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MORPHOLOGICAL CHARACTERIZATION OF INDIGENOUS CHICKEN POPULATIONS OF CENTRAL AND SOUTHERN PARTS OF BORNO STATE, NIGERIA

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Abstract

Morphological characterization of 600 indigenous chickens (normal feathered, naked neck and frizzle feathered) extensively reared in the central and southern parts of Borno State was investigated. Eight morphological measurements examined were body weight (BW), ornithological measurement (OM), wing span (WS), neck length (NL), back length (BL), keel length (KL), tail length (TL), and fold wing length (FW). The mean values were 1454.96 g, 63.87, 64.40, 13.32, 21.90, 11.73, 21.31 and 22.10 cm for BW, OM, WS, NL, BL, KL, TL and FW, respectively. Chickens from central part had higher significant ($P < 0.05$) values for body weight (1466.02 g) and keel length (12.23 cm) while those of the southern part had higher significant values for ornithological forms (neck length, back length, tail length) and some feather attributes (wing span and fold wing lengths). This implies that as chickens from the central could be improved for body weight and keel length those from the south could be developed for ornithological forms. Morphological traits of each chicken type were uniform across locations (central and south) based on phylogenetic tree. Meanwhile, frizzle feathered types were most diverse in terms of morphological characteristics while the naked neck and normal feathered were related in these traits. This characterization could be used to develop breeding strategies for improvement of the chickens and their subsequent conservation.

Key words: Ornithological measurement, hierarchical analysis, normal feathered chickens, naked neck, frizzle feathered chickens

Introduction

Indigenous chickens among other importance play a central role in alleviating hunger and malnutrition to the whole household (Vilaazi *et al.*, 2020). Meanwhile for sustainable use of these genetic resources, characterization is necessary. This would lead to further identification and evaluation of these resources in order to assess their potential contribution to food and agricultural production (Adeleke *et al.*, 2011). In other words, conservation and management of a particular population of domestic animal species becomes imperative. However, this endeavour would not be realized unless characterization is first carried out (FAO, 2007; Mbap, 1985). Characterization connotes detection of variation as a result of differences in DNA sequences or specific genes or a set of modifying factors (de Vicente *et al.*, 2005). Ige *et al.* (2012) mentioned the three levels at which characterization can be assessed to include morphological, protein and DNA level. Morphological characterization is among the first methods used to determine the relationship between breeds and this makes it critical in improvement and conservation (Ramanov, 1999). Although, the indigenous chickens of northern Nigeria have been characterized by some researchers, there is limited information on the morphological characterization of indigenous chickens of Borno State, Northeast Nigeria especially those based on hierarchical cluster analysis. The intent of this work was therefore to characterize the indigenous chickens of central and southern parts of Borno State based on morphological traits.

Materials and Methods

Study area

Borno State lies between Latitudes 10° and 13° N, and Longitudes 12° and 15° E a greater part of which lies on the Chad Formation. According to Ayuba *et al.* (2003), the rainfall varies from 700 to 1000 mm in the southern part and 300 to 500 mm in the north, while the mean annual rainfall is over 800 mm on the Biu



Plateau but less than 500 mm in the extreme north. (Ayuba *et al.*, 2003). Three seasons were identified in the State: the cool dry (harmattan) (October to March); the hot dry (April - June); and rainy season (July - September). The temperatures are high all year round, with hot season mean temperatures ranging between 39^o and 42^o C. Two ecological zones are identified: the Sudan and the Sahel savanna. Agriculture of both crops and animals is the mainstay of the economy (Mohammad and Ahmed, 2014).

Data collection

Morphological characterization was conducted on 600 adult indigenous chickens comprising normal feathered, frizzle feathered and naked neck from Central (Jere, Maiduguri, Konduga) and Southern (Dambuwa, Biu and Chibok) parts of Borno State for the study. Eight morphological measurements were taken on each bird and these were body weight, ornithological measurement, wing span, neck length, back length, keel length, tail length, and fold wing length. Birds were weighed using an electronic scale (precision, 1 g) and all morphological measurements were taken using a measuring tape (± 1 mm). The measurements were carried out following the methodology of Francesch *et al.* (2011) developed for morphological characterization of chickens.

Statistical analysis

Data collected on morphological traits were subjected to Analysis of Variance using General Linear Model (GLM) with sex and location as fixed factors. Significant means were separated using Duncan's Multiple Range Test (Duncan, 1955). All statistical analyses were performed using SPSS version 20.0 (SPSS, 2011). The Dendrogram for the hierarchical cluster analysis was developed based on average linkage between groups using the same software.

The following fixed effect model was adopted for the GLM: $Y_{ijl} = \mu_o + B_i + C_j + E_{ij}$

Where Y_{ij} = observation belonging to $ijkl$ classification, μ_o = Overall mean, B_i = effect of i^{th} location ($i=1, 2$), C_j = effect of j^{th} sex ($j=1, 2$), E_{ij} = random error

Results and Discussion

Table 1 shows mean values for the morphological measurements examined for indigenous chickens based on location. The mean values for body weight, ornithological measurement, wing span length, neck length, back length, keel length, tail length and fold wing length were 1454.96 g, 63.87, 64.40, 13.32, 21.90, 11.73, 21.51 and 22.10 cm, respectively. Chickens from central part had higher significant values for body weight and keel length, those of south had higher significant values ($P<0.05$) for ornithological forms (neck length, back length, tail length) and feather attributes (wing span and fold wing lengths).

The higher mean body weight of chicken from the central part could be associated with higher value of keel length (12.13 g) compared with birds from the southern part. Keel length could be regarded as the proximate indication of the keel muscles (Abdulraheem, 2021). Keel muscles are of economic importance in commercial meat production as they contribute a large proportion of the edible meat of the chicken (Oluyemi and Roberts, 2000).

Table 1: Body weight and morphological measurement of indigenous chickens in the central and southern Parts of Borno State

Trait	Location (part)		Mean	SEM
	Central	Southern		
Body weight (g)	1466.02 ^a	1443.90 ^b	1454.96	10.26
Ornithological measurement(cm)	60.05 ^b	67.67 ^a	63.87	0.39
Wing span (cm)	62.21 ^b	66.59 ^a	64.40	0.33
Neck length (cm)	13.17 ^b	13.47 ^a	13.32	0.07
Back length (cm)	21.21 ^a	22.59 ^a	21.90	0.08
Keel length (cm)	12.13 ^a	11.33 ^b	11.73	0.07
Tail length (cm)	19.99 ^b	23.02 ^a	21.51	0.16
Fold wing length (cm)	21.49 ^b	22.71 ^a	22.10	0.08

Means with different superscripts (a, b) in the same row differ significantly ($P<0.05$) SEM= standard error of means



In contrast, lower body weight of chickens discovered in the southern part could be due to good development of feather characteristics (wing span, tail length and fold wing) compared with those in the central. Good development of feather characteristics as observed in the southern part could be associated with cool weather in this part which favours feather development and good nutrition. The mean body weight (1454.96 g) obtained in this study is similar to the mean value for body weight (kg) reported by Ige *et al.* (2012) for frizzle feathered chickens (1.44 kg) and 1.370 (kg) observed by Yakubu *et al.* (2009) for male chicken of north central Nigeria. Contrary to the report of this study, Ikpeme *et al.* (2016) reported a lower value of 1.13 kg for body weight in normal feathered chickens of south east Nigeria. According to Momoh *et al.* (2007), differences in weight between different ecotypes had been used to group them into two major categories as heavy and light ecotype. The heavy ecotype was found in the dry Savannah of the north and weigh about 0.9-2.5 kg at maturity while the light ecotypes were common in the Swamp, Rain forest and Derived Savannah of the south weighing 0.68-1.5 kg. This further confirmed the result of this study.

The Dendrogram (Figure 1) using average linkage between groups constructed from the morphological traits based on chicken strain and location revealed two main clusters. The first cluster comprised the frizzle genotypes from central and south being the most distinct. The other cluster was sub-divided into two sub-clusters, one clustered the naked neck genotypes from central and south while other sub-cluster comprised the normal feathered genotypes from central and south. The phylogenetic tree grouped the chicken populations based on their genotypes rather than their locations. In other words, morphological traits of each chicken type were uniform across the locations (central and south).

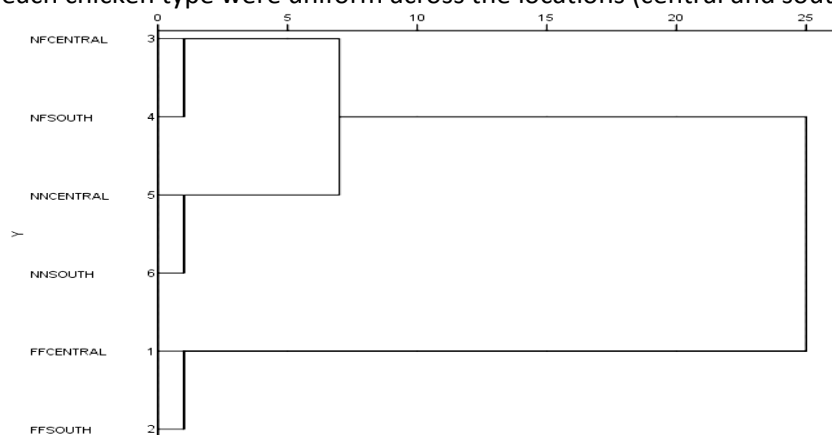


Figure 1: Dendrogram showing the degree of relatedness among the indigenous chicken populations based on location

From relatedness point of view, the frizzle feathered types were most diverse in terms of morphological characteristics while the naked neck and normal feathered were related in these traits. This is confirmed in the work of Abou-Emera *et al.* (2017) who examined genetic diversity of Saudi local chicken breeds based on Microsatellite markers. It is however contrary to the work of Adeleke *et al.* (2011) who conducted a preliminary screening of genetic lineage based on blood protein polymorphism in the south west Nigerian local chickens. The difference in the report of this study and those of others could be linked with the geographical locations of the research environment and the type of technique used for characterization.

Recommendations

Molecular technique procedures should be used to confirm this morphological characterization in these chicken populations.

Conclusion

The indigenous chickens of Borno State were comparable in body weight to other chickens in other parts of Nigeria. Chickens from the central part were heavier than those of the south probably due to their longer keel while those of the southern part were better in ornithological forms and feather attributes.



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Morphological traits of each chicken type were uniform across the locations (central and south) based on phylogenetic tree. This characterization could be used to develop breeding strategies for improvement of the chickens and their subsequent conservation.

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