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(RESEARCH ARTICLE)

Phenotypic correlations of zoometrical traits of Nigeria local turkeys at early and late growth phases (starter, grower and finisher)

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Abstract

A 24 weeks study was carried out with 150 Poults of Nigerian indigenous turkey *(Meleagris galopavo)* at the Teaching and Research farm, Animal Science Department, University of Uyo, Uyo to determine Correlations of body weight and the Linear body traits of Nigerian Local Turkeys. Poults were brooded and reared intensively. Water and feed were given ad libitum. Parameters measured were: Body weight (BW), Thigh (TL), Shank (SL), wing (WL), keel (KL), body (BL) lengths, breast girth (BG). Data collected were analyzed using SPSS software based on the purpose of the study. The results showed a strongest relationship recorded for BW (WL, BG, KL TL) for all the weeks studied. Growth phases results showed that early and late starter phases of growth, a strong significant and positive correlation range of 0.814 and 0.866; $p < 0.01$ and 0.778 – 0.916; $p < 0.01$, were recorded, respectively. For early and late grower phases a significant strong and positive correlation range (0.783 – 0.922 and 0.856 – 0.954 $p<0.01$) were recorded, respectively. For finisher phases of growth all linear body parameters measured were found to exhibit very strong relationship with BW in both the early (0.828 – 0.967) and late phase (0.831 – 0.990). Strongest relationship observed at early phase was BW/BL (0.943) and at late phase BW (BL (0.990), BG (0.987), KL (0.954) and TL (0.946). Conclusively, for all the phases of growth a significant strongest positive correlation was observed in BW (B/L). It is recommended that BL should be given priority in selections due to its high tendency of influencing body weight.

Keywords: Body Weight; Growth Phases; Relationship; Traits; Zoometrical

1. Introduction

Nigeria is endowed with various promising poultry species though underrated such as guinea fowl, quails and turkeys. Domesticated turkeys are descendant of wild turkeys indigenous to North and South America [1]. Turkey (*Meleagris gallopavo*) is one of the most promising local poultry genetic resources in Nigeria being raised mainly for eggs and meat. They are ranked the second largest contributor of poultry meat globally [2]. Nigeria, indigenous turkey production contributes substantially to small-scale farmers' economies and protein sufficiency [3]. According to Ewuola, *et al*.,[4] who have been able to identify three of Nigerian indigenous turkey based on plumage which were more adaptable, more resistant to diseases, have faster propensity for growth and better carcass yield of compared to indigenous counterparts. Turkey production however has not been fully exploited in developing countries despite having greater potential than the chicken [5]. Analysis of biometrical traits into shape and size in domesticated animals is an important area of interest to animal breeders [6]. Body weight is one of those important traits in animals. Body weight of an animal is a phenotypic expression of its genetic makeup under the prevailing environmental or rearing conditions. Analysis of morphostructural traits can provide a solid representation of the variability among breeds as well as provide a basis on which genomic analysis can be carried out [6].

Zoometrical or quantitative analyses of form, structure, shape and size of an animal have been found useful in contrasting size and shape of animals [7]. Morphometric traits such as shank length and shank diameter are good indicators of leg development while body girth is an indicator of breast development. In turkey, the breast and legs are

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the major structural components of the body. Kabir *et al*. [8] reported that the relationship between body weight and shank length, a parameter of leg development, has important bearing on table quality of turkey.

Body weight and body dimensions have been used as parameters for selection by local sellers and for research. The use of morphometric traits is therefore a practical technique to derive the bird's body weight [9]. Phenotypic correlation between body weight and morphometric traits could be a useful guide to resource poor rural turkey breeders in the choice of body size traits that can be incorporated into their selection program [10]. Also, breeders need to establish relationships that exist between body weight and zoometrical measurements to organize the breeding program in order to achieve an optimum combination of body weight and good conformation for efficient production and maximum economic returns [11].

Indigenous turkeys are functionally and genetically viable because they possess genetic materials which may be harnessed for improvement. Knowledge of their phenotypic traits at various weeks are important for drug administration, nutritional rationing, marketing and designing breeding programs on the sustainable utilization of their genetic resources. Also, knowing their interrelationship among their phenotypic traits is very importance in the correlation study of different turkey strains. This necessitates the topic Correlations of Zoometrical Traits of Nigeria Indigenous Turkeys at early and late stages of Starter, Grower and Finisher Growth Phases

2. Materials and Methods

2.1. Study Area

The study was carried out in the poultry unit, Teaching and Research Farm of the Department of Animal Science, University of Uyo. Uyo is located between latitude $05^{0}02'$ North and longitude $07^{0}56'$ East with a natural day length of 12-13 hours. The monthly mean minimum temperature was from 21.3^{0} C – 24.9^{0} C and the mean maximum temperature was from 28.4^{o} C – 34.5^{0} C. The annual mean rainfall ranged between 2000mm and 3000mm. Relative Humidity ranged from 78 – 93 % [12]. The research was carried out for the period of 24 weeks (6 months).

2.2. Acquisition and Experimental Birds Management

A total of 150-day old Nigerian Local breed of Poults (Turkeys) was obtained from a reputable farm (Foxy Green Agro Enterprises in Oluyole) in Oyo State. The brooding and rearing pen were thoroughly cleaned and fumigated and allow for one week to the arrival of the Poults. Electrical bulbs were installed strategically at different locations within the brooding pen to serve as sources of heat. Coal pot with charcoal was also put on standby in case of power outage and to serve as additional source of heat. Wood shavings was laid on the floor of the pen to provide litter beddings. The entire brooding pen was covered with polythene wrappers to conserve heat within the pen. Good hygiene, cleanliness and other biosecurity measures was ensured throughout the experimental period. Turkey is known to be more resistant to diseases than most poultry species. However, the following vaccination regime was observed during the period of the research

The floor space of the brooding pen was 0.12 m^{2} while the feeder and water space were 2.5 cm and 1.5 cm respectively. The floor spaces of the rearing pen were 0.37 m2 while feeder space and water space were 6.5 cm and 2.5 cm, respectively. Turkeys were brooded using the deep litter system. The Poults were brooded for 8 weeks. A brooding temperature of 37.5^{0}C (Daikwo *et al*. [13] was maintained during the first ten days of brooding after which the temperature was reduced by 5^{0}C (Momoh *et al*. [14] weekly until the end of eight weeks of age when the birds were transferred to their rearing pen. The temperature was monitored using a thermometer and Poults were observed regularly to ensure the temperature was not too hot or too cold. The wood shavings were replaced when soiled or dampened. Veterinary medications were administered to the turkeys based on the drawn-up schedule.

At 8 weeks of age, Poults were transferred into a rearing pen where they were reared throughout the rearing period. The birds were reared in a deep litter system of management where feed, water and vaccines were provided up to week 24 of age. Turkeys were fed *ad libitum* with formulated feed from 0 – 8 weeks old with turkey starter ration (28.64% CP and 2761.15kcal/kgME; 8 – 16 weeks old with grower mash (22.40%CP and 3000kcal/kgME); 16 – 24 weeks old with finisher mash (18.05% CP and 3100kcal/kgME)

2.3. Data Collection and Statistical Analysis

Body weight was taken using an electronic sensitive scale measured from 0.001 kilogram (kg) to 10.00 kilogram (kg) while linear body measurements for breast girth; body, keel, wing, shank and thigh lengths were taken using a tailor's measurement tape.

Phenotypic correlations among growth, body, and linear body measurement at the different ages was ascertained with Pearson's product moment correlation coefficient (r) using SPSS Software Computer Programme [15]. The significance of the correlation coefficient was determined at P - value of less than 0.05. The model for the correlation is shown as

$$r = \frac{\sum X1Y1}{\sum X12 \sum Y12}$$

Where r = Pearson's correlation

- X_1 = first random variable of the ith body weight or linear body measurements.
- Y_1 = Second random variable of the ith body weight or linear body measurements.

3. Results and Discussion

3.1. Phenotypic Correlations between Body Weight and Linear Body Measurements of Nigerian Local Turkeys

3.1.1. Phenotypic Correlations between Body Weight and Linear Body Measurements of Nigerian Local Turkeys at weeks 2 and 4 (Early starter phase).

The result in Table 1 showed the phenotypic correlation between body weight and linear body measurements of indigenous turkeys at week 2 and week 4. For week 2, positive correlations between body weight and linear body measurements ranged between 0.014 and 0.866 whereas positive and significant correlations ranged between 0.344 and 0.866. The strongest relationship (0.866) existed between body weight/body length, followed by body weight/thigh length (0.864), body weight /breast girth (0.814), body length /thigh length (0.750), Body length /breast girth (0.717), breast girth / thigh length (0.700), wing length /thigh length (0.610). Moderate relationships existed between body weight/wing length (0.537), breast girth / wing length (0.486), body length and wing length (0.478). Weak relationship was observed only between keel length / shank length (0.344). Also, weak but not significant relationships were observed between breast girth / shank length (0.275), body weight / shank length (0.615), shank length /thigh length (0.163), body length / shank length (0.146), wing length and shank length (0.142), breast girth /keel length (0.115) and body weight /keel length (0.014). Negative relationships occurred between keel length / wing length (-0.250), keel length / thigh length (-0.189) and body length / keel length (-0.084).

In week 4, strength of the phenotypic correlations was moderate to high and these relationships were highly significant (Table 1). All linear measurements were strongly related with body weight at week 4. The relationship between thigh length and body weight was the strongest (0.861). Between the linear body measurements, phenotypic correlations were either moderate or strong. There was no weak relationship at this age.

Table 1 Phenotypic Correlations between Body Weight and Linear Body Measurements of Nigerian Local Turkeys (pooled sex) at week 2 (above diagonal) and week 4 (below diagonal)

	BW	BL	BG	KL	WL	SL	TL
BW		0.866**	0.814**	0.014	0.537**	0.165	0.864**
BL	0.829**		0.717**	-0.084	0.478**	0.146	0.750**
BG	0.621**	0.652**		0.115	0.486**	0.275	0.700**
KL	0.630**	0.672**	.701**		- 0.250	0.344*	-0.189
WL	0.715**	0.681**	.638**	0.620**		0.142	0.610**
SL	0.673**	0.598**	0.489**	0.650**	0.577**		0.163
TL	0.861**	0.828**	0.734**	0.628**	0.736**	0.540**	

Where BW = Body Weight; BL = Body Length; BG = Breast Girth; KL = Keel Length; WL = Wing Length; SL = Shank Length; TL = Thigh Length, ** Correlation is significant at 0.01 level, * Correlation is significant at 0.05 level

3.1.2. Phenotypic Correlations between Body Weight and Linear Body Measurements of Nigerian Indigenous Turkeys at weeks 6 and 8.

The result in Table 2 shows the phenotypic relationships between body weight and linear body measurements of male and female turkeys (pooled sex) at weeks 6 and 8. In week 6, the relationships of linear measurements with body weight were found to be weak. The strongest relationship at this week was between breast girth/body length (0.949). Apart from the relationship between breast girth / body length (0.949), wing length / breast girth (0.919), wing length/body length (0.870) and wing length/keel length (0.680) which had strong, relationships other traits pairs were ranged between very low to moderate.

In week 8, the relationships between body weight and linear body measurements were either strong or very strong and these correlations were highly significant ($p < 0.01$). Phenotypic correlations in this week ranged between 0.604 and 0.916 (Table 2). Body length had the strongest relationship (0.916) with body weight and was followed by keel length (0.837) and breast girth (0.813). Between linear trait pairs, the relationship between keel length/body length (0.824), was the strongest at this week. Other trait pairs were either strong or moderately correlated and very significant. No weak relationship existed among traits at this week.

Table 2 Phenotypic Correlations between Body Weight and Linear Body Measurements of Nigerian Indigenous Turkeys (pooled sex) at week 6 (above diagonal) and week 8 (below diagonal) (Late starter phase)

	BW	**BL**	**BG**	**KL**	**WL**	**SL**	**TL**
BW		0.385*	0.390*	0.295	0.384*	0.160	0.200
BL	0.916**		0.949**	0.564**	0.870**	0.389*	0.430**
BG	0.813**	0.774**		0.572**	0.919**	0.360*	0.368*
KL	0.837**	0.824**	0.723**		0.680**	0.279	0.425**
WL	0.778**	0.755**	0.742**	0.604**		0.373*	0.449**
SL	0.801**	0.684**	0.759**	0.677**	0.709**		0.383*
TL	0.801**	0.684**	0.759**	0.677**	0.709**	0.695**	

Where BW = Body Weight; BL = Body Length; BG = Breast Girth; KL = Keel Length; WL = Wing Length; SL = Shank Length; TL = Thigh Length, ** Correlation is significant at $p<0.01$ level, * Correlation is significant at $p<0.05$ level

3.1.3. Phenotypic Correlations between Body Weight and Linear Body Measurements of Nigerian Loal Turkeys (pooled sex) at weeks 10 and 12 (Early grower phase).

The result in Table 3 shows the phenotypic relationship between body weight and linear body measurements of Nigerian Local turkeys (pooled sex) at weeks 10 and 12. In week 10, phenotypic correlations ranged between 0.650 and 0.922. They were all very highly significant ($p<0.05$). The strongest relationship (0.922) was between body weight/breast girth whereas the strong relationship (0.650) of shank length / body length was the weakest. All linear body measurements recorded strong and very strong relationships with body weight at this age. Relationships between linear measurements were either strong or very strong.

In week 12, phenotypic correlations ranged between 0.743 and 0.921 (Table 3). All linear body measurements were either strongly or very strongly correlated with body weight. No moderate or weak relationship existed between any trait pair at this age.

Table 3 Phenotypic Correlations between Body Weight and Linear Body Measurements of Nigerian Indigenous Turkeys (pooled sex) at week 10 (above diagonal) and week 12 (below diagonal) (Early grower phase)

	BW	**BL**	**BG**	**KL**	**WL**	**SL**	**TL**
BW		0.783**	0.922**	0.907**	0.854**	0.878**	0.786**
BL	0.878**		0.719**	0.848**	0.688**	0.650**	0.746**
BG	0.815**	0.838**		0.851**	0.811**	0.862**	0.839**
KL	0.921**	0.853**	0.805**		0.823**	0.844**	0.836**
WL	0.848**	0.842**	0.743**	0.859**		0.866**	0.717**
SL	0.892**	0.848**	0.763**	0.833**	0.792**		0.763**
TL	0.840**	0.773**	0.807**	0.805**	0.806**	0.858**	

Where BW = Body Weight; BL = Body Length; BG = Breast Girth; KL = Keel Length; WL = Wing Length; SL = Shank Length; TL = Thigh Length, ** Correlation is significant at p<0.01 level,* Correlation is significant at p< 0.05 level

3.1.4. Phenotypic Correlations between Body Weight and Linear Body Measurements of Nigerian Local Turkeys (pooled sex) at weeks 14 and 16 (Late grower phase).

The result in Table 4 shows the phenotypic relationships between body weight and linear body measurements of Nigerian Local turkeys (pooled sex) at weeks 14 and 16. In week 14, phenotypic correlations ranged between 0.806 and 0.942. Linear measurements either had significant or highly significant relationships with body weight. The strongest relationship (0.942) was between shank length and body weight. Correlations between other trait pairs were either very strong or strong. There was no weak or moderate relationship between traits pairs at this age.

In week 14, body weight had very strong relationships with all linear measurements except with wing length where a strong relationship (0.653) was recorded. The relationship between body length and body weight was the strongest (0.954). All the phenotypic correlations with wing length were moderate. No weak relationship were recorded at this age (Table 4).

Table 4 Phenotypic Correlations between Body Weight and Linear Body Measurements of Nigerian Indigenous Turkeys (pooled sex) at week 14 (above diagonal) and week 16 (below diagonal) (Late grower phase)

	BW	**BL**	**BG**	**KL**	**WL**	**SL**	**TL**
BW		0.881**	0.865**	0.887**	0.900**	0.942**	0.906**
BL	0.954**		0.912**	0.832**	0.829**	0.918**	0.928**
BG	0.867**	0.855**		0.868**	0.806**	0.876**	0.887**
KL	0.856**	0.848**	0.842**		0.881**	0.888**	0.868**
WL	0.635**	0.675**	0.697**	0.686**		0.905**	0.868**
SL	0.895**	0.889**	0.814**	0.846**	0.667**		0.937**
TL	0.922**	0.882**	0.846**	0.802**	0.671**	0.902**	

Where BW = Body Weight; BL = Body Length; BG = Breast Girth; KL = Keel Length; WL = Wing Length; SL = Shank Length; TL = Thigh Length, ** Correlation is significant at p<0.01 leve, * Correlation is significant at p<0.05 level

3.1.5. Phenotypic Correlations between Body Weight and Linear Body Measurements of Nigerian Indigenous Turkeys (pooled sex) at weeks 18 and 20 Early finisher phase).

The result in Table 5 shows the phenotypic correlations between body weight and linear body measurements of male and female turkeys (sex combined) at weeks 18 and 20. In week 18, phenotypic correlations ranged between 0.804 and 0.967. Relationships between body weight and linear body measurements were very strong. Body length (0.967) had the strongest relationship with body weight. For other trait pairs, correlations were either strong or very strong. No moderate or weak relations was observed between traits at this age.

In week 20, phenotypic correlations ranged between 0.779 and 0.965 (Table 4.21). All the linear body measurements had very strong relationships with body weight. Similar trend of strong and very strong relationships existed between linear body measurements as no moderate or low relationship was observed at this age. This implies that the improvement of any linear body traits results in improvement of the body weight.

Table 5 Phenotypic Correlations between Body Weight and Linear Body Measurements of Nigerian Indigenous Turkeys (pooled sex) at week 18 (above diagonal) and week 20 (below diagonal) (Early finisher phase)

	BW	**BL**	**BG**	**KL**	**WL**	**SL**	**TL**
BW		0.967**	0.957**	0.924**	0.828**	0.918**	0.928**
BL	0.965**		0.920**	0.891**	0.840**	0.899**	0.921**
BG	0.936**	0.908**		0.890**	0.804**	0.877**	0.877**
KL	0.895**	0.855**	0.862**		0.845**	0.866**	0.893**
WL	0.847**	0.834**	0.779**	0.811**		0.896**	0.858**
SL	0.902**	0.859**	0.873**	0.876**	0.815**		0.938**
TL	0.911**	0.888**	0.921**	0.890**	0.793**	0.934**	

Where BW = Body Weight; BL = Body Length; BG = Breast Girth; KL = Keel Length; WL = Wing Length; SL = Shank Length; TL = Thigh Length, ** Correlation is significant at p<0.01 level, * Correlation is significant at p<0.05 level

3.1.6. Phenotypic Correlations between Body Weight and Linear Body Measurements of Nigerian Indigenous Turkeys (without recourse to sex) at weeks 22 and 24 (Late finisher phase).

The result in Table 6 shows the phenotypic correlations between body weight and linear body measurements of pooled sex of Nigerian Local turkeys (sex combined) at weeks 22 and 24. In week 22, phenotypic correlations ranged between 0.704 and 0.943. Body length (0.943) was the strongest correlated trait with body weight followed by breast girth (0.920). Other linear traits had either strong or very strong relationships with body weight. There was no moderate or weak relationship observed at this age.

In week 24, phenotypic correlations ranged between 0.646 and 0.990 (Table 6). Very strong relationships existed between body weight and body length (0.990), breast girth (0.987), keel length (0.954) and thigh length (0.946). Wing length (0.855) and shank length (0.831) had strong relationships with body weight at this age. The relationships between linear body measurements were similarly found to be strong or very strong. Between linear body measurements, the relationship between body length and breast girth (0.987) was the strongest followed by breast girth and thigh length (0.954); breast girth and keel length (0.940). The relationships between other trait pairs were strong. No moderate or weak relationship existed between traits at this age. This indicated that for any linear body trait improve also improve body weight of the Nigerian Local turkeys

Table 6 Phenotypic Correlations between Body Weight and Linear Body Measurements of Nigerian Indigenous Turkeys (pooled sex) at week 22 (above diagonal) and week 24 (below diagonal) (Late finisher phase)

	BW	**BL**	**BG**	**KL**	**WL**	**SL**	**TL**
BW		0.943**	0.920**	0.914**	0.753**	0.880**	0.907**
BL	0.990**		0.885**	0.887**	0.740**	0.798**	0.883**
BG	0.987**	0.984**		0.862**	0.704**	0.803**	0.871**
KL	0.954**	0.947**	0.940**		0.769**	0.848**	0.863**
WL	0.855**	0.847**	0.835**	0.831**		0.758**	0.817**
SL	0.831**	0.849**	0.853**	0.753**	0.646**		0.905**
TL	0.946**	0.950**	0.954**	0.887**	0.864**	0.881**	

Where BW = Body Weight; BL = Body Length; BG = Breast Girth; KL = Keel Length; WL = Wing Length; SL = Shank Length; TL = Thigh Length, ** Correlation is significant at 0.01 level, * Correlation is significant at 0.05 level.

3.2. Estimates of correlation between body weight and Zoometric traits of Nigerian Local turkeys at starter, grower and finisher phases are presented in Table 7 to 9, respectively.

It was observed that all the significant relationship between morphometric traits were all positive across the different growth phases.

At the early starter phase (Table 7), breast girth, thigh length and body length, were found to have a highly significant strong relationship (0.814 – 0.866; p<0.01) with body weight, but even though the relationship between shank length and keel length were weak, it was not significant (P<0.05). A negatively weak relationship was found between Keel length and body length at week 2. At the later stage of the starter phase, correlation estimates (Table 7) revealed that all the linear measurement parameters were strongly associated (0.778 – 0.916; p < 0.01) with body weight. Body length had the strongest relationship with body weight during this stage of growth development. This is similar to the findings of Ojedapo and Amao [16] who reported a negative relationship (-0.31) between keel length and shank length at the early Starter phase during week 1.

Table 7 Phenotypic Correlations between Body Weight and Linear Body Measurements of Nigerian Indigenous Turkeys at early starter phase (week 2 above diagonal) and late starter phase (week 8 below diagonal)

	BW	**BL**	**BG**	**KL**	**WL**	**SL**	**TL**
BW		0.866**	0.814**	0.014	0.537**	0.165	0.864**
BL	0.916**		0.717**	-0.084	0.478**	0.146	0.750**
BG	0.813**	0.774**		0.115	0.486**	0.275	0.700**
KL	0.837**	0.824**	0.723**		-0.250	0.344*	-0.189
WL	0.778**	0.755**	0.742**	0.604**		0.142	0.610**
SL	0.801**	0.684**	0.759**	0.677**	0.709**		0.163
TL	0.801**	0.684**	0.759**	0.677**	0.709**	0.695**	

Where BW = Body Weight; BL = Body Length; BG = Breast Girth; KL = Keel Length; WL = Wing Length; SL = Shank Length; TL = Thigh Length, ** Correlation is significant at 0.01 level, * Correlation is significant at 0.05 level

Shank Length was found to have a very strong influence on body weight at the grower (Table 8) and finishing phase of growth (Table 9). During the grower phase (Table 8), phenotypic association between morphometric traits were strongly related at the early grower phase (0.783 – 0.922; p<0.01) and the later phase of the grower phase Table 8 (0.856 – 0.954) apart from relationship between BW/WL which was highly moderate (0.635). Similar strong interactions were found to exist between many of the trait pairs. Haunshi *et al.* [17] who observed similar findings stated that strong and positive correlations between body weight and shank length would result in improvement in shank length of local birds which is a desirable trait in free range or semi-intensive system of rearing that mostly characterize the rearing of these birds.

Table 8 Phenotypic Correlations between Body Weight and Linear Body Measurements of Nigerian Indigenous Turkeys at early growers' phase (week 10 above diagonal) and late grower phase (week 16 below diagonal)

	BW	**BL**	**BG**	**KL**	**WL**	**SL**	**TL**
BW		0.783**	0.922**	0.907**	0.854**	0.878**	0.786**
BL	0.954**		0.719**	0.848**	0.688**	0.650**	0.746**
BG	0.867**	0.855**		0.851**	0.811**	0.862**	0.839**
KL	0.856**	0.848**	0.842**		0.823**	0.844**	0.836**
WL	0.635**	0.675**	0.697**	0.686**		0.866**	0.717**
SL	0.895**	0.889**	0.814**	0.846**	0.667**		0.763**
TL	0.922**	0.882**	0.846**	0.802**	0.671**	0.902**	

Where BW = Body Weight; BL = Body Length; BG = Breast Girth; KL = Keel Length; WL = Wing Length; SL = Shank Length; TL = Thigh Length, ** Correlation is significant at 0.01 level, * Correlation is significant at 0.05 level

During the finishers phase of growth (Table 9), all linear body parameters measured were found to exhibit a very strong interaction with body weight at both the early (0.828 – 0.967) and later stage (0.831 – 0.990). However the range obtained in this study were higher than the range of 0.51 and 0.99 range obtained by Ogah [18] for turkeys during this period. This could be due to differences in both geographical location and management practice.

On the whole, in all phases of growth it was observed that body length and breast girth had the strongest influence on body weight. The result in this study compares favourably with the Ojedapo and Amao [16] who reported that breast girth had the strongest relationship with body weight at week 10 (0.550) and week 12 (0.850) whereas, body length had the strongest relationship with body weight at week 2.

The positive correlations between body weight and linear body parameters observed in Nigerian Local turkeys indicated that improvement in any of the zoometric parameters corresponds to improvement in body weight which could be explained by pleiotropy. The positive significant correlations denoted that the pairs of traits have direct relationship or at least they are controlled by the same genes in the same direction, thus selection for one trait will lead to improvement of the other traits, however this corroborates the findings of [19; 20].

Similarly, the correlation trend obtained in these findings is in line with the trend observed by Bachev and Lalev [21] who recorded similar trend between body weight and principal body measurements in turkeys and explained that selection for body weight may lead to increase in other body measurements given that majority of genes influencing the body weight and body measurements of turkeys are of common action. The results of this study showed high correlation coefficient between the body weight and the zoometric traits which corroborates with the findings by Adenaike *et al.* [6] , which observed high correlation coefficient between linear measurements and BW ranged from 0.84 to 0.96 for White turkey, with the highest associations being body length ($r = 0.80$, $p < 0.05$) and the trio of thigh length, keel length, and body length ($r = 0.91$, $p<0.05$) for the Lavender and White turkeys, respectively. The increase in body measurements will almost always result in an increasing the Nigerian's turkey Body Weight, especially if the correlation is positive.

Table 9 Phenotypic Correlations between Body Weight and Linear Body Measurements of Nigerian Indigenous Turkeys at early finisher phase (week 18 above diagonal) and late finisher phase (week 24 below diagonal)

	BW	**BL**	**BG**	**KL**	**WL**	**SL**	**TL**
BW		0.967**	0.957**	0.924**	0.828**	0.918**	0.928**
BL	0.990**		0.920**	0.891**	0.840**	0.899**	0.921**
BG	0.987**	0.984**		0.890**	0.804**	0.877**	0.877**
KL	0.954**	0.947**	0.940**		0.845**	0.866**	0.893**
WL	0.855**	0.847**	0.835**	0.831**		0.896**	0.858**
SL	0.831**	0.849**	0.853**	0.753**	0.646**		0.938**
TL	0.946**	0.950**	0.954**	0.887**	0.864**	0.881**	

Where BW = Body Weight; BL = Body Length; BG = Breast Girth; KL = Keel Length; WL = Wing Length; SL = Shank Length; TL = Thigh Length, ** Correlation is significant at 0.01 level, * Correlation is significant at 0.05 level

4. Conclusion

In this study there were positive correlations between body weight and linear body parameters observed in the Nigeria Local turkeys indicating that improvement in any of the parameters correspond to improvement in body weight which could be explained by pleiotrophy. Conclusively, Correlations between body weight and linear body measurements of Nigerian local turkeys showed strong significant and positive significant relationship between any of the trait pairs throughout the studied period in all phases studied. BL, BG, KL, TL had strong correlations with body weight of Nigerian local turkeys in different phases of growth. In all the three phases of growth studied, it was observed that body length and breast girth had the strongest influence on body weight. Morphometric indices like body length, breast girth and keel length can serve as useful guides in the selection of turkeys for body weight in Nigeria Local turkeys. Conclusively, for all the phases of growth a significant strongest and positive correlation was observed in BW/BL. It is recommended that BL should be given priority in selections due to its high tendency of influencing body weight. At the same time, since the values obtained in correlations vary with age, age and phase of growth should be considered whenever improvement plans are to be undertaken on Nigerian Local turkeys industry.

Compliance with ethical standards

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Disclosure of conflict of interest

Author declares that there is no conflict of interest with any financial, personal, or other relationships with other people or organization related to the material discussed in this manuscript.

Statement of ethical approval

This research was conducted in accordance with ethical guidelines governing the use of animals and genetic materials in scientific research as stipulated by the Ethical Committee of Animal Science, University of Uyo.

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