

The effects of shank length on incubation results of Japanese quails (*Coturnix coturnix japonica*) eggs and hatched chick shank length

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A research was carried out to determine the effect of shank length on incubation results of Japanese quails (*Coturnix coturnix japonica*) eggs and hatched chick shank length. A total of 160 quails were weighed individually and separated into two groups according to their left shank length at 6th wks of age. The male quails with a left shank length between 33.00-35.90 mm were classified as a short group and (>36.91 mm) classified as a long shank length group. The female 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, 2 male-6 female quails were housed in ten separate pens. Shank lengths of quails were measured with a digital caliper at 6th and 20th wks of age. The quails were weighed individually at 6th, 8th, 16th and 20th wks of age. Both female and male quails the mean live weights were significantly lower in the short shank length group. A total of 50 eggs were collected from per shank length group of quails at the age of 8th, 16th and 20th weeks for incubation results. Shank length had not a significant effect on fertility and hatchability. Fertility, hatchability of total eggs and total embryonic mortality were found numerically higher in long shank length group at 8th wks of age ($P>0.01$). The hatched chick weight was found 7.67g in long shank length group and 7.31g in short shank length group at 8th wks of breeder quail age ($P<0.05$). The hatched chick shank length was 16.93 mm in long shank length group and 16.33 mm in short shank length group at 20th wks of breeder quail age ($P<0.01$).

Keywords: Quail; shank length; live weight; hatchability; fertility

Introduction

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). The researches for relationships between some body measurements and production traits of other animals are used in animal production, to put on the agenda about a relationship between shank length and production traits and whether these traits will be used in future (Baco *et al.*, 1998; Gulinski *et al.*, 1997).

Some researches reported that there were relationships between shank lengths and live weight (Missou *et al.*, 2003). Nestor and Noble (1995) found that selection for increased shank width had little influence on egg traits and this was correlated with fertility and hatch of fertile eggs. Whereas only few studies have been conducted on the shank lengths of quails, almost no data available on the effect of shank length on hatchability results of Japanese quails. This research was carried out to determine the effect of shank length on incubation results of Japanese quail (*Coturnix coturnix japonica*) eggs and hatched chick shank length.

Material and Methods

A total of 160 quails that were raised in pens for 6 week were used. Upon reaching six weeks of age, male and female quails were weighed individually and separated into two groups according to their left shank length. The male quails with a left shank length between 33.00 – 35.90 mm were classified as a short group and (>36.91 mm) classified as a long shank length group. The female 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. Quails classified according to shank length groups were placed into pens with 1:3 male to female ratio. For each of the two leg groups, 2 male-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. The composition and feeding value of the diets, as shown in Table 1, were analyzed using the Weende method (Akyildiz, 1984).

Table 1. Composition and feeding value of the diets

Diet Composition	Broiler Starter Diet	Layer Diet
Dry matter, g/kg	1000.0	1000.0
Organic matters, g/kg	934.9	912.5
Crude protein, g/kg	230.0	180.0
Ether extract, g/kg	71.5	51.3
Crude fibre, g/kg	88.7	124.0
Crude ash, g/kg	65.1	87.5
Nitrogen free extract, g/kg	544.7	469.7
ME, MJ/kg	12.8	11.3

Shank lengths of quails were measured with a digital caliper at 6th and 20th wks of age. The quails were weighed individually on a digital balance with 0.01 g precision at 6th, 8th, 16th and 20th wks of age. Dead birds were replaced with birds of similar sex, age and shank length to maintain male to female ratios during the trial. A total of 50 eggs were collected from per shank length group of quails at the age of 8th, 16th and 20th weeks. All incubated egg number was the 150 for each shank length group). The eggs were stored at 16- 18 °C and 65-75 % RH for 3 days. Eggs were weighed before being loaded into trays. They were incubated in a incubator at a temperature of 37.5 °C and 65% RH for 15 days. The eggs were turned 45° every hour. The eggs were transferred to a hatcher maintained at 37.0 °C and 70 % RH until hatching (17th day). All hatchable eggs were incubated and fertility was determined by microscopically examining the embryonic development of all the eggs that did not hatch. Fertility, hatchability of fertile eggs, hatchability of total eggs and embryonic mortalities were determined. The chicks that hatched on the same day were weighed on a digital balance with 0.01 g precision and measured their shank length.

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

The mean values of shank length of male and female quails at 6th and 20th wks of age are given in Table 2. In the trial, significant differences were found between 6th wks of age and 20th wks of age shank length ($P < 0.01$). The shank lengths increased as quail age increased. The mean shank length of females in the long shank length group was 37.98 mm and 35.12 mm in the short shank length group at the 6th wks of age. The mean shank length of males in the long shank length group was 38.21 mm and 34.31 mm in the short shank length group at the 6th wks of age. At the 20th wks of age shank length of females in the long shank length group was 39.36 mm and 37.64 mm in the short shank

length group and for males 39.11 mm and 35.96 mm, respectively. 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 6th wks of age. Yeasmin *et al.* (1998; 2003) reported that birds which had shank length of 6 cm or below was considered as dwarf, while those with shank length above 6 cm were considered as normal size. Yeasmin and Howlider (1998) found that shank length and live weight were higher in normal Deshi hens than in dwarf deshi hens.

Table 2. The mean values of shank length of Male and Female Japanese quails at 6th wks and 20th wks of age ($\bar{X} \pm \text{SEM}$)

Shank Length Groups	6 th wks of age Shank Length, mm	20 th wks of age Shank Length, mm
Female	**	**
Long	37.98 ± 0.2062 ^a	39.36 ± 0.1750 ^a
Short	35.12 ± 0.1724 ^b	37.64 ± 0.2416 ^b
Male	**	**
Long	38.21 ± 0.4447 ^a	39.11 ± 0.6057 ^a
Short	34.31 ± 0.3518 ^b	35.96 ± 0.3488 ^b

^{a,b} Means in the same column with no common superscript are significantly different at the P<0.01 level.

The effects of shank length on live weight of male and female Japanese quails at different age periods are given in Table 3. 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 of female and males were found to be significant at 8th wks of age ($P < 0.05$, $P < 0.01$). In differently, the effect of shank lengths on live weight was found not to be significant at 6th, 16th and 20th wks of age. However, numerically long shank length group's live weight was higher than short shank length group. Both female and male quail's mean live weights were lower in the short shank length group.

Table 3. The effects of shank length on live weight of male and female Japanese quails at different age periods ($\bar{X} \pm \text{SEM}$)

Shank Length Groups	6 th wks of age Live Weight, g	8 th wks of age Live Weight, g	16 th wks of age Live Weight, g	20 th wks of age Live Weight, g
Female	NS	**	NS	NS
Long	123.67 ± 3.1794	208.82 ± 3.3245 ^a	222.8 ± 3.1013	229.80 ± 3.3540
Short	117.14 ± 3.5406	189.27 ± 4.7868 ^b	215.60 ± 4.2957	220.48 ± 4.4006
Male	NS	*	NS	NS
Long	114.64 ± 4.4521	168.08 ± 4.2396 ^a	181.21 ± 6.7824	188.09 ± 6.7432
Short	109.37 ± 4.6352	154.40 ± 3.0367 ^b	178.37 ± 3.4075	177.11 ± 3.9595

^{a,b} Means in the same column with no common superscript are significantly different at the P<0.01 and P<0.05 level.

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

Table 4. The effects of shank length on hatchability results of quails at 8th, 16th and 20th wks of age ($\bar{X} \pm \text{SEM}$)

	8 th wks			16 th wks			20 th wks		
	Long	Short		Long	Short		Long	Short	
Fertility, %	90 ± 7.74	70 ± 14.14	NS	96 ± 2.45	96 ± 2.44	NS	96 ± 2.45	94 ± 4.00	NS
Hatchability of fertile eggs, %	85.11 ± 7.16	87.08 ± 5.28	NS	89.56 ± 3.17	95.78 ± 2.59	NS	90.00 ± 3.16	94.00 ± 6.00	NS
Hatchability of total eggs, %	78.00 ± 11.13	72.50 ± 10.30	NS	86.00 ± 4.00	92.00 ± 3.74	NS	90.00 ± 3.16	88.00 ± 5.83	NS
Total Embryonic Mortality, %	31.48 ± 9.19	15.42 ± 3.56	NS	13.06 ± 2.32	10.56 ± 0.55	NS	15.00 ± 5.00	30.00 ± 7.07	NS
Egg Weight, g	10.90 ± 0.11	10.66 ± 0.12	NS	11.11 ± 0.19	10.91 ± 0.17	NS	11.82 ± 0.15	11.76 ± 0.14	NS
Hatched Chick weight, g	7.67 ± 0.10 ^a	7.31 ± 0.14 ^b	*	6.92 ± 0.15	6.71 ± 0.14	NS	8.07 ± 0.12	8.03 ± 0.12	NS
Chick Shank Length, mm	16.37 ± 0.12	16.25 ± 0.18	NS	16.94 ± 0.15	16.79 ± 0.12	NS	16.93 ± 0.10 ^a	16.33 ± 0.12 ^b	**

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

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

The effects of shank length on hatchability results and hatched chick weight of Japanese quails at different age periods are given in Table 4. Shank length had not a significant effect on fertility and hatchability. Fertility, hatchability of total eggs and total embryonic mortality were found numerically higher in long shank length group at 8th wks of age ($P>0.01$). Nestor and Noble (1995) found that fertility was higher in selected for increased shank width line, but hatch of fertile eggs was reduced relative to the normal shank width line. In the trial the effect of shank length on egg weight was found not significant, but numerically egg weight was higher in long shank length group. Nestor et al. (1985) did not observe any differences in egg weight, fertility, or hatch of fertile eggs between the selected for increased shank width line and normal shank width line. The hatched chick weight was found 7.67g in long shank length group and 7.31g in short shank length group at 8th wks of breeder quail age ($P<0.05$). The hatched chick shank length was 16.93 mm in long shank length group and 16.33 mm in short shank length group at 20th wks of breeder quail age ($P<0.01$).

A high level of genetic correlation exists between the live weight and egg weight of female breeders (Strong *et al.*, 1978; Marks, 1983). Heavy birds produce heavier eggs than lighter birds (Strong *et al.*, 1978; Marks, 1983; Leeson *et al.*, 1991). Egg weight is critical on the hatchability (Altan *et al.*, 1995), chick weight (Shanawany, 1987). The small egg size reflects the high and positive correlation between body weight and egg size and may be associated with the smaller reproductive tract of dwarf layers (Katongole *et al.*, 1990).

In conclusion, in short shank length group skeleton development has not reached final statue and depending on that reproduction organelles are late to develop. This development delay caused small size egg production in short shank length group and depending on that hatched chick weight was low in these small size eggs. But, however, hatchability results were not affected from shank length of quails, but significantly hatched chick weight effected from shank length. The results were expected to assist quail production, while also contributing to the scientific literature.

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