COMPARISON STUDY OF EGG MORPHOLOGY, COMPONENT AND CHEMICAL COMPOSITION OF MALLARD DUCK AND DOMESTIC PEKING DUCK

Faris A. Al-Obaidi1* and Shahrazad M.J. Al-Shadeedi2

[1]Iraq Natural History Research Center & Museum

[2]College of Agriculture, University of Baghdad, Baghdad, Iraq.

(**Received on Date: 19th January 2016** **Date of Acceptance : 10th July 2016**)

ABSTRACT

A total of 120 eggs of Mallard duck (Anasplatyrhynchos) and 120 eggs of Peking duck(Anasplatyrhynchosdomestica) freshly laid were collected from five different traditional poultry marketing in Baghdad city during the period from January 15th to December 20th of 2015, to determined egg morphology characteristics included egg shape, dimensions, weight, volume, specific gravity, egg components percentages and chemical composition which included protein, lipids and ash percentages.Results revealed that significant differences (P<0.05) were appeared in egg morphology characteristics,components percentages and some chemical composition values due to duck strain. Egg breadth and length,weight, volume values were high in Peking duck eggs compared with Mallard duck eggs, whereas shape index and specific gravity values were significantly (P<0.05) high in Mallard duck eggs. Results also revealed that protein and lipid percentages were high in Mallard duck eggs compared with Pecking duck eggs, in the same time no statistical differences were appeared in egg in ash percentages.

Keywords: Mallard duck, Peking duck, Egg morphology, Components, Chemical composition.

No: of Tables : 4 **No: of References: 19**

INTRODUCTION

Duck is the common name for a large number of species in the Anatidaefamily of waterfowl which also includes swans and geese. Ducks are mostly aquatic birds, mostly smaller than the swans and geese, and may be found in both fresh water and sea water.Ducks are considered one of the most versatile poultry species that are of commercial significance due to their ability to reared under a wide range of climatic and nutritional conditions. Ducks are shown to be resistant to common poultry diseases and feed on a variety of food (Chang et al., 2003; Hay and Scott, 2007; Cherryand Morris, 2008; Al-Shadeediet al., 2013).

Ducks were known in ancient China and Egypt and they had already achieved considerable status at that time. The use of meat of duck and also eggs as well as feathers and downs goes back to very early times in the history. Nowadays consuming Duck eggs were rises, also per-capita duck egg production is about 7.6 per cent of total world egg production (Farrell, 2015;Farrell, 2014).Duck eggs belong to the food with high nutritional quality. People eat egg of ducks for its high nutritional value because of the optimal composition of essential amino acids and the favorable composition of fatty acids with a high percentage of polyunsaturated fatty acids and a favorable ratio of omega 6- to omega 3-fatty acids. It is economical, and quick and easy to prepare and serve. The utilization of eggs of waterfowl for processing as salted eggs, thousand year eggs pidan and balut has a long tradition in some Asian countries. Waterfowl is also widely used as a source of down feathers (Pingel, 2009).Domestic duck in Iraq belong to many species of waterfowl, all population belong to two large groups which are Mallard duck and Pekin duck.Mallard duck (Anasplatyrhynchos), is a large group reared and raised in all Iraqi regions, its clutch size of 8–13 eggs, which are incubated for 27–28 days to hatching with 50–60 days to fledgling. The ducklings are Precocial and fully capable of swimming as soon as they hatch (BirdLife International, 2012; Al-Shadeediet al., 2013).Pekin or Peking duck Anasplatyrhynchos domestica, or Anaspeking is a commercial breed of domestic duck used primarily for egg and meat production. It was bred from the Mallard duck in China, its egg production are more than 150 egg per year (Siregar and Farrell, 1980; Liet al., 2001).Poultry egg is one of most complex and highly differentiated reproductive cell, birds egg diverge widely in shape, volume, weight and the amount of yolk and albumen material due to genetic factors; species, breed and strain and non-genetic factors; nutrition, diseases and season (Romanoff and Romanoff, 1949; Stadelman and Cotterill, 1995).The aim of this study was to comparison egg morphology, component and chemical composition of Mallard duck which still semi-domestic waterfowl and domestic Peking duck reared in Baghdad city.

MATERIALS AND METHODS

A total of 120eggs of Mallard duck (Anasplatyrhynchos) and 120 eggs of Peking duck (Anasplatyrhynchos domestica) freshly laid were collected from five different traditional poultry marketing in Baghdad city during the period from January 15th to December 20thof 2015.

Egg morphology: Egg shape were determined according to the description and sketches made by Romanoff and Romanoff (1949) and Al-Obaidi (2010). Egg shape index determined using the micrometer according to Stadelman and Cotterill (1995) using the equation:

$$\text{Egg shape index} = \frac{\text{egg breadth (short circumference) mm}}{\text{egg length (long circumference) mm}} \times 100$$

Egg weight determined using a very sensitive digital Sartorius balance according to Stadelman and Cotterill (1995).

Egg volume determined according to Al-Obaidi (2010) using the equation:

Egg volume cm3 = 0.51 LB2 , L: egg length, B: egg breadth.

Egg specific gravity determined according to Stadelman and Cotterill (1995) using the equation:

$$\text{Egg specific gravity (gm/cm3)} = \frac{\text{egg weight (gm)}}{\text{egg volume (cm3)}}$$

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 as hing samples using muffle furnace oven at 600oC for 6hrs. Lipids analysis was conducted on all samples using mixture of chloroform: methanol (1:1) and stirred for 20min using magnetic stirrer for several rinsing times. Protein determined by the method of semi-micro kjeldal determination of N% and the values obtained multiplied with 6.25 to calculate protein%.

Statistical analysis: Data were analyzed by using the General Linear Model Procedure of SAS (2001). Means were compared by the Duncan's Multiple Range test at 5% probability (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Mallard duck and Peking duck egg breadth, length and shape index values were verified among the five different regions of Baghdad city and the average values were 27.72 ±0.32cm, 38.37 ±0.44cm and 72.24 ±0.63respectively for Mallard duck whereas the average values were 42.91 ±0.25cm, 67.61 ±0.46cm and 63.47 ±0.61respectively for Peking duck (Table 1).Statistical analysis revealed that significant differences (P<0.05) were appeared in egg breadth, length and shape index values due to duck strain ,egg breadth and length values were high in Peking duck eggs compared with Mallard duck eggs, in the same time egg shape index values were high in Mallard duck eggs. Mallard duck egg just like most poultry egg have an oval shape(shape index value more than 72%), 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, whereas Peking duck egg has elliptical shape (shape index value less than 72) due to high length values (Sturkie, 1986;Stadelman and Cotterill, 1995).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 and artificial selection. In contrast, many hole-nesting birds have nearly spherical eggs (Romanoff and Romanoff, 1949).

Peking duck have a large egg weight ranged from 91.41 to 92.35gm with an average value 91.89 gm, its volume ranged from 60.51 to 66.86 cm3 with an average value 63.49 cm3, whereas egg weight of Mallard duck ranged from 62.60 to 65.12 gm with an average value 63.44 gm, its volume ranged from 14.84 to 15.30 cm3 with an average value 15.03 cm3, in the same time egg specific gravity were high in Mallard duck eggs compared withPeking duck eggs, which the average values were4.22 and 1.45 respectively (Table 2).Egg weight is expressed in terms of size, egg size mainly influenced by body size, evolutionary status, climate, the amount of available food and some other factors,alsothere are 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 body size, evolutionary status,climate, the amount of available food and some other factors (Stadelman and Cotterill, 1995;Downingand Taylor, 2010).Table (3) shows egg components of Mallard duck and Peking duck,statistical analysis revealed that significant differences (P<0.05) were appearedin components percentage,Mallard duck eggs had high percentages of yolk and white (33.84 ±0.33and 55.59 ±0.20% respectively) compared withPeking duck(32.26 ±0.63and55.35 ±0.21%), in the same time Peking duckeggs had high percentage of shell (12.39 ±0.82%) compared with Mallard duck (10.57 ±0.24%). Although Peking duck had high egg weight, it had low percentages of shell, this due to genetic selection of this breedod duck and its crosses compared with Mallard duck which still semi-domestic waterfowl in Iraq (Downing and Taylor, 2010;Al-Shadeediet al., 2013; Farell, 2015).as a result of domestication other than in body size and growth rate.

Table (1):Egg breadth, length and shapeof Mallard duck and domestic Peking duck

Duck groups	Regions	Egg breadth (cm)	Egg length (cm)	Egg shape index (%)
	A	27.73 ±0.35	38.42 ±0.46	72.18±0.64
Mallard duck	B	27.54 ±0.31	38.36 ±0.44	71.79±0.67
	C	28.02 ±0.32	38.20 ±0.41	73.35±0.67
	D	27.64 ±0.30	38.33 ±0.43	72.11±0.62
	E	27.66 ±0.33	38.53 ±0.45	71.79±0.68
	Average	27.72 ±0.32	38.37 ±0.44	72.24±0.63*
	A	42.09 ±0.25	67.72 ±0.46	62.15±0.56
Peking duck	B	43.11 ±0.24	67.80 ±0.47	63.58±0.57
	C	42.09 ±0.25	66.97 ±0.45	62.85±0.62
	D	44.10 ±0.28	67.41 ±0.46	65.42±0.57
	E	43.15 ±0.27	68.17 ±0.45	63.30 ±0.58
	Average	42.91 ±0.25*	67.61 ±0.46*	63.47 ±0.61
Significant		*	*	*

*Significant ($p<0.05$)

Table (2): Egg weight (gm), volume (cm^3) and specific gravity (gm/cm^3) of Mallard duck and domestic Peking duck

Duck groups	Regions	Egg weight (gm)	Egg volume (cm^3)	Egg specific gravity (gm/cm^3)
	A	63.44 ±0.33	15.07±0.22	4.21±0.27
Mallard duck	B	62.89 ±0.30	14.84±0.21	4.24±0.27
	C	65.12 ±0.33	15.30±0.23	4.26±0.24
	D	62.60 ±0.30	14.93±0.21	4.19±0.26
	E	64.27 ±0.31	15.03 ±0.21	4.28±0.26
	Average	63.44 ±0.30	15.03±0.21	4.22±0.25*
	A	91.56 ±0.45	61.19±0.24	1.49±0.26
Peking duck	B	92.27 ±0.43	64.26±0.24	1.44±0.23
	C	91.41 ±0.45	60.51±0.22	1.51±0.24
	D	91.88 ±0.46	66.86±0.23	1.37±0.26
	E	92.35 ±0.42	64.73 ±0.23	1.43±0.26
	Average	91.89±0.44*	63.49 ±0.24*	1.45±0.24
Significant		*	*	*

*Significant ($p<0.05$

Table (3): Egg components (%) of Mallard duck and domestic Peking duck

Duck groups	Regions	Egg shell (%)	Egg yolk (%)	Eggwhite (%)
	A	10.54±0.26	33.87±0.35	55.59±0.22
Mallard duck	B	10.58±0.20	33.88 ±0.32	55.54±0.22
	C	10.56 ±0.25	33.88 ±0.35	55.56±0.20
	D	10.61 ±0.25	33.81 ±0.35	55.58±0.22
	E	10.55 ±0.26	33.76 ±0.34	55.69±0.21
	Average	10.57±0.24	33.84±0.33*	55.59 ±0.20*
	A	12.46±0.79	32.25±0.63	55.29±0.21
Peking duck	B	12.34±0.83	32.24±0.62	55.29±0.21
	C	12.38±0.85	32.28 ±0.65	55.34±0.20
	D	12.40±0.84	32.27±0.61	55.33±0.23
	E	12.36±0.79	32.26±0.63	55.38±0.21
	Average	12.39±0.82*	32.26±0.63	55.35±0.21
Significant		*	*	*

*Significant ($p<0.05$)

Table (4): Egg protein (%), lipids (%) and ash (%) of Mallard duck and domestic Peking duck

Duck groups	Regions	Egg protein (%)	Egg lipids (%)	Egg ash (%)
	A	21.29±0.33	10.31±0.22	1.12±0.10
Mallard duck	B	21.43±0.36	9.94±0.26	1.13±0.10
	C	21.27±0.34	9.97 ±0.24	1.12±0.10
	D	21.66±0.32	10.22±0.23	1.12±0.11
	E	21.40±0.32	10.36±0.23	1.14±0.10
	Average	21.41±0.34*	10.16±0.24*	1.12±0.10
	A	20.56±0.21	9.63±0.16	1.13±0.11
Peking duck	B	20.60±0.20	9.59±0.15	1.13±0.10
	C	20.59±0.20	9.59±0.17	1.12±0.11
	D	20.57±0.22	9.60±0.13	1.13±0.10
	E	20.60±0.20	9.64±0.15	1.13±0.10
	Average	20.58±0.21	9.61±0.14	1.13±0.10
Significant		*	*	N.S.

*Significant ($p<0.05$), N.S. no significant differences in traits values among duck strain

Table (4) shows chemical composition of the edible portions of the egg (the mixture of albumen and yolk), Statistical analysis revealed that significant differences (P<0.05) were appeared in egg,Mallard duck eggs had high percentages of protein and lipids (the average values were21.41 ±0.34 and 10.16 ±0.24% respectively) compared with Peking duckeggs which had highpercentage of ash (). No significant differences were appeared in ash percentages values due to duck strain were noticed.

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. 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, and all duck strains and groups belong to this class, newly hatched chicksare fully capable of eating and swimming (BirdLife International, 2012;Al-Shadeediet al., 2013). High content of protein, lipids inMallard duckegg is essential and needed to this strain which still semi-domestic waterfowl for advanced stage of development of chicks at hatching compared with domestic Pecking duck(Downingand Taylor, 2010; Al-Shadeediet al., 2013; Farell, 2015).

CONCLUSION

In conclusion, as a result of domestication other than in body size and growth rate,Pecking duck hassignificant differences in egg morphology characteristics,components percentages and some chemical composition values compared with to Mallard duck strain and this may affect incubation and hatching behavior of their chicks and its nutrition requirements.

REFERENCES

Al-Obaidi, F.A. 2010. Egg morphology characteristics and components of collared dove (Streptopeliadecaocto) in Baghdad. 11th Scientific Symposium of Arab Scientific Heritage Revival Research Center, University of Baghdad, October 27th 2010: 219-222.

Al-Shadeedi, S.M.J.; Al-Obaidi, F.A. and Al-Dalawi, R.H. 2013. Breeding and Management of Ducks and Geese. 1st ed., (in Arabic). Al-QimaPress, Baghdad, Iraq.

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

Bird Life International, 2012. Anasplatyrhynchos. IUCN Red List of Threatened Species. Version 2013.2. International Union for Conservation of Nature. Retrieved 26 November 2013.

Chang, H.;Dagaas, C.; de Castro, N.;Ranola, R.; Lambio, A. and Malabayuabas, M. 2003 An overview of the Philippine duck industry. Australian Center for International Agricultural Research, pp. 1-26.

Cherry, P. and Morris, T. 2008. Domestic Duck Production Science and Practice. CAB International, Cambridge, Mass, USA.

Downing, J.A. and Taylor, W. 2010. The effect of strain and season on the performance of commercial ducks under

Australian conditions. Proceedings of the Australian Poultry Science Symposium 10: 182-185.

Farrell, D.J. 2014. Small-scale duck production: the way ahead. J. Anim. Husb. Sci. Technol., (IAHST) (8): 73-80.

Farrell, D. 2015. Recent advances in the production, management and nutrition of intensively-farmed domestic ducks. The PoultrySite - Poultry News, Health, Welfare, Diseases, Markets and Economics 5m Publishing, Benchmark House, 8 Smithy Wood Drive, Sheffield, S35 1QN, England, Uk.

Hay, G.C. and Scott, T.A. 2007. Growth performance and its prediction in two commercial strains of meat duck, p45-48. Proceedings of the Australian Poultry Science Symposium 19: 45-48.

Li, P.; Wei, L.; Gen-Pei, L.; Rong-Huan, Z. and Da-Cheng, W. 2001. Overexpression, purification, crystallization and preliminary X-ray diffraction analysis of Cu, Zn superoxide dismutase from Peking duck. ActaCrystallographica, 57(11): 1646–1649.

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

Pingel, H. 2009. Water fowl production for food security. IV World Waterfowl Conference, 11-13 November,2009, Thrissur, India.

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

SAS Institute, 2001. SAS/STAT User's Guide for Personal Computer. Release 6.12 SAS Institute, INC., Cary, N.C., USA.

Siregar, A.P. and Farrell, D.J. 1980. A comparison of the energy and nitrogen metabolism of fed ducklings and chickens. British PoultrySci., 61: 213-227.

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, UK.

Steel, R.G. and J.H. Torrie, 1980. Principle and Procedures of Statistics. 2nded., McGrow-Hill Book Co., Inc, New York, USA.

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