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Comparative study of egg quality traits in local breeds and commercial lines of chickens

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Abstract

Eggs are highly important food because of their high value of protein and richness of vitamins and minerals. Similarly to other types of food, eggs have become subject of discussions about food safety. Intensive production techniques, in which several chemical additives are used, are put into question by consumers. In this study, village eggs are compared with commercial eggs, which are produced under conditions of intensive agriculture in terms of egg quality characteristics. Rural eggs were collected from four different villages in District Dir Upper, while commercial eggs were collected from four different markets in same District. Significant difference was found in rural and commercial egg in egg quality parameters. Highest egg weight (52.3g) and albumen weight (33.71g) was noted for commercially produced eggs. Similarly, egg to albumin weight ratio was highest (64.40 g) for commercial eggs. Significantly, thicker shell (0.40 cm), higher egg yolk weight (15.47 g) and egg to yolk weight ratio (33.96 g) was recorded for rural eggs. Rural eggs had higher haugh unit (85.52) as compared to commercial eggs (84.71). It is concluded, that eggs produced in rural farming system had high nutritional value as compared to commercially produced eggs.

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Introduction

Hen's eggs have been traditionally considered as an important source of nutrients for humans (Nau *et al*., 2003).Thanks to their low production cost, they represent a cheap source of animal proteins and lipids (Nys and Sauveur, 2004). Moreover, they are culturally accepted worldwide and are not submitted to any religious nor traditional interdiction.

Nowadays, it is widely recognized that eggs are more than a source of nutrients, numerous studies describing biological properties potentially exploitable by pharmaceutical, food-processing and cosmetic industries (Mine and Kovacs-Nolan, 2004). In the context of the growing demand for industrially processed egg products (Tixier-Boichard *et al*., 2006), egg dry matter efficiency, both in terms of yield and quality, is of substantial interest (Suk and Park, 2001).

The major constituent of albumen is water amounting to 88% of total weight. Its solid content is predominantly composed of proteins (11%). The total solid content of egg yolk is generally 50% and the major constituents of yolk are proteins (16%) and lipids (32%) (Ahn *et al*., 1997). The most important trait of egg composition, linked to egg dry matter, is the yolk: albumen ratio (Hartmann *et al*., 2003). Beside the Y: A ratio, eggshell resistance to shocks is an economically primordial trait as it determines the ability of eggs to withstand transportation from producers to consumers (Mertens *et al*., 2006). Important losses, up to 10 % of total egg production, can be attributed to eggshell fragility (Washburn, 1982). Moreover, an intact eggshell is also necessary to impede bacterial invasions of eggs and so to reduce food poisoning risks (Mertens *et al*., 2006).

Egg composition is not a uniform trait. Several factors affect it, such as breed, age, size or laying season (Coutts *et al*., 2006). In rural area, poultry eggs are mostly produced under traditional and non-intensive production system and play a key role in economic development of rural community (Kondombo *et al*., 2003).

Rural eggs are presumed to be a natural food and mostly preferred by the consumers (Tugcu, 2006). This study was carried out to determining egg quality in terms of composition and eggshell resistance of rural and commercial eggs.

Materials and methods

Experimental material

Two hundred eggs were randomly collected (one hundred eggs were collected from the rural area and one hundred were collected from the commercial form). All eggs were properly numbered and stored at 6°C till the day following collection.

Eggs measurement

Eggs measurements were started with weighing of eggs (accuracy 0.01 g). Then, length and width of eggs were measured by means of an electronic sliding calliper (accuracy 0.01 mm) to calculate egg shape index, defined as the ratio between length and width multiplied by 100. In an attempt not to distort results about eggshell strength and internal quality, all eggs were checked for cracks and cracked eggs were excluded from further measurements. Crack detection was done by means of the acoustic egg tester, a lab scale device which measures the acoustic response of an egg's shell after a light impact with a rod using this information to determine whether an egg is cracked.

When an egg is intact, the same device can be used to define eggshell strength, expressed as the Dynamic stiffness (K_{dyn}) which is calculated by the following formula :$K_{dyn} = k * m * RF^2$, with m as egg mass (kg), k a constant and RF the resonance frequency of the egg shell vibration in Hz. Next, the more classic egg shell breaking force (F_{max}) was determined using a universal tensile and compression test machine (UTS test system Gm BH., Ulm, Germany). Eggs were placed horizontally between two steel plates compressing them at a speed of 10 mm/min. F_{max} was the force at which egg breakage occurred.

Eggs quality

To define the internal egg quality, eggs were broken onto a flat surface. The height of the thick albumen was measured at its widest part at a position half way between the yolk and the outer margin using tripod micrometer.

Haugh units

Individual Haugh units (HU) were calculated from the height (H) of the albumen and egg weight (W) using the simplified HU formula (SILVERSIDES, 2004): $HU = 100 \log (H - 1.7 W^{0.37} + 7\text{-}57)$.

Albumen weight

The yolks were carefully separated from the albumen. The shell, including membranes and yolks were weighted separately (accuracy 0.01 g). Albumen weight was determined by subtracting yolk and shell weights from total egg weight. The shell thickness was measured at three different random points in the equatorial shell zone using an electronic micrometre (accuracy 0.01 mm). The calculated average was used as a trait.

Statistical analysis

Data were statistically analyzed using analysis of variance technique (10) in completely randomized design. Egg quality parameters were considered is dependent variables and farming system was considered as treatment variable. Posthoc analysis was computed to compare the means using Tukey procedure. Statistical package SAS (11) was used for statistical analysis. Significance was found at level of ($p<0.05$).

Results

Egg weight and composition parameters:

Total egg weight

Breed differences for egg weight and composition parameters was shown in (Table 1).

Table 1. Whole egg weight, shell weight (g; Mean ± SE) and shell thickness (mm) of commercial and rural eggs.

Farming system			
Characteristics	Commercial	Rural	p- value
Egg weight	52.30^{a}±1.66	45.75^{b}±1.27	0.00
Shell weight	4.44±0.174	4.68±0.158	0.30
Shell thickness	0.36^{b} ±0.85	0.40^{a}±0.01	0.01

Means with different superscripts within same row is significantly different at p<0.0.

Highly significant ($p<0.05$) differences were found in egg weight between rural and commercial breeds. The average egg weight of commercial (52.30 g) and rural eggs was(45.75 g).

Eggshell weight

Table (1) shows comparison of the egg shell of commercial and local breed**s**. These breeds show highly significant differences for the egg shell. The highest egg shell weight was noted for commercial (4.68 g) as compared to rural eggs (4.44 g).

Egg shell thickness

Highly significant differences were found for egg shell thickness in rural and commercial breeds (Table 1). The highest egg shell thickness was found in rural Eggs (0.40 mm) while (0.36 mm) in commercial eggs.

Egg yolk weight

The egg yolk weight comparison of the rural and commercial lines was shown in the (Table 2). Significant ($p<0.05$) differences were observed for egg yolk weight in the studied lines. The average yolk weight for commercial was (13.90 g), while (15.469 g) in ruralbreeds.

Egg albumen weight

Table (2) shows the significant differences in egg albumen weight between the commercial and rural lines. The highest (33.71g) egg albumen weight was recorded for commercial eggs as compared to rural eggs (25.91g).

Ratio of albumen to egg weight

The ratio of albumen to egg weight was shown in the (Table 2). The ratio of albumen to egg weight was noted significantly higher for commercial eggs as compared to rural eggs.

Table 2. Mean ± SE of internal egg quality parameters of commercial and rural eggs.

Characteristics	Farming system		
	Commercial	Rural	P-value
Yolk weight	13.91^{b}±0.73	15.46^{a}±0.40	0.00
Albumen weight	33.71^{a}± 1.23	25.91^{b}±1.16	0.00
Yolk weight %	26.53^{b}±1.05	33.96^{a}±0.86	0.00
Albumen %	64.40^{a}±1.05	56.34^{b}±1.04	0.00
Shell weight %	9.05±0.36	9.84±0.51	0.22
Haugh unit	84.71± 0.84	85.52± 0.61	0.44

Means with different superscripts within same row was significantly different at $p<0.05$.

Haugh unit

Haugh's Units were measured in this study to ascertain freshness of the investigated eggs. Non-significant difference was observed for Haugh unit between commercial and rural eggs. The highest Haugh unit (85.52) wasin rural eggs as compared to commercial eggs (84.71).

Discussion

Egg composition is not a uniform trait and depends on many factors such as the hen breed or age. As poultry being endangered worldwide provides a broad genetic diversity, there is an urgent need for assessment of egg quality in local breeds, which have already been proven to bear some economically advantageous traits. Highly significant differences were recorded between breeds in total egg weight, egg composition and mechanical resistance. In this respect, the tested local breeds showed very interesting characteristics. The present results, regarding whole egg weight, shell thickness and shell weight are in line with the findings of (Cicek and Kartalkanat, 2009; Yakubu *et al* 2008) who reported significant effect of farming system on external egg quality parameters. It is known that egg weight is affected by factors like genotype, age, nutrition, parental average body weight and other nutritional factors (Yakubu *et al*., 2002). It can be assumed that the lower weight of the rural egg in this study is due to the above factors. The shell is a structure that contains calcium, since calcium concentration is high in the fodder therefore free range birds consume sufficient quantity of calcium resulting high shell thickness for rural egg (Boltumelo, 2005).

It also attributes the fact that rural birds consume more calcium as compared to commercial chicken. Significant differences were observed for egg yolk and albumen weights. The results of the present study are an agreement with the findings of by (Wang, 2009; Hussein, 1993). Difference in internal egg quality may be due to different housing conditions, age, storage condition and feed scavenged by the chickens (Jones and Musgrove, 2005. Zaman, 2005).

In developing countries, rural poultry farming are of high importance in terms of maintenance for people living. It provides them not only with food but also at considerable amount offers the opportunity of economic support. In past the rural eggs were primarily consumed by the local people, but now a day's people from other area tends to consumed these products. It is a known fact that rural products are of top rank probably due to high nutritive value for almost all age groups, an important iron source for children and a low caloric and easily digested nutrition for adults. Rural eggs were found with thicker egg shell, higher egg yolk weight and higher Haugh unit and can be considered as with high nutritional value as compared to commercially produced eggs (Silversides, 2004).

References

Ahn DU, Kim SM, Shu H. 1997. Effect of egg size and strain and age of hens on the solids content of chicken eggs. Poultry Science **76,** 914-919.

Boltumelo PT. 2005. Influence of limestone particle size in layer diets on shell characteristics at peak production. Erisim: Etd. Uovs. Edu.

Coutts JA, Wilson GC, Fernandez S, Rasales E, Weber G, Hernandez JM. 2006. Optimum Egg Quality - A Practical Approach. 5M Publishing: Shefield UK, p 63.

Hartmann C, Johansson K, Strandberg E, Wilhemson M. 2000. One-generation divergent selection on large and small yolk proportions in a White Leghorn Line. Poultry Science **41,** 280-286.

Haugh R. 1937. The Haugh unit of measuring egg quality. US Eggs Poultry Managemen**43**, 522-555.

Hussein SM, Harms RH, Janky DM. 1993. Effect of age on the yolk to albumen ratio in chicken eggs. Poultry Science **72**, 594–597.

Jones DR, Musgrove MMT. 2005. Effects of extended storage on egg quality factors. Journal of Poultry Science **84,** 1774-1777.

Kondombo SR, Nianogo AJ, Kwakkel RP, Udo HYM, Slingerland M. 2003. Comparative analysis of village chicken production in to farming systems in Burkina Faso. Tropical Animal Health and Production**35**, 563-574.

Mertens K, Bamelis F, Kemps B, Kamers B, Verhoelst E, Deketelaere B, Bain M, Decuypere E, Baerdemaeker JD. 2006. Monitoring of eggshell breakage and eggshell strength in different production chains of consumption eggs. Poultry Science **85,** 1670-1677.

Mine Y, Kovacs-Nolan J. 2004. Biologically active hen egg components in human health and disease. JournalofPoultry Science **41,** 1-29.

Nau F, Anton M, Nys Y. 2003. Lœuf de poule: une mine de moleculesa activités biologiques. In: Cinquièmes Journées de la Recherche Avicole, Tours.

Nys Y, Sauveur B. 2004. The nutritional value of eggs. INRA Production and Animal **17**, 385-393.

Silversides FG. 2004. The Haugh unit correction for egg weight is not adequate for comparing eggs from chickens of different lines and ages. Journal of Applied Poultry Research **3**, 120-126.

Steel RGD, Torrie JH. 1982. Principle and procedures of Statistics. International Student Edition. Mc Graw Hill. Koga Kusha Ltd. Tokyo Japan.

Suk YO, Park C. 2001. Effect of Breed and Age of Hens on the Yolk to Albumen Ratio in Two Different Genetic Stocks. Poultry Science **80**, 855-858.

Tixier-Boichard M, Joffrin C, Gourichon D, Bordas A. 2006. Improvement of yolk percentage by crossbreeding between a commercial brown-Egg layer and a local breed, The fayoumi. In: 8th world congress on genetics applied to livestock production. Belo Horizonte, MG, Brasil.

Tugcu E. 2006. The village imagery created in commercial and integrated chickens produced by Avian Flu. Journal of Milli Folklar Dergis **18**, 71-74.

Wang XL, Zheng JX, Ning ZH, Qu LJ, yang N. 2009.Laying performance and egg quality of blue-shelled layers as affected by different housing systems. Poultry Science **88,** 1485-1492.

Washburn KW. 1982. Incidence, cause and prevention of egg shell breakage in commercial production. Poultry Science **61**, 2005-2012.

Yakubu A, Ogah DM, Barde RE. 2008. Productivity and egg quality characteristics of free range Naked Neck and Normal Feathered Nigerian Indigenous Chickens. International Journal of Poultry Science **7,** 579-585.

Yakubu PLM, Mtambo MMA, Minga UM, Gwakisa PS, Mdegela RH, Olsen JE. 2002. Productivity of natural disease resistance potential of free-ranging local chicken ecotypes in Tanzania. Livestock Research for Rural Development.

Zaman MA, Ahmed A, Sutradhar BC. 2005. Study on the egg quality of a breed and three crossbreds at various ages under semi scavenging system of management. Pakistan Journal of Biological Science **28,** 211-214.