EFFECTS OF SEXUAL DIMORPHISM ON BIOMETRY OF MAJOR RESPIRATORY ORGANS OF NIGERIAN INDIGENOUS CHICKEN

Mahmud, M.A.[1]* Aliyu, M.A. [2] and Danmaigoro, A.[3] , Abdulsalam, W.[1] and Ndagimba, R.J.[1]

[1]*Department of Animal Health and Production Technology, Niger State College of Agriculture, Mokwa, Niger State, Nigeria.*

[2]*Department of Pre-ND Science, Niger State College of Agriculture, Mokwa, Niger State, Nigeria*

[3]*Department of Veterinary Anatomy, Usmanu Danfodiyo University, Sokoto, Nigeria.*

***Corresponding author's Email:** drmahmud2@gmail.com; **Telephone: +2348036347603**

ABSTRACT

Thirty apparently healthy Male and Female local chickens (Fifteen per sex, **all above one year of age**) were purchased from local markets in Mokwa **and slaughtered. The major respiratory organs were harvested for sexual dimorphic biometric studies.** The weight, length, diameter, thickness and volume of the segments were considered for the studies. The mean weights, lengths, diameters, thicknesses and volumes of major respiratory organs of Male and Female Nigerian local chickens studied, were not significantly different ($P>0.05$) from one another except the length of the trachea which was significantly ($P\leqslant 0.05$) longer in the females than the males of Nigerian local chickens. However, these measurements differed from the values in the literature for chickens and for birds in general. This study will add to the knowledge of avian comparative anatomy and aid the pathologist in diagnoses in this species.

Key Words: Effects, Sexual dimorphism, Biometry, Respiratory organs, Chicken

INTRODUCTION

The Nigerian native chicken plays major role not only in rural economics but also contributes substantially to the gross national product (Momoh *et al*., 2007). They contain a highly conserved genetic system with high level of heterozygote (Wimmers *et al*., 2000). Ebozoje and Ikeobi (1995) reported the adaptive potentials of the Nigerians indigenous chickens to varied ecological conditions, stresses and diseases. Many major species effects which include of growth, resistance to infection, fertility, adaptability, sources of production and semen's characteristic have been reported (Ebozoje and Ikeobi, 1995). However, there are scanty reports on similarities and differences which may exist among this species of poultry in particular comparative biometric studies of respiratory system. Since the lung plays an important role in exchange of gases between the environment, any alteration and impairment of the lungs in farm birds, both in structure and function will have a profound effect on the performance of the birds (Dyce *et al*., 2010). Therefore, this study was carried out with the aim of studying the effects of sexual dimorphism on the biometry of the major respiratory organs in the Nigerian indigenous chicken. This study will add to the knowledge of avian comparative anatomy and aid the pathologist in diagnoses in this species.

MATERIALS AND METHODS

The present study was conducted in the Anatomy Department of Animal Health and Production Technology, Niger State College of Agriculture, Mokwa, North Central, Nigeria. Mokwa is locate at latitude $90^0$19'38" North and Longitude $50^0$3'16 East (Google Map 2022). Thirty apparently healthy Male and Female local chickens (Fifteen per sex) were purchased from local markets in Mokwa. They were quarantined for two weeks and then stabilized for another two weeks in a pen at the poultry unit, livestock farm of the College. They were fed commercial grower diet (Animal Care® feed) within these periods and water *ad libitum* under a good management practice. At the end of these periods, all birds were fasted for 12 hours, live body weights were recorded and then all of them were slaughtered using *Halal* method (Wilson, 2005) of slaughtering. They were allowed to bleed for two (2) minutes before been de-feathered. Organs were noted in situ and then were eviscerated. The respiratory organs were collected for gross morphometric studies. The weight, length, diameter, thickness and volume of the segments were considered for the studies. The weight (g), length (cm), thickness (cm), diameter (mm), and volume (cm^3) were measured using a weighing balance (Shimadzu AW320, Germany), metre rule, digital Vernier caliper, thread and volume displacement respectively. The major respiratory organs data obtained were expressed as Mean ± SEM (Standard Error of Mean) and subjected to statistical analysis using Statistical

Package for the Social Sciences (SPSS) version 26.0. Independent T-Test at 95% confidence interval (CI) was used to determine the level of significant difference in mean values between Male and female Nigerian Local chickens. Values of ($P \leq 0.05$) were considered significant.

Results

The results for mean weights, mean lengths, mean diameter, and mean thickness / mean volume of segments of the respiratory organs in the Male and female Nigerian local chickens studied are presented in Table 1. Among all the parameters measured in both sexes, only the Length of Trachea was significantly ($P \leq 0.05$) different from each other.

Table 1: Effects of Sexual dimorphism on biometry of major respiratory organs in Nigerian local chickens

Parameters	Male	Female	P-value
Weight (gm)			
Body weight	881.25±149.48	799.08±89.87	0.656
Overall weight of major respiratory organs	4.85±0.88	5.14±0.46	0.790
Weight of right lung	1.70±0.29	1.73±0.15	0.928
Weight of left lung	1.63±0.32	1.70±0.16	0.865
Weight of trachea	1.03±0.41	0.95±0.09	0.860
Length (cm)			
Length of thoracic inlet to trachea bifurcation	1.22±0.14	2.05±0.47	0.118
Length of trachea	14.65±0.30	15.60±0.25	0.043*
Length of right primary bronchus	1.37±0.17	1.28±0.12	0.681
Length of left primary bronchus	1.92±0.36	1.33±0.05	0.200
Length of left lung	2.75±0.13	3.00±0.09	0.157
Length of right lung	2.65±0.15	2.94±0.09	1.680
Diameter (mm)			
Diameter of the trachea	0.55±0.06	0.60±0.02	0.523
Diameter of the right lung	2.22±0.18	2.09±0.07	0.548
Diameter of left lung	2.09±0.09	2.03±0.07	0.660
Diameter of the right primary bronchus	0.40±0.04	0.34±0.01	0.253
Diameter of the left primary bronchus	0.45±0.06	0.35±0.01	0.252
Diameter of proximal trachea ring	0.75±0.06	0.73±0.03	0.832

Volume (cm^3)			
Volume of the right lung	4.35±0.60	3.86±0.37	0.525
Volume of the left lung	4.70±0.67	4.09±0.54	0.504
Thickness (mm)			
Thickness of the right lung	4.45±1.29	3.81±0.18	0.659
Thickness of the left lung	4.23±1.22	3.56±0.18	0.627
Others			
Number of lobulations of the left lungs	4.50±0.28	4.41±0.14	0.808
Number of lobulations of the right lungs	4.50±0.28	4.16±0.11	0.343
Total trachea ring number	108.50±4.97	98.33±2.09	0.131

*Significant (P≤0.05)

DISCUSSION

The present results on the body weight of the male and female chickens to be 881.25 ± 149.48g and 799 ± 89.87g respectively are lower than the mean values of 1000.50 ± 25.01 g, 898.00± 20.11 g and 908.00 ± 31.41 g earlier reported by Peters *et al*. (2010) in matured No, Na and F genotypes respectively that had undergone at least one breeding cycle. Also, they are lower than the live weight values reported by Peters *et al*. (2010) in Nigerian native chickens, Okpe *et al*. (2010) in Nigerian local breed of chicken and Mekonnen *et al*. (2010) for indigenous scavenging chickens in Ethiopia. They were however within the range reported by Gueye (1998) for chickens in Africa and Aini (1999) for family rural chickens in East Asia. They are also less than the values reported by Maina *et al*. (1982) in Aseel and Vanaraji chickens of 1472.43 ±68.94g and 3322.14 ±90.49g respectively. This difference might be due to genetic, climatic or nutritional factors. The present results on the (Mean ± SEM) weights of trachea of male and female Nigerian local chickens to be 1.03 ± 0.41g and 0.95 ± 0.09g respectively disagrees with reports of Pierko (2008) and al-Mahmoori (2016) in scaup (0.152±0.018g) and kingfisher bird (3.66±0.66g) tracheal weights respectively. This difference might be attributed to genetic variations. The present result on the length of trachea in male and female chicken found to be 14.65 ± 0.30cm and 15.60 ± 0.25cm respectively this result disaccord with the reports of al-Mussawy (2011), Ibe *et al*. (2008) and Pierko (2008) who showed that the length of trachea in turkeys (26 ± 1.23 cm); in West African guinea fowl (26.363 ± 0.383 cm) and in scaup (*Aythya marila)* was (15.8 ± 0.53 cm). This difference could be due to species and body volume of birds. Also, the significant longer tracheal length in the females than the males might be one of the reasons why tone of vocalization in the females is not as high as found in the males. The present result on the (Mean ± SEM) numbers of lobulations of the right lung of male and female chickens were 108.50 ± 4.97 and 98.33 ± 2.09 respectively are not in accord with the studies of al-Mussawy (2011), Ibe *et al*. (2008), Rajathi (2009), Hogg (1982) Onuk (2010) and Kabak *et al*. (2007) in West African guinea fowl (*Numida meleagris galeata*) (119 – 159); in scaup (*Aythya marila*) (97 ± 7.6); in Japanese Quail (110 – 116); in the domestic fowl (107- 138); in goose (*Anser anser domesticus*) (137 – 140) and in the long-legged buzzard (Buteo rufinus) (89 – 96). This difference could be due to species and body volume of birds. However, the present results coincide with reports of Nickel *et al*. (1977), who reported the presence of 100 to 130 rings in the trachea of fowl. The present results on the (Mean ± SEM) diameters of proximal trachea ring of male and female chickens were 0.75 ± 0.06mm and 0.73 ± 0.03mm

respectively differed from the reports of Al-Mussawy (2011), Ibe *et al*. (2008) and Maina and Nathanael (2001), as mean diameter in turkeys (1.01 ± 0.03 cm); in West African guinea fowl (0.0875 ± 0.0031 cm) and in ostriches (2 cm). The present results on the (Mean ± SEM) lengths of right primary bronchi of male and female chickens found to be 1.37 ± 0.17cm and 1.28 ± 0.12cm respectively and the (Mean ± SEM) lengths of left primary bronchi of male and female chicken found to be 1.92 ± 0.36cm and 1.33 ± 0.05cm respectively, disagree with the results of al-Mussawy (2011), Alumeri (2013) and al-Mahmoori (2006) who mentioned that in Bee-eater the length of right and left bronchi were 1.025 ± 0.15 cm and 1.075 ±0.14 cm respectively, while the length of left and right bronchi in *Columba palumbus* were (0.7 ± 0.1 cm) and (0.65 ± 0.05 cm) respectively, and in the turkey the lengths of left and right primary bronchi were 4cm and 5cm respectively.

CONCLUSION

The mean weights, lengths, diameters, thicknesses and volumes of major respiratory organs of Male and Female Nigerian local chickens studied, were not significantly different ($P>0.05$) from one another except the length of the trachea in which it is significantly ($P\leqslant 0.05$) longer in the females than the males of Nigerian local chickens. However, these measurements differed from the values in the literatures for chickens and for birds in general. This study will add to the knowledge of avian comparative anatomy and aid the pathologist in diagnoses in this species.

REFERENCES

Aini, I. (1999). Diseases in rural family chickens in South East Asia. In: The First International Network for Family Poultry Development (INFPD), Electronic Conferences on the Scope and Effect of Family Poultry Research and Development, FA.

al-Mamoori, N.A. (2016). Anatomical and Morphometric Study of the Trachea in Pied Kingfisher Birds (*Ceryle rudis*). *Kufa Journal of Veterinary Medical Sciences*, 7 (2): 15 -23.

al-Mussawy, A.M.M. (2011). Anatomical and Histological Study of Major Respiratory Organs (Larynx, Trachea, Syrinx, Bronchi and Lungs) In Indigenous Male Turkey *(Meleagris gallopava).* M.S. Thesis. AL-Qadisiya University Veterinary Medical College.

Alumeri, S.K., Al-Mamoori, N.A. and Al-Bishtue, A. (2013). Grossly and microscopic study of the primary bronchi and lungs of wood pigeon (*Columba palumbus*). *Kufa Journal of Veterinary Medical Sciences*, 2: 72- 79.

Dyce, K.M., Sack, W.O. and Wensing, C.J. (2010). Text Book of Veterinary Anatomy. *Philadelphia, London New York.*

Ebozoje, M.O. and Ikeobi, C.O.N. (1995). Productive performance and occurrence of major genes in the Nigerian local chicken. *Nigerian Journal of Genetics*, 10: 67–77.

Google Maps (2022). www.maps.google.com.ng/maps?hl=en&tab=ll, retrieved 2022-04-22

Gueye, E.F. (1998). Village egg and fowl meat production in Africa. *World's Poultry Science Journal*, 54: 73-86.

Hogg, D.A. (1982). Ossification of the laryngeal, tracheal and syringeal cartilages in the domestic fowl**.** *Journal of Anatomy*, 134 (1): 57-71.

Ibe, C.S., Onyeanusi, B.I., Salami, B.I., Umosen, A.D. and Maidawa, S.M. (2008). Studies of the major respiratory pathways of the West African guinea fowl (*Numida meleagris galeata)*. The Morphometric and Macroscopic Aspects. *International Journal of Poultry Science*, 7(10): 997-1000.

Kabak, M. Orhan, I. and Haziroglu, R.M. (2007). The gross anatomy of larynx, trachea and syrinx in the long-legged buzzard (Buteo rufinus). *Anatomia, Histologia, Embryologia,* 36 (1): 27 – 32.

Maina, J.N. and Nathaniel, C. (2001). A qualitative study of the lung of an ostrich, *struthis camelus. Journal of Experimental Biology*, 204: 2313. 2330.

Maina, J.N, Abdallah, M.A. and King, A.S. (1982). Light Micro-Scopic Morphometry of the lung of 19 avian species. *Acta Anatomica (Basel).* 112 (3): 264-70.

Mekonnen, H., Kelay, B., Berhan, T. and Mulatu, D. (2010). Assessment of nutritional status of indigenous scavenging chickens in Ada'a district, Ethiopia. *Tropical Animal Health and Production*, 42: 123-130.

Momoh, O.M., N.G. Ehiobu and C.C. Nwosu. (2007). Egg production of two Nigerian local chicken ecotypes under improved management. Proceedings 32nd Annual conference of Nigerian Society for Animal Production, March 18-22, University of Calabar, Nigeria, pp: 278-281

Nickel, R., Schummer, A. and Seiferle, E. (1977). Anatomy of the Domestic Birds. Verlg Paul Parey, Berlin- Hamburg. 65-70.

Okpe, G.C., Nwatu, U. and Anya, K. (2010). Morphometric study of the testes of the Nigerian local breed of chicken. *Animal Research International*, 7(2): 1163 – 1168

Onuk, B. Haziroglu, R.M. and Kabak, M. (2010). The gross anatomy of larynx, trachae and syrinx in goose (*Anser anser domesticus*). *Kafkas University Veterinary Faculty, Derg*, 16 (3): 443 - 450.

Peters, S.O., Olusegun, M.O.I., Brilliant, O.A, Egbede ,R.O. and Fafiolu, A.O. (2010). Genotype and Sex Effect on Gastrointestinal Nutrient Content, Microflora and Carcass Traits in Nigerian Native Chickens. *International Journal of Poultry Science*, 9 (8): 731-737.

Pierko, M. (2008). Size of the upper respiratory tract with reference to the body in scaup *(Aythya marila)*. ***Electronic Journal of Polish Agricultural Universities,* 11**(4), 34.

Rajathi, S., Lucy, K.M., Maya, S. and Chungath, J.J. (2009). Anatomical studies on the trachea in Japanese Quail (*Coturnix coturnix japonica*). *Journal of Veterinary and Animal Sciences*, 40: 17-19.

Wilson, G.W. (2005). Wilson's Practical Meat Inspection. 7th edition. Blackwell Publishing, USA. Pp. 82

Wimmers, K., Ponsuksili S, Hardge T, Valle-Zerate A, Marthur PK, Horst P (2000). Genetic distinctness of African, Asian and South American local chickens. *Animal Genetics*, 31: 159-165