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The Effect of the Age of the First Egg-Laying on the Egg Production, Hatchability and Egg Quality of Pheasants (*Phasianus colchicus*)

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Abstract: The aim of this study was to determine the effect of the age of the first egg laying on the egg production, hatchability and egg quality of pheasant. Seventy two female ring-necked pheasants of the same age and breed under identical circumstances were included in the study. The individual egg production was recorded daily until 53 weeks of age and four groups were formed using the age for the first egg-laying (<34, 35-36, 37-38, >39 weeks). The parameters investigated in this study included egg production, egg weight, hatchability of total eggs, fertility, hatchability of fertile eggs, shape index, shell weight, shell thickness, yolk weight, albumen weight, yolk index, albumen index and the haugh unit of the groups. There was a significant difference between the groups in terms of egg production and egg weight ($p<0.05$). The difference between the groups for the hatchability of total eggs, fertility and hatchability of fertile eggs was also significant ($p<0.05$). In addition, the differences between the groups for shape index, shell weight and index, yolk weight and index, albumen weight and index and Haugh unit were significant ($p<0.05$). It was concluded that a selection program including those with earlier possible age for the first egg-laying in pheasants would be convenient for the egg production whereas a selection including the ones with older ages for the first egg-laying would be convenient for the egg weight, hatching and egg quality.

Key words: Pheasant, first laying egg age, egg production, hatching characteristics, egg quality, Turkey

INTRODUCTION

The pheasant is a poultry species the breeding of which has recently become popular. Breeding meat production is continuously gaining importance as an alternative source of animal protein. Therefore, determining the hatching qualifications and internal and external quality features and the influencing factors of the pheasant eggs, both for the efficiency of hatching studies in breeding companies and for commercial companies indicates the need for more detailed research in this area.

Naturally, pheasants begin egg production in the spring season. The initiation of early egg-laying may be related to factors including the genotype of the flock, health status, age, lightening, feeding and temperature under intensive conditions. Pheasants produce their first eggs at the age of 35-40 weeks under convenient conditions. The laying season lasts for 16-20 weeks. Eggs should not be obtained from female pheasants younger than 8 months of age (Cetin and Kirikci, 2000).

It has been shown in many studies that the age of the first egg-laying and season may affect the quality of the egg in later periods of time of pullets (Oruwari and Brody, 1988; Tserveni-Gousi, 1993). The age of sexual maturity can be affected by many factors including genetic constitution (Narayan *et al*., 1996), feeding program and the composition of the bait (Lewis *et al*., 1994; Narayan *et al*., 1996), body weight and body composition (Lui *et al*., 1995; Oruwari and Brody, 1988; Yannakopoulos *et al*., 1995), lighting program, light intensity and the light color (Lewis *et al*., 1994; Robinson *et al*., 1990), design of the cage and the timing of the placing in the cage in poultry species (Kling *et al*., 1985).

It has been reported that the age of sexual maturity is related to some quality features such as the egg production and the egg weight, shape index, shell thickness and haugh unit in chickens and Japanese quails (Fasenko *et al*., 1992; Haung *et al*., 1997; Lewis *et al*., 1994; Robinson *et al*., 1990). It has been showed that the total egg production and the rate of the laying were decreased by the age of the laying and the mean egg weight increased in chickens.

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Gilbert *et al.* (1978) reported that the weight of the egg is a function of the chicken's age rather than the hatching period. Tserveni-Gousi and Yannakopoulos (1995) reported that the mean egg weight was not different in the groups of age for sexual maturity in Japanese quails. They reported that the weight of the egg increased as the age of the animal increased and that the increase was greater in those with late sexual maturity.

The effects of shape index on the features of hatching (Phillips *et al*., 1992) and on the shell resistance and thickness in the table egg are important (North, 1972). Hicks (1958) reported that the shape index was hereditary and that it was related to the egg size in chickens.

There is a close correlation between the age of the first laying and the weight at that time in poultry (Lui *et al*., 1995; Yannakopoulos *et al*., 1995). It may be possible to think that early egg collection in animals with early sexual maturity may result in a reduction in the cost till present and hence, a reduction in the production cost per egg (Tserveni-Gousi, 1993; Tserveni-Gousi and Yannakopoulos, 1995). However, the effect of the age of sexual maturity should be taken into account not only for the egg production but for the other features of the egg as well.

There is no adequate number of studies in pheasants on developing genotypes for meat and eggs. Such studies should provide an increase in the egg production without impairing the quality. The effect of the age of the first laying on these features should be taken into account.

This study was performed to determine the effect of the age for the first egg-laying or the age of sexual maturity on the egg production, hatching and egg quality features in ring-necked pheasants.

MATERIALS AND METHODS

Animals and husbandry: Seventy female ring-necked pheasants were studied at the Faculty of Veterinary Research and Practice Center, Firat University. These pheasants have Hungarian and native pheasant phenotypes. Pheasant chicks (n = 300) of both sexes combined were reared in environmentally controlled housing units from hatch to 10 weeks of age then, reared outside in 3 range pens (10 m width, 20 m length and 2 m height) until they were moved into the breeding units at 28 weeks of age. The chicks were fed a starter diet containing 28% CP from hatch to 5 weeks of age, a 24% CP diet from 5-12 weeks of age and a 16% CP diet from 12-28 weeks of age. A total of 72 female and 18 male pheasant were randomly selected from the flock and used in this study. Pheasants were mated as 1 male and 4 female.

The pheasants were mated inside 18 cages in open area and each cage having a 1.5 m width×2 m length×1.5 m height at 28 weeks age. No artificial lighting was used. Birds were provided with ration *ad libitum* including 18% HP and 2, 850 MJ kg^{-1} of ME to the pheasants and water was provided from automatic drinkers. The day of the first egg-laying pheasants was determined and they were grouped as follows:

- Group 1 (n: 18): The age of first laying ≤34 weeks
- Group 2 (n: 18): The age of first laying 35-36 weeks
- Group 3 (n: 18): The age of first laying 37-38 weeks
- Group 4 (n: 18): The age of first laying ≥39 weeks

After the first egg was obtained, eggs from each pheasant were collected daily at the same time and the number of eggs was divided by the number of pheasants to calculate the daily egg production (%) and egg weight and egg length and width were measured. The eggs were stored at 14°C with 75% humidity for up to 7 days for incubation. The individual records were kept until the pheasants were 53 weeks old.

Egg quality analyses: To determine quality characteristics of eggs, randomly selected 20 eggs were used from each pheasant group. The short and long diameters of the eggs were measured by digital calipers with a sensitivity of 0.001 mm to determine the shape index. Then eggs were broken out individually onto a flat surface and allowed to sit for 5 min. The heights of yolk and albumen, the long and short diameters of albumen and the diameter of yolk were measured using the caliper. Yolks were separated from albumen and both were weighed. The shells of the broken-out eggs were washed under gently flowing tap water to remove albumen residues then, they were air dried and weighed. The shell thickness at equator, blunt and pointed edges of the eggshells was measured using the caliper. From the values obtained, the following data were calculated using the equations shown (Yannakopoulos and Tserveni-Gousi, 1986):

$$\text{Shape index} = (\text{Breadth}/\text{Length})\times 100$$

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

$$\text{Albumen index} = [\text{Albumen height}/(\text{Long diameter of albumen} + \text{Short diameter of albumen}/2)]\times 100$$

$$\text{Shell thickness} = (\text{Pointed end} + \text{Equator} + \text{Blunt end})/3$$

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

To determine hatchability characteristics of pheasant groups, randomly selected 120 eggs at different laying time were used from each pheasant group. Hatching treatment was replicated 4 times. The numbers of chicks hatched were recorded and then, the numbers of fertilized and unfertilized eggs were determined by breakout of eggs.

Statistical analysis: In this study, the egg production, egg weight, egg production rate, hatching characteristics and egg quality at first egg laying age group of pheasant were studied. Analysis of variance was used to determine the significance of differences between egg production and egg quality characteristics of the various groups. The significance of the differences among the groups was determined by Duncan's multiple range test (Petrie and Watson, 1999). Statistical analysis was done using the SPSS 11.5 program package (SPSS, 2002) Inc., Chicago, IL).

RESULTS AND DISCUSSION

The values for egg production, egg weight and damaged egg rate in the groups of the first egg-laying for pheasants are shown in Table 1. The difference between the groups was significant for egg production and egg weight ($p<0.05$).

The values for hatching characteristics, hatchability of total eggs, fertility and hatchability of fertile eggs shown in Table 2. The difference between the groups was found to be significant for the hatchability of total eggs, fertility and hatchability of fertile eggs ($p<0.05$).

The values for shape index, shell weight, shell thickness, yolk weight, albumen weight, yolk index, albumen index and Haugh units are shown in Table 3. There was a significant difference between the groups for the shape index, shell weight, shell thickness, yolk weight, albumen weight, yolk index, albumen index and haugh units ($p<0.05$).

In this study, four groups were formed at the basis of the age of the first laying in a flock of ring-necked pheasants at the same age groups and these groups were compared for egg production, hatching characteristics and egg quality features. A significant variation was observed for the age of the first laying in this flock at the same age and environment. There was an interval of 5 weeks between the pheasant' earliest egg-laying (at age of 34 weeks) and latest egg-laying (at age of 39 weeks).

Table 1: Egg production, egg weight and damaged egg rate of the pheasants

	The age of first laying (n:18)				
Characteristics	Group 1 (≤34 weeks)	Group 2 (35-36 weeks)	Group 3 (37-38 weeks)	Group 4 (≥39 weeks)	p-value
Egg production rate (%)	49.35±2.14^{a}	48.56±2.31^{a}	44.73±2.08^{b}	40.86±1.87^{c}	*
Egg weight (g)	28.52±1.23^{a}	31.64±1.63^{b}	32.48±1.54^{bc}	30.86±1.38^{bd}	*

Values are shown as $\bar{x} \pm S\bar{x}$ (Mean±SD); n: Number of the pheasants in each group; $^{a-d}$The differences of means holding different letters in the same row are important (*$p<0.05$); NS: Non Significant ($p>0.05$)

Table 2: Hatchability characteristics of the pheasant groups

	The age of first laying				
Characteristics (%)	Group 1 (≤34 weeks)	Group 2 (35-36 weeks)	Group 3 (37-38 weeks)	Group 4 (≥39 weeks)	p-value
Hatchability of total eggs	52.67±5.86^{a}	54.54±6.32^{a}	60.79±7.12^{b}	58.56±8.05^{b}	*
Fertility	55.31±6.91^{a}	57.87±7.34^{a}	65.80±7.51^{b}	67.43±8.75^{b}	*
Hatchability of fertile eggs	65.36±4.87^{a}	69.85±6.68^{b}	74.06±6.43^{c}	79.54±9.23^{d}	*

Values are shown as $\bar{x} \pm S\bar{x}$ (Mean±SD); $^{a-d}$:The differences of means holding different letters in the same row are important (*$p<0.05$)

Table 3: Some egg quality characteristics of the pheasant groups

	The age of first laying				
Characteristics	Group 1 (≤34 weeks)	Group 2 (35-36 weeks)	Group 3 (37-38 weeks)	Group 4 (≥39 weeks)	p-value
Shape index (%)	80.480±0.73^{a}	82.340±0.96^{ab}	78.750±0.65^{ac}	76.580±0.89^{cd}	*
Shell weight (g)	2.560±0.43^{a}	3.150±0.54^{b}	3.580±0.69^{c}	3.710±0.72^{c}	*
Shell thickness (mm)	0.218±0.02^{a}	0.267±0.01^{b}	0.296±0.03^{bc}	0.308±0.01^{c}	*
Yolk weight (g)	9.120±0.34^{a}	9.870±0.45^{b}	10.720±0.53^{c}	10.860±0.65^{c}	*
Albumen weight (g)	14.560±0.56^{a}	16.960±0.68^{b}	18.570±0.87^{c}	18.850±0.76^{c}	*
Yolk index (%)	42.620±1.98^{a}	46.780±2.24^{b}	49.320±2.57^{c}	50.210±2.79^{c}	*
Albumen index (%)	1.435±0.43^{a}	1.716±0.57^{b}	1.943±0.79^{c}	1.987±0.89^{c}	*
Haugh units	86.450±0.78^{a}	90.630±0.56^{b}	92.320±0.92^{b}	85.410±0.57^{a}	*

Values are shown as $\bar{x} \pm S\bar{x}$ (Mean±SD); $^{a-d}$The differences of means holding different letters in the same row are important (*$p<0.05$)

As it was accepted that this pheasant flock had similar genetic constitution, the wide variation for the age of first laying and the reflection of this feature which has a low degree of inheritance ($h^2 = 0.15$) to phenotype (Narayan *et al*., 1996) may be due to various factors such as care-feeding, lighting, environmental temperature and environment-genotype interactions (Haung *et al*., 1997; Yannakopoulos *et al*.,1995) because although the animals were kept in the same room and fed with the same bait, their position in the poultry may have caused them to be affected differently by the mentioned factors.

When the groups of the first age for egg-laying were compared for egg production, it was found that group 1 which had the earliest age for laying had the highest egg production (49.35). This situation was consistent with the expectations (Demirel and Kirikci, 2009; Kirikci *et al*., 2003, 2004, 2005). It was reported by Lewis *et al*. (1994) that the total egg production of animals at early age of the first egg-laying would be high. The reduction in the egg production with later ages of the first egg-laying may be due to reasons including the extension of intervals between the egg-laying with increasing age, reduction in the production of new follicle and the decrease in the length of clutch (Fasenko *et al*., 1992; Robinson *et al*., 1990). In this study, the values of group 4 with the latest egg-laying confirmed these explanations.

The egg weight increases as the age of the first egg-laying increases (Lewis *et al*., 1994; Tserveni-Gousi and Yannakopoulos, 1995). The values for egg weight showed an increase till group 3 and decreased in group 4. Tserveni-Gousi (1993) reported similar results.

When the ages of the first egg-laying were compared for the hatchability characteristics, it was found that the hatchability of total eggs, fertility and hatchability of fertile eggs increased as the age of the first laying increased.

A significant difference ($p<0.05$) was found between the groups for the ages of the first egg-laying when they were compared for the shape index. The shape index increased as the age of the first laying increased and there was a positive relationship between the age of the first laying and shape index as North (1972) reported. Besides, the values of the shell weight and thickness, yolk weight and index, albumen weight and index and Haugh unit showed significant increases ($p<0.05$) as the age of the first egg-laying increased.

CONCLUSION

The study shows that for the age of the first laying, group 1 produced the highest number of eggs. The increase in the age for the first egg-laying has led to a decrease in the egg production and an increase in the egg weight. The egg production decreased as the age of the first laying increased however, hatching and egg quality features decreased.

Thus, the researchers concluded that a selection program including those with earlier possible age for the first egg-laying would be convenient for the egg production whereas a selection including those with older ages at the first laying would be convenient for hatching and egg quality features.

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