

Some Quality Characteristics of Pheasant (*Phasianus colchicus*) Eggs with Different Shell Colors

Kemal KIRIKÇI, Aytekin GÜNLÜ, Mustafa GARİP
Department of Animal Science, Faculty of Veterinary Medicine, Selçuk University, Konya - TURKEY

Received: 03.06.2003

Abstract: In this study, some external and internal quality characteristics of pheasant (*Phasianus colchicus*) eggs with white, blue, brown, or olive green shells were investigated. A total of 120 pheasant eggs including 9 white, 4 blue, 24 brown and 83 olive green eggs (collected in the same laying period and randomly) were used in this study. The values of egg weight, shape index, eggshell weight and shell membrane weight of the brown and the olive green eggs were found different from those of the blue and white color eggs ($P < 0.05$). Yolk and albumen weights of the white, blue, brown, and olive green eggs were found 9.03 and 16.28 g, 9.57 and 14.37 g, 10.72 and 17.96 g, 10.13 and 17.79 g, respectively ($P < 0.05$). The effect of eggshell colors on the yolk index, albumen index, shell thickness, membrane thickness, and Haugh Unit was found to be insignificant ($P < 0.05$).

As a result of this study, the quality of brown and olive green eggs were better than blue and white eggs.

Key Words: Pheasant, egg, eggshell color, quality

Farklı Kabuk Rengine Sahip Sülün (*Phasianus colchicus*) Yumurtalarının Bazı Kalite Özellikleri

Özet: Bu araştırmada kabuk rengi beyaz, mavi, kahverengi ve zeytin yeşili olan sülün yumurtalarının bazı iç ve dış yumurta kalite özellikleri incelenmiştir. Materyal olarak bir sülün sürüsünden bir yumurtlama sezonu boyunca elde edilen 9 adet beyaz, 4 adet mavi, 24 adet kahverengi ve 83 adet zeytin yeşili kabuklu sülün yumurtası kullanılmıştır. Beyaz, mavi, kahverengi ve zeytin renkli yumurtaların yumurta ağırlığı, şekil indeksi, kabuk ağırlığı ve zar ağırlığı yönünden kahverengi ve zeytin renkli yumurtalar lehine önemli farklılıklar ($P < 0,05$) tespit edilmiştir. Beyaz, mavi, kahverengi ve zeytin renkli yumurtaların sarı ve ak ağırlıkları sırasıyla; 9,03 ve 16,28 g, 9,57 ve 14,37 g, 10,72 ve 17,96 g, 10,13 ve 17,79 g olarak belirlenmiştir ($P < 0,05$). Sarı indeksi, ak indeksi, kabuk kalınlığı, zar kalınlığı ve Haugh birimi üzerine kabuk renginin etkisi önemsiz bulunmuştur. Bu araştırmanın sonucunda kahverengi ve yeşil kabuklu sülün yumurtalarının beyaz ve mavi kabuklulara göre daha kaliteli olduğu anlaşılmıştır.

Anahtar Sözcükler: Sülün, yumurta, yumurta kabuğu rengi, kalite

Introduction

Eggs produced by the pheasant (*Phasianus colchicus*) are highly variable in color, ranging from the more typical brown and olive green shells to the less frequent blue and white shells (1-3). There is an association between hatchability and shell color, with blue eggs hatching at around half the rate of brown and green eggs (3). Despite these forming about 1-2%, blue eggs collected are often discarded at settings (4). This has an economic impact on egg production in pheasant farming.

Reasons for an association between hatchability and eggshell color are unclear, but preliminary observations indicated that in blue and white eggs there is a significant

negative correlation between the age of embryonic mortality and the weight loss of it during incubation (5). This implies that the blue color is probably associated with structural defects in the eggshell. Blue eggshell appears to be caused by structural defects in the mammillary layer of the eggshell, which leads to a thinner shell. These defects could affect the water loss during the incubation, so the hatchability can be depressed (6). Hulet et al. (1) reported that hatchability of blue eggs and white eggs is lower than that of brown eggs and olive green eggs in pheasant.

Given the economic importance of the pheasant, the present study was undertaken to compare the quality characteristics of eggs with different eggshell colors.

Materials and Methods

The eggs used in this study were chosen by eye as white, blue, brown or olive green categories from the Pheasant (*Phasianus colchicus*) Farm in Veterinary Faculty of Selçuk University. A total of 120 pheasant eggs including 9 white, 4 blue, 24 brown and 83 olive green eggs (collected in the same laying period and randomly) were used in this study.

The eggs were weighed and measured by digital calipers in the sensitivity of 0.001 at short and long diameters in order to designate the shape index. Then, the eggs were broken one by one on a flat layer with a waiting period of 5 minutes. The heights of yolk and albumen, and long and short diameters of albumen, and the diameter of yolk were measured with the calipers. The yolks separated from albumen and weighed. The shells of the broken eggs were washed gently under flowing tap water to be released from albumen residues and then dried in the air. Eggshells were weighed, and the shell thicknesses at equator, and blunt and pointed edges of the eggshell with or without membrane were measured with calipers. From the values obtained, the data related to investigated characteristics with the aid of the below formulas (7,8) was attained.

$$\text{Shape index} = \text{Short edge} / \text{Long edge} \times 100$$

$$\text{Yolk index} = \text{Yolk height} / \text{Yolk diameter} \times 100$$

$$\text{Albumen index} = \text{Albumen height} / (\text{long diameter of albumen} + \text{short diameter of albumen} / 2) \times 100$$

$$\text{Shell thickness} = (\text{pointed end} + \text{equator} + \text{blunt end}) / 3$$

$$\text{Shell membrane thickness} = (\text{pointed end} + \text{equator} + \text{blunt end}) / 3$$

$$\text{Haugh unit: } 100 \times \log (\text{Albumen height} + 7, 57 - 1.7 \times \text{egg weight}^{0.37}) \text{ (9).}$$

Variance analysis was used in designation of the differences between egg quality characteristics, and the importance control of the difference among the groups was determined by Multiple Range Test (10). Statistical analysis was done using SPSS 11.0 (11).

Results

Average values of the investigated characteristics of egg weight, shape index, yolk index, albumen index and Haugh unit are given in Table.

Table. Some quality characteristics of pheasant eggs of different colors.*

Characteristics	White (n=9)	Blue (n=4)	Brown (n=24)	Olive green (n=83)
Egg weight, g	+28.10 ± 0.63 ^b	26.71 ± 0.62 ^b	31.89 ± 0.34 ^a	31.16 ± 0.23 ^a
Shape index	77.87 ± 0.69 ^b	81.24 ± 1.80 ^a	80.55 ± 0.44 ^a	80.98 ± 0.35 ^a
Yolk index	43.05 ± 0.69	40.65 ± 1.89	42.27 ± 0.70	43.75 ± 0.41
Albumen index	1.40 ± 0.09	1.32 ± 0.13	1.39 ± 0.05	1.37 ± 0.03
Eggshell thickness, mm	0.202 ± 0.001	0.210 ± 0.008	0.230 ± 0.007	0.220 ± 0.004
Membrane thickness, mm	0.003 ± 0.000	0.004 ± 0.000	0.003 ± 0.000	0.003 ± 0.001
Eggshell weight, g	2.789 ± 0.14 ^b	2.768 ± 0.13 ^b	3.210 ± 0.07 ^a	3.166 ± 0.03 ^a
Eggshell weight, %	9.88 ± 0.36	10.40 ± 0.10	10.07 ± 0.20	10.18 ± 0.10
Membrane weight, g	0.541 ± 0.02 ^b	0.740 ± 0.10 ^a	0.530 ± 0.05 ^b	0.592 ± 0.01 ^b
Membrane weight, %	1.93 ± 0.10 ^b	2.77 ± 0.38 ^a	1.67 ± 0.16 ^b	1.91 ± 0.05 ^b
Haugh Unit	83.96 ± 1.41	79.91 ± 2.68	82.12 ± 0.86	81.41 ± 0.57
Yolk weight, g	9.03 ± 0.47 ^c	9.57 ± 0.36 ^{bc}	10.72 ± 0.20 ^a	10.13 ± 0.09 ^{ab}
Yolk weight, %	31.99 ± 1.05 ^b	35.91 ± 1.73 ^a	33.65 ± 0.58 ^{ab}	32.57 ± 0.31 ^b
Albumen weight, g	16.28 ± 0.23 ^a	14.37 ± 0.86 ^b	17.96 ± 0.29 ^a	17.79 ± 0.22 ^a
Albumen weight, %	58.13 ± 1.34 ^a	53.65 ± 2.16 ^b	56.28 ± 0.56 ^{ab}	56.98 ± 0.40 ^{ab}

* Values in the same row with different superscripts letters differ significantly (P < 0.05).

±: mean ± Standard deviation

It can be seen from Table that average weights of the white eggs and blue eggs were lower than those of the brown eggs and olive green eggs ($P < 0.05$). Shape index of white eggs was smaller than the others ($P < 0.05$). Eggshell weights of the brown eggs and the olive green eggs were higher than those of the white eggs and the blue eggs ($P < 0.05$). However, shell thicknesses of eggs with different eggshell color were similar to each other. The white eggs were found to have the lightest yolk, while the lightest was found in the blue eggs ($P < 0.05$).

Discussions

Egg weights of pheasant were reported as 30.6 g (12), 31.9-34.4 g (13), 31.0-32.3 g (14), 30.49 g (15) and 33.36 (16). While it was found that egg weights of brown eggs and olive green eggs were similar to those reviewed in the literature blue eggs and white eggs were found lighter than the reported values in the literature. At the same time, it was determined that egg weights of the white eggs and blue eggs are lighter than those of brown and olive green eggs ($P < 0.05$).

While blue eggs was lighter in weight than brown eggs and olive green eggs, these eggs were similar to each other with respect of shape index. However, shape index of white eggs is different from the others ($P < 0.05$). Shape index of blue, brown, and olive green eggs is similar to the value of 80.24 reported by Tserweni-Gousi and Yannakopoulos (15). However, determined

shape index of these eggs are higher than the reported value of 78.00 by Song et al. (17).

In this study, the effect of eggshell color on yolk index, albumen index, shell thickness and membrane thickness were found insignificant. On the contrary, Richards and Deeming (6) reported that blue eggs had thinner shell thickness from the others and brown eggs and olive green eggs had heavier shell weights than the others ($P < 0.05$). The low hatchability value of the blue eggs and white eggs (1,2) might be arisen not only from having more shell thickness but also from insufficiency of shell components. The effect of egg color on membrane thickness and Haugh unite value was found nonsignificant.

In this study, a variation was determined among egg colors with respect to yolk weight ($P < 0.05$). While white eggs were of the lightest yolk weight, brown eggs were of the heaviest yolk weight. However, blue eggs are of lighter albumen weight than the others ($P < 0.05$). Yolk and albumen weights determined in brown eggs and olive green eggs are heavier than the reported values of 9.78 g yolk weight and 16.10 g albumen weight by Tserweni-Gousi and Yannakopoulos (15).

In summary, some quality characteristics of pheasant eggs of different colors were investigated. It was determined that the eggs with blue and white shells had lower values than brown and olive green eggs for same quality characteristics.

References

1. Hulet, R.M., Marquez, B.J., Molle, S., Flegal, C.J.: Relationship of pheasant egg color and hatchability. *Poultry Sci.*, 1978; 57: 1146-1148.
2. Hulet, R.M., Flegal, C.J., Carpenter, G.H., Champion, L.R.: Effect of eggshell color and thickness on hatchability in Chinese ring-necked pheasants. *Poultry Sci.*, 1985; 64: 235-237.
3. Anonymous: Egg Production and Incubation. Fordingbridge: The Game Conservancy, 1993; 52-114.
4. Deeming, D.C., Wadland, D.: Influence of mating sex ratio in commercial pheasant flocks on bird health and the production, fertility and hatchability of eggs. *Brit. Poultry Sci.*, 2002; 43: 16-23.
5. Deeming, D.C., Wadland, D.: Observations on the patterns of embryonic mortality over the laying season of pheasants. *Brit. Poultry Sci.*, 2001; 42: 569-573.
6. Richards, P.D.G., Deeming, D.C.: Correlation between shell colour and ultrastructure in pheasant eggs. *Brit. Poultry Sci.*, 2001; 42: 338-343.
7. Yannakopoulos, A.L., Tserweni-Gousi, A.S.: Quality characteristics of quail eggs. *Brit. Poultry Sci.*, 1986; 27: 171-176.
8. Poyraz, Ö.: Kabuk kalitesi ile ilgili yumurta özellikleri arasındaki fenotipik korrelasyonlar. *Lalahan Zootek. Araşt. Ens. Derg.*, 1989; 29: 66-79.
9. Nesheim, M.C., Austic, R.E., Card, L.E.: *Poultry Production*. 12th ed., Lea & Febiger. 1979; 82-98.
10. Petrie, A., Watson, P.: *Statistics for Veterinary and Animal Science*, Blackwell Science. Malden, USA. 1999; 78.
11. SPSS 11.0: SPSS for windows 2001.

12. Woodard, A.E., Abplanalp, H., Pisenti, J.M., Snyder, R.L.: Inbreeding effects on reproductive traits in the ring-necked pheasant. *Poultry Sci.*, 1983; 62: 1725-1730.
13. Blake, A.G., Balander, R., Flegal, C.J., Ringer, R.K.: Ahemeral light-dark cycles and egg production parameters of ring-necked pheasant (*Phasianus colchicus*). *Poultry Sci.*, 1987; 66: 258-263.
14. Slauch, B.T., Johnston, N.P., Patten, J.D., White, G.W.: Effects of photoperiod and intermittent lighting on reproduction in pheasant hens. *Theriogenology.*, 1988; 30: 291-301.
15. Tserweni-Gousi, A.S., Yannakopoulos, A.L.: Quality characteristics of pheasant eggs and effect of egg weight and shell quality on chick weight. *Arch. Geflügelk.*, 1990; 2: 54-56.
16. Çetin, O., Tepeli, C., Kırıkçı, K.: Sülünlerin (*P. colchicus*) entansif ortam ve karasal iklimde yetiştirilme imkanlarının araştırılması: I. Yumurta verimi ve kuluçka özellikleri. *Vet. Bil. Derg.*, 1997; 13: 5-10.
17. Song, K.T., Choi, S.H., Oh, H.R.: A comparison of egg quality of pheasant, chukar, quail and guinea fowl. *Asian-Australian J. Anim. Sci.*, 2000; 13: 986-990.