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RELATIONS BETWEEN BODY WEIGHT AND LINEAR BODY MEASUREMENTS AT SPECIFIC GROWTH STAGES IN ARBOR ACRE BROILER CHICKENS.

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ABSTRACT: Data collected from one hundred (100) Arbor Acre broiler chickens were used to establish the relationships between body weight (BW) and morphometric body parts at four and eight weeks of age respectively. The body parts measured were, Body length (BL), Body girth (BG), Drumstick length (DL), Shank length (SL), Thigh length (TL), Wing length (WL) and Keel length (KL). The results indicated that the body weight was significantly (P<0.05,0.01) and positively correlated with BL, BG, SL and KL (0.46* to 0.75**), while BL correlated significantly (P<0.05) with BG (0.59*) and SL (0.49*), SL correlated positively and significantly (P<0.05) with BG (0.50*) and association of KL with BL, BG, and SL were significant (P<0.01) and positive (0.65** to 0.76**) at four weeks of age. At eight weeks of age, BW correlated significantly with BL, DL, TL, WL, and KL (0.64** to 0.76**). The relationship between BL and DL was positive and significant (0.54*), SL correlated significantly and positively with BG (0.64**) and TL (0.51*). DL, TL, WL and KL were positive and significantly (P<0.01) correlated (0.60**, 0.74** and 0.71**), while TL and two other traits (WL and KL) were also positive and significantly (P<0.01, P<0.05) correlated (0.67**, 0.55*). These results showed that body parts are reliable indicators of weight development in adult Arbor Acre broiler, and inform the breeder of the likely proportionate gain in bodyweight arising from gains in morphometric body parts during selection for the former.

INTRODUCTION

Measurement of quantitative traits is a vital tool for decision making in animal breeding since it provides better assessment of conformation upon which production of all meat animals including chicken largely depends (Salako, 2004). Poultry breeders are interested in gaining information on juvenile traits which can be used to predict performance at adult stage as means of achieving quick economic returns on investment and prevention of wastage of scarce resources on feed. This is particularly true of broiler production which usually involves huge investments in terms of cost of purchase, feeding, maintenance and provision of other facilities for optimal performance. Therefore, information on the nature of relationship between body weight and body size parameters will likely assist the livestock farmer on the appropriate time to cull or sell an animal at early age.

The use of body measurement in the prediction of weight and productivity of animals has been reported by Ozoje and Hurbert (1997), Fourie *et al.* (2002), Searle *et al.* (1989) and body parts measurement and other conformation values have been used to assess growth performance in animals. Furthermore, information on the genetic parameters of a flock permits the formulation of appropriate breeding plans for the improvement of such a flock. The information becomes more relevant especially in flocks that are undergoing selection, in view of the fact that

continued selection tends to bring about considerable changes in heritability and genetic correlations among traits (Sharma and Krishma, 1998). Correlations between phenotypic traits are also important in diverse contexts in animal behaviour, evolution and integrative biology. For example, phenotypic correlations are used to assess functional relationships between biochemical, morphological and whole organism traits while genetic association can dictate method of selection.

Estimation of phenotypic correlation between body weight and some body size parameters will at a glance provide essential information about the level of relationship between the examined traits. A detailed knowledge of the magnitude and direction of association between characters will therefore provide an insight on how changes in one character brings about a corresponding change in the other and helps in knowing how improvement in one character will bring about a change in the other character in an animal. The present study was designed to investigate the nature of relationship between body weight and some body parts of Arbor Acre broiler birds.

MATERIALS AND METHODS

Origin and Management of Experimental Birds

One hundred (100) day old Arbor acre broiler chicks were obtained from a commercial farm (Zarm farm Nig. Ltd.) Ilemona, Kwara State, Nigeria. The birds were kept in cages throughout the eight weeks and provided with adequate temperature and other brooding requirements from day old to four weeks as suggested by Atteh (2004) and were reared for another four weeks. All necessary medication and vaccination were given to the birds accordingly and they were fed recommended diets for broilers (NRC, 1994).

Measurements of Body Parameters

Measurements of body weight and body parts were carried out on weekly basis for 8 weeks. The body weight (BW) was measured in gram using Scout II electronic sensitive scale (600g, capacity) and top loading Mettler Balance (20 kg capacity). The linear body parts were measured using tape rule and Vernier Calliper. Body length (BL) was measured as the linear distance between the nasal opening and the top of pygostlye when the neck is carefully stretched and the measuring tape positioned along the midline of the birds back, body girth (BG) was determined by winding a tape rule around the region of the breast, shank length (SL) was measure as the distance from the foot pad to the hock joint, thigh length (TL) was measured from the tip of the tarsus to the ball joint. Keel length (KL) was measured from the cranial to the caudal terminals of the keel bone, wing length (WL) was measured by stretching the wing and the measurement taken from humerous – coracoids junctions to the tip of the digit while the drumstick length (DL) was measured from the tip of the hock joint to the ball joint of femur.

Statistical Analysis

Measurements of individual body weight and other body parts carried out at four and eight weeks age was used to estimate phenotypic correlation of growth traits in the ArborAcre broiler. Covariance and variance for estimating phenotypic correlations were generated from the data collected.

The phenotypic correlations were obtained from the expression:

$$rP = \frac{Cov(PxPy)}{\sqrt{Vx}\sqrt{Vy}}$$

rP = Phenotypic correlation
Cov (PxPy) = Phenotypic co variance of traits x and y
Vx = phenotypic variance of trait x
Vy = Phenotypic variance of trait y

Pearson correlation coefficient software was used for the analyses (SAS, 2003).

RESULTS AND DISCUSSION

Phenotypic correlations between body weight (BW) and other body parts at four weeks, revealed that BW of Arbor Acre broiler was positively and significantly (P<0.05 or P< 0.01) correlated with BL (0.75**), BG (0.66**), SL (0.46*) and KL(0.76**) as shown in Table 1. Negative but non-significant correlation existed between BW and DL (-0.03), while positive but non-significant correlations were also observed between BW, TL and WL (0.09 to 0.18), at 4 weeks old. Phenotypic correlations among body parts measured indicated that BL was positively and significantly (P<0.05 or P< 0.01) correlated with BG (0.59*), SL (0.49*) and KL (0.66**), but not significantly correlated with DL (0.06), TL (0.13) and WL (0.09) Table 1. The association between BG, SL and KL were significant and positive at P<0.05and P< 0.01 (0.50* and 0.65**), but non significant correlation was observed between BG and DL, TL as well as WL. SL was significantly correlated (P<0.01) with KL (0.61**), and negatively but not significantly correlated with DL, TL, WL, (-0.34 to – 0.07). DL did not correlate significantly with other body parts and body weight at four weeks of age (Table 1).

Table 1**.** Phenotypic correlations of bodyweight and linear body measurement in Arbor Acre broiler at 4 weeks of age.

	BW	BL	BG	SL	DL	TL	WL	KL
BW	1							
BL	0.75**	1						
BG	0.66**	0.59*	1					
SL	0.46*	0.49*	0.50*	1				
DL	-0.03	0.06	0.01	-0.07	1			
TL	0.18	0.13	0.03	-0.34	0.23	1		
WL	0.09	0.09	0.02	-0.21	0.14	0.38	1	
KL	0.76**	0.66**	0.65**	0.61**	0.09	0.01	0.00	1

*Significant at P<0.05; **Significant at P <0.01.

BW = Body weight, BL=Body length, BG= Body girth, WL= Wing length, DL= Drumstick length, KL= Keel length, TL =Thigh length, SL= Shank length.

Body weight was significantly (P<0.01) and positively correlated with BL (0.64**), DL (0.80**), TL (0.65**) , WL (0.76**), and KL (0.71**) at eight weeks of age (Table 2) but not significantly correlated with BG and SL (0.14 and 0.30, respectively). BL correlated positively and significantly (P<0.05) with DL (0.54*), WL (0.47*) and KL (0.46*). BG correlated positively and significantly (P<0.01) with SL (0.64**), but not with DL, TL, WL and KL (0.07 to 0.30) Table 2. The association between SL and TL (0.51*) was significant (P<0.05), whereas SL was not significantly correlated with DL, WL, and KL (0.21 to 0.28). Significant (P<0.01) and positive correlation existed between DL and TL (0.60**), WL (0.74**) and KL (0.71**). TL was significantly correlated with WL at P<0.01 (0.67**) and KL (0.55*) at P<0.05, while KL was significantly (P<0.01) and positively correlated with WL (0.71*) as shown in Table 2.

Table 2. Phenotypic correlations of bodyweight and linear body measurement in Arbor Acre broiler at 8 weeks of age.

	BW	BL	BG	SL	DL	TL	WL	KL
BW	1							
BL	0.64**	1						
BG	0.14	0.06	1					
SL	0.30	0.11	0.64**	1				
DL	0.80**	0.54*	0.22	0.21	1			
TL	0.65**	0.39	0.37	0.51*	0.60**	1		
WL	0.76**	0.47*	0.07	0.28	0.74**	0.67**	1	
KL	0.71**	0.46*	0.11	0.25	0.71**	0.55*	0.71*	1

*Significant at P<0.05; ** Significant at P <0.01.

BW = Body weight, BL=Body length, BG= Body girth, WL= Wing length, DL= Drumstick length, KL= Keel length, TL =Thigh length, SL= Shank length.

High and positive correlations between body weight and some body parts measured in this study, is in line with the earlier observations of Musa *et al. (*2005) and Olowofeso (2009) who reported high and positive correlation coefficients between body weight and other body measurements in poultry species. Some of the body parts measured in this study also had significant associations among themselves at four and eight weeks of age respectively, which confirms earlier findings Ayeni *et al.* (1983) of the existence of positive significant relationship among quantitative traits such as body weight and body parts, as well as various carcass determinations in different strains and sexes of various poultry species.

The results from this study also showed that linear measurements can be used to evaluate breed performance in relation to body weight, as a criterion for selecting replacement animals and evaluating breeds in a controlled environment Searle *et al*. (1989). Other studies, Maciejowski and Zieba (1982) and Ayorinde (1995) have revealed the relevance of linear body measurements in poultry body weight development and stated that they are useful tools in improving poultry production.

Generally, keel length, shank length and diameter are taken as indicators of body weight and meatiness in birds (Maciejowski and Zieba,1982). In this study, body length, body girth, shank length and keel length had positive and significant correlations with body weight at four weeks of age, while body length, drumstick length, thigh length, wing length and keel length correlated positively and significantly with body weight at eight weeks of age , and it could be said that those body parts are indicators of body weight and meatiness in the Arbor Acre broiler strains studied.

CONCLUSION AND RECOMMEDATION

This study has shown that as some body parts increase in the broiler birds at the specific growth stages (four and eight weeks of age), so is the likelihood of a corresponding increase in the

birds body weight. It also indicates that improvement in body weight will bring about a positive change in related parts, which will contribute significantly to cut parts in the broiler strain examined. The relationships between body parts and body weight reported here should inform the breeder of the likely commensurable gain in body weight arising from gains in morphometric body parts during selection.

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