The Effects of Shank Length on egg production and egg quality traits of Japanese Quails (*Coturnix coturnix japonica*)

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A research was carried out to determine the effect of shank length on egg production and egg quality traits of Japanese quails (*Coturnix coturnix japonica*). A total of 120 quails were separated into two groups according to their left shank length at 6th wks of age. Female quails with the left shank length between 32.00-35.90 mm were classified as short shank length group, while those with shank length >36.50 mm were classified as long shank length group. Sixty female quails were used for each of the two leg groups and housed in ten separate pens. A total of 40 eggs were collected per shank length group at the 9th, 14th and 20th wks of quail age. Thereafter, egg interior and exterior quality characteristics were measured. The average age for the first egg laid (sexual maturity age) from the long shank length group was 49.40 days and from the short shank length group was 51.80 days P<0.01); 53.80 and 56.60 days when the 50% of egg production was reached (P<0.05); 60.40 and 67.60 days for the egg peak production (P<0.05), respectively. It was found that mean egg production of the long shank length group was 35.72% and short shank length group was 20.95% between 8-9th wks of age (P<0.05), 90.48% and 76.19% between 19-20th wks of age (P<0.01), respectively. Egg quality traits found to be not significant in groups. In conclusion, shank length affected quail's egg production traits.

Keywords: Quail; shank length; egg production; egg quality

Introduction

Japanese quail is the smallest avian species farmed for meat and egg production (Panda and Singh, 1990). Distinct characteristics include rapid growth – enabling quail to be marketed for consumption at 5-6 wks of age, early sexual maturity- resulting in short generation interval, high rate of egg laying and much lower feed and space requirements than domestic fowl.

The egg layers who had low live weight at the beginning period of egg laying, that caused low rate of egg lay after the pike egg lay period. Thus, further production yield of egg layers are affected by their uniformity at the beginning period of egg laying period (Leeson and Summers, 1997). The skeletal development is an important measurement at reaching optimum live weight and uniformity for hens. In addition, shank length is an important measurement of skeletal development (North and Bell, 1990; Anonymous, 1997). Baco *et al* (1998) and Gulinski *et al*. (1997) were investigated relationships between shank length and production traits.

Egg quality has been defined by Stadelman (1977) as the characteristics of an egg that affect its acceptability by the consumers. Egg quality is the more important price contributing factor in table and hatching eggs. Therefore, the economic success of a laying flock solely depends on the total number of quality eggs produced (Monira *et al.,* 2003).

Some researches reported that there were relationships between shank lengths and live weight (Missou *et al*., 2003), egg production traits (Petek *et al.,* 2000), egg quality traits (Shinde *et al*., 1993).

Nestor and Noble (1995) found that selection for increased shank width had little influence on egg traits of turkeys. Almost no data available on the effect of shank length on egg quality traits of Japanese quails. This research was carried out to determine the effect of shank length on egg production and egg quality traits of Japanese quails (*Coturnix coturnix japonica*).

Material and Methods

A total of 120 quails that were raised in pens for 6 week were used. Upon reaching six weeks of age, quails were individually separated into two groups according to their left shank length. The quails with a left shank length between 32.00 – 35.90 mm were classified as a short shank length group and (> 36.50 mm) classified as a long shank length group. For each of the two leg groups, 6 female quails were housed in ten separate pens. Wing numbers were attached to the wings of all birds. Respectively, 14 and 16 hours of illumination were applied during the growth and laying periods. Water and feed were supplied *adlibitum*. All treatment groups were fed a broiler starter diet containing 230 g CP/kg and 12.8 MJ ME/kg during the growth period. A layer diet containing 180 g CP/kg and 11.3 MJ ME/kg was used from the sixth week onwards.

Shank lengths of quails were measured with a digital calliper at $6^{th}$and 20^{th} wks of age. Egg production was recorded daily. The age of sexual maturity was determined when the quails laid their first eggs in each pen. This situation forms 16 % productivity for each pen. The reach age of %50 and pik egg production were determined.

A total 40 eggs were collected for per shank length group at 9^{th}, 14^{th}, 20^{th} wks of quail age, that were used for egg interior and exterior quality characteristics measurement. Eggs were collected and their interior and exterior quality characteristics were determined within 5 h of collection. (Yannakopoulos and Morris, 1979). The maximum widths and lengths of each egg were measured to the precision of 0.01 mm with calliper and their shape indices were calculated using formula: (maximum width/maximum length) x 100 (Esen and Özçelik, 2002; Allen and Young, 1980). Eggs were weighed and then broken, and the yolks were separated from the albumen. The chalazae were carefully removed from the yolk, using forceps, prior to weighing the yolk. Before weighing, all yolks were also rolled on a paper towel to remove adhering albumen. The shells were carefully washed and dried over night in a drying oven at 105°C then weighed. Albumen weight was determined by subtracting yolk and shell weights from the original egg weight. The shell thickness was randomly measured from the three different parts of shell in each egg using a micrometer and was averaged. The weights off egg components and shell thickness were measured to the precision of 0.01 g or 0.01 mm, respectively. (Suk and Park, 2001; Yannakopoulos and Tserveni-Gousi, 1986).

The data were subjected to analysis of variance (Minitab, 1998), utilizing ANOVA procedures for balanced data. Analyses for percentage data were conducted after arcsine transformation. Significant differences among treatment means were determined by a Duncan multiple range test.

Results and Discussion

Shank length heritability estimates are also high, except for 1^{st} and 5^{th} week which are particularly low. This suggests that shank length should not be used for selection in the 1^{st} and 5^{th} wks of age of quails (Adeogun and Adeoye, 2004). Depend on this finding our trial started at the age of 6^{th} wks of age at which quails' sexual maturiy age.

The mean values of shank length and the effects of shank length on live weight, the age of first egg laying (sexual maturity), %50 rate of egg lay age and pike rate of egg lay age are given in Table 1. In the trial, significant differences were found between 6^{th} wks of age and 20^{th} wks of age shank length and live weight values. The shank lengths and live weights increased as quail age increased. Adeogun and Adeoye (2004) reported that mean shank length and live weight were found 3.66 cm and 197 g, respectively for quails at the 6^{th} wks of age. In the trial, mean shank length in the long shank length group was 37.98 mm and 35.12 mm in the short shank length group at the 6^{th} wks of age. At the 20^{th}

wks of age shank lengths were found 39.36 mm and 37.64 mm, respectively. Yeasmin and Howlider (1998) found that shank length and live weight were higher in normal Deshi hens than in dwarf deshi hens. Adeogun and Adeoye (2004) found that a positive phenotypic correlation between live weight and shank length, indicating that an improvement in live weight will likely lead to improvement in shank length. In the trial, the effect of shank lengths on live weight was found not to be significant. However, numerically long shank length group's live weight was higher than short shank length group. Petek *et al.* (2000) found that long shank length group reached to 50% rate of egg lay age earlier than short shank length group in ISA brown layers. In the trial, the age of first egg laying (sexual maturity), %50 rate of egg lay and pike rate of egg lay (egg production) values were found earlier in long shank length group than in short shank length group (P<0.01, P<0.01 and P<0.05, respectively).

Table 1. The mean values of shank length and the effects of shank length on live weight, the age of first egg laying (sexual maturity), %50 rate of egg lay and pike rate of egg lay

	Long Shank Length	**Short Shank Length**	
6th wks of age shank length, mm	37.98 ± 0.20[a]	35.12 ± 0.17[b]	**
20th wks of age shank length, mm	39.36 ± 0.17[a]	37.64 ± 0.24[b]	**
6th wks of age live weight, g	123.67 ± 3.179	117.14 ± 3.540	NS
20th wks of age live weight, g	229.80 ± 3.354	220.48 ± 4.400	NS
First Egg Laying age, d	49.40 ± 0.40[b]	51.80 ± 0.58[a]	**
% 50 Egg Production age, d	53.80 ± 0.73[b]	56.60 ± 0.87[a]	*
Pik egg production age, d	60.40 ± 0.67[b]	67.60 ± 2.69[a]	*

[a,b] Means in the same line with no common superscript are significantly different at the P<0.01and P<0.05 level.

* P<0.05 ** P<0.01 NS: not significant

Marthur and Horst (1985) and Shinde *et al.* (1993) stated that rate of egg lay was affected from layer shank length. The effect of shank length on rate of lay at different age periods is given in Table 2. In the trial, at the different age periods long shank length group's rate of egg lay were found significantly higher than short shank length group (P<0.05, P<0.01). Similar to our findings, Merat *et al.* (1994) reported that rate of egg lay of dwarf white leghorn hens was lower than normal sized hens. On the other hand, Yeasmin and Howlider (1998) found that the dwarf deshi hens had significantly higher rate of egg lay than their normal sized counterparts.

Table 2. The effect of shank length on rate of egg lay at different age periods ($\overline{X}$ ± SEM)

	Long Shank Length	Short Shank Length	
8-9th wks, %	35.7 ± 4.64[a]	20.9 ± 3.48[b]	*
11-12th wks,%	90.0 ± 3.48[a]	75.7 ± 6.36[b]	**
15-16th wks, %	97.6 ± 1.06[a]	82.3 ± 8.73[b]	**
19-20th wks, %	90.4 ± 2.91[a]	76.1 ± 6.77[b]	**

[a,b] Means in the same line with no common superscript are significantly different at the P<0.01and P<0.05 level.

* P<0.05 ** P<0.01

The selection for increased shank width had little influence on egg traits (Nestor and Noble, 1995). The effect of shank length on mean egg weight, shape index, yolk diameter, yolk weight, albumen weight, shell weight and shell thickness at 9th, 14th and 20th wks of age are given in Table 3. Missohou *et al.* (2003) reported that egg yolk weight was found similar in normal sized and in dwarf hens, but albumen weight and shell weight were higher in dwarf hens than in normal hens, even though the differences were not significant. In the trial, except from albumen weight (P<0.05), all investigated egg traits were numerically affected from shank length. Numerically egg weight, shape index, yolk diameter, yolk weight, albumen weight, shell weight and shell thickness values were found higher in long shank length group than values in short shank length group. Similar to our findings, Yeasmin *et al.* (2003) reported that all of the investigated egg quality characteristics were similar in both types of groups, except for the yolk weight, which was higher in eggs of dwarf hens than that of normal sized birds. However, Shinde *et al.* (1993) found that long shank length dwarf layers' eggs weight are heavier than short shank length layers' eggs weight.

Table 3. Mean egg quality traits of quails at 9th, 14th, 20th wks of age (x ± sem)

Egg quality traits	**9th wks**			**14th wks**			**20th wks**		
	Long	Short		Long	Short		Long	Short	
Egg Weight,g	10.95 ± 0.17	10.42 ± 0.27	NS	11.71 ± 0.16	11.16 ± 0.36	NS	11.65 ± 0.19	10.95 ± 0.30	NS
Shape Index, %	78.36 ± 0.57	77.37 ± 0.65	NS	78.16 ± 0.35	77.31 ± 0.61	NS	78.75 ± 0.65	77.64 ± 0.67	NS
Yolk Diameter, mm	20.55 ± 0.26	20.46 ± 0.33	NS	22.08 ± 0.21	21.44 ± 0.44	NS	21.16 ± 0.20	21.19 ± 0.30	NS
Yolk Weight, g	3.12 ± 0.06	3.08 ± 0.09	NS	3.71± 0.08	3.44 ± 0.15	NS	3.45 ± 0.08	3.32 ± 0.12	NS
Albumen Weight, g	6.97 ± 0.11[a]	6.54 ± 0.17[b]	*	7.12 ± 0.10	6.84 ± 0.21	NS	7.25 ± 0.11[a]	6.71 ± 0.18[b]	*
Shell Weight, g	0.86 ± 0.01	0.80 ± 0.05	NS	0.89 ± 0.02	0.88 ± 0.02	NS	0.94 ± 0.01	0.90 ± 0.02	NS
Shell Thickness, mm	0.21 ± 0.00	0.21 ± 0.00	NS	0.21 ± 0.00	0.20 ± 0.01	NS	0.22 ± 0.00	0.21 ± 0.01	NS

[a,b] Means in the same line with no common superscript are significantly different at the P<0.05 level.

* P<0.05 NS: not significant

In conclusion, our trial results showed that rate of egg lay were affected from shank length of quails. The skeleton development has reached its final status until 5 wks of age in quails, after this reproduction organelles have started to develop and live weight increased with age. In short shank length group, skeleton developments have not reached final status and depending on that reproduction organelles are late to develop. Parallel to this situation rate of egg lay are lower in short shank length group. Thus, it is important to separate these short shank length quails in the early ages of skeleton development and apply to them a different feeding program. As a result, providing uniformity in the flock before the quails reach to the age of first egg laying is an important factor in terms of productivity. The results were expected to assist quail production, while also contributing to the scientific literature.

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