Univ. j. zool. Rajshahi Univ. Vol. 31, 2012 pp. 85-87
http://journals.sfu.ca/bd/index.php/UJZRU
ISSN 1023-6104

Scientific Note

Egg morphometric analyses in chickens and some selected birds

Md. Ashraful Kabir[1], M. Saiful Islam* and Ripon Kumar Dutta
Department of Zoology, University of Rajshahi, Rajshahi 6205, Bangladesh; [1]Present address: Department of Biology, Holy Land College, Dinajpur 5200, Bangladesh; *Corresponding author (email: saifulzoo@yahoo.co.uk).

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 (Farooq *et al*., 2001), 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 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; Jones *et al.,* 2010; Momoh *et al.,* 2010) revealed results that are important to poultry breeders. Here we report a detailed account of egg morphometrics from six available chicken breeds and five other bird species.

Experimental: Eggs from breeder hens of an indigenous (non-descriptive, *Deshi*), five purebred exotics *viz*., Cobb-500, RIR, ISA Brown, ISA White and Fayoumi, and a crossbred called *Sonali* (derived from RIR♂ × Fayoumi♀) were collected for this study. Moreover, eggs from five selected pet birds namely goose, duck, pigeon, dove and quail were also collected. A total of 120 fresh eggs (12 birds × 10 replicates each) were collected for estimating egg quality traits *viz*. egg length (EL in cm), egg width (EW in cm), egg volume (EV in cm^3), gross egg weight (GW in g) and shell weight (SW in g). In addition, four internal egg quality traits *viz*. shell index (SI=EW÷EL×100), shell ratio (SR=SW÷EW×100), yolk weight (YW in g) and albumin weight (AW in g) were taken into account. The eggs were numbered first and then weighed on an electronic balance to determine their weights. Subsequently, EV was determined using the formula, $EV= \pi \times EL \times EW^2/6$ (cm3). Each egg was broken on a table and its contents poured into a plate or small pot. Then the yolk was separated from the albumen with the help of a spoon and weighed. Moreover, the phenotypic associations between the relevant external and internal egg quality traits were determined by Karl Pearson's product moment co-efficient of correlation (r). Mean, standard deviation (SD), analysis of variance (ANOVA), least significant differences (LSD) and r values were computed using the SPSS (version 11.0 for Windows). Data on various egg morphometrics and external and internal egg quality traits were subject to these statistical procedures to detect the significant differences between the genetic groups of chicken under study.

Egg morphometric parameters in chickens: It is apparent from the results presented in Table 1 that the parameters like EL, EW, EV, GW, SW and AW were found to be the highest in ISA Brown and the lowest in the indigenous chickens. This trend was altered for YW, SI and SR traits where the highest values were recorded respectively in Cobb 500, Cobb 500 and RIR, whereas the indigenous, ISA White and ISA White showed the lowest values. A descending order of ISA Brown > ISA White > Cobb 500 > Fayoumi >RIR > *Sonali* > indigenous was obvious for EV. Depending on GW, the chicken breeds could be arranged in a descending order of ISA Brown > Cobb 500 > ISA White > Fayoumi >RIR > *Sonali* > indigenous. The AY of the chickens was recorded as follows: ISA Brown > Cobb 500 > ISA White> Fayoumi > RIR > *Sonali* > indigenous while the YW was recorded as Cobb 500 > ISA White> ISA Brown > Fayoumi > *Sonali* > RIR > indigenous. One-way ANOVA demonstrated that all the egg morphometric parameters varied significantly among the chicken breeds ($P<0.001$) except for EL ($F_{6, 63}= 1.24$; $P>0.05$).

Egg morphometric parameters in other birds: In birds other than chickens, goose had the highest values for EL, EW, EV, GW, SW, AW and YW, whereas quail and pigeon attained the highest values for SI and SR, respectively. On the other hand, quail (EL and AW), dove (EW, EV, GW and SW), pigeon (YW) and goose (SI and SR) showed the lowest values for the parameters in parentheses (Table 1). On the basis of EV and GW, a descending order of goose > duck > pigeon

> quail > dove was recorded for each parameter. On the other hand, the sequences of AW and YW were goose > duck > pigeon > dove > quail, and goose > duck > quail > dove > pigeon, respectively. Unlike chicken breeds, one-way ANOVA revealed highly significant variations among the five bird species under study (P<0.001).

Table 1. Egg morphometric parameters in chickens and some other birds

Breeds	EL	EW	EV	GW	SW	AW	YW	SI	SR
Indigenous	4.59 ±0.47^{a}	3.56 ±0.19^{a}	30.72 ±5.81^{a}	20.20 ±4.76^{a}	4.20 ±1.69^{a}	8.10 ±2.08^{a}	7.90 ±2.03^{a}	78.10 ±7.11^{a}	20.17 ±4.65^{b}
Cobb 500	5.86 ±0.15^{a}	4.09 ±0.17^{bh}	51.45 ±5.18^{b}	56.20 ±1.62^{b}	9.20 ±0.92^{b}	32.00 ±2.40^{b}	15.00 ±2.87^{b}	69.79 ±1.95^{c}	16.35 ±1.35^{c}
ISA Brown	5.93 ±0.54^{a}	4.56 ±0.14^{c}	62.01 ±4.80^{c}	57.50 ±2.72^{bc}	10.20 ±1.14^{bc}	35.50 ±2.17^{c}	11.90 ±1.10^{ce}	79.90 ±2.83^{a}	17.78 ±1.53^{c}
ISA White	5.90 ±0.14^{a}	4.25 ±0.10^{bd}	55.78 ±2.58^{bdh}	53.90 ±2.64^{bd}	8.50 ±1.51^{bd}	31.70 ±1.4^{bd}	13.70 ±2.67^{bde}	72.08 ±2.70^{c}	15.75 ±2.59^{c}
RIR	5.11 ±0.15^{a}	3.83 ±0.07^{ef}	39.26 ±2.20^{ef}	28.80 ±0.80^{e}	6.70 ±0.68^{e}	13.30 ±1.25^{e}	8.80 ±1.40^{a}	74.99 ±1.93^{b}	23.25 ±2.09^{a}
Fayoumi	5.06 ±0.23^{a}	3.92 ±0.13^{fgh}	40.73 ±3.31^{f}	38.00 ±3.30^{f}	8.60 ±0.84^{bf}	19.40 ±2.01^{f}	10.00 ±1.63^{ac}	77.64 ±4.80^{a}	22.71 ±2.24^{a}
Sonali	4.96 ±0.14^{a}	3.77 ±0.09f^{g}	36.94 ±2.55^{efg}	26.60 ±4.81^{eg}	5.10 ±2.18^{ae}	12.50 ±3.21^{eg}	9.00 ±1.33^{a}	76.04 ±2.15^{b}	18.94 ±6.00^{b}
Goose	8.80 ±0.19^{a}	5.96 ±0.19^{a}	63.91 ±3.57^{a}	66.30 ±3.34^{a}	20.00 ±1.25a	81.60 ±1.35^{a}	64.70 ±1.83^{a}	67.57 ±1.16^{c}	12.02 ±0.62^{c}
Duck	5.87 ±0.17^{b}	4.07 ±0.09^{b}	51.42 ±2.85^{b}	53.50 ±5.76^{b}	9.00 ±2.16^{b}	28.70 ±3.02^{b}	15.80 ±2.53^{b}	69.36 ±1.51^{c}	16.74 ±3.34^{b}
Pigeon	3.82 ±0.19^{c}	2.73 ±0.12^{c}	14.97 ±1.97^{c}	11.70 ±0.82^{c}	2.40 ±0.52^{c}	6.30 ±0.68^{c}	3.00 ±0.82^{c}	71.50 ±1.64^{b}	20.69 ±5.18^{a}
Dove	3.26 ±0.08^{d}	2.30 ±0.08^{d}	9.05 ±0.84^{cd}	9.40 ±0.52^{cd}	1.60 ±0.52^{cd}	4.30 ±0.48cd	3.30 ±0.48^{cd}	70.55 ±1.49^{b}	15.78 ±4.96^{b}
Quail	3.15 ±0.09^{de}	2.41 ±0.09^{de}	9.59 ±0.81^{ce}	10.90 ±1.73^{ce}	2.20 ±0.63^{ce}	3.70 ±0.68^{def}	5.00 ±1.56^{ce}	76.54 ±3.04^{a}	19.11 ±6.14^{a}

EL= egg length; EW= egg width; EV= egg volume; GW= gross egg weight; SW= shell weight; AW= albumen weight; YW= yolk weight; SI= shell index; SR= shell ratio. Figures (mean ± SD values) followed by different superscripts for each parameter in the same column (chickens and other birds considered separately) differ significantly by LSD (P<0.05).

Associations between egg morphometric parameters: The GW was significantly correlated with EV in indigenous (r= 0.88; P<0.001) and ISA Brown (r= 0.72; P<0.001), with SW in indigenous (r= 0.88; P<0.001) and Cobb 500 (r= 0.72; P<0.05), with AW in indigenous (r= 0.84; P<0.01), ISA Brown (r= 0.77; P<0.01), Fayoumi (r= 0.90; P<0.001)and *Sonali* (r= 0.81; P<0.01), with YW in indigenous (r= 0.75; P<0.05), Cobb 500 (r= 0.69; P<0.05), ISA White (r= 0.74; P<0.05), Fayoumi (r= 0.64; P<0.05) and *Sonali* (r= 0.71; P<0.05), with SI in ISA White (r= -0.78; P<0.01) and Fayoumi (r= -0.65; P<0.05); and with SR in indigenous chickens (r= 0.63; P<0.05) only. In birds other than chickens, significant correlations were found to exist between GW and EV for goose (r= 0.91; P<0.001), duck (r= 0.83; P<0.01) and pigeon (r= 0.66; P<0.05); between GW and SW and GW and AW for goose (r= 0.64, 0.67 and 0.89, respectively), duck (r= 0.66, 0.69 and 0.89, respectively) and dove (r= 0.67, and 0.80, respectively); between GW and YW for goose (r= 0.89; P<0.001), duck (r= 0.89; P<0.001), pigeon (r= 0.66; P<0.05) and quail (r= 0.82; P<0.01); and between GW and SR for dove only (r= 0.73; P<0.05). All other correlations between the egg parameters in chickens and other bird species were statistically insignificants.

Economically important egg morphometric parameters such as weight, size, albumen and yolk contents are quantitative traits that show continuous variability (Chatterjee *et al*., 2007; Islam & Dutta, 2010). It is also an established fact that the weight of an egg is a direct proportion of shell, albumen and yolk that it contains and this varies significantly between breeds or strains of the bird species (Jones *et al*., 2010; Momoh *et al*., 2010). The present results lend support to the findings of Yeasmin & Howlider (1998) and Islam

(2006) for indigenous, Nahar *et al*. (2007) for broiler, Islam & Nahar (2008) for White Leghorn, RIR and indigenous, and Miazi (2008) for Fayoumi and *Sonali* chickens. Internal egg parameters such as AW and YW are very important from nutritional and health viewpoints (Sparks, 2006). In this regard, ISA Brown eggs showing the highest albumen contents (35.50±2.17g) and indigenous eggs showing the lowest yolk content (7.96±2.03g) could be considered preferable. Significant correlations between GW and various external and internal egg parameters of the present study agree with Pohle & Cheng (2009) and Momoh *et al*. (2010). But unfortunately, owing to scarcity of experimental data on egg morphometrics of such birds as goose, duck, dove, pigeon and quail, the present results could not be compared.

Conclusions: Chicken eggs contribute substantially to the human nutrition and so their dietary profile including lipid, cholesterol and antioxidant contents are particularly important. In addition, because yolk weight is related to the amount of cholesterol, choice for the nutritionally potential and healthier eggs is a matter of considerable concern, especially to patients suffering from cardiovascular diseases, oxidative stress, endothelial dysfunction and inflammatory syndromes. Apart from these, information on the egg morphometric parameters is also vital for an understanding of fertility, development of embryo, egg quality and disease of the poultry and other pet birds.

References

Chatterjee, R.N., Rai, R.B., Kundu, A., Senai, S. & Sundar, J. 2007. Egg quality traits in indigenous breeds of chickens of Andaman. *Indian Vet. J*. **84**: 206-208.

Danilov, R.V. 2000. Effect of hens' age on quality of hatching eggs and embryonic development. *Proc. 21st World's Poultry Congress.* Montreal, Canada.

Farooq, M., Mian, M.A. Ali, M., Durranim F.R., Asquar, A. & Muqarrab, A.K. 2001. Egg traits of Fayoumi bird under subtropical conditions. *Sarad J. Agri.* **17:** 141-145.

Islam, M.A. 2006. Comparative egg production and egg quality of indigenous full feathered and naked neck chicken at hot-humid climate. *Bang. J. Anim. Sci.* **35(1-2):** 99- 105.

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. & Nahar, M.S. 2008. An analysis of some quantitative characters of the White Leghorn, Rhode Island Red and local chicken breeds. *16th Biennial International Conf. Zool. Soc*. p.70.

Islam, M.S. 2005. Comparative performance of Sonali and Fayoumi chicken from day old to eight weeks of age with or without supplementary feeding, MS thesis, Dept. of Poultry Science, Bangladesh Agricultural University, Mymensingh, 47+14 pp.

Jones, D.R., Musgrove, M.T., Anderson, K.E. & Thesmar, H.S. 2010. Physical quality and composition of retail shell eggs. *Poult. Sci.* **89:** 582-587.

Mamum, S.H. 2005. Comparative assessment of hatchability of different strains of broiler parent stock. *MS thesis, Dept. of Poultry Science, Bangladesh Agricultural University, Mymensingh.* 35+14 pp.

Miazi, O.F. 2008. Liveability of Fayoumi and Sonali chicks. *M. Phil. thesis, Dept. of Zoology, Chittagong University.* 49+42 pp.

Momoh, O.M, Ani, A.O. & Ugwuowo L.C. 2010. Part-period egg production and egg quality characteristics of two ecotypes of Nigerian local chicken and their F_1 crosses. *Int. J. Poult. Sci.* **9(8):** 744-748.

Nahar, K., Ahmed, S., Monir, M.M. & Rahman, M.S. 2007. Comparative evaluation of egg quality characteristics of broiler parent stock and synthetic broiler. *Bang. J. Anim. Sci.* **36 (1 & 2):** 82-87.

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.

Pohle, K. & Cheng, H.W. 2009. Comparative effects of furnished and battery cages on egg production and physiological parameters in White Leghorn hens. *Poult. Sci.* **88:** 2042-2051.

Sarker, S.I. 2006. A comparative study on egg quality of few breeds of different poultry species. *MS thesis, Dept. of Poultry Science, Bangladesh Agricultural University, Mymensingh.* 28+14 pp.

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.

Sparks, N.H.C. 2006. The hen's egg: Is its role in human nutrition changing? *World's Poult. Sci. J.* **62**: 308-315.

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.

Yeasmin, T. & Howlider, M.A.R. 1998. Comparative physical features on egg production and egg quality characteristics of normal and dwarf indigenous (*Deshi*) hens. *Bangladesh J. Anim. Res.* **13**: 191-196.

Manuscript received on 10.11.2012, accepted on 07.12.2012