African Scientist Vol. 23, No. 4 December 31, 2022
Printed in Nigeria

1595-6881/2022 $10.00 + 0.00

http://www.niseb.org/afs

AFS2022038/23414

Variations by Sex and Genotype in Morphometry of the Oropharyngeal Cavity in Nigerian Indigenous Chickens

Mahmud, M.A.[1]*, Aliyu, M.A.[2], Danmaigoro, A.[3], Shehu, S.A.[4] and Abdulsalam, W.[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.
[4]Department of Veterinary Anatomy, Bayero University, Kano, Nigeria.

*Corresponding author Email: drmahmud2@gmail.com Tel: +234 (0) 803 634 7603

(Received November 21, 2022; Accepted in revised form December 19, 2022)

ABSTRACT: This study was conducted with the aim of studying the variations by sex and genotype in morphometry of the Oropharyngeal Cavity in Nigerian indigenous chickens. Avian mouth and pharynx do not show any definite line of demarcation, but constitute a common Oropharyngeal Cavity. Generally, anatomical structures found in the dorsal wall of the oropharynx include the palate, choanal slit, and infundibulum, while structures in the ventral wall of the Oropharynx include a concave depression between the rami of the lower beak, laryngeal mound and glottis. Thirty apparently healthy adult indigenous chickens were purchased from local market in Mokwa, quarantined, stabilized, slaughtered, de-feathered and the heads were collected for morphometric studies. The width, length and thickness of structures in the Oropharyngeal cavity parameters were used for this study. The data obtained were expressed as Mean ± SEM and subjected to statistical analysis using Multivariate Analysis of Variance at 95% Confidence Interval (CI). Values of [$P \leq 0.5$] were considered significant. There was no significant interaction between sex and genotype on the combined dependent variables, Wilks' $\Lambda = 0.00$, F (36, 2) = 3.495, $p = 0.247$; multivariate η^2=0.984. The main effects of sex and genotype were not significant, Wilks' $\Lambda = 0.03$, F (18, 1) = 17.334, $p = 0.187$; multivariate η^2=0.997 and Wilks' $\Lambda = 0.01$, F (36, 2) = 1.635, $p = 0.452$; multivariate η^2=0.9676 respectively. This indicates that linear composite of the combined dependent variables does not differ between Male and Female chickens and across the genotypes. The mean lengths, thicknesses and widths of upper beak at commissure at the transverse row of papillae of three genotypes studied were significantly different from one another ($P<0.05$) except the lower beak at lateral side ($P \geq 0.05$). This study also established a base line data for further oropharyngeal cavity in these three genotypes of Nigerian indigenous chicken.

Keywords: Genotype, Morphometry, Oropharynx, Chickens

Introduction

The indigenous poultry species represent valuable resources for livestock development because their extensive genetic diversity allows for rearing of poultry under varied environmental conditions, providing a range of product and functions. Thus, great genetic resources embedded in the indigenous poultry await full exploitation that will provide basis for genetic improvement and diversification to provide breeds that adapted to local condition for the benefit of farmers in developing countries (Horst, 1988; Sonaiya *et al.,* 1999). In Nigeria, indigenous chickens were characterized along genetics line of feather and plumage colour (such as normal or frizzle feathered), body structure (such as Naked neck, dwarf type) and colour variants (such as Black, white, brown nettled etc.). The wide variety in the structure of oral cavity in birds is related to the adaptation of strategies for feeding methods, different kinds of food and climatic conditions (Iwasaki, 2008). Avian mouth and pharynx do not show any definite line of demarcation, but constitute a common Oropharyngeal Cavity (Bacha and Bacha, 2000; Gussekloo, 2006; Igwebuike and Eze, 2010; Igwebuike and Anagor, 2013). The

Oropharyngeal Cavity plays a very important role in the maintenance / movement of Oral Cavity and swallowing of food bolus. Generally, anatomical structures found in the dorsal wall of the Oropharynx include the Palate, Choanal Slit, and Infundibulum, while structures in the ventral wall of the Oropharynx include a concave depression between the rami of the lower beak, laryngeal mound and glottis (Dehkordi *et al*., 2010). Avian Oropharynx is known to exhibit major morphological variation as a reflection of differences in habitats, feeding habits and nature of diets consumed by the birds (King and Mcleland, 1984). Indeed, it has been demonstrated that some correlation exists between the form-function complexes of the feeding apparatus and the extent of diversity of food habits shown by birds (Bhattacharya, 1994). Some recent studies on the morphology of the Avian Oropharynx have been restricted in general to gross inspection of the region and to the chickens in general (Igwebuike and Eze, 2010; Igwebuike and Anagor, 2013). Very little information exists in the literature regarding the genetic variations in the oral cavity of the Nigerian indigenous chicken genotypes. Thus, this study was conducted with the aim of studying the effects of sex and gene on gross morphometry of the Oropharyngeal Cavity in Nigerian indigenous chickens.

Materials and methods

The present study was conducted in the Anatomy Laboratory, Department of Animal Health and Production Technology, Niger State College of Agriculture, Mokwa, North central, Nigeria. Mokwa is located at the Latitude 9°19'38" North and Longitude 5°3'16" East (Google map, 2022). Thirty apparently healthy adult Normal feathered, naked neck and frizzle feather genotypes of Nigeria indigenous chickens (five male and five females of each genotype all above one year of age) were purchased from local market in Mokwa. They were quarantined for two weeks and stabilized for another two weeks in a pen at poultry unit, livestock farm of the college. They were fed commercial grower diet (Animal care$^{(R)}$ 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 (Willson, 2005) of slaughtering. They were allowed to bleed for two (2) minutes before being de-feathered. The heads were collected for gross morphometric studies. The width, length and thickness of structures in the Oropharyngeal cavity (Plates 1 & 2) were considered for studies. The lower beak length was measured from the median plane to transverse row of papillae, the commissure of the mouth cavity was measured from the upper beak to the lower beak at joint points, the tongue length was measured over the lingual apex, body and root, within the width of tongue at papillary crest were measured. Also, the Laryngeal mound length and its widths were measured at posterior and anterior region accordingly. The weight (g), length (cm), width (cm) and thickness (cm), were measured using weighing balance and thread, meter rule, compass (divider) and digital vernier calliper respectively. The Oropharyngeal cavity data obtained were expressed as mean±SEM (Standard Error of Mean) and subjected to statistical analysis using Statistical Package for the Social Science (SPSS) version 26.0. Multivariate Analysis of Variance (MANOVA) at 95% Confidence Interval (CI) was used to determine the level of significant difference in mean values among the three genotypes as well as their sexual dimorphism. Values of [$P \leq 0.5$] were considered significant. Where there were differences in means, they were separated by Tukey's HSD. (Kaps and Lamberson, 2004).

Results

The means for oropharyngeal cavity (Plates 1 & 2) parameters of the Nigerian indigenous chickens are presented in Tables 1, 2 & 3. There was no significant interaction between sex and genotype on the combined dependent variables, Wilks' $\Lambda = 0.00$, F (36, 2) = 3.495, $p = 0.247$; multivariate η^2=0.984. The main effect of sex was not significant, Wilks' $\Lambda = 0.03$, F (18, 1) = 17.334, $p = 0.187$; multivariate η^2=0.997. This indicates that linear composite of the combined dependent variables does not differ between Male and Female Nigerian indigenous chickens. The main effect of genotype was not significant as well, Wilks' $\Lambda = 0.01$, F (36, 2) = 1.635, $p = 0.452$; multivariate η^2=0.9676. This indicates that the linear composite of the combined dependent variables does not differ across the three genotypes (Table 1). The follow-up ANOVA and Student T-test results for genotype and sex relations respectively to the morphometry of the oropharyngeal cavity in the Nigerian indigenous chicken are presented in Tables 2 and 3

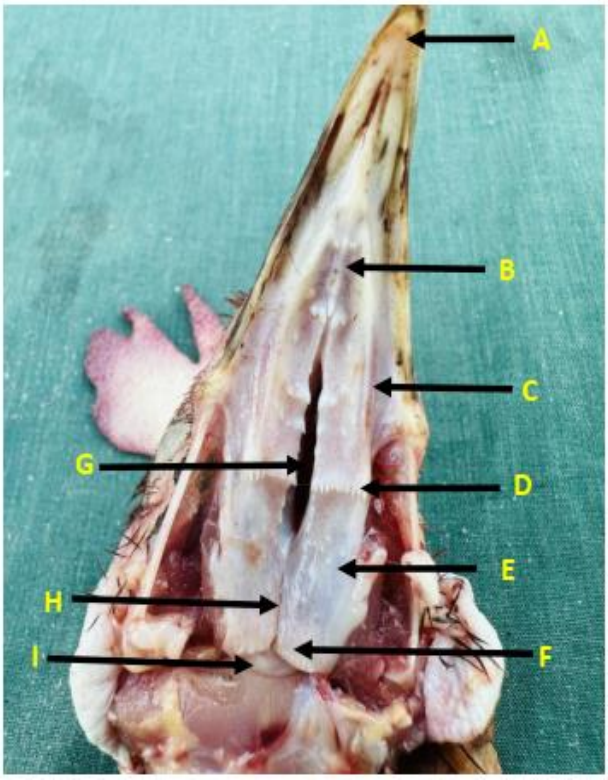

Plate 1: Roof of oropharyngeal cavity showing upper beak (A), median ridge (B), lateral palatine ridge (C), last row of papillae on the palate (D), pharynx (E), row of pharyngeal papillae (F), palatine cleft (choanal cleft) (G), infundibular cleft (H), esophagus (I).

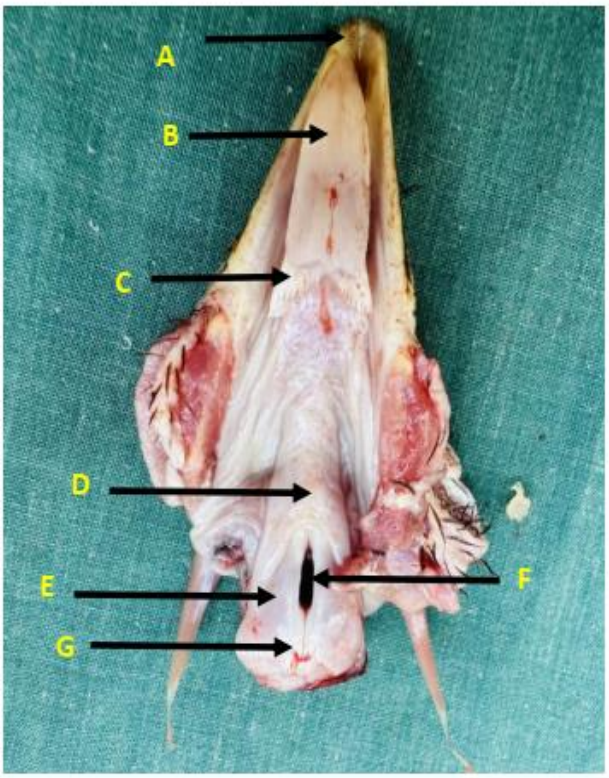

Plate 2: Floor of oropharyngeal cavity showing lower beak (A), tongue (B), row of lingual papillae (C), pharynx (D), laryngeal mound (E), laryngeal cleft (F), row of pharyngeal papillae on laryngeal mound (G)

Genotype wise: The means of lower beak length on the lateral side and lower pharynx length in the NC were significantly different ($p \leq 0.05$) from those of NN and FF while the means of upper pharynx width at anterior region, upper pharynx width at posterior region, lower pharynx width at posterior region, total lengths of palate and total lengths of choanal cleft in NC were significantly different ($P \leq 0.05$) from those of FF. The mean glottis length in NC was significantly different ($p \leq 0.05$) from that of the NN. All other parameters measured in the oropharyngeal cavity of the three genotypes were not significantly different ($P > 0.05$) from one another.
Sex wise: the means of lower beak length on the lateral side, lower pharynx length and glottis length in male and female Nigerian Indigenous chickens irrespective of genotype were significantly different ($P \leq 0.05$) from one another while all other parameters measured were not significantly different ($P > 0.05$) from one another.

Table 1: Effects of genotype and sex on morphometry of oropharyngeal cavity in three Nigerian indigenous genotypes of chicken

Parameters			NC		NN		FF	
Beak			**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
Upper beak length			4.53 ± 0.13	4.10 ± 0.80	5.18 ± 0.29	4.53 ± 0.25	5.20 ± 0.29	3.68 ± 0.54
Upper beak width	At the commissure of the mouth cavity		1.50 ± 1.09	1.70 ± 0.42	2.15 ± 0.91	1.95 ± 0.81	1.90 ± 0.64	1.88 ± 0.10
	At the level of the last transverse row papillae		3.20 ± 0.80	2.38 ± 0.26	2.28 ± 0.82	2.40 ± 0.95	2.18 ± 0.70	2.18 ± 0.71
Lower beak length	At the median plane up to transverse row of papillae		3.35 ± 0.44	3.75 ± 0.75	4.43 ± 0.78	3.95 ± 0.44	3.95 ± 0.31	3.30 ± 0.47
	On lateral side (commissure of mouth cavity)		2.30 ± 0.14	2.30 ± 0.28	2.95 ± 0.25	2.65 ± 0.24	3.18 ± 0.21	2.45 ± 0.39
Pharynx								
Upper part	Length		2.38 ± 0.19	1.68 ± 0.59	2.50 ± 0.32	2.33 ± 0.27	2.68 ± 0.93	2.25 ± 0.97
	Width	Anterior region	0.35 ± 0.10	0.38 ± 0.96	0.75 ± 0.33	0.63 ± 0.30	0.70 ± 0.35	1.10 ± 0.29
		Posterior region	0.45 ± 0.37	0.38 ± 0.22	0.78 ± 0.31	0.75 ± 0.28	1.10 ± 0.62	0.90 ± 0.22
Lower part	Length		1.25 ± 0.44	1.00 ± 0.22	2.70 ± 0.88	2.13 ± 1.19	2.55 ± 0.77	2.10 ± 0.67
	Width	Anterior	1.10 ± 0.41	0.98 ± 0.40	0.88 ± 0.25	0.80 ± 0.24	0.83 ± 0.40	0.75 ± 0.21
		Posterior	0.93 ± 0.15	0.78 ± 0.17	1.03 ± 0.05	0.88 ± 0.15	1.03 ± 0.13	1.15 ± 0.19
Laryngeal Mound								
Length			1.88 ± 0.25	1.05 ± 0.47	1.60 ± 0.62	1.15 ± 0.71	1.30 ± 0.36	1.03 ± 0.49
Width	Anterior region		1.18 ± 0.59	1.00 ± 0.22	1.23 ± 0.21	0.98 ± 0.26	1.00 ± 0.00	0.85 ± 0.13
	Posterior region		1.60 ± 0.80	0.70 ± 0.29	0.93 ± 0.29	0.75 ± 0.33	1.03 ± 0.05	1.00 ± 0.14
Glottis Length			0.50 ± 0.08	0.38 ± 0.15	0.75 ± 0.17	0.55 ± 0.24	0.75 ± 0.19	0.50 ± 0.08
Palate								
Total length of the palate			3.53 ± 1.15	2.68 ± 0.97	4.08 ± 0.53	3.28 ± 0.83	4.55 ± 0.67	3.70 ± 0.37
Total length of choanal cleft			1.43 ± 0.17	1.80 ± 0.56	1.98 ± 0.25	1.73 ± 0.41	2.15 ± 0.24	2.58 ± 1.16
Width of the rostral part of the choanal cleft (caudally)			0.83 ± 0.35	0.63 ± 0.43	0.53 ± 0.19	0.48 ± 0.35	0.48 ± 0.17	0.35 ± 0.17
Width of the rostral part of the choanal cleft (rostrally)			0.45 ± 0.06	0.25 ± 0.06	0.38 ± 0.22	0.28 ± 0.17	0.43 ± 0.17	0.23 ± 0.15
Length of lateral palatine ridge			3.00 ± 0.08	2.40 ± 0.41	2.55 ± 0.45	2.15 ± 0.19	3.05 ± 0.71	2.20 ± 0.22
Length of median palatine ridge			1.48 ± 0.05	1.10 ± 0.20	1.15 ± 0.24	1.05 ± 0.17	1.70 ± 0.72	1.13 ± 0.34
Total number of transverse rows of caudally pointing papillae			4.50 ± 0.58	4.50 ± 1.00	4.25 ± 0.50	4.50 ± 0.58	4.25 ± 0.50	4.25 ± 0.50
Infundibular cleft Length			0.78 ± 0.26	0.60 ± 0.82	0.75 ± 0.06	0.58 ± 0.10	0.63 ± 0.19	0.63 ± 0.10

` NC= Normal Chicken, NN=Necked Neck Chicken and FF = Frizzle Feather Chicken

Table 2: Effect of genotype on the oropharyngeal cavities of Nigerian indigenous chicken

Parameters	**Genotypes**		
	NC	**NN**	**FF**
Upper beak length (cm)	4.31 ± 0.16	4.85 ± 0.16	4.44 ± 0.16
Upper beak with at the commissure of the mouth cavity (cm)	1.60 ± 0.26	2.05 ± 0.26	1.89 ± 0.26
Upper beak width at the level of the last transverse row of papillae (cm)	2.79 ± 0.26	2.34 ± 0.26	2.18 ± 0.26
Lower beak length at the median plane up to transverse row of papillae (cm)	3.55 ± 0.20	4.19 ± 0.20	3.63 ± 0.20
Lower beak length on the lateral side (cm)	2.30 ± 0.09 [a]	2.80 ± 0.09 [b]	2.81 ± 0.09 [b]
Upper pharynx length (cm)	2.03 ± 0.22	2.41 ± 0.22	2.47 ± 0.22
Upper pharynx width at the anterior region (cm)	0.36 ± 0.09 [a]	0.69 ± 0.09[ab]	0.90 ± 0.09 [b]
Upper pharynx width at the posterior region (cm)	0.41 ± 0.13 [a]	0.76 ± 0.13 [ab]	1.00 ± 0.13 [b]
Lower pharynx length (cm)	1.13 ± 0.27 [a]	2.41 ± 0.27 [b]	2.33 ± 0.27 [b]
Lower pharynx width at the anterior region (cm)	1.04 ± 0.12	0.84 ± 0.12	0.79 ± 0.12
Lower pharynx width at the posterior region (cm)	0.85 ± 0.05 [a]	0.95 ± 0.05[ab]	1.09 ± 0.05 [b]
Laryngeal mound length (cm)	1.46 ± 0.18	1.38 ± 0.18	1.16 ± 0.18
Laryngeal mound width at the anterior region (cm)	1.09 ± 0.10	1.10 ± 0.10	0.93 ± 0.10
Laryngeal mound width at the posterior region (cm)	1.15 ± 0.14	0.84 ± 0.14	1.01 ± 0.14
Glottis length (cm)	0.44 ± 0.06 [a]	0.65 ± 0.06 [b]	0.63 ± 0.06 [b]
Total length of palate (cm)	3.10 ± 0.28 [a]	3.68 ± 0.28[ab]	4.13 ± 0.28 [b]
Total length of choanal cleft (cm)	1.61 ± 0.20 [a]	1.85 ± 0.20 [ab]	2.36 ± 0.20 [b]
Width of the rostral part of choanal cleft caudally (cm)	0.73 ± 0.11	0.50 ± 0.11	0.41 ± 0.11
Width of the caudal part of choanal cleft rostrally (cm)	0.35 ± 0.05	0.33 ± 0.05	0.33 ± 0.05
Length of lateral palatine ridge (cm)	2.70 ± 0.14 [a]	2.35 ± 0.14[b]	2.63 ± 0.14 [a]
Length of median palatine ridge (cm)	1.29 ± 0.13	1.10 ± 0.13	1.41 ± 0.13
Total number of transverse rows of caudally pointing papillae (cm)	4.50 ± 0.22	4.38 ± 0.22	4.25 ± 0.22
Infundibular cleft length (cm)	0.69 ± 0.05	0.67 ± 0.05	0.63 ± 0.05

[a, b] The means within the same row with different superscripts, are significantly different at (P<0.05). NC= Normal Chicken, NN=Necked Neck Chicken and FF = Frizzle Feather Chicken

Table 3: Effect of sex on the oropharyngeal cavity of Nigeria indigenous chickens

\	Gender		
	Male	**Female**	**P-value**
Upper beak length (cm)	4.97 ± 0.13	4.10 ± 0.13	0.063^{NS}
Upper beak width at the level of the last transverse row of papillae (cm)	2.55 ± 0.21	2.32 ± 0.21	0.257 ^{NS}
Lower beak length at the median plane up to transverse row of papillae (cm)	3.91 ± 0.16	3.67 ± 0.16	0.070 ^{NS}
Lower beak length on the lateral side (cm)	2.81 ± 0.07	2.47 ± 0.07	0.001*
Upper pharynx length (cm)	2.54 ± 0.18	2.08 ± 0.18	0.334 ^{NS}
Upper pharynx width at the anterior region (cm)	0.60 ± 0.08	0.70 ± 0.08	0.003 ^{NS}
Upper pharynx width at the posterior region (cm)	0.78 ± 0.11	0.68 ± 0.11	0.016 ^{NS}
Lower pharynx length (cm)	2.17 ± 0.22	1.74 ± 0.22	0.005*
Lower pharynx width at the anterior region (cm)	0.93 ± 0.10	0.84 ± 0.10	0.303 ^{NS}
Lower pharynx width at the posterior region (cm)	0.99 ± 0.04	0.93 ± 0.04	0.016*
Laryngeal mound length (cm)	1.59 ± 0.15	1.08 ± 0.15	0.491 ^{NS}
Laryngeal mound width at the anterior region (cm)	1.13 ± 0.09	0.94 ± 0.09	0.430 ^{NS}
Laryngeal mound width at the posterior region (cm)	1.18 ± 0.11	0.82 ± 0.11	0.310 ^{NS}
Glottis length (cm)	0.67 ± 0.05	0.48 ± 0.05	0.035*
Total length of palate (cm)	4.05 ± 0.23	3.22 ± 0.23	0.059 ^{NS}
Total length of choanal cleft (cm)	1.85 ± 0.17	2.03 ± 0.17	0.049 ^{NS}
Width of the rostral part of choanal cleft caudally (cm)	0.61 ± 0.09	0.48 ± 0.09	0.123 ^{NS}
Width of the caudal part of choanal cleft rostrally (cm)	0.42 ± 0.04	0.25 ± 0.04	0.930 ^{NS}
Length of lateral palatine ridge (cm)	2.87 ± 0.12	2.25 ± 0.12	0.214 ^{NS}
Length of median palatine ridge (cm)	1.44 ± 0.10	1.09 ± 0.10	0.236 ^{NS}
Total number of transverse rows of caudally pointing papillae (cm)	4.33 ± 0.18	4.42 ± 0.18	0.737 ^{NS}
Infundibular cleft length (cm)	0.72 ± 0.04	0.60 ± 0.04	0.705^{NS}

^{NS} Not Statistically significant at $\propto$ = 0.05, * Statistically Significant at $\propto$ = 0.05

Discussion

The present findings on the mean lengths of upper beak in NC, NN and FF to be 4.31 ± 0.6 cm, 4.85 ± 0.16 cm and 4.44 ± 0.16 cm respectively are higher than the mean value of 3.61± 0.08cm earlier reported by Gupta *et al.* (2015) in fowl. However, the mean values obtained in this present study as lengths of upper beak is much lower compared to the one reported in ostrich (6.3± 0.4 cm) by Tadjalli *et al.* (2008). These discrepancies could be explained on the bases of breed and/or species variations. The present results on the mean width of upper beak at the commissure of mouth cavity in NC, NN, and FF found to be 1.60 ± 0.26 cm, 2.05 ± 0.26 cm and 1.89 ± 0.26 cm respectively are lower than the mean value of 2.53 ± 0.04 earlier reported by Gupta *et al.* (2015) in fowl. The present results on the mean width of upper beak at the level of transverse rows of papillae in NC, NN, and FF found to be 2.79 ± 0.26 cm, 2.34 ± 0.26 cm, and 2.18 ± 0.26 cm respectively are higher than the mean value of 1.51 ± 0.02 earlier reported by Gupta *et al.* (2015) in fowl. The Present findings of mean lengths of lower beak at the median plane up to transverse row of papillae in NC, NN and FF found to be 3.55 ± 0.20cm, 4.19 ± 0.20cm and 3.63 ± 0.20cm respectively are higher than the mean value of 2.88 ± 0.18cmearlier reported by Gupta *et al.* (2015) in fowl. The present results on the mean lengths of lower beak at the lateral side of NC, NN and FF found to be 2.30 ± 0.09cm, 2.80 ± 0.09cm and 2.81 ± 0.09cm respectively are lower than the mean value of 3.17± 0.08 cm as earlier reported in fowl by Gupta *et al.* (2015). The differences seen in all the above results could be attributed to genetic influence. The present results on the mean lengths of upper pharynx in NC, NN and FF found to be 2.03 ± 0.22cm, 2.41 ± 0.22cm, 2.47 ± 0.22 respectively are higher than the mean width value of 1.57 ± 0.04 cm reported by Gupta *et al.* (2015) in fowl. The mean widths of pharynx at the anterior region of NC, NN and FF found to be 0.36 ± 0.09cm, 0.69 ± 0.09cm and 0.90 ± 0.09cm respectively in this present study are lower than the mean widths value of 1.51 ± 0.02cm reported by Gupta *et al.* (2015) in fowl. The mean length of lower pharynx of NC, NN and FF found to be 1.3 ± 0.27cm, 2.41 ± 0.27cm and 2.33 ± 0.27cm respectively in the present study are within the range mean length value of 2.29 ± 0.08 cm earlier reported by Gupta *et al.* (2014) in fowl. The mean width of lower pharynx at anterior region in NC, NN and FF found to be 1.04 ± 0.12cm, 0.84 ± 0.12cm, 0.79 ± 0.12cm respectively the mean width value of 1.17 ± 0.03cm reported by Gupta *et al.* (2015) in fowl. The mean width of lower pharynx at the posterior region of No, NC, NN and FF were 0.85 ± 0.05cm, 0.95 ± 0.05cm, and 1.09 ± 0.05cm respectively are lower than the mean value of 1.46 ± 0.05cm reported by Gupta *et al.* (2015) in fowl. The mean length of Laryngeal Mond in NC, NN and FF found to be 1.40 ± 0.18cm, 1.38 ± 0.18cm and 1.16 ± 0.18cm respectively in the present study are in close range of the mean value of 1.09 ± 0.03cm earlier reported by Gupta *et al.* (2015) in fowl. The mean length of Glottis of NC, NN FF, found to be 0.44 ± 0.06cm, 0.65 ± 0.06cm and 0.63 ± 0.06cm respectively in this present study

are in the same range of the mean value of 0.56 ± 0.02 cm earlier reported by Gupta *et al.* (2015) in fowl. The mean length of Choanal cleft in NC, NN and FF found to be 1.61 ± 0.20cm, 1.85 ± 0.20cm and 2.36 ± 0.20cm respectively in this study, are in the same range of the mean value of 1.66 ± 0.05 cm earlier reported by Gupta *et al.* (2015) in fowl. The mean length of lateral palatine ridge in NC, NN and FF to be 2.70 ± 0.14cm, 2.35 ± 0.14 cm, and 2.63 ± 0.14cm respectively in this present study are in agreement with the mean value of 2.36 ± 0.05 cm earlier reported by Gupta *et al.* (2015) in fowl. The mean length of median palatine ridge in NC, NN and FF found to be 1.29 ± 0.13cm, 1.10 ± 0.13cm and 1.41 ± 0.13cm respectively in this present study in agreement with the mean value of 1.42 ± 0.03cm earlier reported by Gupta *et al.* (2015) in fowl. The mean number of Transverse rows of Caudally pointing papillae in NC, NN and FF found to be 4.50 ± 0.22cm, 4.38 ± 0.22cm and 4.25 ± 0.22cm respectively in this study are lower than the mean value of 5 ± 0.17cm earlier reported by Gupta *et al.* (2015) in fowl. The mean length of Infundibular cleft in NC, NN and FF, found to be 0.69 ± 0.05cm, 0.67 ± 0.05cm and 0.62 ± 0.05cm respectively in this present study are similar the mean value of 1.09 ± 0.03cm earlier reported by Gupta *et al.* (2015) in fowl.

Conclusion

The mean lengths, thicknesses and widths of upper beak at commissure at the transverse row of papillae of three genotypes studied were significantly different from one another ($P<0.05$) except the lower beak at lateral side ($P\geq0.05$). The mean total lengths of tongues at the lingual apex, lingual body and lingual root in the three genotypes studied were significantly different from one another ($P<0.05$). This study in addition to its contribution on to the knowledge of Avian Anatomy up to the level of genotypes, it has also established a base line data for further oropharyngeal cavity studies in these three genotypes of Nigerian indigenous chicken.

References

Bacha WJ, Bacha LM: Color Atlas of Veterinary Histology. Lippincott Williams and Wilkins Company, UK. 2000.

Bhattacharyya BN: Diversity of feeding adaptations in certain columbid birds: a functional morphological approach. J Biosci, 19:415–427. 1994.

Dehkordi RAF, Parchami A, Bahadoran S: Light and scanning microscopic study of the tongue in the Zebra finch *Carduelis cardueli* (Aves: Passeriformes: Fringillidae). Slov Vet Res, 47-144. 2010.

Google Maps: Mokwa Local Government, Nigeria. Google Search Engine. 2022.

Gupta SK, Pathak A, Farooqi MM: Anatomy of oropharyngeal cavity of fowl (*Gallus domesticus*). Ind J Vet Anat, 27 (1): 12-14. 2015.

Gussekloo SWS: Feeding Structures in Birds: In: Feeding in Domestic Vertebrates: From Structure to Behaviour, V Bels (ed.) CABI Publishing, UK, pp. 14-19. 2006.

Horst P: Native fowl as reservoir for genomes and major genes with direct and indirect effects on production adaptability. Proceedings of the 18th World Poultry Congress, Japan, pp. 156-160. 1988.

Igwebuike UM, Anagor TA: Morphology of the oropharynx and tongue of the Muscovy duck (*Cairina moschata*). Vet Arhiv 83: 685 – 693. 2013.

Igwebuike UM, Eze UU: Anatomy of the Oropharynx and Tongue of the African Pied crow (Corvus aebus). Vet Arhiv 80, 523 – 531. (2010).

Iwasaki S: Evolution of the structure and function of the vertebrate tongue. J Anat, 201:1-13. 2008.

Kaps M, Lamberson WR: Biostatistics for Animal Science. CABI Publishing, UK. pp 72-97. 2004.

King AS, Mclelland J: Birds - Their Structure and Function. Bailliere Tindall, London. pp. 102. 1984.

Sonaiya EB, Branckaert RDS, Gueye EF: Research and development options for family poultry. First INFPD/FAO Electronic Conference on Family Poultry: 7 December, 1998 - 5 March, 1999. http://www.fao.org/ag/agap/1pa/famp01/Intropap.htm.

Tadjalli M, Mansouri SH, Poostpasand A: Gross anatomy of oropharyngeal cavity in the ostrich (*Ostruthio camelus*). Iran J Vet Res Shiraz Univ, 9(4): 316-323. 2008.

Wilson GW: Wilson's Practical Meat Inspection. Blackwell Publishing, USA, pp. 82. 2005.