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EGG MORPHOLOGY, COMPONENTS AND CHEMICAL COMPOSITION OF CAPE SHELDUCK (*TADORNA CANA*) REARED IN BAGHDAD

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

[1]Iraq Natural History Research Center & Museum, Iraq.
[2]Market Research and Consumer Protection Center, University of Baghdad, Baghdad, Iraq.

Abstract

The aim of this first native study was to identify the egg morphology, components and chemical composition of cape shelduck (*Tadorna cana*) reared outdoor in Baghdad. A total of 110 eggs of cape shelduck were freshly laid collected from a flock reared in poultry farms west of Baghdad city, Iraq during the period from January 17th to December 24th of 2018. The flock were separated by ages into two groups, group one; first year egg production and group two second year egg production, to determined egg morphology, components percentages and chemical composition which included protein, lipids and ash percentages, also lipid profile were determined. Results revealed that cape shelduck eggs were differ significant ($P<0.05$) in their egg breadth and egg length, egg weight, egg volume, egg shell, egg yolk, chemical composition of the egg yolk, cholesterol, LDL and HDL values due to the year of egg production. No differences were appeared in egg shape index, egg specific gravity, egg white (albumen) percentage, chemical composition of the egg white and triglycerids values due to the year of egg production. In conclusion cape shelduck egg is equivalent to chicken egg in components and chemical composition, so it's fully acceptable for consumers as table eggs and it will be a new trend in table egg consumption in Iraq and it's a novel native study of cape shelduck and the results will provide a new data for Ornithologists and poultry breeders in Iraq.

Key words: Cape shelduck, *Tadorna cana*, Egg morphology, Components, Chemical composition, Baghdad.

Introduction

Fowl or Poultry are valuable domesticated birds reared by mans for their meat and for eggs they produces (Farrell, 2014; Al-Obaidi, 2018). These birds includes chickens, quails, turkeys, ducks and geese which they are very important as a source of animal protein for man diets. Poultry were known in ancient world and the use of poultry meat and eggs as well as feathers and downs goes back to very early times in the history. Nowadays production and consuming eggs were rises (Farrell, 2015; USDA, 2016), up to 81 million tons of fowl eggs were produced during 2016, also world poultry meat production were increased to 120 million metric tons (MMT) in 2016. The United States of America is the world's largest poultry meat producer, with 18 percent of global output, followed by China, Brazil and the Russian Federation, Asia is the largest egg-producing region, with more than 60 percent of global output (150% increased). most of the production increases were in Asia and developing countries (80% increased), which is also the source of increasing demand (FAO, 2019).

Although chicken are currently most commonly reared by mans around the world, the other birds are also reared for used for daily egg and meat consumption. For example Japanese quail eggs are gaining popularity in Europe and America, ostrich eggs in South Africa (Horanczuk *et al.,* 2008). In Iraq, ducks, geese, turkey and quails were in the second category as table egg and meat consumption (Al-Obaidi and Al-Shadeedi, 2015; 2016; Al-Obaidi, 2018).

Cape shelduck or South African shelduck (*Tadorna cana* J.F. Gmelin, 1789) is a species of large duck which is part of the bird family Anatidae. This duck species is a common and endemic species to South Africa. Cape shelduck have a 61–66 cm; male weight 910–2200g and the female weight 700–1835g, ruddy bodies and wings strikingly marked with black, white and green. The male has a grey feathers head. Although, the color on the

***Author for correspondence :** E-mail : dr_faris07@yahoo.com

females head is highly variable, female has a white face and black crown feathers. Clutch size is usually 7-15 cream-white eggs and are incubated by the female for 30 days (*Kear, 2005; BirdLife International, 2012*; Al-Shadeedi *et al.,* 2013; Carboneras, 2019; Purely poultry, 2019).

To our knowledge there are no previously studies about Cape shelduck (*Tadorna cana* J.F. Gmelin, 1789)in Iraq, because it is a new breed for outdoor reared in small groups of poultry farms and this is a novel native study to identified the egg morphology, components and chemical composition of cape shelduck during two years of egg production and the results will provide a new data for Ornithologists and poultry breeders in Iraq.

Materials and Methods

Birds: A total of 110 eggs of cape shelduck were freshly laid collected froma flock of 38 (9 males and 29 females) individuals of cape shelduck (*Tadorna cana* J.F. Gmelin, 1789) reared in a poultry farm west of Baghdad city, Iraq during the period from January 17th to December 24th of 2018. The flock were separated by ages into two groups, group one; first year egg production(less than 3 years) and group two second year egg production (more than 3 years).

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:

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

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 $cm^3 = 0.51\ LB^2$, L: egg length, B: egg breadth.

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

$$\text{Egg specific gravity } (gm/cm^3) = \frac{egg\ weight\ (gm)}{egg\ volume\ (cm^3)}$$

Egg components: Egg components percentage (Yolk, Albumen and shell percentages) were determined according to Stadelman and Cotterill (1995) as described by Al-Obaidi (2010), all eggs were weighted using a very sensitive digital Sartorius balance and shells were braked then the yolk and the albumen were separated and each were weighted then percentages of each component were determined using the equation:

$$\text{Egg component (\%)} = \frac{egg\ component\ weight\ (gm)}{egg\ weight\ (gm)} \quad 100$$

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°C 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-microkjeldal determination of N% and the values obtained multiplied with 6.25 to calculate protein%. Cholesterol was determined calorimetrically using ethanol extraction and ferric chloride-sulfuric acid detergent according to the methods described by Franey and Elias (1968). Low density lipoprotein (LDL) and high density lipoprotein (HDL) were determined using Enzy Chrom HDL and LDL commercial Kite. Triglycerides were eluted and determined by silica gel column according to the methods described by AOAC (1980).

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

Cape shelduck were differ significant ($P<0.05$) in their egg breadth and egg length due to the year of egg production, the values were 36.82mm and 51.35mm for first year egg production respectively and were 38.23mm and 53.28mm for the second year egg production respectively. No differences were appeared in egg shape index values due to the year of egg production. The average values of Cape shelduck egg breadth, egg length and egg shape index were 37.52mm, 52.31mm and 71.73 respectively (Table 1). Cape shelduck just like most duck species and other domestic poultry egg have an oval shape (value near 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 (Sturkie, 1986; Stadelman and Cotterill, 1995).

Table 1: Egg breadth, length and shape of cape shelduck.

Egg production	Egg breadth (mm)	Egg length (mm)	Egg shape index (%)
First year	36.82 ±0.40[b]	51.35 ±0.48[b]	71.70 ±0.46
Secondyear	38.23 ±0.42[a]	53.28 ±0.47[a]	71.75 ±0.47
Average	37.52 ±0.42	52.31 ±0.46	71.73±0.44
Significant	*	*	N.S.

*Significant ($p<0.05$), N.S. not significant.

Table 2: Egg weight (gm), volume (cm^3) and specific gravity (gm/cm^3)of cape shelduck.

Egg production	Egg weight (gm)	Egg volume (cm^3)	Egg specific gravity (gm/cm^3)
First year	67.04 ±0.48[b]	34.32 ±0.35[b]	1.95 ±0.20
Second year	74.51±0.51[a]	38.68 ±0.34[a]	1.92 ±0.17
Average	70.78±0.47	36.50 ±0.34	1.94 ±0.19
Significant	*	*	N.S.

*Significant ($p<0.05$), N.S. not significant.

Table 3: Egg components (%)of cape shelduck.

Egg production	Egg shell (%)	Egg yolk (%)	Eggwhite (%)
First year	10.21±0.28[a]	31.13 ±0.34[b]	58.66 ±0.48
Second year	9.85±0.28[b]	31.44 ±0.35[a]	58.71 ±0.46
Average	10.03±0.26	31.28 ±0.34	58.69 ±0.49
Significant	*	*	N.S.

*Significant ($p<0.05$), N.S. not significant.

Table 4: Egg protein (%), lipids (%) and ash (%) of cape shelduck.

Egg production	Protein (%)	Lipids (%)	Ash (%)
		Egg white	
First year	10.26±0.38	-	1.04±0.12
Second year	10.35±0.35	-	1.05±0.11
Average	10.31±0.37	-	1.04±0.12
Significant	N.S.	-	N.S.
		Egg yolk	
First year	17.17±0.30[a]	32.79±0.61[b]	1.22±0.11
Second year	16.49±0.33[b]	34.31±0.64[a]	1.28±0.11
Average	16.83±0.30	33.55 ±0.63	1.25±0.11
Significant	*	*	N.S.

*Significant ($p<0.05$), N.S. not significant.

Second year egg production cape shelduck has an average egg weight and egg volume values 74.51gm and 38.68cm^3 which were significant ($P<0.05$) heavier than first year egg production cape shelduck (67.04gm and 34.32cm^3 respectively), its egg specific gravity ranged from 1.95to 1.92gm/cm^3 for first and second year production respectively with no significant differences. The average values of egg weight, egg volume and egg specific gravity of the two production years were 70.78 gm, 36.50cm^3 and 1.94gm/cm^3 as shown in table 2. Egg weight or egg size mainly influenced by body size, genetic factors, egg clutch size, feed or the amount of available food, climate and cycles of egg production. Egg size and its volume will increased in second and third years production compared with first year egg production due to increases of bird weight and egg clutch size (Stadelman and Cotterill, 1995; Downing and Taylor, 2010), this finding agree with our results, birds body weight is the key to increased egg size. Our results revealed that Cape shelduck has large and heavier egg weight from native mallard duck due to Al-Obaidi and Al-Shadeedi (2016) which reported that egg weight of mallard duck reared in Iraqranged from 62.60 to 65.12 gm with an average value 63.44gm.

Table 3 shows egg components of cape shelduck during the two production periods, statistical analysis revealed that significant ($P<0.05$) differences were appeared in egg shell and egg yolk percentage values due to the year of egg production, in the same time no significant differences were appeared in egg white (albumen) percentage values. The average values of egg shell, egg yolk and egg white percentage were 10.03, 31.28 and 58.69% respectively.

Table 4 shows no significant differences in chemical composition of the egg white portion of cape shelduck egg during the two production periods. In the same time significant ($P<0.05$) differences appeared in the chemical composition of the egg yolk portion during the two production periods, yolk protein percentage were high (17.17%) during first production year and decreased (16.49%) during second production year. Yolk lipid percentage were low (32.79%) during first production year and increased (34.31%) during second production year. No significant differences were appeared in ash percentage values. Egg white is a viscous colorless liquid consists of 88% water, 10-12% protein and some minerals. The amount of lipid in the egg white is trace (0.02%) compared with the amount present in the yolk. The yolk comprises 48% water, 15-17% protein, 32-34% fat and some minerals and vitamins (Stadelman and Cotterill, 1995; Al-Obaidi and Al-Shadeedi, 2016).

Cape shelduck egg yolk lipid profile shows in table 5, statistical analysis revealed that significant differences ($P<0.05$) were appeared in cholesterol and LDL, which were high (17.40 and 59.73mg/gm yolk respectively) during second year egg production compared with first year egg production (13.27 and 42.24mg/gm yolk respectively), in the same time HDL value were high

Table 5: Egg yolk lipid profile of cape shelduck.

Egg production	Cholesterol (mg/gm yolk)	LDL (mg/gm yolk)	HDL (mg/gm yolk)	Triglyceride (mg/gm yolk)
First year	13.27±0.13[b]	42.24 ±0.45[b]	71.85 ±0.53[a]	66.31 ±0.51
Second year	17.40±0.16[a]	59.73 ±0.46[a]	62.31 ±0.55[b]	65.89 ±0.49
Average	15.34±0.13	50.99 ±0.46	68.69 ±0.56	66.10 ±0.50
Significant	*	*	*	N.S.

*Significant ($p<0.05$), N.S. not significant.

(71.85mg/gm yolk) during first year egg production compared with second year egg production (62.31mg/gm yolk). No significant differences were appeared in egg yolk triglycerides due to the year of egg production. Yolk has the greatest nutritional values, it contains a mixture of proteins, fats, carbohydrates and vitamins in a watery medium (Marshall, 1960) 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 (Stadelman and Cotterill, 1995; Pingel, 2009; Al-Shadeedi *et al.,* 2013; Al-Obaidi and Al-Shadeedi, 2016). The relatively large yolk materials assures a fairly advanced stage of development in the young at hatching, the newly hatched chicks are fully capable of eating, drinking and walking (Al-Obaidi *et al.,* 2013).

Conclusion

Cape shelduck egg is equivalent to chicken egg in components and chemical composition, so it's fully acceptable for consumers as table eggs and it will be a new trend in table egg consumption in Iraq and it's a novel native study of cape shelduck and the results will provide a new data for Ornithologists and poultry breeders in Iraq.

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