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Genetic Variation and Phenotypic Correlations of an Exotic Turkey Reared in Savanna Region of Nigeria

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Abstract – **The study was carried out to determine the phenotypic correlation between body weight and other body linear measurement of an exotic strain of turkey. A total number of 75 day-old poults of an exotic turkey were used for the study and were housed on a deep litter system. Data were collected on body weight, body length, keel length, breast girth, drum stick and shank length. The result showed very highly significant (P<0.001) between body weight and body length, breast girth and drum stick at first week of age. The correlation increases positively with ages of the poult. Higher correlations were observed at breast girth, drum stick and body length against body weight at all ages. At the first week of rearing, highest correlation were seen at body length, followed by breast girth and drumstick. Also, at the second week a very highly significant (P<0.001) correlation was observed across the body linear measurements. A very highly significant (P<0.001) relationship exist at body weight (BW) against linear body measurements (Body Length (BL), Breast Girth (BG), Keel Length (KL), Shank Length (SL), Drum Stick (DS) at eleventh and twelfth week of age with the values ranging from 0.46 to 0.98. For the linear measurements, breast girth and drum stick proved to be the most reliable. The study therefore revealed the existence of phenotypic correlation between body weight and other body linear measurements in exotic strain of turkey.**

Keywords – **Exotic Turkey, Body Measurement, Phenotypic Correlation, Savanna Region.**

I. INTRODUCTION

Turkey is not common among poultry growers in Nigeria: a number of farms are beginning to rear the bird at commercial level owing to increasing interest as a provider of meat complementing chicken. They are mostly located in urban areas and are gradually spreading even to village farms [1]. The fast growth in the industry requires an intensive research approach to boast its production especially considering the potentials associated with it.

The main purpose of animal breeding practices is to improve traits of economic value [2] and body weight is one of those important economic traits in the selection of animals. Body weight and body dimensions have been used as parameters for selection by local sellers and for research [3]. Growth traits are useful to livestock farmers and particularly geneticists in improving the market quality of breeding stocks [4]. According to [1], the first approach in livestock characterization apart from evaluation of its production performance is the evaluation of body size and conformation. The important criteria for judging market broilers are body size and body conformation or type. A quantitative measure of conformation will no doubt enable reliable genetic parameters for the traits to be estimated but also make it possible to include conformation in breeding programme. A lot of techniques, which are simple or sophisticated and expensive or inexpensive, are available to get information on animal's body traits. The easiest way to assess an animal's body mass is to weigh the animal. However, under some situations scale may not be available and prediction of body weight from body measurements could be preferred practically [5]

Although weights can be precisely determined by using platform scales, unfortunately, these facilities are not available in many farms in Nigeria [6]. He went further to say the body weights of turkey at different ages have to be predicted with reasonably accuracy by taking various body measurements. Body measurements and live weights taken on live animals have been used extensively for a variety of reasons both in experimental work and in selection practices [7].

The biometric measurements are used to assess several characteristic of animals. These measurements provide important evidences for the growth of the breed and the properties that change with environmental effects and feeding factors. In addition, body measurements are important data sources in terms of reflecting the breed standards [8] and are also important in giving information about the morphological structure and development ability of the animals. Body measurements differ according to the factors such as breed, gender, yield type and age. The most common parameters used for body measurements in turkey are; shank length, breast girt, keel length, body length and thigh length [9]. Assessment of body weight and linear body measurements have been found useful in quantifying body size and shape [10] . Linear body measurements have also been used to predict live weight in poultry[11]. The multitudes of different body measurements available lead several researchers to use multivariate techniques to simultaneously examine the relationship among body measurements and production traits. Therefore, the aim of this present study was to evaluate the genetic variation and phenotypic correlations of an exotic turkey reared in savanna region of Nigeria.

II. MATERIALS AND METHODS

A. Experimental Site

This research work was carried out at the Poultry unit of Teaching and Research Farm of Ladoke Akintola University of Technology, Ogbomoso, Oyo State. Ogbomoso is situated in the derived savanna zone of

Nigeria on the longitude $4^0 15'$ East and latitude 8^0 15' North east of the Greenwich meridian. It is about 145km North-East ward from Ibadan, the capital of Oyo State. The altitude is between 300 and 600m above sea level. The mean annual rainfall and temperature are 1247mm and 27°C respectively [12]

B. Management of Poults.

A total of 75 day-old poults of an exotic turkey were procured from a reputable farm in Ibadan. This study lasted for 12 weeks. The birds were brooded for six weeks due to the environmental condition of winter. i.e raining season. The poults were brooded on deep litter pens. All poults were wing-tagged for proper identification and subjected to the same management practices throughout the experimental period. Commercial feeds were provided for the birds *ad libitum*. Starter mash containing 28% Crude Protein (CP) with 2800 kcal/kgME grower mash containing 24% CP with 2200 kcal/kgME were fed to the birds from 0-6, and 7-12 weeks of age respectively. Clean, cool water were supplied *ad libitum*. Necessary vaccinations against Newcastle, fowl pox and gumboro diseases as well as prophylactic antibiotics and anticoccidial drugs were administered to the birds.

C. Data Collection.

The Linear Body Measurements (LBMs) were taken as suggested by [11, 13]right from week one and differences in the parameters measured due to age were noted. Body weight was recorded at every weeks using weighing scale in grams (g) while the body parameters were taken in centimeters with the use of tape rule and transparent ruler, body length, keel length and breast girth,

D. Statistical Analysis.

The data collected were subjected to analysis of variance using the general model of [14] with the following model.

$$r = \frac{\sum XY}{\left(\sum X^2 \sum Y^2\right)^{0.5}}$$

Where: r = correlation coefficient

$\sum X^2, \sum XY$ and $\sum Y^2$ = sum of variables.

III. Results

Table 1 shows the phenotypic correlation between body weight and other body linear measurements of an exotic turkey at first and second week of their life .The upper diagonal represents first week while the lower diagonal represents the second week of rearing of the birds. The upper diagonal shows a very highly positive significant (P<0.001) correlation. BL against BW (0.37); BG against BW (0.37); KL against BL (0.41); SL against BG (0.42); DS against BW (0.45); DS against BL (0.47) while SL against BW (0.34); DS against KL (0.33); DS against SL (0.34) are highly positive significant (P<0.01) correlated. Correlation was also obtained from a highly negative significant (P<0.001) at SL against KL (-0.31) while a positive significant (P<0.01) correlation were also obtained at KL against BW (0.21); DS against BG (0.21). The lower diagonal shows a very highly positive (P< 0.001) correlation. BL against BW (0.43); DS against BW (0.48); KL against BW (0.38); DS against KL (0.35). A highly positive significant (P<0.01) correlation was obtained for DS against BL and SL (0.28, 0.31) respectively; SL against BG; (0.25) while a positive significant (P<0.01) correlation were also obtained at SL against BL (0.18); DS against BG (0.19).

Table 2 shows the phenotypic correlation between body weight and other body linear measurements of an exotic turkey at third and fourth week of their life .The upper diagonal represents third week while the lower diagonal represents the fourth week of rearing of the birds. The upper diagonal shows a very highly positive significant (P<0.001) correlation at BW against BL, BG, SL and DS (0.68, 0.51, 0.42 and 0.42) respectively; BL against BG and DS (0.46 and 0.45); BG against KL and DS (0.54 and 0.41) while KL against BW (0.32); KL against SL and DS (0.34 and0.30) are highly positive significant (P<0.01) correlated while a positive significant (P<0.01) correlation were also obtained at SL against BG (0.21); DS against SL (0.24). The lower diagonal shows a very highly positive (P< 0.001) correlation. BL against BW (0.66); BG against BW (0.39); KL against BW, BL and BG (0.91, 0.66 and 0.35) respectively ; SL against BW (0.41); DS against BW, BL, BG, KL and SL (0.87,0.57 ,0.41, 0.79 and 0.42) respectively. A highly positive significant (P<0.01) correlation was obtained for SL against BL and KL (0.30, 0.32) while a positive significant (P<0.01) correlation were also obtained at SL against BG (0.24).

Table 3 shows the phenotypic correlation between body weight and other body linear measurements of an exotic turkey at fifth and sixth week of their life .The upper diagonal represents fifth week while the lower diagonal represents the sixth week of rearing of the birds. The upper diagonal shows a very highly positively significant (P<0.001) relationship BW against BL, KL, SL and DS (0.66, 0.52, 0.69 and 0.41) respectively ; BL against BG, KL, SL, DS (0.54, 0.39, 0.44, 0.60); BG against DS (0.48); KL against DS (0.53); BW against BG (0.34); BG against KL (0.31) are positive highly significant (P<0.01) correlated while a positive significant (P<0.01) correlation were also obtained at SL against KL (0.27). The lower diagonal shows a very highly positive (P< 0.001) correlation BL against BW (0.56); BG against BW (0.42) ; KL against BW (0.88); KL against BL (0.60); SL against BW, BL, BG and KL (0.86, 0.41, 0.18 and 0.79); DS against BW, BL, KL and SL (0.71, 0.35, 0.53 and 0.72) respectively. A highly positive significant (P<0.01) correlation was obtained for KL against BG (0.32); DS against BG (0.28).

Table 4 shows the phenotypic correlation between body weight and other body linear measurements of an exotic turkey at seventh and eighth week of their life .The upper diagonal represents seventh week while the lower diagonal represents the eighth week of rearing of the birds. The upper diagonal shows a very highly positive significant (P<0.001) relationship. BW against BL, BG, KL, and SL (0.74, 0.43, 0.69 and 0.75) respectively ; BL against BG, KL and SL (0.49, 0.68 and 0.71) respectively. BG against KL and SL (0.64 and 0.63); KL against SL (0.90) while

DS against SL (0.29) are highly positive significant (P<0.01) correlated. While a positively significant (P<0.01) correlation were also obtained at DS against BW (0.23); DS against BL (0.25); DS against KL (0.20). The lower diagonal shows a very highly positive (P< 0.001) correlation BG against BL (0.80); KL against BL and BG (0.92 and 0.88); SL against BW, BG and KL (0.68, 0.46 and 0.45); DS against BW, KL and SL (0.66, 0.51 and 0.54); respectively. A highly positively significant (P<0.01) correlation was obtained for KL against BW (0.30); SL against BL (0.32); DS against BL and BG (0.28 and 0.29) while a positive significant (P<0.01) correlation were also obtained at BG against BW (0.22).

Table 5 shows the phenotypic correlation between body weight and other body linear measurements of an exotic turkey at nineth and tenth week of their life .The upper diagonal represents the nineth week while the lower diagonal represents the tenth week of rearing of the birds. The upper diagonal shows a very highly positively significant (P<0.001) relationship BW against BL, BG, KL, SL and DS (0.95, 0.86, 0.83, 0.48 and 0.92) respectively ; BL against BG, KL, SL and DS (0.81, 0.88, 0.49 and 0.93) respectively ; BG against K, SL and DS (0.89, 0.79 and 0.87) respectively ; KL against SL and DS (0.66 and 0.83); DS against SL (0.65). The lower diagonal shows a very highly positive (P< 0.001) correlation BG against BW (0.56); KL against BW and BG (0.64 and 0.35); SL against BG (0.38); DS against BW and KL (0.44 and 0.68). A highly positive significant (P<0.01) correlation was obtain for KL against BL (0.29) while a positive significant (P<0.01) correlation were also obtained at SL against BW, BL and KL (0.25, 0.23 and 0.19) respectively.

Table 6 shows the phenotypic correlated between body weight and other body linear measurement of an exotic turkey at eleventh and twelfth week of their life. The upper diagonal represent the eleventh week of their rearing, at the upper diagonal, It shows a very highly positive significant (P<0.001) correlation at BW against BL, BG, KL, SL, and DS (0.78, 0.82, 0.79, 0.78 and 0.46) respectively. Correlation were also obtained at SL against BW, BL and KL (0.25, 0.23 and 0.19) respectively. Also, BL against BG, KL, SL, and DS (0.49, 0.72, 0.69, and 0.63) respectively. Correlation were also obtained at SL against BW, BL and KL (0.25, 0.23 and 0.19) respectively were also correlated. Correlation were also obtained at SL against BW, BL and KL (0.25, 0.23 and 0.19) respectively.; BG against KL, and SL (0.76 and 0.59); SL against KL (0.53); DS against SL (0.58) while a positive significant (P<0.01) correlation were also obtained at DS against KL (0.20). The lower diagonal represents the twelfth week of rearing of the birds. The lower diagonal shows a very highly positive significant (P<0.001) correlated at against BL against BW (0.87); BG against BW and BL (0.85 and 0.91); KL against BW, BL and BG (0.77, 0.87 and 0.98) correlation were also obtained at SL against BW, BL and KL (0.25, 0.23 and 0.19) respectively.; SL against BW, BL, BG and KL (0.85, 0.93, 0.84 and 0.78); DS against BW, BL, BG, KL and SL (0.73, 0.94, 0.90, 0.89 and 0.93).

IV. Discussion

The positive and strong nature of the correlation between body weight (BW) and body measurement traits means that body weight (BW) could be estimated from body measurements. This is because growth in animals could be evaluated from the component parts of the animal [15]. This means that an improvement in the body measurements will invariable lead to a corresponding improvement in the body weight (BW) of the indigenous Nigerian chickens especially if the correlation is positive as was observed in the present study. Similar high correlation coefficients between body weight (BW) and body measurements have been reported for indigenous chickens of Senegal [11], Jinghai yellow chicken [16] and Gaga chickens of Indonesia [17]. In local fowls, [18] reported positive phenotypic correlation between body weight and linear measurements, while [19] reported significant strain differences in body weight at different ages among breeds of broiler chickens.

Values obtained for coefficients of correlation at week 2, 4, 6, 8 and 12 agreed with literature values reported by (Okon *et al.,*1996) for moderate to high and positive ranges of genetic correlations between body weight and the body measurements were observed at this age in their study. This shows that favourable relationships exist among traits that had higher correlation coefficients, it further explains that such traits could be collectively included in the selection index to achieve positive genetic progress. Thus, this recent report on some body measurements and their correlations with live weight in an exotic turkey was corroborated with the findings of [3, 21, 22]for moderate to high range of correlation in rock patridge, broiler chickens and local chickens respectively.

V. Conclusion

The results from this study demonstrated a positive relationship between body weight and body measurement components (body length, breast girth and drum stick) showing that increase in the growth rate of any of the components will correspondingly increase live weight gain. The implication is that body weight of turkey could be determined accurately using body measurements such as body length, breast girth and drumstick. Since breast girth and drumstick was the main criterion used in the market to determine preference, breeders and researchers could work and improve on it in order to attain optimal meat production to the consumers. Selecting and improving these traits will impact positively on the body weight of turkey.

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Table 1: Phenotypic correlation between body weight and other body linear measurements of an exotic turkey at first and second week of their life.

	BW	BL	BG	KL	SL	DS
BW		0.037***	0.37***	0.21*	0.34**	0.45***
BL	0.43***		0.51	0.41***	0.21	0.47***
BG	- 0.02	0.05		-0.10	0.42***	0.21*
KL	0.38***	0.09	0.04		-0.31**	0.33**
SL	0.11	0.18*	0.25*	-0.10		0.34**

* = (P <0.05) significant ** = (P < 0.01) highly significant *** = (P<0.001) very highly significant.
BW = body weight, BL body length, BG = breast girt, KL = keel length, SL = shank length, DS = drumstick.
Upper diagonal = first week, Lower diagonal = second week.

Table 2: Phenotypic correlation between body weight and other body linear measurements of an exotic turkey at third and fourth week of their life.

	BW	BL	BG	KL	SL	DS
BW		0.68***	0.51***	0.32**	0.42***	0.42***
BL	0.66***		0.46***	0.14	0.16	0.45***
BG	0.39***	0.11		0.54***	0.21*	0.41***
KL	0.91***	0.66***	0.35***		0.34**	0.30**
SL	0.41***	0.30**	0.24*	0.32**		0.24*
DS	0.87***	0.57***	0.41***	0.79***	0.42***	

*= (P <0.05) significant ** = (P < 0.01) highly significant *** = (P<0.001) very highly significant.
BW = body weight, BL body length, BG = breast girt, KL = keel length, SL = shank length, DS = drumstick.
Upper diagonal = third week, Lower diagonal = fourth week.

Table 3: Phenotypic correlation between body weight and other body linear measurements of an exotic turkey at fifth and sixth week of their life.

	BW	BL	BG	KL	SL	DS
BW		0.66***	0.34**	0.52***	0.69***	0.41***
BL	0.56***		0.54***	0.39***	0.44***	0.60***
BG	0.42***	0.09		0.31**	0.03	0.48***
KL	0.88***	0.60***	0.32**		0.27*	0.53***
SL	0.86***	0.41***	0.18***	0.79***		-0.12
DS	0.71***	0.35***	0.28**	0.53***	0.72***	

*= (P <0.05) significant ** = (P < 0.01) highly significant *** = (P<0.001) very highly significant.
BW = body weight, BL body length, BG = breast girt, KL = keel length, SL = shank length, DS = drumstick.
Upper diagonal = fifth week, Lower diagonal = sixth week.

Table 4: Phenotypic correlation between body weight and other body linear measurements of an exotic turkey at seventh and eighth week of their life.

	BW	BL	BG	KL	SL	DS
BW		0.74***	0.43***	0.69***	0.75***	0.23*
BL	0.07		0.49***	0.68***	0.71***	0.25*
BG	0.22*	0.80***		0.64***	0.63***	0.17
KL	0.30**	0.92***	0.88***		0.90***	0.20*
SL	0.68***	0.32**	0.46***	0.45***		0.29**
DS	0.66***	0.28**	0.29**	0.51***	0.54***	

*= (P <0.05) significant ** = (P < 0.01) highly significant *** = (P<0.001) very highly significant.
BW = body weight, BL body length, BG = breast girt, KL = keel length, SL = shank length, DS = drumstick.
Upper diagonal = seventh week, Lower diagonal = eighth week

Table 5: Phenotypic correlation between body weight and other body linear measurements of an exotic turkey at nineth and tenth week of their life.

	BW	BL	BG	KL	SL	DS
BW		0.95***	0.86***	0.83***	0.48***	0.92***
BL	-0.15		0.81***	0.88***	0.49***	0.93***
BG	0.56***	0.05		0.89***	0.79***	0.87***
KL	0.64***	0.29**	0.35***		0.66***	0.83***
SL	0.25*	0.23*	0.38***	0.19*		0.65***
DS	0.44***	-0.09	-0.04	0.68***	-0.06	

*= (P <0.05) significant ** = (P < 0.01) highly significant *** = (P<0.001) very highly significant.
BW = body weight, BL body length, BG = breast girt, KL = keel length, SL = shank length, DS = drumstick.
Upper diagonal = ninth week, Lower diagonal = tenth week.

Table 6: Phenotypic correlated between body weight and other body linear measurement of an exotic turkey at eleventh and twelfth week of their life.

	BW	BL	BG	KL	SL	DS
BW		0.78***	0.82***	0.79***	0.78***	0.46***
BL	0.87***		0.49***	0.72***	0.69***	0.63***
BG	0.85***	0.91***		0.76***	0.76***	0.17
KL	0.91***	0.66***	0.35***		0.53***	0.20*
SL	0.85***	0.93***	0.84***	0.78***		0.58***
DS	0.73***	0.94***	0.90***	0.89***	0.93***	

*= (P <0.05) significant ** = (P < 0.01) highly significant *** = (P<0.001) very highly significant.
BW = body weight, BL body length, BG = breast girt, KL = keel length, SL = shank length, DS = drumstick.
Upper diagonal = eleventh week, Lower diagonal = twelfth week.