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Hatching Traits as Influenced by Different Body Weight Categories in Four Close-Bred Flocks of Japanese Quails (*Coturnix coturnix japonica*)

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Abstract.- The present study was aimed at investigating the effect of different body weight categories in four close-bred flocks of Japanese quails on some hatching traits. A total of 432 adult (12 weeks old) quails, comprising 108 males and 324 females were randomly picked up from the available stock and then divided into 108 experimental units (replicates comprising one male and three females of each.) These experimental units were randomly assigned to 12 treatment groups having 4 close-bred flocks (imported, local 1, local 2, and local 3) x 3 female body weights (heavy 300-350g, medium 250-300g and small 200-250g) with randomized complete block design in factorial arrangements having 9 replicates in each treatment. The results showed significant (P<0.05) difference in dead germ, infertile egg and hatchability percent and non- significant differences in dead in shell percent in all the close-bred flocks of Japanese quails. With respect to body weight categories, significant (P<0.05) differences were found in dead germ, dead-in-shell, infertile egg and hatchability percent. The interaction between flocks and body size categories was significant (P<0.05) in respect of all the above hatching traits. No mal-positions were detected.

Key words: Dead germ, dead-in-shell, egg infertility and hatchability percent.

INTRODUCTION

The breeding of birds is one of the ancient occupations of man. From ancient time, he tried to domesticate, breed and improve different bird's species, thus creating races, lines, and varieties and highly performing hybrids. The domestic quail (*Coturnix coturnix japonica*) is the smallest bird subspecies that is maintained at farms for its meat and egg production worldwide due to its easy maintenance, early sexual maturity, shorter generation interval, high rate of egg production and therefore has become a pilot animal in the field of research (Cain and Cawley, 2000; Minvielle, 2004). In meat and egg lines of Japanese quail, the hatching traits are important for economical breeding and also for propagation of the flocks.

However, little information is available on the effect of different body weight of parent quail flocks on hatchability traits. Keeping this in view the present study was conducted to investigate effect of different body weight categories on some hatching traits in four close-bred flocks of Japanese quails. However, in the specialty literature there is little information regarding the hatching traits (dead germ, dead-in-shell, infertile egg and hatchability percent) of quail eggs. No serious attempt has yet been made to study hatching traits of these close-bred flocks of Japanese quails with different body weight categories. The purpose of this study was to determine the hatching traits of domestic quail eggs.

MATERIALS AND METHODS

The present study of 31 weeks duration was conducted to evaluate the productive performance of 4 close-bred flocks of Japanese quails with different body weights, at Avian Research and Training Centre, University of Veterinary and Animal Sciences, Lahore, Pakistan. A total of 432 adult (12 weeks old) quails, comprising 108 males and 324 females were used. The birds were randomly picked up from the available stock (27 males and 81 females from each flock) and then divided into 108

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experimental units (replicates comprising one male and three females of each.) These experimental units were randomly assigned to 12 treatment groups having 4 close-bred flocks (imported, local 1, local 2, and local 3) x 3 female body weights with randomized complete block design in factorial arrangements having 9 replicates in each treatment (Table I). The body weight categories of heavy male and female quails are given in Table II. The maximum and minimum temperature of the quail house was recorded daily. Natural day light was provided to the birds at the start of the experiment and then light hours were increased by half an hour weekly till 16 hours light per day. Fresh and clean drinking water was provided at all the times through automatic nipple drinkers. The birds were fed *ad libitum* a balanced quail breeder ration according to NRC standards (1994), containing Metabolizable energy 2900 kcal/kg, crude protein 20%, calcium 3% and available phosphorus 0.4%.

Table I.- Mating plan of experimental quails.

Parental body weights	Close-bred flocks in each treatment	Replicates	Quails/ replicate
♂ ♀			♂ ♀
H x H*	Imported	3(1, 2, 3)	04(1+3)
H x M	Local-1		
H x S	Local-2		
	Local-3		
M x H	Imported	3(1, 2, 3)	04 (1+3)
M x M**	Local-1		
M x S	Local-2		
	Local-3		
S x H	Imported	3(1, 2, 3)	04 (1+3)
S x M	Local-1		
S x S***	Local-2		
	Local-3		

H*, heavy; M**, medium; S***; small.

Table II.- Different body weight (g) categories of experimental quails.

Body weights	♂	♀
Heavy	270-315	300-350
Medium	225-270	250-300
Small	180-225	200 -250

The experimental birds were tagged for their proper identification. Daily eggs laid were stored properly after fumigation at a storage temperature of 15°C in egg storage cabinet. After completion of 14 days, eggs stored from different close-bred flocks were set in 108 separate hatching baskets. The eggs were incubated for a period of 17 days in Victoria incubators (Italian made) under standard conditions of incubation as described by North and Bell (1991). At completion of the hatchings (1814 eggs used during the study), following hatching parameters were recorded for each setting:

Dead germ

Dear germ defined as an embryo that died after growing large enough to be seen when candled. A dead germ can be distinguished by the presence of a blood ring around the embryo. This is caused by the movement of blood away from the embryo after death. There will be no movement of the embryo and network of blood vessels, if noticed, will not be extensive (Sreenivasiah, 2006). Dead germ was identified during the break out analysis and its percentage was calculated by the following formula:

$$\textbf{Dead germ}\ \% = \frac{\textbf{No. of dead germ}}{\textbf{No. of eggs set}} \times 100$$

Dead-in-shell

Dead-in-shell defined as embryos which have developed sufficiently but are unable to come out the shell whether they are able to pierce the shell or not. Higher incidence of dead-in-shells is indicative of improper hatchery management (Sreenivasiah, 2006). Dead-in-shell were identified through break out analysis. The percentage was calculated by using the following formula:

$$\textbf{Dead in shell}\ \% = \frac{\textbf{No. of dead in shell}}{\textbf{No. of eggs set}} \times 100$$

Egg infertility

The clear eggs were identified as infertile eggs. The infertile/clear eggs percentage was calculated by using the following formula:

$$\textbf{Infertile egg}\ \% = \frac{\textbf{No. of clear eggs}}{\textbf{No. of eggs set}} \times 100$$

Hatchability

Hatchability percent was calculated by using the following formula:

$$\text{Hatchability \%} = \frac{\text{No. of chicks}}{\text{No. of eggs set}} \times 100$$

Mal-positions

Mal-position defined as embryonic positions in the egg that are not normal for that specific stage of development and for that species. Some are fatal, e.g. head under left wing; whereas others such as beak over right wing may be normal variants. A common mal-position is head in the small end of the egg, commonly caused by incubating the egg with the small end up. Mal-positioned chicks were also determined in each hatch (Sreenivasiah, 2006).

Statistical analysis

The data thus collected were analyzed using ANOVA techniques (Steel *et al.* 1997) with randomized complete block design (RCBD) with more than one observation for further interpretation using general linear model (GLM) procedures (SAS 9.1, 2002-03) portable software, assuming following mathematical model:

$$Y_{ijkl} = \mu + F_i + S_j + W_k + Sj^{*}W_k + e_{ijkl}$$

where,

Y_{ijkl} = The l^{th} observation of the k category of female of the j^{th} category of male of the i^{th} flock

μ = Population mean

F_i = Effect of the i^{th} flock (i = 4), treated as blocks

S_j = Effect of the j^{th} category of male (k = 3)

W_k = Effect of the k^{th} category of female (j = 3)

e_{ijk} = Random error associated with the i^{th} flock and j^{th} body weight category.

The comparison of means was made using Duncan's Multiple Range (DMR) test (Duncan, 1955).

RESULTS

The findings of this study showing effect of different parental body weights of male and female Japanese quails on the hatching traits (dead germ, dead-in-shell, egg infertility, hatchability percent and mal-positions of chicks) in four close-bred flocks (imported, local-1, local-2 and local-3) are presented in Figure 1.

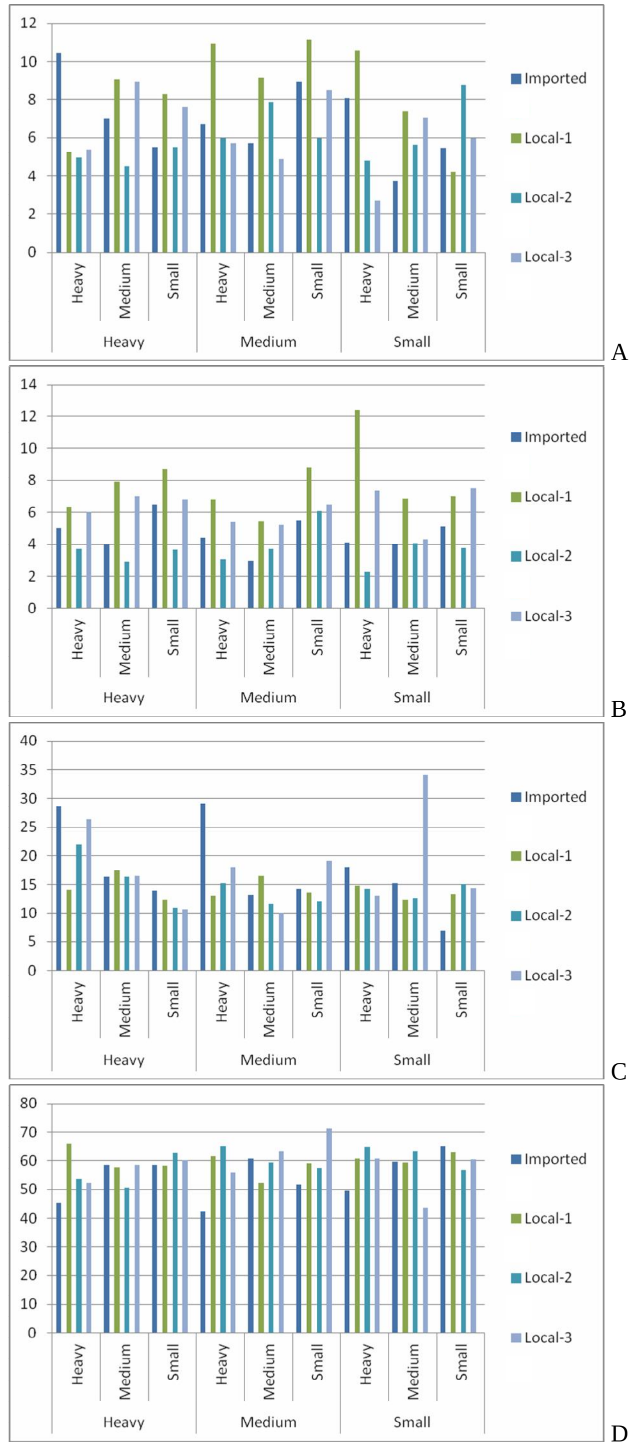

Fig. 1. Dead germ (A), dead-in-shell (B), egg infertility (C) and hatchability (D) percent influenced by 3 different parental body weight categories in 4 close-bred flocks of Japanese quail.

Dead germ percent

In the present study, different parental body weight significantly ($P<0.05$) influenced dead germ percent in different close-bred flocks of Japanese quails (Fig. 1A). The minimum dead germ percent was recorded in local-3 flock in S male x H female (2.68±0.34) parents which did not significantly differ from that of all the other parents in the same flock. The second lowest dead germ percent was recorded in imported flock in S male x H female (3.74±0.93) parents differing non- significantly from all the other parents in the same flock except H male x H female (10.42±0.89). In local-2 flock, the lowest dead germ percent was observed in H male x S female (4.52±0.54) parents which differed non-significantly from all the parental groups in the same flock. In local-1 flock, the lowest dead germ percent was noted in S male x S female (4.22±0.87) parent which differed non-significantly from all of the other parental groups in the same flock. The dead germ percent among different close-bred flocks differed significantly ($P<0.05$). The interaction between parental body weight and close-bred flocks was significant ($P<0.05$).

Dead-in-shell percent

The results of the present study show significant ($P<0.05$) effect of parental body weight on dead-in-shell percent in different close-bred flocks of Japanese quails (Fig. 1B). The minimum dead in shell percent was recorded in S male x H female (2.25±0.83) in local-2 flock followed by that of M male x M female (2.95±1.50) in imported flock, then in S male x M female (4.28±1.48) in local-3 flock, all these showing significant ($P<0.05$) difference from all other parental groups of their respective flocks. In local-1 flock, lower dead in shell percent was noted in M male x M female (5.44±0.77) which differed significantly ($P<0.05$) from that of S male x H female (12.36±2.72) in the same flock. The dead in shell percent in different close-bred flocks differed significantly ($P<0.05$) in all the parental groups except in H male x H female, M male x M female, S male x M female and S male x S female. The interaction between parental body weight and close-bred flocks differed significantly ($P<0.05$).

Infertile egg percent

In the present study, different parental body weights significantly ($P<0.05$) influenced infertility percent in Japanese quails (Fig. 1C). The minimum infertility percent was noted in S male x S female (6.95±1.09) parent of imported flock which differed significantly ($P<0.05$) from that of M male x H female (29.19±2.07) in the same flock. In local-1 and 2 flocks, lowest infertility percent was recorded in H male x S female (12.30±1.28 and 10.92±2.53, respectively) which differed non-significantly in all the other parental groups in their respective flocks. In local-3 flock, the lower infertility percent was noted in M male x M female (9.97±1.68) which differed significantly ($P<0.05$) from that of H male x H female (26.34±3.45) and S male x M female (34.06±16.62) in the same flock. The infertile egg percent in all the close-bred flocks differed significantly ($P<0.05$) from each other. The interaction between parental body size and close-bred flocks was significant ($P<0.05$).

Hatchability percent

In the present study, different parental body weights influenced ($P<0.05$) hatchability percent in Japanese quails (Fig. 1D). The highest hatchability percent was recorded in M male x S female (71.25±13.47) parent of local-3 flock which differed significantly ($P<0.05$) from that of S male x M female (43.77±15.99) in the same flock. In local-1 and local 2 flocks, the higher hatchability percent was recorded in H male x H female (65.88±4.21) and M male x H female (65.23±6.19), respectively, which differed significantly ($P<0.05$) from all the other parental groups in the same flocks. The higher hatchability percent (65.24±4.41) was noted in S male x S female in imported flock which differed significantly ($P<0.05$) from that of M male x H female (42.39±4.14) in the same flock. The hatchability percent among imported and all local flocks in different parental groups differed significantly ($P<0.05$). The interaction between parental body size and close-bred flocks was significant ($P<0.05$).

Mal-positions

During the course of this study no mal-positions were noted.

DISCUSSION

In the present study, dead germ, dead-in-shell and infertile egg percent was significantly ($P<0.05$) influenced by different parental body weight in different close-bred flocks of Japanese quails. These results are fully in line with those of Rehman (2006) who reported significant ($P<0.05$) differences in all the hatching parameters among different local and imported stocks of Japanese quails. The findings of this study further show that dead germ and infertile egg percent differed significantly ($P<0.05$) among different close-bred flocks, whereas, dead in shell percent differed significantly ($P<0.05$) in different close-bred flocks in all the parental groups except in H male x H female, M male x M female, S male x M female and S male x S female parents. These results are in line with those of Gharib *et al.* (2006) who reported significantly higher fertility percent in the smaller line of Fayoumi chickens than that of heavier line. The embryonic mortality during the early period was reported to vary non-significantly (Soliman *et al.,* 1994; Reis *et al.,* 1997; Seker *et al.,* 2004). Ahmad *et al.* (2000) found that light breeds had less embryonic mortality than the heavy breeds. Late embryonic mortality was significantly affected by breed, size and shape of eggs. Joseph and Moran (2005) reported that different selection strategies affected development of the chick embryo and distribution of dead germs was similar among hen sources.

Fertility in Japanese quails can be affected by different factors such as: mating ratio, parental age, rate of laying, climatic and management conditions (Kulenkamp *et al.,* 1973). Higher estimates of fertility percent as 81.7 (El-Fiky, 2002) has been indicated in quails. Marks (1979) reported decrease in fertility percent with increase in body weight of Japanese quails. Rizk *et al*. (2008) reported that eggs from younger birds represented higher significant ($P<0.05$) percentages of fertility compared to those from older layer. Improvement in fertility could be achieved by improving environmental conditions (Magda *et al.,* 2010).

In the present study, hatchability percent was significantly ($P<0.05$) influenced by parental body weight in different close-bred flocks of Japanese quails. The higher hatchability percent (65.24±4.41) was noted in S male x S female imported parent flock which differed significantly ($P<0.05$) from that of M male x H female (42.39±4.14) parent in the same flock. These results are in line with those of Gharib *et al.* (2006) who reported significantly ($P<0.05$) higher hatchability percent in the smaller line of Fayoumi chickens than that of the heavier line. The influence of parent body weight of female (Fasenko *et al.,* 1992) and male (Bramwell *et al.,* 1996) on hatchability has been reported. Marks (1979) reported that hatchability percent decreased with increase in body weight in Japanese quails. Reduced hatchability due to higher body weight on account of obesity in breeding flocks has been indicated (Siegel and Dunnington, 1985). Rizk *et al*. (2008) reported that eggs from younger birds represented higher significant ($P<0.05$) percentages of hatchability compared to those from older layer. The influence on hatchability of various environmental and management factors in the production period, frequency of egg collection (Fasenko *et al.,* 1991), mating ratio (Sainsbury, 1992), time of egg storage (Heier and Jarp, 2001) and improving environmental conditions (Magda *et al.,* 2010) have also been reported from several studies.

CONCLUSIONS

The findings of the present study indicate significant ($P<0.05$) differences in dead germ, infertile egg and hatchability percent and non-significant difference in dead in shell percent in all the close-bred flocks of Japanese quails. With respect to body weight categories, significant ($P<0.05$) differences were found in dead germ, dead in shell, infertile egg and hatchability percent. The interaction between flocks and body size was significant ($P<0.05$) in respect of all the above hatching traits. No mal-positions were noted.

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