Journal of Genetic and Environmental Resources Conservation, 2014, 2(2):140-144.
www.jgerc.com

Seasonal variation in egg phenotype and chemical composition of house sparrow (*Passer domesticus*) in Baghdad

Faris A. Al-Obaidi[1]* and Shahrazad M.J. Al-Shadeedi[2]

[1]Iraq Natural History Research Center and Museum and [2]Arab Scientific Heritage Revival Research Center, University of Baghdad, Iraq.
*Corresponding author: dr_faris07@yahoo.com

Abstract

A total of 24 freshly house sparrow (*Passer domesticus*) eggs without developed embryo were collected from four different regions of Baghdad city to determined egg phenotype characteristics included egg dimensions, egg weight and chemical composition which included protein, lipids and ash percentages of the egg components during Spring and Autumn seasons of 2013. Results revealed that significant differences ($P<0.05$) were appeared in egg breadth and length values due to season. Egg breadth and length values were high in Autumn (2.42 ±0.46cm and 78.06 ±1.47) compared with Spring (2.40 ±0.46cm and 77.67 ±1.44), also egg weight values were high in Autumn (9.11 ±0.24gm and 9.23 ±0.22cm^3) compared with Spring (9.06 ±0.21cm and 9.05 ±0.23cm^3). protein percentage were ranged from 10.30 to 10.32%, lipids percentage were ranged from 18.54 to 18.57%, ash percentage were ranged from 0.96 to 0.98% during Spring season, whereas protein percentage ranged from 10.32 to 10.34%, lipids percentage were ranged from 18.56 to 18.59%, ash percentage were ranged from 0.96 to 0.98% during Autumn season. Statistical analysis revealed that significant differences ($P<0.05$) were appeared in egg protein and lipids percentages values due to season. It can be concluded that the season has a significant effect on the phenotype and chemical composition of house sparrow (*Passer domesticus*) egg in Baghdad.

Keywords: House sparrow, *Passer domesticus*, Eggs, Phenotype, Chemical composition, Baghdad.

Introduction

House sparrow (*Passer domesticus*) is actually a member of the birds of Iraq (Allouse, 1962) belong to the weaver family, a large group of Old World birds. House sparrows have spread from Eurasia, and can now be found living with humankind around the globe. The house sparrow is a brown, chunky bird about 5 3/4 inches (15cm) long and very common in human-made habitats. The male has a distinctive black bib, white cheeks, a chestnut mantle around the gray crown, and chestnut-colored feathers on the upper wings. The female and young are difficult to distinguish from some native sparrows. They have a plain, dingy-gray breast, a distinct, Buffy eye stripe, and a streaked back (Campbell *et al*., 2001; Moudhafer *et al*., 2006; BirdLife International, 2008; Joshi, 2009). From 3 to 7 eggs are laid, 4 to 5 being the most typical (Baker, 1995). Incubation takes 10 to 14 days, and the young stay in the nest for about 15 days (Lowther and Cink, 1992). In Iraq, House sparrow has two breeding seasons, first is Spring and the second in Autumn (Marchant, 1963; Al-Obaidi, 2010). House sparrow usually re-nested in the same nest or very close by, inter clutch intervals were noticed, 89% of completed clutches were of 2 eggs, the rest of only 1, the mean fresh egg weight was 10.0gm (Robertson, 1990).

Seasonal differences in food resources seem to explain latitudinal (and, similarly, other geographic and habitat) trends in clutch size (Ruuskanen *et al*., 2001). Food is also obviously the key to the difference between onshore and offshore feeding seabirds, the former can rear more chicks because they can visit the nest with food more often. Competition for food also probably explains why clutch sizes are smaller in dense rather than sparse populations, declining food resources also explain the evolution of smaller clutch sizes in late breeders (Aparicio, 1999; Al-Obaidi and Al-Shadeedi, 2014).

The birds egg is one of most complex and highly differentiated reproductive cell, germinal cell accumulated relatively enormous amounts of food substances (yolk and albumen material) and all are

enclosed in protective structures (shell), birds egg diverge widely in shape, volume, weight and the amount of yolk and albumen material (Romanoff and Romanoff, 1949). The shape of the egg is recognizable species characteristic, species lay egg diverge widely from oval to conical shape, with one end rounded and the other more pointed (Stadelman and Cotterill, 1995).

The objective of this study was to be determined the effect of season on egg phenotype characteristics and egg chemical composition of house sparrow (*Passer domesticus*) in Baghdad.

Materials and Methods

Egg sample: A total of 24 freshly house sparrow (*Passer domesticus*) eggs without developed embryo were collected from four different region of Baghdad city (A: north Baghdad, B: east Baghdad, C: south Baghdad and D: west Baghdad) during two season, Spring and Autumn of 2013.

Egg phenotype: Egg breadth and length were determined according to the description and sketches made by Romanoff and Romanoff (1949); Al-Obaidi and Al-Shadeedi (2014). Egg weight determined using a very sensitive digital Sartorius balance according to Stadelman and Cotterill (1995).

Chemical analyses: The yolk and the albumen both were distributed into three replicates of glass beakers. protein, lipid a contents in albumen and yolk were carried out according to AOAC (1980), all these measurements were done in triplicates. Ash determined by ashing samples using muffle furnace oven at 600^{o}C for 6 h. Lipids analysis was conducted on all samples using mixture of chloroform: methanol (1:1) and stirred for 20 min using magnetic stirrer for several rinsing times. Protein determined by the method of semi-microkjeldal determination of N% and the values obtained multiplied with 6.25 to calculate protein%.

Results and Discussion

House sparrow egg breadth and length values were verified among the four different regions of Baghdad and the average values were 1.60cm and 2.14cm respectively during Spring season whereas the average values were 1.66cm and 2.18cm respectively during Autumn season (Figures 1 and 2), statistical analysis revealed that significant differences (P<0.05) were appeared in egg breadth and length values due to season. Egg breadth and length values were high in Autumn compared with Spring. House sparrow egg just like most birds egg have an oval shape, with one end rounded and the other more pointed. This shape results from the egg being forced through the oviduct. Muscles contract the oviduct behind the egg, pushing it forward (Sturkie, 1986). The egg's wall is still shapeable, and the pointy end develops at the back side. Cliff-nesting birds often have highly conical eggs. They are less likely to roll off, tending instead to roll around in a tight circle; this trait is likely to have arisen due to evolution via natural selection. In contrast, many hole-nesting birds have nearly spherical eggs (Romanoff and Romanoff, 1949).

House sparrow egg have an egg weight ranged from 2.78 to 2.82gm with an average value 2.80gm during Spring season, whereas egg weight ranged from 2.85 to 2.88gm with an average value 2.88gm during Autumn season (Figure 3), statistical analysis revealed that significant differences (P<0.05) were appeared in egg weight, due to season, egg weight values were high in Autumn compared with Spring.

Al-Obaidi (2010) recorded that house sparrow eggs were Biconical shaped and the average values of egg breadth, length and shape index were 1.62cm, 2.17cm and 72.47 respectively, the average values of egg weight, volume and specific gravity were 2.88gm, 2.90cm^3 and 0.99 gm/cm^3. Percentages of egg components were 7.04, 21.39 and 71.57 % for the egg shell, yolk and albumen respectively in four different regions of Baghdad city during the period from May to June 2009.

Stadelman and Cotterill (1995) explain that the egg weight is expressed in terms of size, there is an enormous range in egg size among different species and within the species between individuals. The size of the eggs laid by one individual may differ widely from those laid by another of the same species and breed, egg size influenced by climate, the amount of available food, parents body size, evolutionary status and some other factors.

Table (1) shows egg chemical composition (the mixture of albumen and yolk), ash percentage were ranged from 0.95 to 0.96%, protein percentage were ranged from 20.31 to 10.33%, lipids percentage were ranged from 8.52 to 8.54% during Spring season, whereas ash percentage were ranged in 0.97%, protein percentage ranged from 20.34 to 20.35%, lipids percentage were ranged from 8.60 to 8.62%, during Autumn season. Statistical analysis revealed that significant differences (P<0.05) were appeared in egg protein and lipids percentages values due to season, egg protein and lipids percentages values were high in Autumn compared with Spring, whereas no significant differences in egg ash values due to season were noticed.

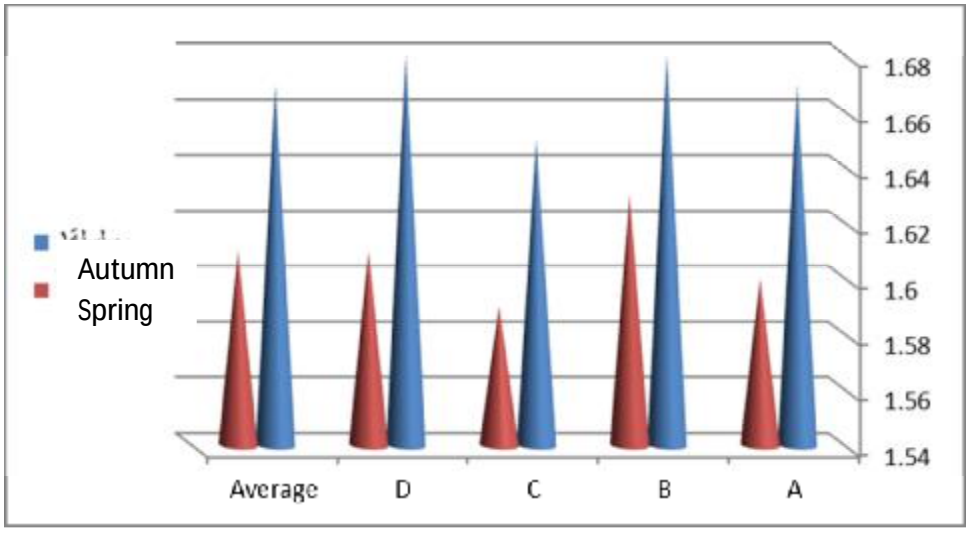

Figure (1): Effect of season on egg breadth (cm) of house sparrow in Baghdad.

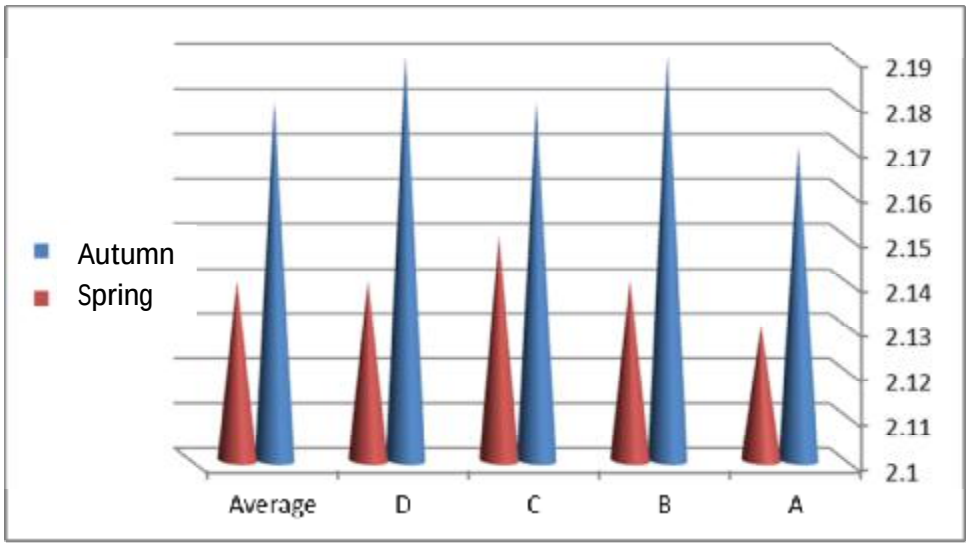

Figure (2): Effect of season on egg length (cm) of house sparrow in Baghdad

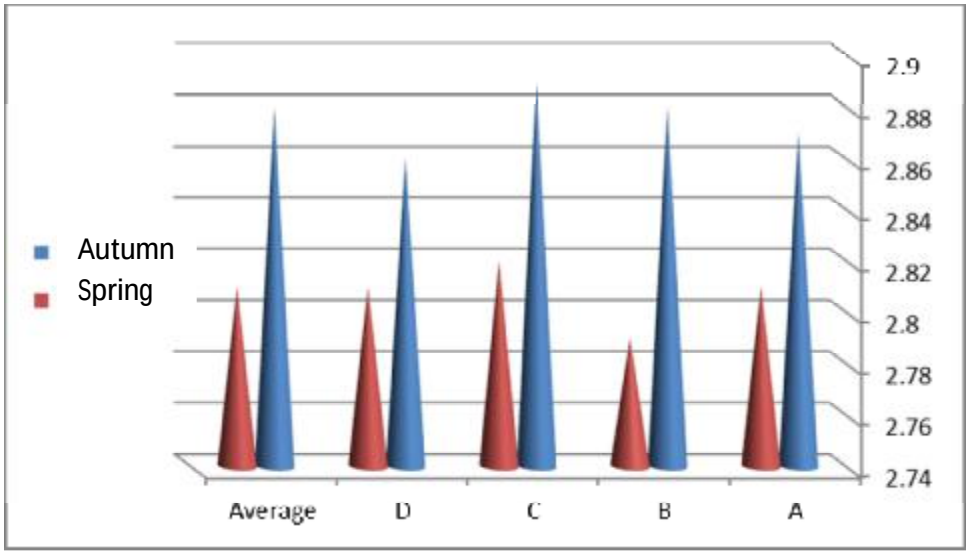

Figure (3): Effect of season on egg weight (gm) of house sparrow in Baghdad.

Table (1): Effect of season on egg protein (%), lipids (%) and ash (%) of house sparrow in Baghdad.

Season	Regions	Egg ash (%)	Egg protein (%)	Egg lipids (%)
Autumn	A	0.97 ±0.12	20.35 ±0.31	8.61 ±0.29
	B	0.97 ±0.12	20.34 ±0.31	8.60 ±0.29
	C	0.97 ±0.12	20.34 ±0.30	8.61 ±0.28
	D	0.97 ±0.14	20.34 ±0.31	8.62 ±0.29
	Average	0.97 ±0.12	20.34 ±0.31	8.61 ±0.29
Spring	A	0.96 ±0.11	20.33 ±0.30	8.54 ±0.24
	B	0.96 ±0.10	20.31 ±0.30	8.52 ±0.25
	C	0.95 ±0.10	20.33 ±0.31	8.52 ±0.23
	D	0.96 ±0.11	20.32 ±0.30	8.53 ±0.24
	Average	0.95 ±0.11	20.32 ±0.31	8.53 ±0.24
Significant		N.S.	*	*

*Significant ($p<0.05$), $^{N.S.}$ no significant differences in traits values among seasons

Birds are grouped according to the relative amounts of the yolk and albumen, they fall naturally into two classes. Egg in which the yolk constitutes between 15 to 20 % of the total weight (lower percentage of yolk and lipids) belong to the Altricial species class, egg in which the yolk constitutes between 30 to 40 % of the total weight (high percentage of yolk and lipids) belong to the Precocial species class (Romanoff and Romanoff, 1949).

The yolk has the greatest food values, it contains a mixture of proteins, fats and carbohydrates in a watery medium (Marshall, 1960), the relatively large yolk assures a fairly advanced stage of development in the young at hatching, but in species that lay small yolked eggs the young are helpless nesting. In addition, most Altricial birds like eagle and dove lay eggs that have relatively thin shells as well as small yolk (Romanoff and Romanoff, 1949).

Al-Obaidi and Al-Shadeedi (2014) recorded that collared dove eggs were oval shaped and the season has a significant effect on the phenotype and chemical composition of collared dove (*Streptopelia decaocto*) egg in Baghdad.

In addition to egg size, maternal investment in offspring quality in the form of different egg components such as lipids, immune factors, hormones and antioxidants critically influences offspring development and survival in many taxa (Bernardo, 1996; Hasselquist and Nilsson, 2009). Yolk lipids and its soluble can affect offspring development and phenotype in many ways, for example growth, immunity, behavior and plumage traits (Groothuis *et al.*, 2005). Carotenoids are antioxidants that reduce lipid peroxidation in the embryo, and they can also enhance immune function (Blount *et al.*, 2002). Deposition of several egg components is known to be affected by environmental or social conditions (e.g. food availability, parasite load or quality of mates) *within* populations (Groothuis *et al.*, 2005; Blount *et al.*, 2002). To our knowledge only very few studies have estimated large-scale geographical variation *among* populations in egg components (Al-Obaidi and Al-Shadeedi, 2014). Most of the existing studies in birds have compared deposition into eggs in two contrasting environments (Hahn *et al.*, 2005), but these results suggest that populations could differ in several maternally-derived egg components.

Conclusions

It can be concluded that the season has a significant effect on the phenotype and chemical composition of house sparrow (*Passer domesticus*) egg in Baghdad, which will influences offspring development and survival.

References

Allouse, B., 1962. Birds of Iraq. Vol. I. (in Arabic). Al-Rabita Press, Baghdad.

Al-Obaidi, F.A. 2010. Egg morphology characteristics and components of house sparrow (*Passer domesticus*) in Baghdad. 6th Scientific Conference of Karbala University, May 1-2nd 2010: 38-42.

Al-Obaidi, F.A. and Al-Shadeedi, Sh.M.J. 2014. Egg morphology characteristics and components of collared dove (*Streptopelia decaocto*) in Baghdad. J. Genet. Environ. Resour. Conserv., 2(1): 69-73.

AOAC, Association of Official Analytical Chemists, 1980. Official Methods of Analysis. 13th ed., Washington, DC.

Aparicio, J.M. 1999. Intraclutch egg-size variation in the Eurasian Kestrel: Advantages and disadvantages of hatching from large eggs. The Auk, 116(3): 825-830.

Baker, M. 1995. Environmental component of latitudinal clutch-size variation in House Sparrows (*Passer Domesticus*). The Auk 112 (1): 249-252.

Bernardo, J. 1996. The particular maternal effect of propagule size, especially egg size: patterns, models, quality of evidence and interpretations. American Zool., 36: 216–236.

BirdLife International, 2008. *Passer domesticus*. 2008. IUCN Red List of Threatened Species. IUCN 2008. Retrieved on 2008-12-15Grindstaff, J.L.; Brodie, E.D. and Ketterson, E. 2003. Immune function across generations: integrating mechanism and evolutionary process in maternal antibody transmission. Proc. R. Soc. Lond. B., 270: 2309–2319.

Blount, J.D.; Surai, P.F.; Nager, R.G.; Houston, D.C. and Møller, A.P. 2002. Carotenoids and egg quality in the lesser black-backed gull *Larus fuscus*: a supplemental feeding study of maternal effects. Proc. R. Soc. Lond. B., 269: 29–36.

Campbell, R.W.; Dawe, N.K.; McTaggart-Cowan, I.; Cooper, J.M.; Kaiser, G.W.; Stewart, A.C. and McNall, M.C.E. 2001. The Birds of British Columbia, Volume 4: Passerines (Wood-Warblers through Old World Sparrows). UBC Press, Vancouver, BC.

Groothuis, T.G.G.; Müller, W.; von Engelhardt, N.; Carere, C. and Eising, C.M. 2005. Maternal hormones as a tool to adjust offspring phenotype in avian species. Neurosci. Biobehav. Rev., 29: 329–352.

Hahn, D.C.; Hatfield, J.S.; Abdelnabi, M.A.; Wu, J.M.; Igl, L.D. 2005. Inter-species variation in yolk steroid levels and a cowbird-host comparison. J. Avian Biol., 36: 40–46.

Hasselquist, D. and Nilsson, J.A. 2009. Maternal transfer of antibodies in vertebrates: trans-generational effects on offspring immunity. Philippines Trans. R. Soc. B., 364: 51–60.

Joshi, D.K. 2009. House sparrow (*Passer domesticus*): The endangered bird. Orissa Review 53- 55.

Lowther, P.E. and Cink, C.L. 1992. House sparrow (*Passer domesticus*). The Birds of North America, No. 12 (A. Poole, P. Stettenheim, and F. Gill, ed.,). The Academy of Natural Sciences, Philadelphia, PA and The American Ornithologists Union, Washington, DC.

Marchant, S. 1963. The breeding of some Iraqi birds. Ibis, 105, 516-557.

Marshall, A.J. 1960. Biology and Comparative Physiology of Birds. Vol. I . Academic Press, New York and London.

Moudhafer, A.S.; Porter, R.F.; Langman, M. Christensen, B.; Schiermacker-Hansen, P. and Al-Jebouri, S. 2006. Field Guide To The Birds of Iraq. (in Arabic). Nature of Iraq and BirdLife International Press, Baghdad.

Robertson, H.A., 1990. Breeding of collared doves *Streptopelia decaocto* in rural Oxfordshire, England, Bird Study, 37(2): 73 - 83.

Romanoff, A.L. and Romanoff, A. 1949. The Avian Egg. John Wiley and Sons Co., New York.

Ruuskanen, S.; Heli S.; Tapio E.; Eugen B.; Antero J.; Anvar K.; Indrikis K.; Juan M.; Chiara M.; Raivo M.; Erich M.; Markku O.; Anna Q.; Juha-Pekka S.; Fred S.; Vallo T.; Marcel E. Wolfgang W.; Herwig Z. and Toni L. 2011. Geographical variation in egg mass and egg content in a passerine bird. PLoS ONE, 6(11): e25360.

Stadelman, W.J. and O.J. Cotterill, 1995. Egg Science and Technology. 4th ed. Food Products Press . An Imprint of the Haworth Press. INC. New York. London.

Sturkie, D.H.D. 1986. Avian Physiology. 4th ed. Springer Verlag, New York.