STUDIES ON THE NUTRITIVE VALUES OF QUAIL EGG *AND* CHICKEN EGG

Nyo Nyo Win

Abstract

Quail egg and chicken egg were collected from battery farm in Pyin Oo Lwin Township, Mandalay Region and the nutritional values of fat by extraction method, protein by Kjeldahl method and carbohydrate by phenol sulphuric spectrophotometric method of these samples were determined. And then, determination of ash content and moisture content were done. Moreover, the samples were assayed by Energy Dispersive X-Ray Fluorescence (EDXRF) and Atomic Absorption Spectroscopy (AAS). According to the EDXRF results, the samples contain calcium, sulphur, phosphorous, potassium, iron, zinc, copper and strontium. The content of iron, copper, cadmium and lead were determined by Atomic Absorption Spectroscopy. According to the determination result, the amount of protein and fat are more content in quail egg. The content of carbohydrate in quail egg and chicken egg are equally amounts.

Key words : EDXRF, AAS

Introduction

Nutrition is the science that interprets the interaction of nutrients and other substances in food (e.g., phytonutrients, antocyanins, tannins, etc.) in relation to maintenance, growth, reproduction, health and disease of an organism. It includes food intake, absorption, assimilation, biosynthesis, catabolism and excretion.

Eggs are laid by female animals of many different species, including birds, reptiles, amphibians and fish and have been eaten by humans for thousands of years. Bird and reptile eggs consist of a protective eggshell, albumen (egg white) and vitellus (egg yolk) contained within various thin membranes. The most popular choice for egg consumption are chicken eggs. Other popular choice for egg consumption are duck, quail, roe and caviar.

Eggs are a very good source of inexpensive, high quality protein. More than half the protein of an egg is found in the egg white along with vitamin B_2 and lower amounts of fat and cholesterol than the yolk. The whites are rich sources of selenium, vitamin D, B_6, B_{12} and minerals such as zinc, iron and copper. Egg yolks contain more calories and fat. They are the source of cholesterol, fat soluble vitamins A, D, E and K and lecithin the compound that enables emulsification in recipes such as hollandaise or mayonnaise.

Lecturer, Department of Chemistry, Yadanabon University

Nutrition of Quail Egg

Quail eggs are proved to be a very valuable source of vitamins A,B_1,B_2,B_6, B_{12} and vitamin D, iron, magnesium, zinc, copper, phosphorus and other essential micro-nutrients, minerals and amino acids, which is why they are recommended for regular consumption.

Quail eggs are packed with vitamins and minerals. Even with their small size, their nutritional value is three to four times greater than chicken eggs. Quail eggs contain 13 percent proteins compared to 11 percent in chicken eggs. Quail eggs also contain 140 percent of vitamin B1 compared to 50 percent in chicken eggs. Unlike chicken eggs, quail eggs have not been known to cause allergies or diathesis.

Regular consumption of quail eggs helps fight against many diseases. They are a neutral combatant against digestive tract disorders such as stomach ulcers. Quail eggs strengthen the immune system, promote memory health, increase brain activity and stabilize the nervous system. They help with anemia by increasing the level of hemoglobin in the body while removing toxins and heavy metals.

Nutrition of Chicken Egg

Chicken egg white are a low-calorie, fat-free food. They contain the bulk of the egg's protein. The egg white contains about 4 grams of protein, 55 mg of sodium and only 17 calories. A single egg white also offers 1-3 micrograms of folate, 6.6 mg of selenium, 2.3 mg of calcium, 3.6 mg of magnesium and 4.9 mg of phosphorous and 53.8 mg of potassium.

Chicken egg yolks carry the cholesterol, the fat and saturated fat of the egg. One egg yolk has around 55 calories, 4.5 grams of total fat and 1.6 grams of saturated fat, 210 mg of cholesterol, 8 mg of sodium and 2.7 g of protein.

Materials and Methods

Sample Collection

The quail eggs and chicken eggs were collected from battery farm in Pyin Oo Lwin Township, Mandalay Region. The components of the quail eggs and chicken eggs were sectionally assayed. The components assayed consist of (1) albumin and (2) yolk.

Determination of Ash Content in Quail Egg and Chicken Egg

The ash of a sample is the inorganic residue remaining after the organic matter has been burnt away.

Samples

(1) Albumin and (2) Yolk

Procedure

The samples were weighed and separated into (1) albumin and (2) yolk. They were separated placed in porcelain crucibles which contained covers. The crucibles were heated carefully on a hot plate. The partially decomposed samples were then incinerated in a muffle furnace at 550°C until the ash results were uniform in color (i.e., white or gray). The crucibles containing ash were then cooled to room temperature in desiccator and weighed. Heating, cooling and weighing were repeated until a constant weight were obtained.

The ash content of the sample was calculated using the following equation.

$$\text{Ash } (\%) = \frac{\text{weight of residue (g)} \times 100}{\text{weight of sample (g)}}$$

Determination of Moisture Content in Quail Egg and Chicken Egg

The moisture content of sample was determined by oven drying method. The moisture content of sample is the weight lost due to the evaporation of water at the drying temperature.

Samples

(2) Albumin and (2) Yolk

Procedure

The samples were weighed and separated into (1) albumin and (2) yolk. They were separately placed in porcelain crucibles which contained covers. The crucible with the sample was placed in an oven and dried for 30 minutes at 100°C. Then, they were removed from the oven and cooled in the air-tight desiccator at room temperature and weighed. The procedure was repeated until the loss in weight had not been changed.

The moisture content can be calculated by the following formual.

$$\text{Moisture (\%)} = \frac{\text{loss in weight (g)} \times 100}{\text{weight of sample (g)}}$$

Determination of Fat Content in Quail Egg and Chicken Egg

Samples

(1) Albumin and (2) Yolk

Procedure

The samples (50 g) was placed into round-bottomed flask. Into the round-bottomed flask, 200 ml of petroleum ether (boiling point 60-80°C) was poured until some of it overflowed into the flask and heated by means of a water bath. Duration of about 10 hours was required for complete extraction. The petroleum ether was removed by simple distillation. The ether solution was transferred into the porcelain basin and the residual petroleum ether was removed by evaporating. The procedure was repeated until a constant weight was obtained, and the fat content was calculated.

The fat content can be calculated by the following formula.

$$\text{Fat (\%)} = \frac{\text{Weight of fat (g)}}{\text{Weight of sample (g)}} \times 100$$

Figure Determination of Fat Content

Determination of Protein Content in Quail Egg and Chicken Egg by Kjeldahl's Method

Accurately weighed defatted sample (ca.1.0g) was placed in the Kjeldahl digestion tube, Kjeldahl catalyst, anhydrous copper sulphate (8g). Pure sulphuric acid (15 ml) and some pieces of pumice stone were added to the Kjeldahl's digestion tube. Then it was shaken until the contents were well mixed. The digestion tube with the sample was placed into the Bloc-digest with the fume removed operating. The digestion was done at a temperature 150°C for 15 min,300°C for 15 min and 400°C for 1 hour. At the end of the transferred into the conical flask. Distilled water (100 ml) was carefully added into the flask with frequent shaking. The Kjeldahl's distillation apparatus was set up, taking care that the tip of the condenser extended well below the surface of the standard sulphuric acid solution (30 ml) in the receiver. The digested solution was poured into the distillation flask and the n 100 ml of 40 % sodium hydroxide solution was added into it through the dropping funnel to make the mixture strongly alkaline. The evolved ammonia was distillate with off and passed into a receiver containing sulphuric acid and the distillate with suspect to excess sulphuric acid was titrated with standard

sodium hydroxide solution using methyl orange as an indicator. A black determination was carried out exactly as above, but instead of sample, 5 ml of distilled water was used.

Calculation

$$\text{Protein \%} = \frac{0.014 \times 100 \times (X - V) M_B}{W} \times 6.25$$

Where,

X = Volume (ml) of NaOH solution used in blank

V = Volume (ml) of NaOH solution used in test

M_B = Concentration of NaOH solution

W = Weight (g) of sample

Figure Digestion of Protein Content

Figure Distillation of Protein Content

Figure Titration of Protein Content

Determination of Carbohydrate in Quail Egg and Chicken Egg

by Phenol Sulphuric Spectrophotometric Method

Procedure

One cm^3 aliquots of sample solution and six standard solution containing 10,20,40,60,80 and 100 μg of glucose cm^3 were put in each test tube. One cm^3 of 5% phenol solution was also added to each test tube and mixed. A blank was also prepared with 1 cm^3 of distilled water instead of sugar solution, 5 cm^3 of 96% sulphuric acid was again added to each tube so that the stream hit the liquid surface directly to produce good mixing. Each tube was agitated during the addition of acid. After ten minutes, the tube were reshaken and placed in water bath at 25°-30° C for twenty minutes. The yellow orange colour was stable for serveral hours.

Abosorbance were measured at 490 nm using 754 UV- spectrophotometer.

A standard curve was plotted by the absorbance of the standard glucose solutions against the concentration in μg per cm^3 .Using this standard curve, the concentration of glucose in the sample was calculated.

The absorbance of the standard glucose solutions were listed in Table.

No.	Concentration of glucose (μg/cm^3)	Absorbance at 490 nm
1.	10	0.115
2.	20	0.150
3.	40	0.324
4.	60	0.404
5.	80	0.572
6.	100	0.752

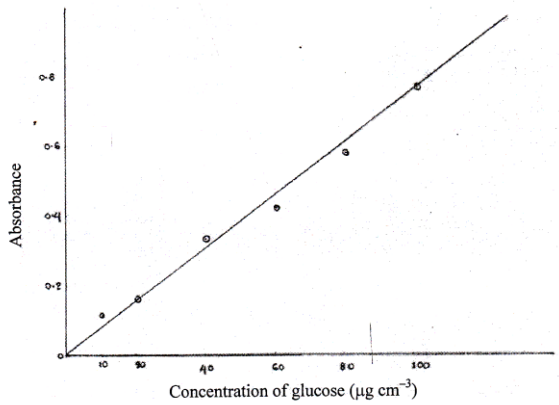

Figure Calibration Curve of Glucose

Elementary Analysis

The constituent of elements were determined by X-Ray Fluorescence Analysis and Atomic Absorption Spectroscopy.

Analysis of Quail Eggs and Chicken Eggs by EDXRF

There are two essential methods of X-ray fluorescent analysis. They are;

1.Wavelength Dispersive X-Ray Fluorescence (WDXRF) method and

2.Energy Dispersive X-Ray Fluorescence (EDXRF) method

Samples Preparation for Atomic Absorption Spectrophotometry (AAS)

About 0.1g of ash samples were accurately weighed and dissolved in 2 cm^3 of concentrated hydrochloric acid solution. The resulting solution of ash samples were evaporated to dryness and dissolved in 6 cm^3 of 25% HCL solution (volume by volume) followed by centrifugation. The centrifuged solutions were decanted and the clear solutions (10 cm^3) were pipetted accurately and made up to 100 cm^3 with deionized water again. The sample solutions prepared were ready for analysis by Atomic Absorption Spectrophotometry.

Determination by Atomic Absorption Spectrophotometer

Results and Discussion

Tabel : The Content of Ash in Quail Eggs and Chicken Eggs

No.	Sample of Egg		Ash (%)
1.	Quail Eggs	Albumin	0.361
		Yolk	0.941
2.	Chicken Eggs	Albumin	0.017
		Yolk	1.158

Tabel : The Content of Moisture in Quail Eggs and Chicken Eggs

No.	Sample of Egg		Moisture (%)
1.	Quail Eggs	Albumin	66.47
		Yolk	32.95
2.	Chicken Eggs	Albumin	67.39
		Yolk	25.96

Tabel : The Content of Fat in Quail Eggs and Chicken Eggs

No.	Sample of Egg		Fat (%)
1.	Quail Eggs	Albumin	18.60
		Yolk	47.67
2.	Chicken Eggs	Albumin	18.98
		Yolk	44.16

Tabel : The Content of Protein in Quail Eggs and Chicken Eggs

No.	Sample of Egg		Protein (%)
1.	Quail Eggs	Albumin	9.44
		Yolk	12.87
2.	Chicken Eggs	Albumin	10.62
		Yolk	13.06

Tabel : The Content of Carbohydrate in Quail Eggs and Chicken Eggs

No.	Sample of Egg		Carbohydrate (%)
1.	Quail Eggs	Albumin	0.904
		Yolk	0.917
2.	Chicken Eggs	Albumin	1.621
		Yolk	1.438

Tabel : Semiquantitative Analysis of Albumin and Yolk from Quail Eggs and Chicken Eggs by EDXRF

No.	Element	Relative Composition (%)			
		Quail Eggs		Chicken Eggs	
		Albumin	Yolk	Albumin	Yolk
1.	P	0.9906	18.82	0.6782	23.09
2.	S	0.9999	0.02756	0.8736	0.01268
3.	K	10.84	4.394	10.96	6.065
4.	Ca	0.6653	4.880	0.6937	6.066
5.	Fe	0.1337	0.3243	0.6824	0.3420
6.	Cu	0.01279	0.00904	0.03163	0.00769
7.	Zn	0.00452	0.1430	0.00192	0.1758
8.	Sr	0.00583	0.02052	0.00507	0.01903

Tabel : The Content of Heavy Metals (Fe, Cu, Cd, Pb) by Atomic Absorption Spectroscopy

No.	Element	Heavy metals content in quail eggs and chicken eggs (ppm)			
		Quail Eggs		Chicken Eggs	
		Albumin	Yolk	Albumin	Yolk
1.	Fe	0.268	0.904	0.180	3.241
2.	Cu	0.007	–	0.035	0.020
3.	Cd	0.111	0.132	0.065	0.084
4.	Pb	0.017	0.034	0.048	0.045

Conclusion

In this research, the nutritional values (fat, protein, carbohydrate) of two samples were determined by their respective methods. According to determination of fat content, the quail eggs and chicken eggs of albumin and yolk were found to be 18.60 %, 47.67 %, 18.98 % and 44.16 %. The higher content of fat was found in the quail egg yolk.

From the measurement of protein content by Kjeldahl's method, the quail eggs anchicken eggs of albumin and yolk were observed as 9.44 %, 12.87 %, 10.62 % and 13.06 % respectively. content of protein in chicken egg yolk was found to be greater than that of others.

The amount of carbohydrate obtained were 0.904 %, 0.917 %, 1.621 % and 1.438 %iquail eggs and chicken eggs of albumin and yolk. The more content of carbohydrate in chicken eggs albumin was 1.621 % and the lower content of carbohydrate in quail eggs albumin was 0.904 %.

In addition, metal contents of samples were determined by EDXRF and AAS. From the EDXRF measurement, the samples contain the essential element iron together with calcium, potassium, phosphorous and sulphur; moreover trace elements such as Zn, Cu and Sr were also found. According to the AAS results of samples, the content of iron was found to be greater than that of other heavy metal in all parts of the samples. Among these samples, iron content is highest in chicken egg yolk (3.241 ppm). Moreover, the mineral contents in quail egg were Fe (0.268-0.904) ppm, Cu (0.007 ppm), Cd (0.111-0.132) ppm, Pb (0.017-0.034) ppm and the chicken egg were Fe (0.180-3.241) ppm, Cu (0.020-0.035) ppm, Cd (0.035-0.084) ppm and Pb (0.045-0.048) ppm respectively.

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References

1. May Thu Thu Win, (2014), "Comparative Studies on the Nutritive Values of Natural Ripen and Artificial Ripen *Carica papaya* L. (Papaya)", MRes Thesis, Department of Chemistry, Yadanabon University.

2Shrinandan Bansal, (2010), “Food and Nutrition”, Sound Edition, A.I.T.B.S Publishers, India.

3. Zaw Min Thu, (2011), "Studies on Chemical Analysis of Chicken Egg in Banmaw Township", MRes Thesis, Department of Chemistry, Banmaw University.