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Morphometric Analysis of Eggs Collected from Moga, PAU and Industrial Area of Ludhiana

KEYWORDS: Calcium content, Egg morphometry, Egg parameters, Pigeon

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ABSTRACT *The present study was planned with an objective to carry out morphometric analysis of Pigeon's eggs collected from Moga, PAU (Punjab Agricultural University) and industrial area of Ludhiana. Egg length, width and weight were measured using vernier caliper and portable weighing balance, respectively, in laboratory. The egg parameters like egg volume, specific gravity, shape index, calcium carbonate content and eggshell thickness were calculated. Weight of egg components (yolk, albumen and shell) were also measured using weighing balance. Results were statistically analyzed using ANOVA. Egg weights, weights of egg albumen and eggshell differed significantly at 5% level of significance among the eggs collected from different locations. Eggshell thickness and calcium carbonate content were significantly higher in eggs collected from Moga, PAU and industrial area of Ludhiana. Significant variations in the morphometry and egg parameters are due to the different location, feeding habits and different environment where the birds live.*

INTRODUCTION

Eggs are one of nature's most nutritious and economical foods in the daily diet. Eggs are included in several food products for various functions (Leggli et al., 2010). Morphometrics in general refers to measurements of the body parts. The knowledge and information on morphometric parameters is therefore essential for understanding an animal and its reproductive biology in particular (Danilov, 2000). Egg morphometric parameters such as egg weight, egg width, albumen and yolk weights are very important in poultry because these factors influence egg quality and grading, reproductive fitness of the chickens and embryonic development (Onagbesan et al., 2007). Effects of feed (Shapira, 2010) and housing system (Wang et al., 2009) on egg composition and its quality have also been reported. Internal egg quality parameters such as albumen weight and yolk weight are very important from nutritional and cholesterol content for human consumption (Sparks, 2006). Egg characteristics of Fayoumi (Islam, 2005), broiler chickens (Mamun, 2005) and indigenous fowl (Sarker, 2006) have previously been reported. In recent years egg quality traits of various chicken breeds (Islam & Dutta, 2010) revealed results that are important to poultry breeders.

MATERIALS AND METHODS

Eggs were collected from nest and brought to laboratory and stored in refrigerator at 4°C until analysis (within two days of collection). A total of 22 eggs from Moga, 11 eggs from PAU Ludhiana, and 15 eggs from industrial area of Ludhiana were collected from Feb 2015 to June 2015. Egg length (mm) and width (mm) were measured using digital vernier caliper while egg weight (g) was measured using a portable digital weighing balance. Egg volume was estimated from length (L) and breadth (B), data were calculated using an empirical formula ((0.457)*(L)*(B^2)*10-^{3}ml) calibrated to Northern Lapwing eggs by Galbraith (1988). Specific gravity (Egg weight (g)/Egg volume (cm^3)) and shape index ([egg width/egg length]*100) were determined according to Stadelman and Cotterill (1995). Weights of the egg shell, yolk and albumen materials were determined using an electronic weight balance after cracking the shell and separating the yolk from albumen materials. Percentages of egg components (shell, yolk and albumen materials) as a ratio to total egg weight were determined by using the equation below (Stadelman & Cotterill, 1995):

$$\text{Egg component percentage} = \frac{\text{Component weight (g)}}{\text{Egg weight (g)}} \times 100$$

Eggshell thickness was measured using travelling microscope. Three little air-dried egg shell pieces were randomly taken from the egg shell and on all three pieces of the egg shell three measurements were taken. The three measurements (mm) were averaged to get a mean value for the egg shell thickness as outlined in the procedure by Dirksen and Boudewijn (2001). For the determination of $CaCO_3$, entire egg shell was taken and inner membrane removed. After crushing the entire contents in a pestle and mortar the powder was put in 250 ml beaker. To it 50 ml of 3 M HCl was added and stirred. After waiting for some time when the bubbling stopped and foam disappeared, the mixture was filtered and dried overnight. The leftover substance was egg shell, not calcium carbonate. Then the mass and percent composition of calcium carbonate was calculated as outlined by Butcher and Miles (2000).

The data were statistically analyzed by analysis of variance (ANOVA) using computer software CPCS1.

RESULTS AND DISCUSSION

Egg weight, length and width

During the study period the variation in the weight of eggs and dimensions (length and width) were recorded for the eggs collected from Moga, PAU and industrial area of Ludhiana (Table 1). The egg weight was significantly different among the eggs collected from three locations. Egg weight of eggs collected from PAU was significantly higher as compared to eggs collected from Moga and industrial

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area of Ludhiana. According to Kabir et al. (2012), average egg weight of pigeon egg was 11.70 ± 0.82 g which was less than the mean egg weights of eggs collected from PAU, Moga and industrial area, Ludhiana. Ibrahim and Sani (2010) reported that mean egg weight of street pigeons (*Columba livia*) was 14.46±0.11 gm which was less then mean egg weight of eggs collected from PAU but more than the eggs collected from Moga and industrial area, Ludhiana. Egg weight of Dove and Quail were recorded as 9.40±0.52 and 10.90±1.73 g respectively (Kabir et al., 2012). The reason of this differentiation may be genetic or environmental conditions. Because, the egg size in birds is determined genetically with an efficiency factor to 70%, while the effects of environmental conditions, such as feeding resources, altitude and ambient temperature at last 3-4 days before egg-laying, are relatively restrained (Foger & Pegoraro, 1996).

According to Saxena et al. (2008), egg length and width of pigeon (*Columba livia*) were 36.80 mm and 28.50 mm, respectively which were slightly more than the mean egg length and egg width of eggs collected from PAU, Moga and industrial area, Ludhiana. Egg length of Dove and Quail were 3.26±0.08 and 3.15±0.09 cm respectively while egg width of Dove and Quail as recorded by Kabir et al. (2012) were 2.30±0.08 and 2.41±0.09 cm respectively. Egg weight, length and width of Red Wattled Lapwing were recorded as 19.02±0.27 g, 41.41±0.33 mm and 30.39±0.14 mm respectively (Kaur 2013).

Egg volume, specific gravity and shape index

During the study period, 12 different egg parameters including egg volume, shape index, weight of egg albumen, yolk and shell along with their proportions in egg, specific gravity, egg shell thickness and calcium carbonate in egg shell were estimated. According to Kabir et al. (2012) mean egg volume and shape index of pigeon eggs are 14.97 ± 1.97 cm^3 and 71.50 ± 1.64 respectively. Egg volume observed in the present study was significantly less while egg shape index was significantly higher than the egg volume and shape index reported by Kabir et al. (2012). Egg volume can be used as predictor of hatchling weight in the brown-headed Cowbird (Nolan & Thompson, 1978). Egg shape index is one of considerable physical parameter; eggs with normal shape have higher hatchability. Shape index affects the hatching results and also that eggs of abnormal shape index should not be used for hatching (Erol & Ismail 2015).

Egg volume of Dove and Quail were recorded by Kabir et al. (2012) as 9.05±0.84 and 9.59±0.81 cm^3 respectively while shape index of Dove and Quail were 70.55±1.49 and 76.54±3.04 respectively. Specific gravity of an egg indicates the quantity of shell relative to other components of the egg. Differences in specific gravity among eggs of similar weights are mainly due to variations in the amount of shell (Butcher & Miles 1991). According to Rayan et al. (2010), specific gravity of layer breeder hens at different ages (25, 47 and 61 weeks) is 1.070, 1.070 and 1.067 gm/cm^3 respectively. Specific gravity, egg volume and egg shape index of Red Wattled Lapwing in the eggs collected from PAU was 1.023±0.008 gm/cm^3, 17.07±0.49 cm^3 and 72.83±0.88 respectively (Kaur 2013).

Weight and proportion of egg components

Weight of egg albumen and egg shell varied significantly among the eggs collected form PAU, Moga and industrial area of Ludhiana. According to Kabir et al. (2012), mean weight of egg albumen, yolk and shell is 6.30 ± 0.68 g, 3.00 ± 0.82 g and 2.40 ± 0.52 g respectively. Weights of egg albumen, yolk and egg shell were significantly lower in the present as compared to egg albumen, yolk and egg shell weights recorded by Kabir et al. (2012). Weight of albumen in the eggs of Dove and Quail were 4.30±0.48 and 3.70±0.68 g respectively while yolk weights were recorded as 3.30±0.48 and 5.00±1.56 g respectively (Kabir et al., 2012). Kaur (2013) recorded the yolk %, albumen % and shell % of Red Wattled Lapwing as 51.92±0.83, 40.84±0.94 and 7.22±0.28 respectively (Kaur 2013).

Eggshell thickness, $CaCO_3$ content and its proportion

Eggshell thickness and $CaCO_3$ content was significantly different in the eggs collected from PAU, Moga and industrial area of Ludhaina. According to Sidel (1993), the egg shell thickness of pigeon (*Columba livia*) egg ranges from 0.15 mm to 0.20 mm with the mean eggshell thickness of 0.175 mm. In the present study the eggshell thickness was between the ranges of egg shell thickness given by Sidel (1993). Variation in thickness of shell among clutches probably depends on: differences in the stages of incubation, differences related to clutch size, genetic and physiological differences between females, differences in diet among females within and between local populations, differences in gene pools between local populations, differences in environmental conditions between years, and other unknown factors (Romanoff and Romanoff 1949).

Faris et al. (2012) studied inorganic elements in egg shell of some wild birds that include House Sparrow, White-earned Bulbul, Collared Dove and Rock Dove. He observed that Ca percentage of House Sparrow, White-earned Bulbul, Collared Dove and Rock Dove were 97.3%, 97.4%, 97.8% and 97.8 % respectively. The $CaCO_3$ percentage of eggs collected from PAU, Moga and industrial area, Ludhiana was significantly less than that reported for other wild bird eggs. Egg shell thickness, $CaCO_3$ content and $CaCO_3$ % of Red Wattled Lapwing recorded were 0.038±0.002 cm, 0.565±0.02 gm and 45.85±1.69 respectively (Kaur 2013).

Table 1: Morphometry of Pigeon's eggs collected from different location

Morphometric Parameters	Location		
	PAU	Moga	Industrial area, Ludhiana
Egg weight (g)	14.52 ± 0.22*	13.65 ± 0.52*	12.75 ± 1.15*
Egg length (mm)	36.59 ± 0.43	36.32 ± 0.30	36.84 ± 0.29
Egg width (mm)	27.33 ± 0.14	27.41 ± 0.21	27.25 ± 0.139
Egg volume(cm^3)	12.49 ± 0.19	12.51 ± 0.27	12.50 ± 0.31
Specific gravity (g/cm^3)	1.22 ± 0.05	1.09 ± 0.03	1.01 ± 0.09
Shape index	74.78 ± 0.96	75.54 ±0.52	74.03 ± 0.80
Albumen weight (g)	8.18 ± 0.31*	9.39 ± 0.26*	8.94 ± 0.32*
% Albumen	56.22 ± 1.82	61.45 ± 1.28	59.93 ± 1.44
Yolk weight (g)	4.43 ± 0.22	4.04 ± 0.26	3.94 ± 0.25
% Yolk	30.38 ±1.54	26.16 ± 1.22	26.37 ± 1.59
Shell weight (g)	1.65 ± 0.05*	1.41 ± 0.07*	1.45 ± 0.03*
% Shell	11.35 ± 0.25*	9.12 ± 0.27*	9.74 ± 0.19*
Eggshell thickness (mm)	0.167 ± 0.002*	0.152 ± 0.003*	0.151 ± 0.002*

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$CaCO_3$ content (g)	0.83 ± 0.03*	0.69 ± 0.05*	0.74 ± 0.03*
$CaCO_3$ %	91.10 ± 0.37*	89.91 ± 1.07*	77.56 ± 0.26*

Values are Mean±SE

***Values are significant at 5% level of significance**

CONCLUSION

In the present study it was observed that there was significant difference in the egg morphometry of the eggs collected from PAU, Moga and industrial area of Ludhiana.

REFERENCE Butcher, G. D. & Miles, R. D. (1991). Egg Specific Gravity - Designing a Monitoring Program. www.edis.ifas.ufl.edu. | Butcher, G. D. & Miles, R. D. (2000). Concepts of Egg shell Quality. Inquiry-Based Experiments in Chemistry, Oxford, New York, Pp. 159-65. | Danilov, R. V. (2000). Effect of hens' age on quality of hatching eggs and embryonic development. Proc. 21st World's Poultry Congress. Montreal, Canada. | Dirksen, S. & Boudewijn, T. (2001). Egg shell thickness measurements of Cormorant eggs: methods and some backgrounds. www.cormorants.freehostia.com | Erol, A. & Ismail, D. (2015) Effect of egg shape index on hatching characteristics in hens. Turkish J Agri Food Sci Tech 3(7): 583-87. | Faris, A. A., Basim, I. M. & Shahrazad, M. A. (2012). Identification of inorganic elements in egg shell of some wild birds in Baghdad. Adv Appl Sci Res 3(3): 1454-58 | Foger, M. & Pagoraro, K. (1996). Uber den Einfluß der Nahrung auf die Eigröße der Kohlmeise. J Ornithologie 136: 329-35. | Galbraith, H. (1988). Effects of egg size and composition on the size, quality and survival of Lapwing (Vanellus vanellus) chicks. J Zool 214: 383-98. | Ibrahim, T. & Sani, Y. (2010). Relationship between Egg weight and Hatch weight in Pigeons (Columba livia). Int J Poult Sci 9(6): 599-601. | Islam, M. S. & Dutta, R. K. (2010). Egg quality traits of indigenous, exotic and crossbred chickens (Gallus domesticus L.) in Rajshahi, Bangladesh. J Life Earth Sci 5: 63-67. | Islam, M. S. (2005). Comparative performance of Sonali and Fayoumi chicken from day old to eight weeks of age with or without supplementary feeding. M.Sc thesis, Dept. of Poultry Science, Bangladesh Agricultural University, Mymensingh. | Kabir, M. A., Islam, M. S. & Dutta, R. K. (2012). Egg morphometric analyses in chickens and some selected birds. Univ j zool Rajshahi Univ 31 : 85-87. | Kaur, M. (2013) Evaluation of environmental contaminants toxicity in eggs of Red Wattled Lapwing. M.Sc Thesis, Punjab Agricultural University, Ludhiana. | Leggli, T. W., Bohrer, D., Nascimento, P. C., Carvalho, L. M. & Garcia, S. C. (2010). Determination of sodium, potassium, calcium, magnesium, zinc and iron in emulsified egg samples by flame atomic absorption spectrometry. Talanta J 80: 1282-86. | Mamum, S. H. (2005). Comparative assessment of hatchability of different strains of broiler parent stock. M.Sc thesis, Dept. of Poultry Science, Bangladesh Agricultural University, Mymensingh. | Nolan, V. J. & Thompson, C. F. (1978). Egg volume as a predictor of hatchling weight in the Brown-headed Cowbird. Wilson Bull 90(3): 353-8. | Onagbesan, O., Bruggeman, V., Desmit, L., Debonne, M., Witters, A., Tona, K., Everaert, N. & Decuypere, E. (2007). Gas exchange during storage and incubation of avian eggs: Effects on embryogenesis, hatchability, chick quality and post-hatch growth. World's Poult. Sci. J. 63: 557-573. | Rayan, G. N., Galal, A., Fathi, M. M. & Attar, A. H. (2010). Impact of layer breeder flock age and strain on mechanical and ultrastructural properties of egg shell in chicken. Int J Poult Sci. 9 (2): 139-147. | Romanoff, A. L. & Romanoff, A. (1949). The Avian Egg. John Wiley and Sons Company, New York. Pp. 1-918. | Sarker, S. I. (2006). A comparative study on egg quality of few breeds of different poultry species. M.Sc thesis, Dept. of Poultry Science, Bangladesh Agricultural University, Mymensingh. | Saxena, V. L., Pandey, E., Agarwal, S. & Saxena, A. K. (2008). Execution of breeding and nidification behaviour in pigeon (Columba livia) and dove (Streptopelia chinensis). Asian J Expt Sci 22(3): 405-10. | Shapira, N. (2010). Every egg may have a targeted purpose: Toward a differential approach to egg according to composition and functional effect. World's Poult Sci J 66: 271-284. | Sidel, E. J. (1993). A methodology for the Identification of Archaeological Eggshells. Upenn Museum of Archaeology 10: 19. | Sparks, N. H. C. (2006). The hen's egg: Is its role in human nutrition changing? World's Poult Sci J 62: 308-315. | Stadelman, W. J. & Cotterill, O. J. (ed) (1995). Egg Science and Technology. An Imprint of the Haworth Press Inc, New York, London, Pp 1-590. | Wang, X. L., Zheng, J. X., Ning, Z. H., Qu, L. J., Xu, G. Y. & Yang, N. (2009). Laying performance and egg quality of blue-shelled layers as affected by different housing systems. Poult Sci. 88:1485-1492 |