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Egg Traits and Hatching Performance of Desi, Fayumi and Rhode Island Red Chicken

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Abstract: Egg and shell weight, egg length and width, % hatchability, fertility, loss in egg contents during incubation and weight of newly hatched chicks were studied in 120 eggs (40 eggs each of Fayumi, Rhode Island Red (RIR) and Desi chicken). %hatchability on the basis of total eggs set and on the basis of fertility was higher in Fayumi (65.96± 0.07 vs. 88.57± 0.08%) than in Desi (60.00± 0.18 vs. 61.76± 0.08%) and RIR chicken (42.86± 0.07% vs. 80.77± 0.10%). Higher fertility was found in Desi (74.47± 0.08%) than in Fayumi (64.71± 0.23%) and RIR chicken (53.06± 0.45%). Larger egg weight and chicken weight was found for RIR (53.94± 0.69 vs. 35.32± 0.86 g) than for Desi (45.88± 0.67 vs. 33.84± 0.83 g) and Fayumi chicken (44.84± 0.54 vs. 30.74± 0.72 g). Egg weight was found significantly and positively correlated (r= 0.4962) with hatching chick weight. Percent loss in egg contents was higher in RIR (24.41± 0.42%) than in eggs of Fayumi (22.11± 0.36%) and Desi chicken (19.18± 0.38%). Egg shell weight was larger in RIR (4.77± 0.09 g) than in Fayumi (4.54± 0.09 g) and Desi chicken (4.46± 0.06 g). Shell was thicker in RIR (0.39± 0.01 mm) and Fayumi (0.38± 0.01 mm) than in Desi chicken (0.34± 0.02 mm). Egg length (5.57± 0.03 cm) and width (4.19± 0.02 cm) were higher in RIR chicken than in Desi (5.26± 0.03 vs. 3.96± 0.02 cm) and Fayumi eggs (5.17± 0.03 vs. 3.93± 0.02 cm). Egg length to width ratio was around 1.33 and non-significant differences were found in all types of chicken. Egg length (r= 0.446) and width (r= 0.426) was found significantly correlated with hatching chick weight. Egg weight (r= 0.184), shell weight (r= - 0.504), egg length (r= 0.581) and width (r= 0.78) were also found significantly correlated with hatching chick weight. On the other hand egg length (r= -0.187) and width (r= -0.181) were found negatively and significantly correlated with % hatchability. On overall basis Fayumi chicken performed better than RIR and Desi chicken.

Key words: Egg, shell, and chick weight, egg length and width, % hatchability

Introduction

Hatchability is a function of chicks hatched and is affected by numerous factors namely fertility, egg quality, handling of eggs and management conditions during incubation and hatching. It also varies from breed to breed (Farooq *et al.*, 2000a; 38.82 and 65 % hatchability, respectively in eggs of Desi and Fayumi chicken). Fertility and egg quality are the two most important factors affecting hatchability, if management would not be a limiting factor during the process of incubation and hatching. Fertility would affect hatchability. Hatchability is reduced with reduced fertility. Murad *et al.* (2001) also reported higher hatchability (85.43%) on the basis of fertile eggs than that on the basis of total eggs set (81.5%).

Egg quality is another aspect affecting hatchability. Egg weight, egg shape (width and length), shell weight and thickness are used as external indicators for detecting quality of eggs. Egg weight plays an important role in hatchability and also influences the weight of day old chicks (Farooq *et al.*, 2000a). Too large and too small eggs have been reported to cause problems in incubation and adversely affect the hatchability. Kalita (1994) reported higher hatchability for medium eggs (51-55 g) than for small (45-50 g) or large sized eggs (56-60 g). Hatchability was found to be lower for thin-shelled eggs (67.76%) than for thick-shelled eggs (78.85%; Ahmed *et al.*, 1983). The present study was an effort to investigate egg traits and hatching performance of eggs of Rhode Island Red (RIR), Fayumi and Desi chicken.

Materials and Methods

A study was planned to investigate various egg parameters namely egg weight, egg length and width, length to width ratio, shell weight and thickness, fertility, hatchability, loss in egg content during incubation and weight of newborn chick in eggs of Desi (non-descript local chicken), Fayumi and RIR chicken. One hundred and twenty eggs (40 each) from Desi, Fayumi and RIR chicken were collected and egg weight, length and width were recorded. Each egg was given a separate identification number and on day 19th, all the eggs were transferred to individual boxes set in the hatcher for facilitation of data on individual basis. The data were analyzed, using relevant statistical techniques namely univariate, correlation analysis and General Linear Model (GLM) procedure (Steel and Torrie, 1981). To ascertain the affect of type of chicken on egg weight, following statistical model was constructed,

$$y_{ij} = \mu + a_i + e_{ij}$$

Where "y_{ij}" were the j-th observations on egg weight of I-th type of chicken, "μ" was population constant common to all observations, "a_i" indicating the effect of I-th type of chicken (I = RIR, Fayumi and Desi chicken) and "e_{ij}" was the residual term associated with each y_{ij}, assumed to be normally identical and independently distributed with zero mean and variance 1. A similar model was employed to ascertain the affect of type of chicken on egg length and width, egg shell weight and thickness, percent hatchability and loss in egg content and weight of newly hatched chick.

Correlations between egg weight, length, width, length to width ratio, shell weight and thickness, per cent loss in egg content and hatching chick weight were also calculated.

Results and Discussion

Type of chicken had a significant ($p< 0.01$) effect on egg and hatching chicken weight. Larger ($p< 0.05$) egg weight was found for RIR (53.94± 0.69 gm) than that for scavenger Desi (45.88± 0.67 gm) and Fayumi chicken (44.84± 0.54 gm; Table 1). Ali *et al.* (1993) reported smaller egg weight (44.1 g) in Fayumi birds under local conditions in Bangladesh than that observed

Table 1: Comparison of percent hatchability, fertility, loss in egg content and egg traits of Desi, Fayumi and RIR chicken

Trait	Desi Scavenger	Fayumi eggs produced under farm conditions	RIR eggs produced under farm conditions
Hatchability on the basis of total eggs set (%)	61.76_{ab}± 0.08	65.96_{a}± 0.07	42.86_{b}± 0.07
Hatchability on the basis of fertile eggs (%)	60.00_{c}± 0.18	88.57_{a}± 0.08	80.77_{b}± 0.10
Fertility (%)	74.47_{a}± 0.08	64.71_{b}± 0.23	53.06_{c}± 0.39
Loss in egg content (%)	19.18_{c}± 0.38	22.11_{b}± 0.36	24.41_{a}± 0.42
Egg weight (g)	45.88_{b}± 0.67	44.84_{c}± 0.54	53.94_{a}± 0.69
Chick weight (g)	33.84_{b}± 0.83	30.74_{b}± 0.72	35.32_{a}± 0.86
Egg shell weight (g)	4.46_{c}± 0.06	4.54_{b}± 0.09	4.77_{a}± 0.09
Shell thickness (mm)	0.33_{b}± 0.01	0.38_{a}± 0.01	0.39_{a}± 0.01
Length of egg (cm)	5.26_{b}± 0.03	5.17_{c}± 0.03	5.57_{a}± 0.03
Width of egg (cm)	3.96_{b}± 0.01	3.93_{b}± 0.02	4.19_{a}± 0.02
Length width ratio	1.32_{a}± 0.04	1.33_{a}± 0.06	1.33_{a}± 0.03

* Means with different subscripts for each trait (across the rows) were significantly different at $\propto = 0.05$

Table 2: Pearson's correlation analysis of egg, and shell weight, egg length, and width, egg length to width ratio and chick weight of Desi, Fayumi and RIR chicken

Traits	Egg weight	Shell weight	Shell thick-ness	% Loss in egg content	Egg length	Egg width	Length to width ratio
% Hatch-	-0.123				-0.187	-0.18	-0.031
ability	0.1641				0.0330	0.040	0.728
Chick	0.4962	0.1104	-0.157	-0.4961	0.4460	0.426	0.0500
weight	0.0001	0.3521	0.1844	0.0001	0.0001	0.001	0.6740
Egg		0.1364	0.0208	0.41342	0.7707	0.814	0.6749
weight		0.2496	0.8615	0.0003	0.0001	0.001	0.4455
Shell				-0.0643	0.0323	0.168	-0.132
weight				0.5942	0.7861	0.155	0.2664
Shell				0.17947	0.0052	-0.09	0.0974
thickness				0.1342	0.9653	0.418	0.4125
% Loss in					0.3032	0.207	0.1795
egg con-tent					0.0102	0.084	0.2460
Egg						0.562	0.5541
length						0.001	0.0001
Egg							-0.373
width							0.0001

in the present study. Similarly, Farooq *et al.* (2001) in Peshawar, Pakistan and Dutta (1993) in India reported smaller egg weights (42.62 and 41.36 g, respectively) whereas, Farooq *et al.* (2000a) reported a little larger egg weight in Fayumi (46.36 gm) and Desi chicken (46.24 gm) than the present findings. The higher egg weight in RIR than Fayumi and Desi chicken could be attributed to its genetic potential for the production of large sized egg. In addition, RIR is a well established breed than Fayumi and Desi chicken and selection for better egg size might have been made generation after generation. Weight of the newborn chick was also higher ($P< 0.05$) in RIR (35.32± 0.86 gm) than in Desi (33.84± 0.67 gm) and Fayumi chicken (30.74± 0.72 gm). Farooq *et al.* (2000a) reported a little higher chick weight in Fayumi (36.14 gm) and Desi (34.02 gm) than the present findings. The higher weight of newborn chick of RIR could probably be due to larger egg size than Desi and Fayumi chicken as is evident from Table 1. Egg weight was also found significantly ($P< 0.01$) and positively correlated ($r= 0.4962$) with hatching chick weight (Table 2), suggesting that increased egg weight will result in increased hatching chick weight. Narkhede *et al.* (1981) also reported positive correlation ($r= 0.93$) of egg weight with hatching chick weight in crossbred chicken (Rhode Island Red x White Leg Horn). On the other hand egg weight was found non-significantly but negatively correlated ($r= þ0.123$) with hatchability. So increased egg weight would result in decrease of hatchability. Kalita (1994) reported higher hatchability for medium eggs (51-55 g) than for small (45-50 g) or large sized eggs (56-60 g). However, comparison of hatchability in relation to egg weight revealed non-significant differences. Thus, findings may not lead to a valid conclusion because, most of the eggs with larger weight were infertile than others in the present study. It would be rather misleading to report present hatchability on the basis of egg weight. However, keeping in view findings of Kalita (1994) whose report suggested that too large eggs must be discarded while setting eggs in the incubator, which is true because too large eggs may create problems in incubation process.

Per cent loss in egg contents was significantly higher ($p< .05$) in eggs of RIR (24.41± 0.42%) than in eggs of Fayumi (22.11± 0.36%) and Desi chicken (19.18± 0.38%). Murad *et al.* (2001) reported similar losses in egg content of Fayumi (21%) and higher in case of Desi chicken than the present findings. The higher losses in egg content of RIR chicken could probably be due to its larger egg length and width than Desi chicken. Because, wider eggs might have been more prone to direct incubating temperature than narrow eggs.

Type of chicken had a significant effect ($p< 0.01$) on per cent hatchability. Per cent hatchability on the basis of total eggs set was significantly higher ($P< 0.05$) in eggs from Fayumi (65.96± 0.07%) and Desi chicken (61.76± 0.08) than in RIR eggs (42.86± 0.07%; Table 1). Similarly, hatchability on the basis of fertile eggs was higher ($p< 0.05$) in Fayumi (88.57± 0.08%) than in RIR (80.77± 0.10%) and Desi chicken (60.00± 0.18%; Table 1). Farooq *et al* (2000b) reported a similar hatchability in eggs of Desi chicken maintained by untrained farmers and higher hatchability (84.05%) for trained farmers on the basis of total number of eggs set under a broody hen. However, in another study less %hatchability was reported in Desi (38.82%) and Fayumi chicken (51%) than the present findings (Farooq *et al.*, 2000a). The smaller percentage hatchability in RIR chicken on the basis of total eggs set could probably be due to smaller fertility (53.06± 0.45%). On the other hand higher hatchability

in RIR and Fayumi eggs on the basis of fertile eggs could be attributed to their genetic make up for better propagation than Desi chicken. Desi chicken is indigenous non-descript with no well documented characters for better hatchability.

Higher ($P< 0.05$) fertility (74.47± 0.08%) was observed in eggs of Desi than in eggs of Fayumi (64.71± 0.23%) and RIR chicken (53.06± 0.45%). Murad *et al.* (2001) reported higher fertility (95.5%) in Fayumi chicken than the present findings. The lower fertility in eggs of RIR and Fayumi chicken could be attributed to poor management and improper proportion of males or poor ability of males in the flock to produce viable sperm.

Type of chicken had a significant effect ($p< 0.01$) on shell weight and thickness. Egg shell weight was significantly larger ($p< 0.05$) in RIR (4.77± 0.09 gm) than in Fayumi (4.54± 0.09) and Desi chicken (4.46± 0.06 gm). Similarly, shell was thicker ($p< 0.05$) in RIR (0.39± 0.01 mm) and Fayumi (0.38± 0.01 mm) than in Desi chicken (0.34± 0.02 mm; Table 2). Farooq *et al.* (2001) reported a little larger shell weight (4.60 gm) and smaller shell thickness (0.34 mm) in Fayumi chicken than the present findings. Egg shell weight could adversely affect hatchability. Ahmed *et al.* (1983) also reported low hatchability in thin shell eggs (67.76%) than in thick shell eggs (78.85%). Thus, shell weight may not affect the hatchability, rather shell thickness would affect hatchability of fertile eggs. Poor or thin shell eggs could hatch rarely. Roque and Soares (1994) also reported that thick shell eggs had increased hatchability as a result of higher fertility and lower intermediate and late embryonic mortalities. Shell weight was found significantly ($P< 0.01$) but negatively correlated ($r = -0.504$) with weight of hatching chick (Table 2). Findings of the present study suggested that increased shell weight will result in reduced weight of hatching chicks.

Type of chicken had a significant effect on egg length, and width. Egg length (5.57± 0.03 cm) and width (4.19± 0.02 cm) was significantly larger in eggs of RIR chicken than in Desi (5.26± 0.03 vs. 3.96± 0.02 cm) and Fayumi eggs (5.17± 0.03 vs. 3.93± 0.02 cm; Table 1). Farooq *et al.* (2000a) reported a similar egg length, and width in Desi chicken and Fayumi chicken. Egg length to width ratio was around 1.33 and differences in egg length ratio of all type of chicken were nonsignificant. Egg length ($r= 0.446$) and width ($r= 0.426$) were also found significantly ($p< 0.01$) correlated with hatching chick weight, suggesting that increased egg width or length will be accompanied by increased chick weight. On the other hand egg length ($r= -0.187$) and width ($r= -0.181$) were found negatively and significantly ($p< 0.04$) correlated with per cent hatchability. The findings suggested that increased egg length and width would result in decreased hatchability of eggs.

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