or form of food which is not improved and beautified by the use of eggs. Cooked in various ways they take the place of meat in many meals; combined with other foods they form various made dishes; in cakes they improve the color, flavor and texture; in custards and creams they thicken and thus give the material the desired consistency; when beaten until light they take the place of a leaven; and the white alone is often employed in icings and confections.

The poet says, "There is a best way of doing everything even if it be to boil an egg." Janet McKenzie says the best way is not to boil at all but to cook at a temperature below that of boiling or about 180° F. The egg possesses its highest nutritive value in a raw state and the higher the temperature to which it is subjected and the longer it is exposed to the heat, the more indigestible it becomes. The egg white consists of albumen and the effect of heat on albumen is to coagulate it and thus render it indigestible, hence the lower the temperature at which an egg is cooked, the more digestible it is.

In selecting eggs for cooking the freshest are always best. An egg <sup>is</sup> probably at its best when about 12 hours old. When fresh the shell is full and as it grows

older the water evaporates, leaving a space into which the air penetrates and the contents deteriorates very rapidly. The freshness of eggs may be determined in various ways. In wholesale houses the method called "candling" is used. The eggs are held in front of a candle frame in a dark room. If they are fresh the center appears clear. If not, a dark spot may be seen in the center. In the home they may be tested by placing in a basin of cold water and if fresh they should sink. Place the large end to the cheek and a warmth should be felt.

There are several stages in the appearance of boiled eggs which depends on the length of time and the amount of heat to which they have been subjected. If the egg white has been gently heated no change is noticed until the temperature reaches 134° F. White fibers appear until about 160° when the whole mass is coagulated, yet tender and jelly like. If the temperature reaches 212° and is continued the white becomes tough and horney like also shrinking. In this stage it is said to be very indigestible. By experiments I have found that an egg dropped into boiling water enough to cover it and left on the back of the range is cooked perfectly palatable. The white was a soft jelly like mass and the yolk slightly thickened. The egg when dropped into the water was at room temperature, so if



taken from the ice box it would have to be left in the water for a minute or two longer. Boiled eggs are classified according to their consistency as "soft cooked", "medium cooked" and "hard cooked" eggs all of which are cooked at a temperature lower than 212° F.

Poached eggs or dropped eggs are removed from the shells and cooked in water. Fried eggs are cooked in a pan of hot fat and may be eaten hard or soft. Eggs are also occasionally baked and in connection with some other food are considered very appetizing.

The egg omelet is regarded as one of the most appetizing forms in which eggs can be served. The yolk and white are separated and beaten very light, then salt and pepper and a tablespoon of milk is added to the yolk. Last of all the white is folded in very gently. The whole is turned into a hot pan in which some butter has been melted. When the omelet has become brown on the bottom it is placed in a hot oven until the top is browned. The omelet is slashed through the middle and served on a hot platter. I have found this omelet very successful and when served with jelly, orange, chopped ham or oysters it is very appetizing as well as making a change in the menu.

Eggs are used in the various made dishes to give smoothness and texture. In custards, puddings and creams the eggs are beaten slightly and added to give a smoothness and texture. In cakes they are beaten light and

added to give a finer appearance and sometimes for lightness. Eggs are used upon many dishes for garnishes and they may be made to appear very pretty and attractive, especially upon salads and other similar made dishes.

As a leaven eggs have long had their uses. In sponge cake the yolks and whites are beaten separately and added to the mixture. Here no other leavening agent is used. The white is beaten up very dry and folded in very gently. Air is entangled in the bubbles, the heat causes the air to expand and thus the cake is made to rise. Sponge cakes when properly made are very light and appetizing. In pop-overs, a form of muffin, the egg alone is used as a leaven. The whole egg is added to the milk and flour and the entire mixture beaten vigorously with a dover beater for ten or fifteen minutes.

Eggs are used very largely in confections. Many candies have egg white as a foundation. Icings for cakes are made from pure egg white. Many tempting little cakes, lady fingers, etc. depend upon the beaten egg whites. In making ice cream, where it is not practical to use pure cream, eggs are very satisfactorily used as a filler. Since eggs are very rich in protein, combining them with fats and carbohydrates makes them a much more balanced food.

In considering any kind of food, preservation plays a very important part. Eggs have been found to be very difficult to keep for any length of time. The water



evaporates through the shell, micro-organisms enter and thus deterioration is commenced. They absorb odors very readily so must be kept in a clean place. In preserving eggs the ways may be classed as follows :

- 1-The use of low temperature i.e., cold storage.
- 2-Excluding air by coating, covering or immersing the eggs.

Eggs are generally placed in cold storage in April or May and held at a temperature of 31° to 34° F. They must be used immediately after removal from storage. They are said to have the flavor of fresh eggs. Stored eggs should be turned quite frequently and are not kept longer than one year. They are sometimes removed from the shells and are stored in bulk in 50 pound cans. These are kept at a temperature of 30° F. and it is said can be kept for any length of time.

Under exclusion of air many devices have been tried. Eggs are packed in salt, oats, or bran. They are packed in lime water, wrapped in paper, coated with vaseline, but none of these ways are very successful. Perhaps the most successful way of preserving eggs other than cold storage is by means of water glass. Water glass or potassium or sodium silicate, is made up into a 10 percent solution and the eggs immersed in the solution. The North Dakota Experiment Station has found that after 3 1/2 months in the solution the eggs were apparently as good as when fresh.

Other ways have been taken up for the preservation of eggs besides those heretofore mentioned, that is evaporating or dessicating the whole egg or the yolk and white separately. It is said that the egg thus prepared will keep for a considerable time and since it is in a very convenient form for packing it is readily seen that this is a very important discovery in connection with the preservation of eggs.

The process of drying was invented by a chemist in Victoria, Australia, a few years ago. It is a simple process on the same principles as that of hermetically preserving fruit at a boiling temperature, or of pasteurizing milk. Eggs freed from the shell are dried at the relatively low temperature of 130° F. The operation is rapidly executed in containers from which the air has been exhausted and from which the vapor is drawn as fast as given off by the evaporation of the eggs. There is no chemical change taking place, simply the loss of a great deal of water. After the egg is thoroughly dried it is packed in various ways. Sometimes it is ground to a fine powder and sometimes it is left in small pieces about the size of a wheat grain. These are sealed in paper packages and when kept in a dry place are supposed to keep almost indefinitely.

In cooking I have tried several typical recipes of the different classes of foods in which eggs are used and the whole have found it entirely satisfactory. The

egg which is in tiny pieces is soaked in water for one or two hours before using. For the equivalent of one egg I used two level tablespoons of the dried egg and the same amount of water. When the egg was all dissolved I beat it thoroughly with a dover beater. It then had the appearance of fresh beaten egg with the exception that it was a little darker color than egg usually is.

In cake making I made two cakes of the same materials and baked under the same conditions using fresh eggs in one and dried egg in the other. The cake made from the dried egg was the lightest of the two and the texture was fine and even. In flavor and color no difference could be noted. In cookies the results were practically the same.

In the experiment I made a simple custard using the same proportions as for fresh egg. Of the two custards made and boiled under exactly the same conditions, there was no difference in the appearance. Both were of about the same consistency, color and texture. In taste there was very little difference, the one from the dried egg tasting a little of the egg, which is a slightly stale taste. I thought that too much egg had been used as made another, using only one half as much of the egg. This custard was entirely too thin and tasted so strong of the dried egg that it was not palatable.

The conclusions drawn from these simple experiments were that dried egg would be very useful to the baker,



and to the house wife in baking but where they were to be used where a heat higher than that of  $212^{\circ}$  F was not used the dried egg was not very satisfactory. Although they could be used in a measure very successfully where fresh eggs are not available. They would be very practical in traveling in very cold or hot countries or on simple camping trips.

As yet dried eggs are more expensive than fresh eggs at average prices. One pound of the preparation costs 60 cents and contains the equivalent of three dozen medium sized eggs, thus making the cost about 20 cents per dozen. Here is a wide field for a great deal of work on the subject of manufacture and improvement of dried eggs. They are now largely used by bakers in the East and on account of their keeping qualities and the ease by which they can be shipped the industry of drying eggs is soon going to become a very valuable industry.

In conclusion I think a word about the importance of the egg industry is not out of place. The total number of eggs produced in the United States in 1890 was estimated as 820,000,000 dozen. The total number of eggs produced in the United States in 1899 was 1,298,000,000 dozen or 17 dozen per capita. In Egg production, Iowa ranks first, Ohio second and Illinois third. The total value of the eggs produced in 1899 was \$144,286,156 an average of 11.2 cents per dozen. As shown by the

census report the average values range from 8 to 34.5 cents per dozen. These statistics are of value because they show how very valuable asset the American hen is. It is demonstrated more clearly every day that the housewife could not get along without the egg, because of its convenience, nutritive value and its ever increasing uses both in the necessities and luxuries of the home.

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