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INFLUENCE OF EGG DIMENSION CHARACTERS ON FERTILITY AND HATCHABILITY TRAITS IN WHITE LEGHORN BIRDS

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Traits related with external quality of the eggs have effects on the hatchability and development of the chicks. The most influential egg parameters in hatching are weight, shell thickness, porosity, shape index and the consistency of the contents (Farooq *et al.*, 2001 and Narushin and Romanov, 2002). At least some of the inability to resist fracture damage can be attributed to deficiencies in shell structure and shape. It is also well known that eggs of normal shape hatch more successfully than those misshapen. (Narushin and Romanov, *loc. cit*). The present study focuses on the effect of genetic strain and shape index on egg dimension, fertility and hatchability traits.

Materials and Methods

A total of 1000 randomly collected hatching eggs, 500 each from two strains of single comb White Leghorn, namely IWN and IWP maintained at AICRP on Poultry. Mannuthy centre, aged from 70 to 75 weeks of age were utilized for this study. The weight of all hatching eggs was taken by using an electronic balance to the accuracy of 0.01 g. Egg length and breadth were measured with the aid of vernier calipers, calibrated in mm. Shape index was estimated from the measurements of length and breadth; Shape Index = [egg breadth / egg length] = 100. The eggs based on their shape index were allocated to five shape index classes viz., ≤ 70 (class I), 70.01 to 75 (class II), 75.01 to 80 (class III), 80.1 to 85 (class iv) and > 85 (class v), independently for IWN and IWP strains. The eggs were incubated under standard conditions. During transfer, the eggs were placed in individual hatching boxes in the hatcher compartment in order to facilitate the recording of individual data. The unhatched eggs were classified as early embryonic deaths (EED), dead germs (DG) and dead-in-shell (DIS), out of total eggs incubated, as described by Morton *et al.*, (1965). Hatchability on fertile egg set (FES) was calculated as the ratio of number of good chicks hatched to the total number of fertile eggs incubated. Hatchability on total egg set (TES) was determined as the ratio of number of good chicks hatched to the total number of eggs incubated.

The data were analyzed for strain difference by ANOVA using a Completely Randomized Design (CRD) and the correlation of shape index classes with other traits were examined (Snedecor and Cochran, 1989). The nature of the relationship of fertility, hatchability and embryonic mortality with shape index classes was examined by linear and curvilinear regression analysis (Draper and Smith, 1998).

Results and Discussion

The overall mean of egg weight in IWN strain was significantly (P<0.01) lower in IWN (54.45 ± 0.19 g) compared to IWP (57.81 ± 0.21 g) strain. Similar egg weights have been

reported earlier by Abanikannda *et al.* (2007) in commercial layer chicken.

The mean length (mm) of egg revealed significant (P<0.01) difference for strain (52.92 ± 0.11 and 54.47 ± 0.11 respectively for IWN and IWP strains). The mean egg breadth (mm) in IWN strain (40.72 ± 0.05) was significantly (P<0.01) lower than that of IWP strain (41.28 ± 0.06). The strain differences for egg length and breadth observed in this study were in conformity with the findings of Anderson *et al.* (2004). The mean values of egg length and breadth observed in this study were in close agreement with those reported earlier for RIR chicken (Farooq *et al.*, 2001) and for commercial egg layers (Abanikannda *et al., loc. cit*).

The values of shape index ranged between 67.24 and 92.31 in IWN strain, wherein the range in IWP strain was from 66.67 to 90.74. The results were in agreement with that of Brar *et al.* (2002). The frequency distribution was high in third class in IWN, but it was in second class in case of IWP strain. The overall mean shape index was significantly (P<0.01) higher in IWN (77.18 ± 0.18) compared to IEP (75.88 ± 0.17) strain. Similar genetic difference for shape index among different breeds has been reported earlier by Swatson and Nshalai (2003).

The overall values (%) were statistically similar in both IWN and IWP strains for fertility (98.20 ± 0.60 and 97.00 ± 0.76 respectively), hatchability on total eggs set (82.80 ± 1.68) and 86.80 ± 1.52 respectively), early embryonic death (7.40 ± 1.17 and 5.69 ± 1.03, respectively), dead germs (4.60 ± 1.17 and 2.80 ± 0.74, respectively) and dead-in-shell (3.40 ± 0.81 and 1.80 ± 0.60, respectively). However, the hatchability % on fertile egg set was significantly (P<0.05) higher in IWP (89.48 ± 1.39) compared to IWN strain. (84.32 ± 1.63). The shape index classes within strain showed no significant difference for fertility, hatchability on both fertile and total egg set and for incidence of early embryonic death, dead germs and dead-in-shell. However, Brar *et.al (loc.cit)* observed higher percentage of hatchability in interior classes of shape index rather than the extreme ones. On the other had, Narushin and Romanov *(loc.cit)* found better hatchabililty in round-shaped eggs having higher shape index.

The correlation analysis revealed that the coefficients of correlation between hatchability and other egg dimension characters like shape index, egg weight, egg length and egg breadth were of very low in magnitude and statistically not significant in both IWN and IWP strains and inconsistent in direction between the strains. Low correlation values between egg characters and hatchability have been reported earlier (Rozycka and Wezyk, 1985). In contrast, Farooq *et al.* (*loc. cit*) reported that egg length and breadth had significant correlation with hatchability in chicken. In the present study, the shape index had significantly (P<0.01) higher negative correlation with egg weight (–0.290 and –0.196, in IWN and IWP respectively) and egg length (–0.804 and –0.746, in IWN and IWP respectively). The correlation between shape index and egg breadth was also significantly (P<0.01) higher, but in positive direction in IWN (0.333) and IWP (0.482) strains. Egg weight was significantly (P<0.01) positively correlated with egg length (0.753 and 0.728, in IWN and IWP strains respectively) and egg breadth (0.725 and 0.673 in IWN and IWP strains respectively). Similarly, the correlation between egg length and egg breadth was also significantly (P<0.01) high and positive in direction in IWN (0.333) and IWP (0.222) strains.

The changes in fertility and hatchability traits in relation to shape index class were

subjected to linear
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subjected to linear and curvilinear regression analysis. The linear regression analysis revealed that the coefficients for egg weight (b = –1.21; R^2 = 0.780; P<0.05), egg length (b = –2.11; R^2 = 0.947; P<0.05) and egg breadth (b = –0.73; R^2 = 0.800; P < 0.05) in IWN strain and egg weight (b = : 1.01; R^2 = 0.842; P < 0.05) and egg length (b = – 2.10; R^2 = 0.967; P < 0.05) were significant. Among other fertility and hatchability traits, DG in IWN (b = –1.45; R^2 = 0.849; P < 0.01) and EED in IWP (b = – 1.74; R^2 = 0.917, P<0.01) strain had significant linear regression on shape index classes. Significant curvilinear relationship was found to exist in egg length (R^2 = 0.998; P<0.05) and egg breadth (R^2 = 0.982; P < 0.05) in IWN strain and egg weight (R^2 = 0.995; P<0.01) in IWP strain. Fertility (R^2 = 0.970) and hatchability on TES (R^2 = 0.958) in IWN and DIS (R^2 = 0.980) and EED (R^2 = 0.982) in IWP strain also depicted significant (P<0.05) curvilinear relationship with the shape index classes. No information is available to make any useful corroboration.

Summary

The effect of the shape index of 500 eggs each for IWN and IWP strains of white leghorn which were classified based on the shape index classes, was examined for fertility and hatchability traits. Significantly higher weight, length and breadth were observed for the eggs of IWP strain compared to those of IWN. The mean shape index was significantly (P<0.01) higher in IWN compared to IWP strain. Hatchability of fertile eggs were significantly (P<0.05) higher in IWP compared to IWN strain. None of the traits studied had significant difference among shape index classes within the strain. Shape index had significant (P<0.01) positive association with egg weight and length and significant (P<0.01) negative association with egg breadth in both the strains. Regression analysis revealed significant linear reduction in egg weight and egg length in both the strains and egg breadth in IWN strain with increasing shape index class. Significant linear regression also observed in per cent dead germs in IWN and early embryonic deaths in IWP with increasing shape index class. Significant curvelinear association of shape index with fertility and hatchability on total egg set in IWN and dead in shell and with early embryonic deaths in IWP strain existed.

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