Effect of Hen Age on Some Egg Quality Characteristics of Pheasants *(P. colchicus)*

Aytekin GÜNLÜ[1] Orhan ÇETİN[2] Mustafa GARİP [2*] Kemal KIRIKÇI[2]

[1] Selçuk University Faculty of Veterinary Medicine, Department of Animal Economics, Konya - Turkey
[2] Selcuk University Faculty of Veterinary Medicine, Department of Animal Science, Konya - Turkey

Abstract: In this study, it was aimed to determine the effects of hen age of pheasants on egg quality characteristics. Totally 48 female pheasants in 37 week of ages were used ready for egg production. Egg quality characteristics of 200 pheasant eggs obtained from 41-51 week ages were investigated. It was determined that effects of hen age on egg weight, shape index, yolk index, albumen index, shell weight, shell thickness, membrane weight, membrane thickness, Haugh unite, albumen weight and yolk weight were statistically important (P<0.05). It was determined that shell weight and thickness, membrane weight, Haugh Unite and yolk weight decreased together with the age while albumen weight increased together with the age (P<0.05). As a result of the study, it was concluded that further investigations are needed to be made inquire the other factors affecting pheasant egg characteristics.

Keywords: pheasant, hen age, egg, quality characteristics.

Sülünlerde Anaç Yaşının Bazı Yumurta Kalite Özellikleri Üzerine Etkisi

Özet: Bu çalışmada, sülünlerde anaç yaşının yumurta kalitesi özelliklerine olan etkilerinin belirlenmesi amaçlanmıştır. 37 haftalık yaşta toplam 48 dişi sülün, yumurta üretimi için kullanıldı. Yaşları 41-51 haftalık olan sülünlerden elde edilen 200 adet sülün yumurtasının yumurta kalite özellikleri araştırıldı. Tavukların yumurta ağırlığı, şekil indeksi, yumurta sarısı indeksi, albümin indeksi, kabuk ağırlığı, kabuk kalınlığı, zar ağırlığı, zar kalınlığı, Haugh Unit değeri, albümin ağırlığı ve yumurta sarısı ağırlığı üzerine etkilerinin istatistiksel olarak önemli olduğu belirlenmiştir (P <0.05). Kabuk ağırlığı ve kalınlığı, zar ağırlığı, Haugh Unite ve yumurta sarısı ağırlığının yaşla birlikte azaldığı, albümin ağırlığının da yaşla birlikte arttığı belirlenmiştir (P <0.05). Araştırma sonucunda sülün yumurtası özelliklerine etki eden diğer faktörleri araştırmak için daha fazla araştırmaya ihtiyaç olduğu sonucuna varılmıştır.

Anahtar kelimeler: sülün, anaç yaşı, yumurta, kalite özellikleri.

*Corresponding author: Mustafa Garip Department of Animal Science, Faculty of Veterinary, University of Sel cuk, Konya, 42031, Turkey e-mail: mgarip@selcuk.edu.tr

INTRODUCTION

The name of pheasant is used by the World Pheasant Association (WPA) as a common name of 49 species of pheasant (1). Recently, breeding of pheasants, mostly as game birds and hobby animal have become increasingly popular both in Turkey and throughout the world. It has been reported that the Ring-necked pheasant has the most adaptable characteristics for intensive breeding and also, it is the most suitable species for meat production purpose among all of the pheasant species (2). The Ring-necked pheasant has been bred for hunting purpose and for meat production in worldwide.

Egg weight, shape index, specific gravity, albumen weight, yolk weight, shell weight and shell thickness of pheasant eggs were reported as 30.49 g, 80.24, 1.07, 16.1 g, 9.78 g, 3.03 g and 0.27 mm respectively. (3). Yannakopoulos (4) reported that egg weight of the pheasant has been increased together with age. Kuzniacka et al. (5) reported that egg weight of pheasant has been decreasing together with the age but this is not important statistically, and also they said that egg shell weight and egg shell thickness have been decreased together with the age. Shape index of the pheasant eggs is not changed with the age. It is also reported that the percentage of the yolk weight to egg weight has been decreased and percentage of albumen weight to egg weight, Haugh unite value has been increased with the age. Kırıkçı et al. (6) reported that egg weight, shape index yolk index, albumen index, shell weight, shell thickness, yolk weight and albumen weight value obtained from different body weight as 30.24-31.89, 79.62-81.23, 41.76-44.29, 1.42-1.56, 3.14-3,35, 0.22-0.26, 9.93-10.56 and 16.99-18.05, respectively. Garip et al. (7) reported that egg weight, shape index yolk index, albumen index, shell weight, shell thickness, yolk weight and albumen weight, Haugh Unit value for pheasant as 31.02; 80.68; 43;52; 1.57; 3.232, 0.265; 10.24; 17.46 and Haugh Unit 16.99-18.05, respectively.

Demirel and Kırıkçı (8) reported that albumen index decreased and albumen index increased with increased egg storage time before hatching ($P < 0.05$), most likely due to water loss from the egg. Shell weight is affected by egg color and hen age in pheasants (5, 9, 10).

The effects of hen weight (6) and storage period (8) on the quality of egg quality in pheasants were investigated but egg quality characteristics were not determined according to the hen age. In this study, the effect of the hen age on some egg quality characteristics in pheasant was investigated.

MATERIAL and METHODS

Animals and Husbandry

The materials of this research were composed of the pheasant breeding flock in the Veterinary Faculty Research and Application Farm of Selçuk University. This flock consisted of Hungarian ring-necked and Turkish native breeds (*Phasianus colchicus*). In this research, 48 female pheasants raised in same environmental conditions at the age of 37 weeks were used.

The pheasants were placed randomly in breeding cages (1x1.3x0.8 m) having 4 departments with 3 divisions in a room (4 m x 4 m x 2.5 m high). Each department consisted of 4 female pheasants in each division. Daily 12 hours of lighting was applied to the pheasants. Lighting was increased 1 hour weekly and was kept steady after reaching 16 hours a day. During the laying period, a ration composed of 18% crude protein was given *ad libitum* to the birds. Water was provided from the automatic water cups. In the study, after the beginning of laying period, every week randomly selected 20 eggs were collected during the 70 days of research period. So, totally 200 pheasant eggs were used as a research material in the study.

Egg Quality Analysis

Short and long diameters of the eggs were measured by digital caliper in sensitivity of 0.001 mm to determine the shape index. After that, the eggs were broken one by one on a flat layer with a waiting period of 5 minutes. The heights of yolk and albumen, the long and short diameters of albumen, and diameter of yolk, were measured using the caliper. The yolks separated from albumen were weighed and the weights were recorded. The shells of the broken eggs were washed gently under flowing tap water to be released from albumen residues and then they were dried in the air. They were weighed to determine their latter weights and the shell thicknesses at the equator, blunt and pointed edges of the egg shells with membrane and without membrane were measured using the caliper. Obtained data were analyzed by using the formulas reported by (11, 12, 13) :

- Shape index = (breadth/length) × 100;
- Yolk index = (yolk height/yolk diameter) × 100;
- Albumen index = (albumen height/(long diameter of albumen + short diameter of albumen/2)) × 100;
- Shell thickness = (pointed end + equator + blunt end)/3
- Haugh unit: 100 × log (albumen height + 7.57 – 1.7 × egg weight 0.37) (13).

Statistical methods

Differences in the egg quality characteristics with the age of pheasant eggs were determined by analysis of variance and differences with the age in pheasant eggs were analyzed with Duncan's multiple range tests. Statistical analysis has been done in the package program of SPSS10.0. (14).

RESULTS

External quality characteristics of pheasant eggs at different hen age are presented in Table 1. It was determined that pheasant egg weight and shape index have been increased according to hen age (P<0.05).

Table 1. External quality characteristic of pheasant eggs different hen age (mean ± SE).

Age	Egg weight	Shape index
41	30.22 ± 0.60 b	78.43 ± 0.76 b
42	30.36 ± 0.52 b	79.89 ± 0.57 ab
43	30.66 ± 0.61 ab	80.10 ± 0.65 ab
44	30.90 ± 0.50 ab	80.42 ± 0.60 ab
45	30.97 ± 0.37 ab	80.78 ± 0.61 a
46	30.96 ± 0.57 ab	80.82 ± 0.69 a
47	31.19 ± 0.48 ab	81.70 ± 0.76 a
48	31.33 ± 0.43 ab	81.34 ± 0.64 a
49	31.52 ± 0.44 ab	81.90 ± 0.91 a
50	32.19 ± 0.44 a	81.53 ± 0.57 a

a, b, c, d; The differences between values with different superscript letters in the same column are significant (P<0.05).

Table 2 shows some internal egg quality characteristics of pheasant egg according to hen age.

Table 2. Internal egg quality characteristic of pheasant egg according to hen age (mean ± SE).

Age	Yolk index	Albumen index	Shell thickness (mm)	Membrane thickness (mm)	Haugh Unite
41	45.56 ± 0.55 a	1.23 ± 0.03 d	0.30 ± 0.01a	0.03 ± 0.01b	83.24 ± 0.50 a
42	45.40 ± 0.71 a	1.34 ± 0.07 cd	0.30 ± 0.01a	0.06 ± 0.01a	84.79 ± 0.45 a
43	44.62 ± 0.85 ab	1.37 ± 0.04 cd	0.27 ± 0.01b	0.04 ± 0.00 b	84.73 ± 0.78 a
44	44.20 ± 1.12 abc	1.43 ± 0.05 bc	0.24 ± 0.00 c	0.04 ± 0.00 b	82.33 ± 1.02 ab
45	43.86 ± 0.77 abc	1.57 ± 0.04 b	0.24 ± 0.01cd	0.03 ± 0.00 b	82.82 ± 1.13 a
46	43.94 ± 0.70 abc	1.50 ± 0.06 bc	0.23 ± 0.01 cd	0.03 ± 0.00 b	83.01 ± 0.95 a
47	41.73 ± 1.33 bcd	1.51 ± 0.06 bc	0.23 ± 0.01 cde	0.03 ± 0.00 b	81.95 ± 1.02 ab
48	41.25 ± 0.68 cd	1.45 ± 0.09 bc	0.21 ± 0.01de	0.03 ± 0.00 b	83.15 ± 1.36 a
49	40.60 ± 0.71 d	1.56 ± 0.05b	0.21 ± 0.01de	0.04 ± 0.00 b	79.71 ± 1.00 b
50	40.74 ± 1.89 d	1.79 ± 0.08 a	0.21 ±0.01e	0.04 ± 0.00 b	79.51 ± 0.92 b

a, b, c, d: The differences of age holding different letters in the same column are important (P<0.05).

When Table 2 is examined, it will be seen that yolk index, shell thickness and Haugh Unit are decreased (P <0.05). The decline in the yolk index is very obvious. On the other hand, there is an increase in albumen index (P<0.05), but there is no visible increase or decrease in membrane thickness value according to egg-laying week.

Shell weight, shell membrane weight, yolk weight and albumin weight of pheasant eggs according to hen age are given in Table 3.

Table 3. Shell, membrane albumen, and yolk weight of pheasant eggs according to hen age (mean ± SE).

Age	Shell weight (g)	Membrane weight (g)	Yolk weight (g)	Albumen weight (g)
41	3.50 ± 0.09 a	0.87 ± 0.08 a	10.71 ± 0.27 a	16.82 ± 0.25b
42	3.46 ± 0.09 ab	0.80 ± 0.06 a	10.63 ± 0.23 ab	17.10 ± 0.45 ab
43	3.25 ± 0.08 bc	0.65 ± 0.04 b	10.26 ± 0.22 ab	17.33 ± 0.38 ab
44	3.23 ± 0.08 bc	0.63 ± 0.03 b	10.26 ± 0.23 ab	17.35 ± 0.65 ab
45	3.19 ± 0.086 c	0.61 ± 0.03 b	10.15 ± 0.20 ab	17.59 ± 0.30 ab
46	3.12 ± 0.06 c	0.59 ± 0.04b	10.09 ± 0.19ab	17.45 ± 0.36 ab
47	3.15 ± 0.06 c	0.58 ± 0.06 b	10.04 ± 0.18 ab	17.74 ± 0.34 ab
48	3.12 ± 0.01 c	0.57 ± 0.04 b	9.99 ± 0.29b	17.88 ± 0.51 ab
49	3.15 ± 0.06 c	0.57 ± 0.02 b	9.93 ± 0.19b	18.08 ± 0.33ab
50	3.09 ± 0.07 c	0.52 ± 0.02 b	9.91 ± 0.18b	18.42 ± 0.41 a

a, b, c, d: The differences of age holding different letters in the same column are important (P<0.05).

In the pheasant egg, shell weight, shell membrane weight and yolk weight are declining according to hen age (P <0.05), but the albumen weight increased (P <0.05).

DISCUSSION

In this study, it was determined that egg weight of pheasant has been decreased together with the age. Egg weight of pheasant obtained from the first week was 30.22 g and last week this value was determined as 32.19 g. This value was similar to the value reported by Yannakopoulos (4). Egg weight of pheasant was reported as follows; Woodard and Snyder (15) 28.1-29.5, Woodard et al. (16) 30.6 g, Blake et al. (17) 31.9-34.4 g, Slaugh et al. (18) 31.0-32.3 g,

Tserweni-Gousi and Yannakopoulos (3) 30.49 g, Song et al (19) 33.39 g. Çetin et al. (20), had reported egg weight as 33.36 g, for the same genotype used in present study. Genotype, feeding - housing condition and the other environmental conditions could be a reason for the egg weight differences.

Average shape index value determined in this study was 80.69. This value was found similar to the reported values as 80.24, by Tserweni-Gousi and Yannakopoulos (3), 78.00 by Song et al. (19) and 79.62-81-23 by Kırıkçı et al. (4). It was determined that egg weight of pheasant has been decreased together with the age in this study. But, Kuzniacka et al. (5) were reported that shape index of pheasant eggs was not changed together with the hen age. Determined increases together the age in the pheasant egg shape index could be attributed to the increase of the egg weight together with the age.

It could be said that there was a decrease in yolk index value of the pheasant eggs together with the age. This decreasing value could arise from the decrease of the yolk weight. As it was seen from the table 3, yolk weight was decreased nearly 1 g with the age. Kırıkçı et al. (6) reported yolk index values for control, heavy, middle and light groups as 44.29, 44.16, 41.76 and 42.55 respectively. These values were found similar to those obtained from the present study. Similarly, Kuzniacka et al. (5) reported that yolk index has been decreasing with the age and Demirel and Kırıkçı (8) reported that yolk index has been decreasing. On contrary to the yolk index, albumen index value has been increased together with the age. Albumen index value was 1.23 for the first week of laying and was 1.79 for the at 50 weeks old. This increasing could arise from the increasing of the albumen weight.

Average egg weight of the first-week laying was determined as 16.82 g and this value was determined as 18.42 g for 10th-week laying eggs. Kuzniacka et al. (5) were reported that slightly increasing the albumen weight was detected together with the age but this increasing was not important statistically. Albumen weight was reported as 18 g for pheasant eggs by Kuzniacka et al. (5) and as 17-18 g Demirel and Kırıkçı (8). Demirel and Kırıkçı (8) also reported that there was no significant effect of storage time on albumen weight.

Egg weight has been increased together with the age but, shell thickness value has been decreased together with the age ($P<0.05$) and membrane thickness value, except 2nd-week value, was not changed. Shell thickness value was determined for the first week laying eggs as 0.30 mm and for a 10th week laying eggs as 0.21 mm. Similarly, Kuznicka et al. (5) have been reported a decreasing in the shell thickness value of the pheasant eggs from 0.30 mm to 0.29 mm together with the age. These results could be explained by the reduction of the body calcium store. Shell thickness value determined in this research was similar to the reported values by Song et al (19) and Kırıkçı et al. (6). Haugh Unite value, as an important criterion for egg quality, decreased in this study together with the age ($p<0.005$). This decreasing became clear in the 7.th week. In contrary to this, Kuznicka et al. (5) have been reported that Haug Unite value has been increased together with the age.

It was determined that there was a decrease in shell weight of the pheasant eggs together with the age. While egg shell weight of the first week was 3.50, last week egg shell weight was 3.22 g ($p<0.05$). Similarly, Kuzniacka et al. (5) have been reported that the egg shell weight was decreased from 3.3 g to 3.0 g ($p<0, 05$) together with the age. Egg shell weight value was different from the value reported by Yannakapoulos (4) and was similar to the value reported by Kırıkçı et al. (6).

There was a decreases egg shell membrane weight of the pheasant egg together with the age like that shell weight. In the 10 week period, 0.40 g decreases were determined in the egg shell membrane weight of the pheasant ($P<0.05$). The decrease was very clear in the first two week period and then this decreasing was slowly. Egg shell membrane weight of the pheasant egg was similar to reported value as 0.60-0.69 by Kırıkçı et all. (6) Together with the age, it was determined decreases in the yolk weight of the pheasant eggs ($P<0.05$). Yolk weight of the pheasant eggs was 10.71 g in the 41 week age and 9.91g in the 50 weeks age. Determined yolk weight as 10.20 g was heavier than the reported value by Tserweni-Gousi and Yannakopoulos (3) but was similar to the reported value by Kırıkçı et al. (6). This results could be explained genotypic different of the pheasant used as a research material.

In contrary to the yolk weight, albumen weight of the pheasant eggs has been increased together with the age ($P<0.05$). Albumen weight determined 16.82 g at the first week has been increased to the 18.42 g at the end of the research period (Table 2). So, it could be said that increasing egg weight of the pheasant could be raised from the increased albumen weight. In this research, both external and internal quality characteristics of pheasant eggs were determined and what kind of variation was occurred in the pheasant egg with together the age.

As a result of the study, it was concluded that further investigations are needed to be made inquire the other factors affecting pheasant egg characteristics.

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