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Michigan Agricultural College, 19[redacted].

THESIS

Thesis

On Eggs.

The egg of the chicken is the one chiefly utilized for human food, but the eggs of other domesticated fowls such as the duck, goose, turkey and guinea are occasionally eaten.

The eggs of all birds are suitable for food as they all have the same chemical composition, but the flavor, which is the discriminating feature, depends much upon the food and habits of the bird.

Eggs form a complete food. According to Baron Liebig there is more nutriment in an egg than in anything else of equal bulk that exists in nature or that chemistry can produce. They contain all the elements of the blood, and from them the organism of the young chick is developed. But when regarded in the light of a complete food, in this instance the shell must be taken into consideration, as it is from the shell that certain essentail constituents of the organism of the chick are obtained. In the process of incubation the earthy salts in the shell are dissolved by the phosphoric acid which is developed by the oxidation of the phosphorous. These salts are thus in a condition to be absorbed and go to form bone.

For experiment, the chicken egg has been selected. Its average weight is given by Bauer as 750 grains; of which 105 grains is shell, 405 grains white, and 240 grains yolk.

The shell of the egg is a compound of lime, not the phosphate as it exists in the bones, but chiefly the carbonate. It is a porous body and admits air for the need of the young in incubation. Its weight is usual-

ly about one tenth that of the entire egg.

The white of the egg is separated from the shell by a thin membrane. It contains less solid matter than the yolk, also much less fat and consists chiefly of albumen dissolved in water. There is usually from 5 to 20% of the albumen in an egg. Egg albumen resembles serum albumen, but is not identical with it.

The yolk contains an albumeneus constituent called vetellin, also fats such as Oline, Palmatine, and a small amount of Cholertine, much Lecithin and a yellow coloring matter, inorganic salts, extractives, and a small amount of grape sugar.

Table of Constituents.

	White.	Yolk.
Water.	84.8%	51.5%
Albumen.	12	15
Fat.	2	30
Mineral.	1.2	1.4
Pigment, extractive, and sugar.		2.1

Composition of shell.

Calcic carbonate - 91%. Calcic phosphate- 6%. Organic material- 3%.

The freshness of an egg can be determined by puttin g the large end to the tongue. If it feels warmer than the small end, the egg may be considered fresh. Another test is to hold the egg up towards the sun. If the outline of the yolk is well shaped and can be distinctly traced, thus indicating the clearness of the surrounding albumen, it is safe to consider the egg a good one.

The most decided and satisfactory test, however, is to place the egg into a deep pan of cold water. A fresh egg will sink to the bottom immediately. An egg that sinks slowly, one may regard with suspicion, and if a stiff meringue is desired, one should not use it. An egg that floats on top, may safely be discarded as spoiled.

The decomposition of an egg is due to the breaking of the tissue between the shell and the albumenous coating, which allows the air from the air-chamber in the large end of the egg to mingle with the white and yolk. This immediately starts decomposition and in this process a gas which is lighter than air is generated and mixes with the entire egg.

Compared with meat, eggs contain more albumenoids, but less fat than an equal weight. Their nutrient ratio is 1:1.3

It has been calculated that eighteen (18) eggs would contain an amount of flesh-forming substance or nitrogenous nutrients sufficient for the needs of life for one person for one day. It would be necessary, in order to provide the same amount of albumen from fruit, such as the pear, to consume not less than seventy (70) pounds.

The following is a table showing the ash constituents of three most important animal foods.

	K.	Na.	Ca.	Mg.	FeO.	P_2O_5H	H_2SO_4	Cl.
Ash of flesh.	41.4	3.63	3.83	3.21	.70	42.54	1.56	3.05
" " milk.	24.61	9.7	20.05	3.05	.53	28.45	.30	14.28
" " eggs.	18.23	17.5	8.44	2.43	1.16	33.05	.96	13.97

The digestibility of eggs when fresh is almost perfect. They are more easily digested raw than cooked. Slight cooking impairs this

quality but little, while with eggs that are cooked to a condition of hardness, digestibility is very speedily lessened.

Experiments showing this were made by adding a small amount of Pepsin to dilute hydrochloric acid, in which solution was placed a small quantity of hard-boiled egg. Keeping this mixture at or near the temperature required for the natural assimilation of food, 98 degrees, I found that the egg was completely dissolved through the liquid in one day. Another mixture made in the same manner but with uncooked egg in place of the egg hard-boiled, I found that it required only a few hours to digest the egg through the liquid. This I take as conclusive evidence that the nearer the raw condition the egg is when eaten, the more nutrition it contains and the more easily it is digested and assimilated. In the experiment made to determine the temperature at which eggs should be cooked, it was so arranged that the heat would increase gradually and could be accurately noted. A test-tube containing the albumen was placed in a glass vessel which was in turn placed in a double boiler each part of which contained water. The water was heated and the temperature taken. The egg began to coagulate at 138 degrees, was soft cooked at 170, and hard cooked at 190 degrees. On heating it to 212, the albumen became hard, tough, and horny. It is thus rendered unfit for food, but in this condition proves to be an excellent cement.

The yolk of the egg heated in the same manner began to coagulate at 130 degrees, was soft cooked at 150, and hard cooked at 170.

Eggs may be preserved for a long time by various devices which are intended to prevent the entrance of air through the pores of the shell.

Several preservatives are considered good and are quite extensively

used.

(1) Packing the eggs in common salt to which has been added a small amount of starch to prevent lumping, 1 part of starch to 25 parts of salt. Eggs which were packed in this way for eighty (80) days were at the end of that time found to be in excellent condition, the white of the egg making almost as good a x as the fresh egg. Quite a difference was manifest, however, in the form of the yolk and white:that of the fresh egg being firm and rounded, while the old egg was watery and flatt oned.

(2) The lime solution is very widely used by shippers, but is not to be recommended, as eggs preserved in this way show by both odor and flavor that the lime gas has penetrated the shell and affected the white and yolk.

(3) Another method is a tedious task of coating the egg with paraffine and as shown by the experiment (after keeping them eighty (80) days we found the eggs spoiled) an unsuccessful one.

As a conclusion regarding the packing of eggs, we may say that the salt method is by far the most practical, as eggs are not affected in taste or odor, and the mixture, being a dry one, can be used again and again.

Eggs should be packed with the small end down as the air chamber in the large end is apt to break the inner coating by being forced by pressure, to another part of the egg where the weight is less.

The meranque made by an old egg is much less in amount as compared with that of a fresh one, owing to the presence or formation of water in the former; the vesiculation is also coarser and breaks down much

quicker.

Eggs in the raw state will not affect metals, but when cooked, the hydro-sulphate is developed which very readily discolors silver. No other metal used for cooking purposes is affected by it.

Nitric, sulphuric, tartaric, and acetic acid applied to the white or yolk of the egg affects it in the same manner as though it were cooked, thus we must appreciate the prime importance of using acids in connection with egg mixtures, too strongly.

Conclusive tests for eggs.

The shell of a fresh egg is thick and rough.

The shell of an old egg is thin and smooth.

The covering next to the shell of a fresh egg is thin: that of an old egg is very much thickened and tough.

Shake a fresh egg gently; it is full: shake a stale egg or an old one and it rattles.

The yolk of a brown shelled egg is richer and richer than a light-shelled one.