INVESTIGATION OF SOME MORPHOMETRIC, HAEMATOLOGICAL AND BIOCHEMICAL MARKERS FOR BODY WEIGHT IMPROVEMENT IN MARSHALL STRAIN OF BROILERS

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ABSTRACT

A study was conducted using a total of 160 day old unsexed broilers chicks, with the aim of investigating the relationship between some morphometric and blood profile in order to identify markers capable of improving body weight. The effects of sex on morphometric trait were also investigated. The birds were reared on deep litter, and fed starter and finisher mash at starter and finisher phases, respectively. Data were collected on some morphometric traits, haematological and biochemical parameters. The results revealed that there was no significant ($P>0.05$) effect of sex on body weight, breast girth and tibia length at four weeks of age. However, significant ($P<0.05$) sex effect was observed on body weight and tibia length at 8 weeks of age which was probably due to the principle of sexual dimorphism. Relationship between blood profile and some morphometric traits with body weight showed that there was no significant relationship except breast girth which was highly significant ($P<0.01$) with a correlation coefficient of 0.703. Therefore, highly polymorphic DNA-based techniques such as single nucleotide polymorphisms are advocated to develop reliable markers for improving body weight of broilers.

INTRODUCTION

Broiler chicken is one of the principal livestock species which supply the human populace protein. The prominence of broiler chicken in Nigeria is due to the short generation interval and relatively quick turn over on investment and high quality protein from poultry products (Adeyemo *et al.*, 2010) hence the need for extensive and intensive studies into every aspect that could contribute to the future improvement of this species. Genetic diversity plays an important role in animal selection and improvement and it is detected at three levels: morphological, protein and DNA (Das and Deb, 2008). Protein which comprise the haematological and serum biochemical indices are widely used to determine systemic relationship and physiological/pathological adaption including the evaluation of general health conditions, diagnosis and prognosis of various types of animal diseases (Shah *et al.*, 2007). Much genetic research is now directed towards the investigation of the relationship between physiological, biochemical and metabolic product/markers to the productive efficiency of farm animals (Isidahomen *et al.*, 2011). Several researches have been carried out on haematological and biochemical parameters of chickens (Isidahomen *et al.*, 2011; Alewi *et al.*, 2012) but information on their association with body weight is scanty. Consequently, there is need to investigate the relationship between these traits and body weight as they may be useful in developing a marker assisted technology. Therefore, the present study sought not only to determine the effect of sex some morphometric traits but also to determine the relationship between these traits and body weight.

MATERIALS AND METHODS

Experimental Location

The study was conducted at the Poultry Unit of the Teaching and Research Farm of Kogi State University, Anyigba, Nigeria, located between latitude 07^0N and longitude $06^0$4'E with an average altitude of 420m above sea level (Ifatimehin *et al.*, 2011).

Experimental birds and Management

A total of 160 day-old Marshall Strain of broiler chicks was used for this study. The birds were raised on deep litter; feed and water were provided *ad libitum*. They were fed broiler starter (ME of 2900 kcal/kg and CP of 23%) and finisher diets (ME of 2935 kcal/kg and CP of 20%) at starter and finisher phases, respectively. They were offered medication and vaccination as recommended. They were tagged and sexed at 4 weeks of age.

Data Collection

Body weight, breast girth and tibia length were measured and recorded on each of the birds at 4 and 8 weeks of age. The body weight was measured using sensitive weighing scale (sensitive at 1g) while breast girth and tibia length were measured using flexible measuring tape as described by

Fayeye *et al.* (2006). A total of 80 (40 from each sex) blood samples for haematological and serum biochemical studies were collected from the wing vein of the broilers using syringe and needle at 4 and 8 weeks of age. The blood samples were taken to the Biochemical Laboratory of Grimmard Catholic Hospital, Anyigba, Kogi State for analyses.

Statistical Analysis

General linear model procedure of Statistical Analysis System program (SAS, 2002) was used to test the effects of sex. Significant means were separated using Least Significant Difference. Phenotypic correlations among traits were evaluated using the correlation procedure of the same SAS software. The model below was used:

$$Y_{ij} = \mu + S_i + e_{ij}$$

Where: Y_{ijk}= the observation on the j^{th} bird of the i^{th} sex; μ = overall mean; S_i = effect of the i^{th} sex; e_{ij} = random error

RESULTS AND DISCUSSIONS

The least square means and standard error (±SE) of morphometric traits as affected by sex is presented in Table 1. There was no significant (P>0.05) effect of sex on morphometric traits at 4 weeks of age. However, at 8 weeks of age, significant (P<0.05) sex effect was observed in body weight and tibia length whereas there was no significant (P>0.05) effect on breast girth. The finding of this present study was in agreement with the findings of Adedibu and Ayorinde (2011) and Egena *et al.* (2011) who reported significant effect of sex on body weight and tibia length of chickens but disagreed with the report of Ojo *et al.* (2014) who reported no significant effect of sex on body weight and tibia length in Japanese quail. The discrepancy in results obtained may be due to differences in experimental birds. The higher BWT and TL in males at 8 weeks of age is consistent with the principle of sexual dimorphism in the Gallus bird, where the males are consistently bigger than the females, which may be as a result of sex differential hormonal effect on growth. The correlation coefficient between morphometric traits, haematological and biochemical parameters are presented in Table 2. The correlation coefficient ranged from -0.794 to 0.703. The relationship between breast girth and tibia length was significant (P<0.05) but negatively correlated (r= -0.794) while body weight and breast girth was highly significant (P<0.01) with correlation coefficient of 0.703. All other parameters varied in magnitude and direction with no significant (P>0.05) correlation between the traits. The positive relationship between body weight and breast girth revealed that body weight can be predicted from body measurement which agreed with the report of Ajayi *et al.* (2008) who reported positive relationship between body weight and breast girth in two commercial meat type chickens. The negative relationship between tibia length and breast girth observed in this study, disagreed with the results of Amao *et al.* (2010) in Ross and Anak strains of broilers and Egena *et al.* (2011) in Nigerian indigenous chickens, who reported positive correlation between tibia length and breast girth. This may be due to difference in broiler strains or specie of experimental birds.

CONCLUSIONS

In summary, sex effect was observed at 8 weeks of age in body weight and tibia length which was consistent with the principle of sexual dimorphism in Gallus birds. Amongst all the traits studied, only breast girth had significant relationship with body weight thus, breast girth may be a useful criterion in selection or improving body weight. Furthermore, haematological and biochemical parameters may not be reliable as markers in improving body weight in Marshall Strain of broilers. Therefore, to develop more reliable markers for improving productivity of broilers, it is recommended that polymorphic DNA-based techniques like SNPs or other molecular techniques be employed.

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Table 1: Least square means and standard error (±SE) of body weight (g) and body linear measurements (cm) as affected by sex in Marshall broilers

	Body weight (g)	Breast girth (cm)	Tibia length (cm)
		4 weeks of age	
Male	793.20±18.45	20.05±0.24	4.95±0.051
Female	758.61±16.45	19.42±0.21	4.90±0.046
SEM	12.28	0.160	0.0342
LOS	NS	NS	NS
		8 weeks of age	
Male	2499.21^{a}±49.15	31.30±0.33	7.39^{a}±0.042
Female	2204.62^{b}±47.25	30.64±0.31	7.06^{b}±0.040
SEM	34.06	0.226	0.0290
LOS	*	NS	*

Means with different superscript on the same column differ significantly. LOS= Level of significance, SEM= Standard error of means. *: (P<0.05); NS: (P>0.05)

Table 2: Correlation coefficients between body weight, body linear measurements, haematological and serum biochemical parameters in Marshall broilers

Traits	BWT	BG	TL
PCV	-0.177	-0.042	0.103
Hb	-0.487	-0.292	0.174
WBC	-0.195	0.236	-0.563
HET	0.452	0.158	0.194
LYMP	-0.144	-0.082	0.008
MCV	-0.103	-0.161	-0.128
MCH	-0.483	-0.485	0.239
MCHC	-0.192	-0.255	0.002
EOSI	-0.202	-0.183	0.334
AST	-0.438	-0.109	-0.246
ALT	0.321	-0.193	0.49
ALP	0.488	0.242	0.125
CHO	-0.054	-0.39	0.477
BG	0.703**	-	-
TL	-0.198	-0.794*	-

PCV= Packed cell volume, Hb= Haemoglobin, WBC= White blood cells, HET= Heterophils, LYMP= Lymphocytes, MCV= Mean corpuscular volume, MCH= Mean corpuscular haemoglobin, MCHC= Mean corpuscular haemoglobin concentration, EOSI= Eosinophils, AST= Aspartate aminotransferase, ALT= Alanine aminotransferase, ALP= Alkaline phosphatase, CHO= Cholesterol, BWT= Body weight, BG= Breast girth, TL= Tibia length, *= $P<0.05$, **= $P<0.01$