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Sexual Dimorphisms on Body Weight, Morphometric and Haematological Parameters of Indigenous Chicken Reared in Lafia

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The present study examined sexual dimorphisms on body weight, morphometric and haematological parameters of indigenous chicken reared in Shabu and Kwandere areas of Lafia, Nasarawa State. The study revealed that, there were marked sexual differences in the body weight and morphometric parameters of indigenous chicken. The result of the body weight (BW) and body length (BL) was higher in males chickens than in the female chickens of Shabu whereas the females has better and higher ($P<0.05$) thigh circumference (TC) than those of their male counterparts. The results of total leg length (TLL) and wing length (WL) were higher in female chickens than in the male chickens; nevertheless, the result of TC was higher and better in male chickens than in the female chickens of Kwandere. The results of haematological indices for both sexes were not significant ($P<0.05$) although the mean values for mean corpuscular volume (MCV) and mean corpuscular haemoglobin concentration (MCHC) was slightly higher in males than in the female chickens investigated. The highest and positive correlation was observed between WL and TLL ($r=0.690$), followed by correlation between BW and breast circumference (BC), BW and foot length (FL) ($r = 0.474$) at ($P<0.05$, $P<0.01$). The correlation between FL and TLL($r =0.402$) was also positive and significant ($P<0.05$, $P<0.01$). There was also a positive correlation between BW and TC ($r =0.309$) at ($P<0.05$) respectively. The strong relationship existing between body weight and body measurements may be useful as selection criterion, thereby providing a basis for the genetic manipulation and improvement of the indigenous chicken.

Keywords: Dimorphisms, morphometric, haematological, traits, chickens

INTRODUCTION

Sexual differences in external morphology are of interest in studies of reproductive biology and descriptively, to analyse population composition (Piersma, 1988). This can be used to detect the amount and distribution of genetic variation within and between populations of the indigenous chickens thereby increasing the understanding of the historical processes underlying the genetic diversity. It can also provide important basic information for selection and breeding programmes.The Nigerian indigenous or local chicken is a light strain or breed possessing a small body size with extremely variable plumage colour, early maturing of rather nervous disposition and produces white-shelled eggs (Oluyemi and Robert, 2003). Poultry keeping is of great importance to the human race, providing the teeming populace with a vital source of animal protein and income (Gondwe, 2004), and plays a key role within the context of many social events. In tropical countries, poultry production is largely based on the traditional scavenging system and chickens are the most important poultry species. Village chickens are generally birds of indigenous breeds living in symbiotic relationship with human communities (Spradbrow, 1993). Out of a total of 72,400,856 chickens in Nigeria, 86.17% are free-range kept mainly in the rural areas.The indigenous chickens are repositories of unique genes that could be used in other parts of the world

(Adebambo,2004). Hence, the need for their conservation is to keep genetic variation within and between local breeds. The future improvement and sustainability of local chicken production systems is dependent on the availability of genetic variation (Benitez, 2002). According to FAO, a global strategy involves identifying and understanding a unique genetic resource in a particular region and to develop the proper use of the associated diversity (Franklin, 1997).Characterisation of a breed of livestock is the first approach to a sustainable use of its animal genetic resource (Lanari, 2003). The first step of the characterisation of local genetic resources falls on the knowledge of the variation of morphological traits (Delgado *et al*., 2001). Morphometric measurements have been found useful in contrasting size and shape of animals (Afolayan *et al*., 2006; Ajayi *et al*., 2008). Analysis of normal haematological parameters of chickens is very much essential in diagnosing the various pathological and metabolic disorders and can be used as a tool to assess the health status of an individual or a flock. Haematological values of poultry are influenced by age, sex, breed, climate, geographical location, season, day length, time of day, nutritional status, life habit of species, present status of individual and their factors (Islam *et al.,* 2004). There is scanty information on the haematological values of the Nigerian local chicken. The little information available were derived from those scavenging on the free range whose management in term of feeding, housing, health/medication etc. were neither standardized nor documented. Therefore the present study sought to examine sexual dimorphisms on body weight, morphometric and haematological parameters of indigenous chicken reared in Shabu and Kwandere areas of Lafia, Nasarawa State.

MATERIALS AND METHODS

Study location and the experimental birds

Data were obtained from a total of sixty (60) randomly selected adult indigenous normal feathered chickens of both sexes (30 males and 30 females respectively). The birds were selected in their breeding tracts in certain smallholder farms in Shabu and Kwandere in Lafia Nasarawa State, Nigeria from March, 2018 to May, 2018. The State falls within the guinea savanna agroecological zone, and is found between latitudes 7°52 N and 8°56 N and longitudes $7^0$25 E and 9°37 E respectively. It has two distinct seasons.

The wet season lasts from about the beginning of May and ends in October. The dry season is experienced between November and April. Annual rainfall figures range from 1100 to 2000 mm. The mean monthly temperatures in the State range between 20 and 34ºC, with the hottest months being March/April and the coolest months being December/January (Lyam, 2000). The birds were managed through the traditional scavenging system.

Parameters measured

Body weight (BW) and six morphometric traits body length (BL), breast circumference (BC), thigh circumference (TC), foot length (FL), total leg length (TLL) and wing length (WL) were measured on each adult bird. Body weight (BW):- 10-kg digital measuring scale was used for the individual weight measurement, Body length (BL):- Body length was taken between the tip of the Rostrum maxillare (bill) and that of the Cauda (tail, without feathers), Breast circumference (BC):- Was taken under the wings at the edge of the sternum, Thigh circumference (TC):-Was measured as the circumference of the drumstick at the coxa region, Foot length (FL):- Was taken as the distance from the shank joint to the extremity of the Digitus pedis, Total leg length (TLL):- Was taken as the length of the femur, shank and metatarsal, Wing length (WL):- Was taken from the shoulder joint to the extremity of the terminal phalanx, digit 111 as described by Udeh *et al.* (2011).

Blood samples collection

Blood samples (about 1.5 millilitres) were collected from the prominent wing veins of 40 randomly selected birds of the two areas studied (20 males and 20 females) with a 21-G needle connected to a 5 ml syringe. Specimens for haematological studies were collected separately in a bottle containing dipotassium salts of ethylene diamine tetra-acetic acid (EDTA) as anticoagulant.

Laboratory analysis

The blood samples were analysed using routinely available clinical methods. These include packed cell volume (PCV) or haematocrit, red blood cell (RBC) count, white blood cell (WBC) count and haemoglobin concentration (Hb), using Witrob‟s micro-haematocrit, improved Neubaur haemocytometer and cyanomethaemoglobin methods respectively. The mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC) were computed according to Jain, (1986).

Statistical analysis

Two-tailed, two-sample t-test was used to compare the means of body weight, morphometric and haematological parameters (RBC, WBC, Hb, PCV, MCV, MCH and MCHC) of birds in the two selected areas (Shabu and Kwandere) of the study. Pearson's correlation coefficients among the body variables were analysed using SPSS version 22 statistical package. Body weight and

Table 1. Sex dimorphisms on body weight and morphometric traits of the indigenous normal feathered chicken reared in Shabu region of Lafia metropolis.

Traits	Males (n=15)	Females (n=15)	Significant
	Mean±SE	Mean±SE	
Body weight (BW) kg	0.64 ± 0.01[a]	0.59 ± 0.01[b]	**
Body length (BL) cm	20.03± 0.36[a]	19.21± 0.16[b]	**
Breast circumference (BC) cm	17.68± 0.38[a]	16.90± 0.42[a]	Ns
Thigh circumference (TC) cm	8.34 ± 0.24[b]	9.04 ± 0.15[a]	**
Foot length (FL) cm	6.41 ± 0.16[a]	5.88 ± 0.13[a]	Ns
Total leg length (TLL) cm	16.07± 0.28[a]	15.99± 0.21[a]	Ns
Wing length (WL) cm	16.39± 0.24[a]	16.03± 0.20[a]	Ns

ab= means within the same rows carrying different superscripts are statistically different (P< 0.05) for sex dimorphism in Shabu. **significant at (P<0.05); ns-not significant. SE=Standard error of mean.

Table 2. Sex dimorphism on body weight and morphometric traits of the indigenous normal feathered chicken reared in Kwandere region of Lafia metropolis.

Traits	Males (n=15)	Females (n=15)	Significant
	Mean±SE	Mean±SE	
Body weight (BW) kg	0.60 ± 0.03[a]	0.63 ± 0.03[a]	Ns
Body length (BL) cm	20.19± 0.38[a]	19.95± 0.33[a]	Ns
Breast circumference (BC) cm	17.68± 0.38[a]	17.14± 0.30[a]	Ns
Thigh circumference (TC) cm	8.34 ± 0.24[a]	7.43 ± 0.16[b]	**
Foot length (FL) cm	6.17 ± 0.15[a]	6.45 ± 0.13[a]	Ns
Total leg length (TLL) cm	16.37± 0.22[b]	19.04± 0.39[a]	**
Wing length (WL) cm	16.54± 0.29[b]	18.51± 0.16[a]	**

ab= means within the same rows carrying different superscripts are statistically different (P< 0.05) for sex dimorphism in Kwandere.
*significant at (P<0.05); ns=not significant. SE= Standard error of mean.

morphometric parameters were also subjected to analysis of variance to determine sex effect using the General Linear Model of same package.
The following linear model was used:

$Y_{ijk} = \mu + S_i + e_{ijk}$
Where;
Y_{ijk} = Individual mean population
μ = General mean of the population
$S_{i=}$ Sex effect

RESULTS

The results of BW, BL and TC were statistically significant (P<0.05). The result of the BW and BL was higher in males chickens than in the females in Shabu regions while the females has better and higher (P<0.05) TC than those of the male counterparts. The results of BC, FL, TLL and WL for both sexes were not significantly different (P<0.05) (Table 1). TC, TLL and WL were significant (P<0.05) whereas all the other parameters measured were not significantly different (P<0.05). The results of TLL and WL were higher in female chickens than in the male chickens; nevertheless, the result of TC was higher and better in male chickens than in the females of Kwandere as indicated in (Table 2). All the results of haematological indices for both the male and the female chickens were not significant (P<0.05) as shown in (Table 3). Although the mean values for MCV and MCHC were slightly higher in male than in the female chickens investigated. The result of the Pearson's correlation is presented in (Table 4). The highest and positive correlation was observed between WL and TLL (r=0.690), followed by correlation between BW and BC, BW and FL (r = 0.474) at (P<0.05, P<0.01). Although correlation between FL and TLL (r =0.402) was also positive and significant (P<0.05, P<0.01). There was also a positive correlation between BW and TC (r =0.309) at (P<0.05) respectively.

DISCUSSION

Sexual dimorphisms on body weight and morphometric parameters of the indigenous normal feathered chicken reared in Shabu and Kwandere

Table 3. Haematological parameters on the health status of indigenous normal feathered chickens of both sexes of Shabu and Kwandere.

Parameters	Males N=20	Females N=20	Significant
PVC (%)	37.50 ± 0.50	37.50 ± 1.50	ns
Haemoglobin (g/dl)	12.91 ± 0.31	12.40 ± 0.60	ns
RBC (x 10^3/µ)	3.75 ± 0.25	3.20 ± 0.20	ns
WBC (x 10^3/µ)	21.50 ± 0.50	21.65 ± 1.50	ns
MCV (fl)	134.50± 0.50	132.55± 0.45	ns
MCH (pg)	45.50 ± 0.50	46.90 ± 0.10	ns
MCHC (%)	34.30 ± 0.30	32.90 ± 0.50	ns

ns = not significant at (P<0.05). Mean ± SE , PVC= Packed Cell Volume, RBC= Red Blood Cell, WBC= White Blood Cell, MCV= Mean Corpuscular Volume, MCH= Mean Corpuscular Haemoglobin, MCHC= Mean Corpuscular Haemoglobin Concentration.

Table 4. Pearson correlation between body weight and morphometric traits of indigenous normal feathered chicken reared in the two locations studied.

Traits	BL(kg)	BC(cm)	TC(cm)	FL(cm)	TLL(cm)	WL(cm)
BW (kg)	-0.076^{ns}	0.474^{**}	0.309^{*}	0.474^{**}	0.188^{ns}	0.102^{ns}
BL (cm)	-	0.094^{ns}	-0.177^{ns}	0.029^{ns}	0.146^{ns}	0.211^{ns}
BC (cm)		-	0.008^{ns}	0.031^{ns}	-0.003^{ns}	-0.022^{ns}
TC (cm)			-	0.119^{ns}	-0.120^{ns}	-0.132^{ns}
FL (cm)				-	0.402^{**}	0.215^{ns}
TLL(cm)					-	0.690^{**}

**Significant at (p<0.01), *Significant at (p<0.05), BW=body weight, BL= body length, BC= breast circumference, FL= foot length, TLL= total leg length, WL= wing length.

Sexual dimorphism is important because it allows the assessment of sex effect on survival, dispersal and evaluation of population dynamics. These apparent sex-associated differences might be attributed to the usual between- sex differential hormonal effects on growth. This is consistent with the findings of Deeb and Cahaner, (2001) and Zaky and Amin, (2007). The result of the BW and BL of this present study was higher in males chickens than in the females in Shabu regions while the females has better and higher (P<0.05) TC than in the male counterparts. The results of BC, FL, TLL and WL for both sexes were not significantly different (P<0.05).

In a related study, Baeza e*t al.* (2001) attributed the differences between male and female ducks to sexual dimorphism. The average body weight values obtained in the present study are comparable to documented evidence in literature (Sonaiya, 2003), showing that the indigenous chickens of the study area are of the normal class (moderate weight).

The results of TLL and WL were higher in female chickens than in the male chickens, nevertheless, the result of TC were higher (P<0.05) and better in male chickens than in the females of Kwandere and it is in consonant with the report of Deeb and Cahaner, (2001) who observed similar difference in hormonal growth in sex of chicken.

Haematological parameters on the health status of indigenous normal feathered chickens of both sexes of Shabu and Kwandere

Variations in PCV values (37.50 ± 0.50 to 37.50 ± 1.50) observed in the present study were not significant (P>0.05*)* and ranging for healthy chicken. Ikhimioya *et al.* (2000) reported 26.1 to 29.5% PCV for the Nigerian indigenous chicken while 27.38 ± 0.46 to 34.60 ± 0.64% PCV were obtained in Fayoumi, Assil and local chickens in Sylhet region of Bangladesh (Islam *et al.,* 2004). Pampori and Iqbal, (2007) had also reported 35.21 to 40.70% PCV values for the native chicken of Kashmir. The PCV values obtained in the present study were higher than those reported (26.38 ± 0.49%) for 5 week old broilers (Khan *et al*., 2002).

The haemoglobin values of 12.40 to 12.91g/dl reported in the present study disagree with the report of Islam *et al.* (2004) who reported 7.06 to 9.54 g/dl haemoglobin for Fayoumi, Assil and local chickens of Bangladesh. The result of the current findings corroborates with the work of Pampori and Iqbal, (2007) who obtained 11.32 to 13.21% haemoglobin values for the native chicken of Kashmir. The result of RBC of the present study ranged from 3.75± 0.25 to 3.20 ± 0.20 for both sexes. This result agrees with the report of Khan, (2005) who reported RBC of local

grower chicken fed PKC based diets (2.82 ± 0.34 to 3.37 ± 0.02 x 106/mm^3) and are within the range of established values for healthy domestic chickens. The PCV, haemoglobin and RBC values obtained in this study indicated that the birds were healthy and normal. The WBC play prominent role in disease resistance, especially with respect to the generation of antibodies and the process of phagocytosis. This could explain the reason of high degree resistance to disease reported (Anyanwu and Adikuru, 1993) for the Nigerian local chicken. The values of MCV, MCH and MCHC of this study were not significant (P<0.05). The mean values obtained in the present study falls within the normal physiological range (Simaraks *et al.,* 2004).

Pearson correlation between body weight and morphometric traits of indigenous normal feathered chickens

The highest and positive correlation was observed between WL and TLL (r=0.690), followed by correlation between BW and BC, BW and FL (r = 0.474) at (P<0.05, P<0.01). Although correlation between FL and TLL (r =0.402) was also positive and significant (P<0.05, P<0.01).There was also a positive correlation between BW and TC (r =0.309) at (P<0.05) respectively.
The estimates of correlation in the present study are comparable to those reported by earlier workers (Mancha *et al.,* 2008).

Conclusion

The study revealed that there were marked sexual differences in the morphometric measurements of indigenous locally adapted chicken. The result of the BW and BL was higher in males chickens than the females in Shabu regions where as the females has better and higher (P<0.05) TC than those of the male counterparts. The results of TLL and WL was higher in female chickens than those of the male chickens, nevertheless, the result of TC was higher and better in male chickens than those of the females of Kwandere. The results of haematological indices for both the sexes were not significant although the mean values for MCV and MCHC was slightly higher in male than those of the female chickens investigated. The highest and positive correlation was observed between WL and TLL, followed by correlation between BW and BC, BW and FL.

Recommendation

The strong relationship existing between body weight and body measurements may be useful as selection criterion, thereby providing a basis for the genetic manipulation and improvement of the indigenous chicken.

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