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Proximate Analysis and Assessment the Physical Characteristics of Different Types of Duck Eggs in Bangladesh

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Abstract: Egg is a universal food in our regular diet which rich in many nutrients. The purpose of this study was to calculate approximately the proximate nutritional content and assess the physical appearance in variety of duck eggs produced in Bangladesh. Eggs have been collected from four region representing different geographic areas in Bangladesh. Proximate nutritional value of eggs has been analyzed according to AOAC method. Antioxidant activity was determined by Yen and Chen method. Farm duck contains the highest amount of moisture which is 71.18±0.04 % and Native duck contains the lowest amount of moisture which is 68.36±0.11%. On the other hand, Native duck contains the highest amount of fat (13.78±0.30%) and lowest ash 0.93±0.09%. Goose Shows highest amount of protein 13.86±0.56%, ash 1.13±0.07% and lowest amount of carbohydrate 2.98±0.34%. Energy has been calculated based on standard formula, where goose shows the highest energy (263.23 ±0.95 kcal) and farm duck shows the lowest amount (190.77±0.85 kcal). Goose shows maximum antioxidant activity 18.24% and Farm duck shows minimum antioxidant activity 14.32%. Native duck shows 16.46%, Chinese goose 16.78% antioxidant activity. Findings of this study will help to provide nutritional data in food composition table of Bangladesh and plays a significant role to eradicate the nutritional problem of the country.

Key words: *Proximate, Nutritional value, Protein, Egg, Antioxidant activity*

INTRODUCTION

Egg acts as a significant role in the food industry as a good source of high quality protein and highly nutritious profile for human diet. Egg quality is composed with outside quality and inside quality including egg weight, egg shape index, egg shell thickness, ratio of protein and ratio of egg yolk, etc. Egg qualities and nutritional components may vary with the variation of genetic background [1].

Variety of egg's large yolk contains 300 mg of cholesterol which refers more than two-thirds of the recommended daily intake. Human body may not absorb much cholesterol from egg. It also contains all of the choline, which is an essential nutrient for development of the brain, and is said to be vital for pregnant and nursing women to ensure healthy fetal brain development [2].

A balanced diet is essential for normal growth, health and preservation of the human body. Eggs have constituted an important part of human diets for centuries because of its high-quality protein [3]. They are known to supply the best proteins besides milk [4]. It is also rich in amino acids, carbohydrates, easily digestible fats and minerals, as well as valuable vitamins [5].

Chicken eggs are the most commonly consumed eggs; they are also an inexpensive single-food source of protein [6]. Compared to chicken egg duck egg is 30% bigger and its nutritional profile is really high. Its energy is slightly higher because of greater fat percentage. However, saturated fat content of duck eggs has adverse health implications that are comparable with others [7].

Eggs play important culinary roles and are therefore prepared into different dishes. There are many types of

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poultry species' eggs consumable as a protein and amino acid supplement [8].

The human body has an antioxidant compound known as endogenous antioxidants to neutralize free radical compounds. Free radicals are molecule that has one or more unpaired electrons, which are unstable and highly reactive so can result in damage to cellular components such as DNA, proteins and other macromolecules [9]. Antioxidants are play therapeutic and preventive roles against several diseases include cancer, heart disease, cataracts, diabetes and liver.In general, animal products such as meat, milk and eggs are recognized as a source of bioactive compounds, including antioxidant [10]. The availability of antioxidants in eggs associated with the presence of several vitamins, including vitamin A, vitamin E, carotenoids, reduced glutathione, selenium and glutathione peroxidase that relates to embryonic development in the egg and the occurrence of stress during embryogenesis phase [11].

According to Bangladesh Poultry Industries Association, the average production of a rural household may therefore not be more than 200 eggs per year. Bangladesh rural population is estimated at 108 million people. Assuming an average of 5 people per household, it can be estimated that there are 22 million rural households in which an average of 200 eggs are produced per household per year or 4 400 000 000 eggs [12].

There is no experimental data of nutritive value of eggs in our country but some nutritive data is available those are collected from the Indian food composition table. The aim of this research is to evaluate the physical appearance, proximate and antioxidant activity of different types of eggs which are native duck, farm duck, Chinese goose, and goose widely consumed in Bangladesh. The results could provide reference for people to choose reasonable nutritional status among various duck eggs.

MATERIALS AND METHOD

Collection of samples:

Egg samples of native duck, farm duck, Chinese goose and Goose was collected from four regions at Jhenaidah, Sylhet, Gazipur and Dhaka. Then it was kept in the refrigerator at 7°C before analysis.

Preparation of samples:

Egg sample was weighed for whole and separated the edible part of egg and was homogenized it through egg beater (Philips HR1453/70). Then it has been made to powder form by freeze drier (Moduloyd freeze drier-230, Thermo fisher) and transferred it to zipper bag and kept in the desiccators. Triplicate analysis of each sample was conducted.

Determination of proximate nutritional analysis:

Proximate nutritional analysis such as moisture, protein, fat, ash and carbohydrate were studied and determined according to AOAC method [13]. Moisture of egg is commonly determined by drying a sample at some elevated temperature approximate 105^0C and reporting the loss in weight in terms of moisture. Protein content in the egg was determined and demonstrated by AOAC method [13]. The fat content was determined by Soxhlet method [14]. Ash in the egg is readily determined by incineration from dried sample at about 750°C for 8 hours by muffle furnace. The carbohydrate content was determined by subtracting the other food value i.e. Protein, Fat, Moisture, Ash through direct determination method [15]**.** The energy content was calculated based on the formula given by Eknayake et al. [16].

Determination of antioxidant activity:

The scavenging effects of samples for 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical were monitored according to the method of the previously reported by [17]. The ability to scavenge the DPPH radical was calculated using the following equation:

Scavenging effect (%) = [1 - (A sample – A sample blank)/ A control] × 100

Where, A control is the absorbance of the control (DPPH solution without sample); A sample is the absorbance of the test sample (DPPH solution plus test sample) and A sample blank is the absorbance of the sample only (sample without DPPH solution). Synthetic antioxidants: Gallic acid and ascorbic acid were used as positive controls.

Statistical analysis:

Descriptive statistics of proximate of 4 types of eggs were computed first. In order to test the equality of these parameters in these verities of eggs, standard deviation was performed, since some of the parameters varies significantly ($p<0.05$). All types of data analysis were done by SPSS of its version 20.

RESULTS

The physical appearance of egg includes egg weight, egg length, egg width, shell thickness and color of different egg variety presented in Table 1. Table 1 shows the physical appearance of eggs. Here mean weight of native duck, farm duck, Chinese goose, Goose is 56.22±0.006, 63.39±0.001, 62.54±0.005, 143.67±0.03 gm respectively. Here goose egg's weight is greater which is 143.67± 0.03 gm and native duck egg's weight is smaller that is 56.22±0.006 gm among other eggs.

Table 1: Physical appearance of different types of eggs

Egg variety	Egg weight (gm) (Mean ± SD)	Egg length (cm) (Mean ± SD)	Egg width (cm) (Mean ± SD)	Shell thickness (mm) (Mean ± SD)	Color
Native duck	56.22 ± 0.006[a]	5.17 ± 0.09[a]	3.37 ± 0.07[a]	0.38±0.08[a]	Light blue
Farm duck	63.39 ± 0.001[b]	5.82 ± 0.05[b]	3.79 ± 0.06[b]	0.42±0.03[a]	Grey
Chinese Goose	62.54±0.005[b]	5.58±0.07[b]	3.73±0.05[b]	0.39±0.05[a]	Light Greenish
Goose	143.67±0.03[c]	9.52±0.05[c]	5.12±0.09[c]	0.46±0.08[a]	White

The most thicker shell found in goose egg which was 0.46 mm, in previous study [18] it was found 0.47 mm which is most similar with our study. Native duck, farm duck and Chinese goose showed 0.28mm, 0.42 mm and 0.39 mm egg shell thickness respectively. Light blue, grey, light greenish, white color shell in native duck, farm duck, Chinese goose and goose respectively.

Table 2: Proximate nutritional content of various types of eggs.

Parameters	Types of eggs			
	Native duck (Mean±SD)	Farm duck (Mean±SD)	Chinese Goose (Mean±SD)	Goose (Mean±SD)
Moisture	68.66±0.11[a]	71.18±0.04[c]	70.72±0.49[c]	68.76±1.02[b]
Protein	13.32±0.31[b]	12.03±0.14[a]	12.08±0.37[a]	13.86±0.56[b]
Fat	13.78±0.30[b]	12.13±0.48[a]	12.87±0.64[a]	13.27±0.54[b]
Ash	1.09±0.01[a]	0.93±0.09[a]	1.09±0.29[a]	1.13±0.07[a]
Carbohydrate	3.15±0.16[a]	3.73±0.50[a]	3.24±0.42[a]	2.98±0.34[a]
Energy (KCal)	209.45±0.68[b]	190.77±0.85[a]	215.83±0.73[c]	263.23±0.95[d]

Proximate nutritional content of various types of eggs are depicted in Table 2. Table 2 shows that, mean moisture content of egg of native duck, farm duck, Chinese goose, goose is 68.66%, 71.18%, 70.72%, 68.76% respectively. Here farm duck egg contains the highest moisture content which is 71.18%. Moreover, moisture content of native duck and goose is almost same. Shannon et al found 73.88% moisture in Canadian goose which is higher than our findings [19]. Then mean protein content of egg of native duck, farm duck, Chinese goose and goose are 13.32%, 12.13%, 12.87%, 13.27%. In present study goose shows the highest protein content which is 13.87%. 13.44% protein was found [19], which was close to our result. Besides, native duck contains maximum fat which is 13.78%. Mean ash content was highest in goose that 1.13% & mean carbohydrate was higher in farm duck egg 3.73% than others. Finally, energy of goose egg was 263.23 kcal which is most among them. Recently

BBS (Bangladesh Bureau of Statistics) has showed that egg contains 10.3%protein, 13.3% fat and 173 kcal energy per 100 gm, which are below than the value of this study.

Antioxidant Activity:

The Figure 1 showed that the antioxidant activity in the egg varied from 14.32% to 18.24%. Maximum antioxidant activity found in goose egg was 18.24 % and Chinese goose egg, 16.78 %. On the other hand, native duck contains 16.46% antioxidant activity and 14.42% in farm duck egg. Farm duck shows minimum antioxidant activity.

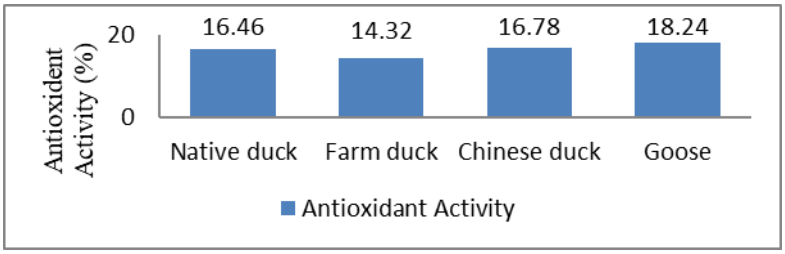

Figure 1: Antioxidant activity of different egg variety produced in Bangladesh

DISCUSSION

It was reported that goose egg weight was 146.6 gm which is higher than our study [18]. But the egg weight and quality can vary from region to region and the feeding types. Goose showed the highest length which is 9.52± 0.05 cm and similarly the highest width also which is 5.12± 0.09 cm. Proximate nutritional content of various types of eggs are depicted in Table 2. Table 2 shows that, mean moisture content of egg of native duck, farm duck, Chinese goose, goose is 68.66%, 71.18%, 70.72%, 68.76% respectively. Here farm duck egg contains the highest moisture content which is 71.18%. Moreover, moisture content of native duck and goose is almost same. Shannon et al found 73.88% moisture in Canadian goose which is higher than our findings [19]. Then mean protein content of egg of native duck, farm duck, Chinese goose, goose is 13.32%, 12.13%, 12.87%, 13.27%. In present study goose shows the highest protein content which is 13.87%. 13.44% protein was found [19], which was close to our result. Besides, native duck contents maximum fat which is 13.78%. Mean ash content was highest in goose that 1.13% & mean carbohydrate was higher in farm duck egg 3.73% than others. Finally, energy of goose egg was 263.23 kcal which is most among them. Recently BBS (Bangladesh Bureau of Statistics) has showed that egg contains 10.3 gm protein, 13.3 gm fat and 173 kcal energy per 100 gm, which are below than the value of this study.

It was found antioxidant activity in 15.70% in duck egg which is lower than our result [20]. The existences of these differences were likely due to the ability of different types of poultry in converting feed containing antioxidant into products. Generally, many studies on antioxidant in egg yolk have shown that bioactive compounds transferred from feed to the egg yolk [21]. Poultry that consume a lot of feed will produce eggs that contain high antioxidants. The type of feed used was not a source of antioxidants so that the antioxidant activity of the egg was less available. Feeding grain or mainly grains containing during germination will provide high antioxidant activity [22]. They state that the increase in antioxidant activity during germination values appear to be associated with an increased content of antioxidant compounds such as vitamins and polyphenols.

There is no experimental data of nutritive value of eggs in our country but some nutritive data is available which are collected from the Indian food composition table. This study will be helpful to fulfill the nutritional need of individuals of their daily diet. This study will be used as an essential guideline for establishing standard egg nutritional chart in our country. Further study will be needed to analyze other nutrients such as essential amino acid, fatty acid, vitamin etc which will fill up the gap of food composition table.

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