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The Effect of Age on Egg Production, Hatchability and Egg Quality Characteristics in Pheasants (*Phasianus colchicus*)

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Abstract: The aim of this study was to determine egg production, hatchability and egg quality characteristics in ring-necked pheasants at the different ages (1, 2 and 3 years old) of hatching. The age of pheasant was determined to affect egg production and egg weight significantly in pheasants ($p<0.05$). While the highest egg production was obtained at the 2 years old of pheasant (53.27%), the highest mean egg weight was obtained at the age of three years old of pheasant (33.83 g). The significant differences between hatchability of total eggs, fertility rate and hatchability of fertile eggs at various ages of pheasants suggested that the hatching season is significantly related to the hatchability characteristics ($p<0.01$). The differences between the shape index, egg shell weight, egg shell thickness, yolk weight and index, albumen weight and index and haugh unit were significant for various age groups ($p<0.05$, $p<0.01$) and the effect of age on these features was significant ($p<0.05$, $p<0.01$). It was concluded that there is no disadvantage in keeping the ring-necked pheasants for breeding for three years and it may be cost-effective for breeders possessing a lower number of brood pheasants. It was found that using ring-necked pheasants for a maximum of two years for breeding has the best outcome if there is no breeding problem.

Key words: Pheasant, age, egg production, hatchability, egg quality characteristics, Turkey

INTRODUCTION

Ring-necked pheasants (*Phasianus colchicus*) are common in many regions of the world including Turkey. Ring-necked pheasants live in mild climates at 400 m of height from sea level and in brushwood in families of one male and 5-6 females. Ring-necked pheasants are the material for intensive pheasant breeding (Cetin and Kirikci, 2000; Kirikci *et al*., 2003a).

It has been reported that the external quality characteristics of the egg, like egg weight and egg shell quality were effective on the hatchability of fertile eggs (Altan *et al*., 1995), hatching period, chick weight (Shanaway, 1987), chick deaths in the first days (Skewes *et al*., 1988) and the performance of chicks at older ages (Al-Murrani, 1978). It has also been reported that genetic and phenotypic relationships between egg quality characteristics were important (Pandev *et al*., 1984).

Egg characteristics are affected by various factors including the genetic structure of the flock, feeding, health, age of the flock, housing, storage conditions and duration (Hurnik *et al*., 1997). The internal and external characteristics of the egg change significantly by age (Roland, 1979).

While egg shell quality deteriorates, egg weight, yolk weight and albumen weight increase as the age increases in chickens (Hurnik *et al*., 1997). Yannakopoulos and Tserveni-Gousi (1986) reported that the egg weight and egg shell weight increased with age but that the egg shell thickness decreased in Japanese quails. It has also been reported that yolk proportion increased, whereas albumen and eggshell proportions decreased by age (Fletcher *et al*., 1983).

The mean egg production in pheasants has been found to vary between 19.38 and 54.09% in different studies (Cetin *et al*., 1997; Tepeli *et al*., 2002; Kirikci *et al*., 2003b; Demirel and Kirikci, 2009) and the egg weight values were reported to range from 28.10-33.36 g (Woodard *et al*.,1983; Blake *et al*., 1987; Woodard and Snyder, 1978; Cetin *et al*., 1997; Kirikci *et al*., 2005; Demirel and Kirikci, 2009). Age and genotype of the pheasants might have played role in these differences.

The values reported from numerous studies for the mean hatchability of total eggs were between 29.46 and 62.03% for the mean fertility ratio were between 47.27 and 83.04% and for the mean hatchability of fertile eggs were between 41.54 and 76.6% (Mashaly *et al*., 1983; Cetin *et al*., 1997; Tepeli *et al*., 2002; Kirikci *et al*., 2003b;

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Demirel and Kirikci, 2009). Some studies (Kirikci *et al*., 2003b, 2004, 2005) conducted to determine the external quality characteristics of pheasant eggs the mean values for shape index, egg shell weight and egg shell thickness were calculated as 77.87-81.24%, 2.768-3.222 g and 2.02-2.70 mm, respectively.

It has been noted that egg weight and egg shell weight increased significantly with age, while the egg shell thickness decreased in Japanese quail. The egg shell thickness is related with genetic structure, age, environmental heat and feeding regime. There was a negative correlation between egg shell thickness and age (Yannakopoulos and Tserveni-Gousi, 1986; Seker *et al*., 2005).

Another study conducted to determine the internal quality features of pheasant eggs, the mean values for yolk weight, yolk index, albumen weight, albumen index and the Haugh unit were reported as 9.03-11.4 g, 40.65-45.46%, 16.10-18.42 g, 1.23-1.79% and 77.2-96.33, respectively. While the albumen index increased as the hatching age increased, there was a negative correlation between the Haugh unit and age (Kirikci *et al*., 2003b, 2005; Kuzniacka *et al*., 2005; Seker *et al*., 2005; Gunlu *et al*., 2007).

The egg characteristics do not only determine the production characteristics of the future generations of that species but also affect the fertility and chick quality. In breeding enterprises, internal and external characteristics of eggs are important for hatchability and production characteristics of the next generations.

The number of studies on pheasants in Turkey is scarce. The present study was carried out to determine for how long ring-necked pheasants can be used for breeding in order to contribute to the spread of pheasant breeding and to future studies on this subject. For this purpose, the egg production, egg weight, hatchability and egg quality features of pheasants at different hatching age were examined.

MATERIALS AND METHODS

Animals and husbandry: A total of 150 (female 120 and of male 30) ring-necked brood pheasants (*Phasianus colchicus*), obtained from the same hatching and bred under similar management and feeding conditions at the Research and Practice Center, Faculty of Veterinary Science, Firat University were used in the study.

The pheasants were bred at an equal ratio of male to female (1:4) in each hatching season and with the same males in a semi-open ground system. No artificial lighting was used until the first egg was produced by the pheasants after which lighting was increased 1 h in addition to daylight per week to 16 h. Birds were provided with ration *ad libitum* including 18% HP and 2850 MJ kg^{-1} of ME to the pheasants and water was provided from automatic drinkers.

Following collection of the first egg at each age, the eggs were collected every day at the same time and the daily egg production (%) was calculated by dividing the number of eggs by the number of pheasants. The recordings were kept after the collection of the first egg and continued at 4 week intervals for 20 weeks.

The hatchability, fertility rate and hatchability of fertile eggs were calculated using the below formulae (Yannakopoulos and Tserveni-Gousi, 1986).

$$\text{Hatchability of total eggs} = [\text{The no. of chicks/No. of eggs loaded into the machine}]\times 100$$

$$\text{Hatchability of fertile eggs (\%)} = [\text{The no. of chicks/No. of fertilized eggs loaded into the machine}]\times 100$$

$$\text{Fertility rate} = [\text{No. of fertilized eggs /No. of eggs loaded into the machine}]\times 100$$

Egg quality analysis: The eggs selected randomly once every 15 days on the same day were used to define external quality characteristics. To determine egg quality characteristics 50 pheasant eggs from each group were used. The selected eggs were given numbers and weighed with the scale balanced at 0.01 mg precision and then measured by a digital caliper at the longest and shortest edge in order to designate the shape index. The shape indexes of the eggs were calculated using the following formula (Yannakopoulos and Tserveni-Gousi, 1986).

$$\text{Shape index (\%)} = \frac{\text{Short edge}}{\text{Long edge}}\times 100$$

In order to determine the internal quality characteristics of the eggs, they were cracked on a glass surface and the height of yolk and albumen, yolk diameter, albumen length and width were measured after 5 min using a digital caliper. The yolk was separated from the albumen and measured with the membrane. The shells were washed under tap water and left to dry for 24 h. The dried shells were weighed with the membrane and shell weights were determined. After the measurement, three pieces of shell were selected to measure the shell thickness using a micrometer at the sharp, blunt and middle sections. The below formula was used to find some internal quality characteristics of the eggs (Yannakopoulos and Tserveni-Gousi, 1986).

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

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

$$\text{Shell thickness} = \frac{(\text{Pointed end} + \text{equator} + \text{blunt end})}{3}$$

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

$$\text{Haugh unit} = 100 \times \log (\text{Albumen height} + 7.57 - 1.7 \times \text{egg weight}^{0.37})$$

The width and length of the eggs were measured in centimeters, the weight as grams, the yolk and albumen heights, the yolk diameter, the albumen length and the width and shell thickness were measured as millimeters.

Statistical analysis: Data were loaded and analyzed using the SPSS 11.5 (2002) packet program. The mean values of the groups were analyzed using the variance analysis followed by the Duncan test. Percentages were analyzed using the Chi-square test (Petrie and Watson, 1999).

RESULTS

The values for egg production, egg weight, hatchability of total eggs, fertility and hatchability of fertile eggs in pheasants at different ages are shown in Table 1.

There were differences between the groups in terms of egg production and egg weight and hatchability of total eggs, fertility and hatchability of fertile eggs ($p<0.05$, $p<0.01$). The hatching season of pheasants at different ages were found to affect the egg production, egg weight, hatchability of total eggs, fertility and hatchability of fertile eggs ($p<0.05$ and <0.01).

The values for shape index, egg shell weight, egg shell thickness, yolk weight, albumen weight, yolk index, albumen index and the Haugh unit in pheasants at different ages are shown in Table 2.

The difference between the groups in terms of shape index, egg shell weight, egg shell thickness, yolk weight, yolk index, albumen weight, albumen index and the Haugh unit were significant ($p<0.05$, $p<0.01$).

The values obtained in the present study for the egg production and egg weight were similar to previous reports with slight positive and negative differences (Woodard and Snyder, 1978; Blake *et al*., 1987; Cetin *et al*., 1997; Tepeli *et al*., 2002; Kirikci *et al*., 2003a, 2005; Woodard *et al*., 1983; Demirel and Kirikci, 2009). The difference between different age groups for egg production and egg weight were significant ($p<0.05$). While the egg production increased in the 2nd year, the values at the 3rd year were lower than those of the 1st and 2nd. The egg weight showed a consistent increase with pheasant age.

Table 1: Egg production, egg weight and hatching characteristics in pheasants at different ages

	Age			
Characteristics	One year old (n:120)	Two years old (n:120)	Three years old (n:120)	p-value
	$\bar{x} \pm S\bar{x}$			
Egg production rate (%)	47.58±2.67^{b}	53.27±3.13^{a}	42.69±2.58^{c}	*
Egg weight (g)	28.74±1.53^{c}	32.11±1.94^{b}	33.83±1.73^{a}	*
Hatchability of total eggs (%)	63.35±4.87^{b}	69.68±5.36^{a}	71.45±4.87^{a}	**
Fertility rate (%)	65.42±5.22^{b}	73.71±6.13^{a}	74.63±5.93^{a}	**
Hatchability of fertile eggs (%)	67.13±6.19^{b}	74.88±5.47^{a}	76.12±4.86^{a}	**

Table 2: Some egg quality characteristics in pheasants at different ages

	Age			
Characteristics	One year old (n: 50)	Two years old (n: 50)	Three years old (n: 50)	p-value
	$\bar{x} \pm S\bar{x}$			
Shape index (%)	84.140±1.35^{a}	78.590±1.43^{b}	77.490±1.51^{b}	**
Shell weight (g)	3.120±0.79^{b}	3.610±0.88^{a}	3.720±0.95^{a}	**
Shell thickness (mm)	0.336±0.03^{a}	0.323±0.04^{a}	0.283±0.03^{b}	**
Yolk weight (g)	10.230±0.79^{b}	10.690±0.74^{a}	10.610±0.86^{a}	*
Albumen weight (g)	18.290±0.81^{b}	18.870±0.92^{ba}	18.590±0.79^{a}	*
Yolk index (%)	48.460±3.11^{b}	51.230±3.06^{a}	52.030±2.98^{a}	*
Albumen index (%)	1.846±0.68^{b}	1.921±0.83^{a}	1.853±0.97^{b}	*
Haugh units	95.270±0.97^{a}	90.380±1.13^{b}	88.650±1.24^{b}	**

$^{a-c}$The differences of means holding different letters in the same row are important (*$p<0.05$, **$p<0.05$)

The values for hatchability characteristics were also similar to those reported previously with slight positive and negative differences (Mashaly *et al*., 1983; Cetin *et al*., 1997; Tepeli *et al*., 2002; Kirikci *et al*., 2003b; Demirel and Kirikci, 2009).

The effect of the pheasant age on the hatchability of total eggs, fertility and hatchability of fertile eggs were significant ($p<0.01$). When the groups were compared for hatchability results, it was found that the hatchability of total eggs, fertility and hatchability of fertile eggs were significantly increased as the pheasant age increased ($p<0.01$).

The values obtained for egg quality characteristics in the study were similar to those reported in previous studies (Kirikci *et al*., 2003b, 2004, 2005; Kuzniacka *et al*., 2005; Seker *et al*., 2005; Gunlu *et al*., 2007) with slight positive and negative differences.

The egg shell weight, yolk weight, albumen weight, yolk index and albumen index increased with pheasant

age. In contrast, the shape index, egg shell thickness and the Haugh unit decreased with pheasant age. The effect of the pheasant age on the shape index, egg shell weight, egg shell thickness, albumen weight and index, yolk weight and index and the Haugh unit were significant ($p<0.05$, $p<0.01$).

CONCLUSION

It was found that the age has significant effect on the egg production, egg weight, hatchability and egg quality characteristics in ring-necked pheasants. It was revealed that the egg production, egg weight, hatching performance, fertility, hatchability of fertile eggs, egg shell weight, yolk weight, albumen weight, yolk index and albumen index increased with age whereas the shape index, egg shell thickness and the Haugh unit values decreased with age.

We concluded that keeping ring-necked pheasants in breeding for 3 years has no disadvantage and it may be cost-effective for breeders who begin production with a small number of pheasants. It was determined that if there were no problems in breeding, use of ring-necked pheasants in breeding for at most years would yield the best results.

REFERENCES

Al-Murrani, W.K., 1978. Maternal effects on embryonic and post embryonic growth in poultry. Br. Poult. Sci., 19: 277-281.

Altan, O., I. Oguz and P. Settar, 1995. Effects of egg weight and specific gravity of the hatchability characteristics in Japanese quail. Turk. J. Agric. For., 19: 219-222.

Blake, A.G., R. Balander, C.J. Flegal and R.K. Ringer, 1987. Ahemeral light-dark cycles and egg production parameters of ring-necked pheasant (*Phasianus colchicus*). Poult. Sci., 66: 258-263.

Cetin, O. and K. Kirikci, 2000. Alternative Poultry Breeding, Pheasant-Partridge. Selçuk Univ. Publ., Konya, Turkey.

Cetin, O., C. Tepeli and K. Kirikci, 1997. Breeding possibilities of pheasants (*P. colchicus*) in intensive conditions and cold climatic zone. I. Egg production and hatchability characteristics. Vet. Bil. Derg., 13: 5-10.

Demirel, S. and K. Kirikci, 2009. Effect of different egg storage times on some egg quality characteristics and hatchability of pheasants (*Phasianus colchicus*). Poult. Sci., 88: 440-444.

Fletcher, D.L., W.M. Britton, G.M. Pesti, A.P. Ratn and S.L. Savage, 1983. The relationship of layer flock age and egg weight on egg component yields and solit content. Poult. Sci., 68: 1800-1805.

Gunlu, A., K. Kirikci, O. Cetin and M. Garip, 2007. Effect of hen age on some egg quality characteristics of pheasants (*P. colchicus*). Proceedings of the Current Problems of Breeding, Health, Growth and Production of Poultry Symposium, Feb. 14-17, Ceska Budejovice, Czech Republic, pp: 211-215.

Hurnik, J.F., J.D. Summer, B.S. Reinhard and A. Sweirczewks, 1997. Effects of age in the performance of laying hens during the first year of production. Poult. Sci., 56: 222-230.

Kirikci, K., A. Günlü, O. Cetin and M. Garip, 2003a. Some quality characteristics of pheasant (*P. colchicus*) eggs. J. Food. Agric. Environ., 1: 226-228.

Kirikci, K., C. Tepeli, A. Günlü and O. Cetin, 2003b. Production characteristics of pheasants (*Phasianus colchicus*) in different breeding regimes. Turk. J. Vet. Anim. Sci., 27: 907-910.

Kirikci, K., O. Cetin, A. Gunlu and M. Garip, 2004. Effect of hen weight on egg production and some egg quality characteristics in pheasants (*Phasianus colchicus*). Asian Aust. J. Anim. Sci., 17: 684-687.

Kirikci, K., A. Günlü, O. Cetin and M. Garip, 2005. Some quality characteristics of pheasant (*Phasianus colchicus*) eggs with different shell colors. Turk. J. Vet. Anim. Sci., 29: 315-318.

Kuzniacka, J., Z. Bernacki and M. Adamski, 2005. Effect of the date of egg-laying on the biological value of eggs and reproductive traits in pheasants (*Phasianus colchicuc*). Folia Biologica, 53: 73-78.

Mashaly, M.M., K.R. Kratzer and O.D. Keene, 1983. Effect of photoperiod on body weight and reproductive performance of ringneck pheasants. Poult. Sci., 62: 2109-2113.

Pandev, N.K., C.M. Mahapatra, S.S. Verma, R.C. Goyal and D.C. Jahari, 1984. Physical quality traits and component of egg from different strains of white Leghorn hens. Indian J. Poult. Sci., 1: 40-44.

Petrie, A. and P. Watson, 1999. Statistics for Veterinary and Animal Science. Iowa State Press, UK., ISBN: 10: 063205025X, pp: 144-146.

Roland, D.A., 1979. Factors influencing shell quality of aging hens. Poult. Sci., 58: 774-777.

Seker, I., S. Kul, M. Bayraktar and O. Yildirim, 2005. Effect of layer age on some egg quality characteristics and egg production in Japanese quail (*Coturnix coturnix japonica*). Istanbul Vet. Fak. Derg., 31: 129-138.

Shanaway, M.M., 1987. Hatching weight in relation to egg weight in domestic birds. World Poult. Sci. J., 43: 107-115.

Skewes, P.A., H.R. Wilson and F.B. Mather, 1988. Correlations among egg weight, chicknweight and yolk sac weight in bobwhite quail (*Calinus virginianus*). Florida Sci., 51: 159-162.

Tepeli, C., K. Kirikci, O. Cetin and A. Gunlu, 2002. The effects of different light periods on some production characteristics in pheasants (*Phasianus colchicus*). Indian J. Anim. Sci., 72: 960-962.

Woodard, A.E. and R.L. Snyder, 1978. Cycling for production in the pheasant. Poult. Sci., 57: 349-352.

Woodard, A.E., H. Abplanalp, J.M. Pisenti and R.L. Snyder, 1983. Inbreeding effects on reproductive traits in the ring-necked pheasant. Poult. Sci., 62: 1725-1730.

Yannakopoulos, A.L. and A.S. Tserveni-Gousi, 1986. Quality characteristics of quail eggs. Br. Poult. Sci., 27: 171-176.