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Eggs Physical Quality and Chicks Performance of Black Neck Ostrich in Sudan

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Abstract

The study was carried out on Ostrich Nile Farm for breeding black neck Ostrich in Soba east Khartoum, Sudan from 5th February to 15th August 2018 to evaluate egg physical quality and chick performance. The experiment include 122 egg and 114 chick reared in semi close system. The results revealed that the average egg weight was 1307.25±11.59 g, egg length 42.55±0.12 cm, egg width 38.49±0.11cm, axes length 13.84±0.13cm, axes width 11.65±0.10cm, egg volume 984.92±28.03m^3, shape index 90.47±0.16%, egg specific gravity 1.40±0.02, and egg surface 562.82±3.29 cm^2. A significant correlation was obtained between external egg characteristics and chick's hatched weight. The correlation coefficient vary between 0.34 – 1.0 (most of the coefficients are above 0.8. The chick's performance include the chick weight, feed intake, weight gain, feed convention ratio (FCR) and mortality rate from the 1st to the 3rd month of age. The average of body weight, was (2056.66g, 6565.08g and 14153g) and FCR was (1.4, 1.1 and 1.9), the mortality rate was (32%, 27% and 12%) for the 1st,2nd and 3rd month respectively.

Keywords*:* egg weight, egg volume, egg shape index, egg surface

Introduction

With the increase of consumer awareness food quality and nutritive value of poultry products, increase in production and decline in prices relative to higher prices of other types of proteins, the demand for poultry products increasing rapidly, however, in of the increased investment in this industry. There is an obvious gap between supply and demand for poultry products. To fill this gap production must be direct towards non-conventional species such as ostrich. Ostrich comes up in all climates and a fast-paced bird (Sahan et al. 2003). In addition, its characters are in line with Sudan's environment and climate. There is a wild red neck ostrich in Sudan that is an indication of the possibility of ostrich's intensive system to cover food security.

Deemed Ostrich Nile farm, is the first-ever farm in Sudan, established in 2012 for breeding black neck ostrich which was imported from the Kingdom Saudi Arabia, the project followed intensive breeding system to breed one male and two female in pen. The farm utilizes an American incubator machinery subject-object produce (leather, meat, feather, and oil) these important items in the country's

exports and contribute significantly to foreign exchange earnings. It is of interest to note that the ostrich produce healthy meat with a very low cholesterol content, high minerals (iron, phosphorus, potassium, copper, and manganese) and high quality leather while the feathers are sold for the fashion industry *(Nashat., 2005*).

Ostrich eggs are the largest eggs produced by a living bird. It measure 44.53 ± 1.13 and 40.35 ± 0.90 cm for mean circumference length and width, 15.43 ± 0.55 and 12.56 ± 0.38 cm for axial length and width in the first year, while the shape index value was 81.79 ± 0.76 (Elobied *et al*., 2010). Whatever the production of good quality chicks surviving to slaughter is essential for cost-efficient commercial production, as well as sufficient numbers of breeder replacement birds for selection in breeding programs. Adewaumi *et al*. (2017) and Selvan *et al.* (2012) observed that ostriches in different regions revealed different body development and high concentrate feed intake resulted in rapid growth during the first four months. Ostrich nutrition is an important part of management. Therefore, knowledge of nutrient needs during the various stages of growth, development and production of the ostrich are vital (Carstens *et al.*, 2014). Nutrition of ostrich chicks must be correct, as they are most vulnerable up to the age of 3 months (Cooper, 2004).The study aimed to evaluate the black neck ostrich egg quality characteristics and chicks performance traits during three months under Sudan conditions.

Martials and methods

Study area and duration:

The current study was carried out at the Ostrich Nile Farm in Soba east Khartoum Sudan from 5thFebruary to 15th August 2018.

The bird's management:

The experimental birds include 26 trioses (26 males and 52 females) 10 years old ostrich black neck (Struthio camelus).Each trios was composed of one male and two females, each female was leg tagged in different color. Trioses are kept in pens of dimension's 50×15m fence. Throughout the reproductive period the experimental birds were fed complete diets delivered once a day morning in amount 2-2.5 kg/bird (2300 kcal ME, 17% crude Protein, 3% calcium and 14% crude fiber). Clean water was also supplied for ad-libitum consumption. Trees provided shade. All females were observed every day in the evening (2-7pm). During egg laying the eggs were collected from pens immediately and numbered according to the serial number and recorded with laying date.

The hatchery management:

The eggs were transferred to the hatchery unit daily. All eggs were disinfected and fumigated with a mixture of potassium permanganate and formaldehyde, and weighed individually using electronic balance and weight was recorded to the nearest 2g. Axial length and width were measured using caliper. Long and short circumferences of the eggs were measured using tape. The eggs were stored for 7days at 18C$^{\circ}$and relative humidity 60-75%. The eggs were transferred to incubator and kept in the setting compartment in which temperature was maintained at 36.5C$^{\circ}$ and relative humidity 25% during incubation, the eggs were turned through an angle of 90° (45°on each side of the vertical axis) four times a day. The eggs were candled in day 14 and fertility was calculated. Infertile eggs were removed from incubation. On the 39th day of incubation the eggs were transferred to the hatching machine (temperature 36°C and relative humidity 50%). From 4 to7days all survival chicks were hatched and the hatchability was calculated. The chicks were marked using permanent ink on a Velcro tape fixed to the chick's leg. Each chick was weighed using electronic

balance nearest 2g. Chicks were allowed to dry off in 1 2 - 24 hrs.

The chick's management:

All chicks were subsequently transferred to brooding unit which designed as semi closed room and annexed with shadowed by shelters (20%). The brooding was supported by gas hoover system and manual fodders and drinkers. The dimension of the room was 6×5×3 m and 6×15 m run distance. The chicks were kept in groups inside the room and after 2days chicks were given starter diet contain 2450 kcal, 22% crude protein,1.1% calcium, CF 6%, av. P 0.67%, lysine 1%, and methionine 0.72%. All experimental groups were fed adlib. Routine vaccination procedures was followed and all chicks were vaccinated against NCD and IBD 1st week and 2nd week respectively.

Eggs quality traits

Eggs quality traits including egg volume, egg shape index, egg shell volume, egg specific gravity were determined according to Moreki *et al*. (2016). Egg surface area was determined according to Mahrous and El-safty (2009).

Egg surface (cm^2) = 4.735X egg weight$^{0.662}$

Egg volume (cm^3) = 0.51X egg length X egg width^2

Egg shape index (%) = $\frac{egg\ width}{egg\ length} X100.$

Egg shell volume (cm^3) = $\frac{egg\ surface\ area}{egg\ lengt}$.

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

Chick's performance traits

The feed intake was calculated by subtracting the feed remaining from the supplied in the previous week. The chicks were also weighed weekly and the weight gain was determined. The feed conversion ratio (FCR) was calculated and the mortality was recorded.

Statistical analysis

The generated data was subjected to correlation and regression analysis according to Steel and Torri (1996) using SPSS software.

Results and discussion

The results pertaining to the external physical characteristics of ostrich eggs were given in table (1). The results revealed that the average egg weight was (1307.25±11.59)g, that's comparable with Elmaghawry *et al*,.(2006), (Mush *at el.*, (2007), Elsayed.,(2009), and Selvan *et al.*, (2014) (1233.2 to 1478.9g). The average axes (length and width) in the current study were (13.84±0.13 and 11.65±0.10) cm respectively. Elmaghawry *et al*,.(2006), Mahrouse and El-Saftyi, (2009) and Selvan *et al.*, (2014) documented the egg axes length and width range between 15.45±0.28 to 14.4± 0.22 and 12.03±0.31 to 10.9±0.16 respectively. The obtained shape index in current study was 90.47±0.16. Comparable values were reported by Nedomova *et al.*, (2013), Selvan *et al.* (2014), Moreki *et al*. (2016) and Sundaram *et al.*, (2018) who presented the shape index of 89.7, 74.2, 78.28 and 82.65% respectively.

Table (1): Some external physical quality traits of ostrich eggs

Parameter	Mean ±SD
Egg weight (g)	1307.25±11.59
Egg long circumference (cm)	42.55±0.12
Egg short circumference (cm)	38.49±0.11
Axis length (cm)	13.84±0.13
Axis width (cm)	11.65±0.10
Egg volume (cm^3)	984.92±28.03
Egg specific gravity g/cm^3)	1.40±0.02
Egg shape index (%)	90.470.16
Egg surface area (cm^2)	562.823.29
Shell volume (cm^3)	13.22±0.04

N=122

The long circumference was 42.55±0.12 cm and the short circumference was 38.49±0.11cm in the current study. Benot *et al.*, (2014) obtained long circumference in rainy and dry season 42.05 vs. 41.38cm and short circumference 39.4 vs. 38.9cm. However a lower egg volume was obtained in this study (984.92±28.03, cm^3) compared to that reported by Benot *et al.* (2014) (1197.42 vs 1157.84 cm^3) in rainy and dry season respectively. The average egg specific gravity in the current study was 1.40±0.02 g/cm^3. Comparable value (1.16g/cm^3) was reported by Moreki *et al.*, (2016). The calculated egg surface area value in this study was 562.82±3.29 cm^2

that's falls within the range obtained by El-safty., (2011) and Elmaghawry, *et al*,.(2006) (554.28±23.13 to 574.46±14.73) cm^2 and lower than that reported by Moreki *et al.,* (2016) (471.6-488.8 cm^2).

The ostrich chick's performance (chick weight, feed intake, weight gain, feed convention ratio (FCR) and mortality rate) was presented in table, 2. The study showed that the average chick's hatched weight, weight at the end of the 1st, 2nd and 3rd month of age as follows 757.3±7.9, 2056.7±14.6, 6565.1±72.0 and 14153.5±115.2g respectively. The average chicks weight as observed in one to three months by Engelbrecht *et al.,* (2008) and Engelbrecht *et al.,* (2011) was (3.26kg, 9.55kg and 12.4kg) (3.2kg, 9.3kg and 16kg) respectively that's in line with this current study. Selvan *et al.,* (2012) described the body weight of ostrich growth from one to three month was (3.78kg, 13.88kg and 26.14kg) which is higher than what has been presented in this study. The average feed intake in the first three months in the present study were 1855.4, 5042 and 14587.63g. And the average weight gain in this study was 1297.69, 4514.26 and 7515.52g. Lack of consistency in weight gain of young ostrich chicks has been attributed to subclinical diseases, embryo weakness, feeding habits, gastric impaction and environmental influences (Deeming *et al,*. 1994 and Huchzermeyer,. 1998). Dedousi *et al,*. (2008) documented the total mean feed intake of ostrich chicks ages from 1to 28 days was 1024 to 1237g. That's in line with the present study findings in the 1st month of age. The result of feed conversion ratio was (1.4, 1.1 and 1.9). Feed conversion ratio was maintained at 1.60 to 1.67 during the 1st three months it then increased to 1.7 in the 4th months (Selvan *et al.,* 2012). The mortality tended to decrease from the 1st to the 3rd month in the current study (32%, 27% and 12%) respectively, Mortality among the ostrich chicks is generally high and annual mortality rates for ostrich and emu chicks during the rearing phase were 29.1 and 21.6%, respectively (Agab *et al.,* 2008). The cumulative mortality values in this study was however lower than what indicated by Adewumi et al., (2017) who reported 66.7% mortality rate within six weeks of age. Also higher than 41.2% mortality reported by Musa *et al*. (2005).

A significant correlation was obtained between external eggs characteristics and chicks hatched weight the correlation coefficients range from 0.342 to 1(table,3). This was also documented by Superchi *et al*. (2002), Sahan *et al*. (2003), Di Meo et al ., (2003), Mahrouse and El-Saftyi, (2009), Elobied *et al*., (2010), Benot *et al*., (2014) and Moreki *et al*.,(2016). With exception of specific gravity all other correlation were found to be positive.

The result of the simple linear equations of egg weight, egg volume, egg Surface and shell volume were presented in table (4). Egg weight, egg volume, egg surfaces and eggshell volume showed significantly high linear relationships (R^2 = 0.532 -0.999), with egg length, egg width, axes length and axes width.

Conclusion

The study of eggs physical quality and chick's performance traits of black necked Ostrich in Sudan indicate that comparable to those reported from other countries. The variability of egg weight, egg length, egg width, axis length, width, shape index, specific gravity and the relationships between these parameters and hatching rate may be taken into account in incubation procedures management. However, the Success of the ostrich industry depends on good management of breeding stock, proper post-lay handling of fertile eggs, the correct incubation process and good quality management of chicks rearing. The potential of ostrich farming has not been fully utilized. Among the various constraints, breeding, hatching, nutrition and chicks rearing management are the major areas; the Low of fertility,

hatchability and chick survivability of ostrich is one of the major factors impeding the success rate of ostrich husbandry.

In conclusion, future research on the conservation and development of ostrich black necked under Sudan climate and how to encourage the survivability of ostrich in captivity.

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Table (2): The performance traits of black neck ostrich chicks for the 1st three months

Parameter Chick age	N	Chick weight (g)	Feed intake (g)	Weight gain (g)	Feed conservation ratio (FCR)	Mortality rate%
1st month	87	2056.7±14.6	1855.4±4.25	1297.69±11.0	1.4±0.5	32%
2nd month	65	6565.1±72.0	5042.5±9.0	4514.24±24.3	1.1±0.0	27%
3rd month	57	14153.5±115.2	14587.6±16.0	7515.52±48.8	1.9±0.3	12%

N=number of chicks'.

Table(3): Correlations of external egg characters and hatch weight of black neck ostrich

Parameters	egg weight (g)	egg length (cm)	egg width (cm)	axis length (cm)	axis width (cm)	egg volume (cm^3)	egg specific gravity (g/cm^3)	egg surface (cm^2)	shell volume
egg long circumference (cm))	.921**								
egg long circumference (cm)	.892**	.809**							
axis length(cm)	.977**	.898**	.863**						
axis width(cm)	.997**	.916**	.890**	.975**					
egg volume (cm^3)	.988**	.901**	.869**	.982**	.988**				
egg specific gravity ($g/cm^{3)}$	-.970**	-.900**	-.871**	-.972**	-.975**	-. 947**			
egg surface (cm^2)	1.000**	.922**	.894**	.977**	.997**	.984**	-.974**		
shell volume	.938**	.733**	.853**	.918**	.937**	.924**	-.918**	.939**	
Hatch chick weight	.488**	.500**	.342**	.456**	.496**	.478**	-.471**	.488**	.414**

**. Correlation is significant at P= 0.01 level (2-tailed).

Table(4) Regression of egg weight, volume, surface and shell volume of black necked ostrich

Prediction Equation	R^2	SE	Sig
EWT=-2345.054+85.835 * EL	0.846	50.433	***
EWT= -2256.097+ 92.588 * EWDT	0.794	58.270	***
EWT= 58.934 +90.219 * EAXL	0.977	27.493	***
EWT= - 0.528 + 112.303 * EAXWDT	0.999	3.325	***
EV = -2142.242+ 2.392 * EWT	0.977	46.688	***
EV = -7689.665 + 203.863 * EL	0.815	133.687	***
EV = -7414.437 + 218.244 * EWDT	0.754	154.25	***
EV= - 2052.659+219.528 * EAXL	0.965	58.093	***
EV = -2142.868 +268.593 EAXWDT	0.976	47.764	***
ESr = -475.486 +24.402 * EL	0.848	14.245	***
ESr =-450.770 +26.336 * EWDT	0.797	16.451	***
ESr = 208.481 +25.608 * EAXL	0.953	7.894	***
ESr = 191.446 + 3.891 * EAXWDT	0.999	1.106	***
ESV = 2.261 + 0.257 * EL	0.532	0.332	***
ESV = 0.344 + 0.334 *EWDT	0.724	0.255	***
ESV = 8.786 + 0.32 *EAXL	0.840	0.194	***
ESV = 8.58 + 0.398 *EAXWDT	0.877	0.701	***

EWT=Egg weight, EL= Egg Length, EWDT=Egg width , EAXL= Egg axes length, EAXWDT = Egg axes width, EV= Egg volume, ESr = Egg surface, ESV= Egg shell volume, SE= Stander Error, R^2= Regression square, Sig = significant,
*** significant P < 0.001,

خصائص البيض الخارجية وميزات الأداء الأنتاجي لكتاكيت النعام ذي الرقبة السوداء

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1-مزرعة النيل للنعام ،شرق النيل ، سوبا.

2-قسم علوم وتكنولوجيا الأنتاج الحيواني ، كلية علوم وتكنولوجيا الأنتاج الحيواني ،جامعة السودان للعلوم والتكنولوجيا .

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المستخلص

أجريت هذه التجربة بمزرعة النيل لتربية النعام بشرق النيل ،الخرطوم ،السودان في الفترة ما بين 5 فبراير إلي 15 اغسطس 2018 وذلك من اجل تقييم الخصائص الخارجية للبيض و الأداء الأنتاجي لكتاكيت النعام.في هذه التجربة تم تحضين 122 بيضة نعامة حتي الفقس ومن ثم تربية114 من كتاكيت النعام الفاقسه في نظام شبه المغلق . أظهرت نتائج التجربة ان متوسط وزن بيض النعام جرام1307.25±11.59والطول0.12 ±42.55 سم والعرض 0.11±38.49 سم والقطر الطولي 0.13±13.84 والقطر العرضي0.10 ±11.65سم وحجم البيضة 28.03±984.92 سم ^{3}و معا مل شكل البيضة%0.16±90.47 والثقل النوعى0.02 ±1.40 ومساحة سطح البيضة 3.96±562.82 سم م ^{2} . وقد أظهرت الدراسة وجود أرتباط معنوي بين الخصاص الخارجية للبيضة ووزن الكتكوت الفاقس ويتراوح مدئ معامل الارتباط بين 0.34- 1.0 (معظم معامل الارتباط أعلي من 0.8). الأداء الانتاجي لكتاكيت النعام تضمن وزن الكتاكيت ومعدل استهلاك العلف والزيادة في الوزن ومعدل التحويل الغذائي من الشهر الأول وحتي الشهر الثالث للتجربة . متوسط وزن كتاكيت النعام كان (±14153,±,14.66565.08±2056.66 جرام)ومعدل التحويل الغذائي (±1.1,1.4و±1.9) والنفوق (27%,32%و12%) من الشهر الأول وحتي الشهرالثالث علي التوالي .