

**Original Article**

**Assessment of body weight, egg quality traits and some selected serum electrolyte concentration (Na, K, Ca and P) of three different breeds of pigeon at Rajshahi region, Bangladesh**

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**ABSTRACT**

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Pigeons are reared in Bangladesh principally with the interest of nutrition, recreation, religious attitude and an income source to earn a livelihood. The study was conducted for the assessment of characteristics of eggs and serum electrolytes concentration (Na, K, Ca and P) of Lakkha, Khaki and Shiraz pigeon's breeds. Three pairs of each breed were reared in cage with commercial feed and water. After laying eggs, the length and width of eggs were recorded. After hatching of eggs, egg shell thickness was recorded. Thickness of eggshell was  $0.20 \pm 0.01$  mm,  $0.13 \pm 0.00$  mm,  $0.21 \pm 0.01$  mm for Lakkha, Khaki and Shiraz breeds respectively. The squabs were sacrificed on the 45<sup>th</sup> day after recording body weights and the blood sample was collected and serum sodium, potassium, calcium and phosphorus were analyzed. Serum sodium, potassium, calcium and phosphorus concentrations were:  $(96.35 \pm 5.20)$  mmol/L,  $(12.11 \pm 0.60)$  mmol/L,  $(5.89 \pm 0.67)$  mmol/L and  $(4.87 \pm 0.33)$  mmol/L for Lakkha breed;  $(102.96 \pm 2.14)$  mmol/L,  $(12.31 \pm 1.58)$  mmol/L,  $(5.80 \pm 0.76)$  mmol/L and  $(4.75 \pm 0.31)$  mmol/L for Khaki breed;  $(103.53 \pm 0.93)$  mmol/L,  $(12.23 \pm 0.60)$ ,  $(5.85 \pm 0.52)$  mmol/L and  $(4.68 \pm 0.17)$  mmol/L for Shiraz breed respectively. A positive correlation between serum calcium and thickness of eggshell was found in Shiraz and khaki breed respectively. On the other hand, a positive correlation was found between eggshell thickness and squab body weight only in the Shiraz breed. It could be concluded that serum calcium and body weight having a potential positive effect on eggshell thickness of corresponding pigeon breed.

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**Introduction**

In Bangladesh, the pigeon is one of the valuable species of poultry, reared conventionally by the poor farmers in rural areas for maintaining their livelihood. This is also reared by the people in urban areas as a symbol of recreation. The contribution of pigeons has not yet been considered in relation to the contribution of livestock sub-sector and whole poultry production though the pigeons provide an alternative source of animal protein (Asaduzzaman *et al.*, 2009). Nowadays, Pigeon rearing has become very popular in Bangladesh and the rise of pigeon lovers is increasing because the practice of pigeon farming as fancy bird is becoming bigger. Pigeon meat is very lean, having high nutritional value, easily digestible, low fat content and rich in proteins, minerals and vitamins (Pomianowski *et al.*, 2009). The establishment of a special relationship between pigeons and man over a period of thousands of years has created a

volume of information about the digestive processes, nutritional habits, feeding and breeding in the pigeon (Griminger, 1983). The growth and reproduction of all species of animal depend largely on feeding habit. The length of the major axis of the eggs was shorter in pigeons fed the lower levels of dietary protein, resulting in eggs that appeared to be rounder. Dietary energy and protein have little effect on egg component percentages, although protein alters some eggshell characteristics (Bu *et al.*, 2015). Biochemical analyses of serum and determination of serum electrolytes are very important components that maintain homeostasis, the transmission of nerve impulse, contraction of muscle, ovulation, ovarian steroidogenesis. When any deviation from normal level of electrolyte occurs, disease condition develops in the body (Mohammadiha, 1991). Sodium level helps to indicate the dehydration status of individuals. Increased K level may indicate kidney failure,

dehydration or may lead to heart failure. P elevations are always associated with kidney disease, hyperthyroidism and bleeding disorders (Tisdall et al., 2006). The plasma Ca and P, eggshell Ca and P levels of chicken were affected by Ca levels and vitamin D<sub>3</sub> (Bolkubasi, 2005). It was seen in hens that different amount of ions in the diet could not have a significant effect on the percent of fertility, hatchability and sex ratio of chicks (Saleh et al., 2010), but there is a positive correlation between the egg hatchability and the nutrients in the pigeon's diet (Wolter et al., 1970). The pigeon health, reproductive performance and disease compared to that of other poultry species have yet to receive much attention from the relevant authority and experts in Bangladesh. However, very little information is available on the serum electrolyte concentrations and their effect on eggs characteristics. Therefore, the present study was performed to determine the body weight of squabs, different characteristic of eggs and some selected serum electrolytes concentration (Na, K, Ca and P) of Lakkha, Khaki and Shiraz pigeon breed.

## Materials and Methods

### Study design

In Rajshahi region of Bangladesh, two farms were selected after making a preliminary survey. For the proposed experiment, three different pigeon breeds (Lakkha, Khaki and Shiraz) have been selected in these farms. For every breed, 3 pairs of pigeons were brought under investigation on their eggs and squabs. After the eggs being laid on the nest, the eggs were observed for diameter and the rate of egg hatchability were assessed.

### Management practices

All birds were supplied with traditional feed and fresh drinking water ad libitum throughout the experimental period. The body weight of the squabs was recorded on the 7<sup>th</sup> day after the eggs were hatched, which was repeated on the 45<sup>th</sup> day after they came out of egg. The squab was sacrificed for the collection of blood on the 45<sup>th</sup> day. The farms were safe enough from wild predators or other biological hazards.

### Production of egg and measurement of egg diameter

Every pair of pigeons were mated within a couple of days and produced two eggs in 18 to 25 days at the age of seven months. First and second egg were identified, marked and the width and length of the eggs were recorded very carefully. The first egg is usually slightly larger than the second.

### Hatching of egg and production of squab

After the egg production, both sex was began incubating the eggs. The eggs took 18-19 days to hatch and every couple brought two squabs. The date was recorded and squab was identified (first and second) as the eggs were marked. After the eggs being hatched, egg shells were collected and shell thickness was recorded.

### Blood collection and preparation of serum

Pigeons were sacrificed on the 45<sup>th</sup> day and blood was collected in the test tube marked with the name, date and other characters of the corresponding breed. After collecting blood sample, test tubes were kept in a slanting position for 6 hours and then incubated in the refrigerator at 4°C overnight. Finally, serum was collected and centrifuged, so that unwanted blood cells were eliminated. All the procedures of

serum collection were done very carefully to avoid contamination.

### Analysis of the samples

Measurement of phosphorus was done by spectrophotometry method mentioned by Darcie and Lewis (2011). Determination of calcium, sodium and potassium of serum were carried out by flame photometry (Corning 410, Sherwood Scientific Limited, UK) as described by Kirk and Sawyer (1991).

### Statistical analysis

All data were subjected to statistical analysis using SPSS 20 program by one-way ANOVA followed by post-hoc Turkey's test.

## Results and Discussion

### Body weight and hatchability of eggs of Lakkha, Khaki and Shiraz pigeon's breed

Body weights of squab on 7<sup>th</sup> and 45<sup>th</sup> day and hatchability are shown in Table 1. The body weight of squab of Lakkha breed at 7<sup>th</sup> and 45<sup>th</sup> day was 147.60±9.20 gm and 293.80±29.12 respectively with 80% hatchability. The body weight of squab of Khaki breed was 86.40±4.03 gm at 7<sup>th</sup> day and 254.4±18.27 gm at 45<sup>th</sup> day. The Khaki breed represents a hatchability of 90%. The body weight of squab of Shiraz breed at 7<sup>th</sup> day was 252.40±12.66 gm and at 45<sup>th</sup> day was 359.40±11.86 gm. The breed hatchability was 80%. Slight differences in case of body weight gaining of squab on the 45<sup>th</sup> day were observed because of breed variations.

**Table 1. Body weight of corresponding pigeon squab at 7<sup>th</sup> and 45<sup>th</sup> day and hatchability of eggs.**

Breed of pigeon	Squab body weight (gm)		Hatchability (%) (n=10)
	Weight at 7 <sup>th</sup> day	Weight at 45 <sup>th</sup> day	
Lakkha	147.60±9.20 <sup>a</sup>	293.80±29.12 <sup>b</sup>	80.00
Khaki	86.40±4.03 <sup>a</sup>	254.4±18.27 <sup>b</sup>	90.00
Shiraz	252.40±12.66 <sup>a</sup>	359.40±11.86 <sup>b</sup>	80.00

Values with different superscripts differ significantly (p<0.05) in the same row.

### Eggshell thickness, width and length of egg of Lakkha, Khaki and Shiraz pigeon's breed

Parameters of eggs of three different breeds are displayed in Table 2. Thickness of eggshell was 0.20±0.01 mm, 0.13±0.00 mm, 0.21±0.01 mm for Lakkha, Khaki and Shiraz breed respectively. The width and length of egg was 29.77±0.07 mm and 41.24±2.05 mm for Lakkha; 24.16±0.38 mm and 35.32±0.87 mm for Khaki; 29.78±0.11 mm and 40.45±1.11 mm for Shiraz breed respectively. In reference to the normal value, none of the parameters showed any deviation. The dimensions of eggs laid by Lakkha and Shiraz were comparable with those of the eggs of feral pigeons studied by Nam and Lee (2006), and Nisianakis et al. (2009). The eggs of all breeds of pigeons had thinner shells than the eggs of feral pigeons (Nam and Lee, 2006). But the breeds had similar eggshells, egg length and egg width with the breed of Budapest Short Face Tumblers and Polish Shield Highfliers (Gugotek et al., 2013).

**Table 2. Characteristics of egg of different breeds of pigeon.**

Breed of Pigeon	Parameters of egg		
	Thickness of eggshell (mm)	Width of egg (mm)	Length of egg (mm)
Lakkha	0.20±0.01	29.77±0.07	41.24±2.05
Khaki	0.13±0.00	24.16±0.38	35.32±0.87
Shiraz	0.21±0.01	29.78±0.11	40.45±1.11

**Serum electrolyte concentrations of Lakkha, Khaki and Shiraz pigeon’s breed**

Table 3 represents the values of serum electrolytes (Sodium, Potassium, Calcium and Phosphorus) concentration of selected three breeds. Serum Sodium concentration was (96.35±5.20) mmol/L, (102.96±2.14) mmol/L and (103.53±0.93) mmol/L in Lakkha, Khaki and Shiraz pigeon’s breed respectively. Serum Potassium concentration of Lakkha was (12.11±0.60) mmol/L, Khaki was (12.31±1.58) mmol/L, and Shiraz was (12.23±0.60) mmol/L. Serum Calcium concentration of Lakkha was (5.89±0.67) mmol/L, Khaki was (5.80±0.76) mmol/L, and Shiraz was (5.85±0.52) mmol/L. Serum Phosphorus concentration was (4.87±0.33) mmol/L, (4.75±0.31) mmol/L and (4.68±0.17) mmol/L in Lakkha, Khaki and Shiraz pigeon’s breed respectively. These parameters are closely associated with reference values showed no deviation from normal. These findings are in close agreement with the works reported by Lumeij and Bruijne (1985). In reference to the normal values, a slight fluctuation among electrolytes was observed. This type of relation is due to breed differences of pigeon.

**Table 3. Serum electrolytes concentration of corresponding pigeon squab (n=5; N=18).**

Breed	Sodium (mmol/L)	Potassium (mmol/L)	Calcium (mmol/L)	Phosphorus (mmol/L)
Lakkha	96.35±5.20	12.11±0.60	5.89±0.67	4.87±0.33
Khaki	102.96±2.14	12.31±1.58	5.80±0.76	4.75±0.31
Shiraz	103.53±0.93	12.23±0.60	5.85±0.52	4.68±0.17

**Relationship of serum calcium with eggshell thickness and eggshell thickness with final body weight of the squab at 45<sup>th</sup> day for corresponding three breeds**

The correlation of serum calcium with eggshell thickness and eggshell thickness with body weight of squab is presented in Table 4. There is a positive correlation between calcium and thickness of eggshell, which is similar with previous findings of Nisrin et al. (2013). Serum calcium levels of Shiraz and Khaki breed are strongly correlated with eggshell thickness. Calcium may help in the formation of eggshell and it is thought that calcium of circulating blood deposits on eggshell and maintains its thickness. On the other hand, a positive correlation is found between eggshell thickness and squab body weight in Shiraz breed. But in Khaki and Lakkha breed, egg shell thickness and body weight are not significantly correlated with the previous reports of Yamak et al. (2015).

**Table 4. Correlation of serum calcium with eggshell thickness and eggshell thickness with final body weight of the squab at 45<sup>th</sup> day.**

Parameters	Eggshell Thickness			Squab body weight on 45 <sup>th</sup> day		
	Lakkha	Khaki	Shiraz	Lakkha	Khaki	Shiraz
Serum Calcium	0.16	0.91*	0.97*			
Eggshell thickness				0.03	0.74	0.96*

Values with superscript indicate significant ( $t > 2.776$ ) correlation between the parameters.

Here t value is calculated at 5% level of significance.



**Figure 1. Shiraz pigeon breed.**



**Figure 2. Khaki pigeon breed.**



**Figure 3. Lakkha pigeon breed.**



**Figure 4. Eggs of Lakkha pigeon breed.**



**Figure 5. Lakkha squab.**

**Conclusion**

In Bangladesh, most of the pigeon farmers rear pigeon in small scale scavenging system with supplementary feeding. They have no idea about breed, variety and prevention of common diseases. The present research could be helpful for poultry specialists and pigeon farmer by providing a gateway in regard to serum electrolytes and eggs morphometry connection. Pigeon farming may be increased in future by providing training facilities to farmers. Introduction of improve breeds and varieties may ensure better income and employment opportunity.

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### Authors' contribution

MK Islam designed the experiment, and KM Sujan performed the experiment and wrote the draft. SH Tareq and M Biswas analyzed the data and interpreted the results. KM Sujan and MK Islam critically revised the manuscript.

### Conflict of interest

The author declares that no conflict of interest exists.

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