Sexual differentiation and phenotypic correlations among biometric traits of Nigerian local turkey (*Meleagris gallopavo*)

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Abstract

One-hundred and twenty-four (124) Nigerian local turkeys at six months of age were used for this study. The turkeys were raised from day old in a commercial farm located at Ibadan and data were collected on growth traits to determine the effect of sex and phenotypic correlations among growth traits. Highest coefficient of variation was observed in body weight in both male (9.95 %) and female (15.74 %) while the least (5.71%) was observed for wing span in female and 4.95% for body length in male. Sex had significant effect ($p < 0.05$) on all the variables in favour of male. The body weight, shank length, thigh length, body length, wing length, wing span and breast girth for males were 3.80 kg, 9.01 cm, 21.68 cm, 63.00 cm, 32.44 cm, 72.86 cm and 40.17 cm, respectively, while the corresponding values for female were 2.93 kg, 7.27 cm, 17.96 cm, 55.37 cm, 28.18 cm, 63.92 cm and 36.14 cm. The correlation coefficients between body weight and the linear measurements in the two sexes were positive and mostly significant in male. It ranged between 0.291 and 0.561 in male and 0.233 and 0.721 in female. Sexual dimorphism was obvious in all the traits considered in favour of male. The positive correlations between body weight and the linear body measurements in the two sexes means improvement in any of the traits will lead to improvement in the body weight.

Keywords: Nigerian local turkey, sex, wing length, body length and breast girth

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 (Ibe, 1989). The fast growth in the industry requires an intensive research approach to boost its production especially considering the potentials associated with it. The main purpose of animal breeding practices is to improve traits of economic value (Mendes *et al.*, 2005) 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 (Olowofeso, 2009).

Growth traits are useful to livestock farmers and particularly geneticists in improving the market quality of breeding stocks (Latshaw and Bishop, 2001). According to (Ibe, 1989), 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

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some situations scale may not be available and prediction of body weight from body measurements could be preferred practically (Ogah, 2011). Although weights can be precisely determined by using platform scales, unfortunately, these facilities are not available in many farms in Nigeria (Lawrence and Fowler, 20002). He went further to say the body weights of turkey at different ages have to be predicted with reasonable 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 (Nwachukwu *et al.*, 2011).

Protein supply from livestock products was estimated to be only 3.0 g/caput/day in 1993 and a projection of 5.32 g/caput/day was made for the year 2010 (Shaib *et al.*, 1997). This is dismally short of the 35 g recommended by FAO (1993).

Poultry farming in Nigeria was mostly a backyard venture up to about 1960. Some indigenous poultry used for the production of eggs and meat were hardy but poor in productivity. Lack of interest in poultry was due to low productivity of indigenous birds (poor genetic make-up), low prices for eggs and meat, inadequate knowledge of poultry diseases and scientific methods of feeding and management (including housing/nutritional requirements). The first approach in livestock characterization apart from evaluation of its production performance is the evaluation of body size and conformation (Ibe, 1989). 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. Body weight has been commonly used to measure body size. Assessment of body weight and linear body measurements have been found useful in

quantifying body size and shape (Ibe and Ezekwe, 1994).

Growth is a fundamental property of biological systems and it can be defined as an increase in the number of cells in the body size per unit of time (Schulze *et al.*, 2001; Lawrence and Fowler, 2002). Growth of fowl is analogous to growth of mammalian; consisting of three or four cycles, which however, occurred after hatching. Indigenous chickens, like improved breeds has a sigmoid growth pattern with differences in growth rate and feed efficiency (Nwosu, 1979), although the indigenous fowl seemed to complete the rapid growth phase earlier than improved breeds (Oluyemi, 1980). Growth is affected by genetic and non-genetic factors (Singh and Singh, 1983; Gupta *et al.*, 1988; Pinchasov, 1991).

Phenotypic characterization of Animal Genetic Resources (AnGR) is the process of identifying distinct breed populations and describing their external and production characteristics in a given environment and under given management, taking into account the social and economic factors that affect them. The information provided by characterization studies is essential for planning the management of AnGR at local, national, regional and global levels. The *Global Plan of Action for Animal Genetic Resources* (FAO, 2007) recognizes that “A good understanding of breed characteristics is necessary to guide decision-making in livestock development and breeding programmes”.

The developmental processes of males and females are governed by partially different hormonal and physiological controls (Nestor *et al.*, 2000). Such sex differences in physiological parameters may translate into sex-specific responses to selection among males and females of the same age and, ultimately, can lead to a rapid change in sexual size dimorphism even under

constraints of shared gene pool (Rhen, 2000). Therefore, the aim of this study was to determine the effect of sex on growth traits and the phenotypic correlations among the growth traits.

Materials and methods

The experiment was carried out in a private farm at Ibadan in Oyo State. Ibadan is located on latitude 07° 23N and longitude 03°54E and has a semi-hot equatorial climate characterized by seven or more uninterrupted humid months and one to three dry months. One- hundred and twenty-four turkeys were raised from day-old to six month of age in a deep litter system, where they were fed with commercial feed and water supplied *ad libitum*. At the sixth month of age, the turkeys were weighed individually and linear body measurements taken as follows: Linear body measurements were as suggested by Gueye *et al.* (1998) and Solomon (1996). The weights of the birds were obtained using a 20 kg weighing scale, while a measuring tape was used for body measurements in centimeter. Wing Length (WL) was taken from the shoulder joint to the extremity of terminal phalanx while Shank Length (SL) was measured from the hock joint to the spur. Thigh Length (TL) was taken as the distance between the hock joint and the pelvic joint. Body Length (BL) is the length between the tip of the *rostrum maxillare* (beak) and that of the *cauda* (tail, without feathers). Breast girth (BG) was taken under the wing at the edge of the sternum while wing span (WS) is length between tips of right and left wings after both are stretched out in full. To ensure accuracy, each measurement was taken twice and the mean was used in subsequent analysis. All the measurements were taken by the same person.

Data analysis

The data collected were subjected to statistical analysis using T- test SAS (2007). Pearson correlation was used to determine the correlation coefficients among the traits. The statistical model used is as follows:

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

where:

Y = Observations of each growth traits

μ = Universal mean

S_i = Effect of sex

Result

Table 1 shows the statistics of the body weight and linear body measurements on the basis of sex. The coefficient of variation ranged between 5.73 % and 15.74 % for female while between 4.95% and 9.95 % for male. Sex had significant effect ($p < 0.05$) on all the variables considered. Higher values were recorded in favour of male. The body weight, shank length, thigh length, body length, wing length, wing span and breast girth for male were 3.80 kg, 9.01 cm, 21.68 cm, 63.00 cm, 32.44 cm, 72.86 cm and 40.17 cm, respectively while the corresponding estimates for female were 2.93 kg, 7.27 cm, 17.96 cm, 55.37 cm, 28.18 cm, 63.92 cm and 36.14 cm.

The correlation coefficients between the body weight and linear measurements for male and female are shown in Table 2. The upper diagonal shows the correlations for male while the lower diagonal is for the female. The correlations between body weight and the linear measurements were positive, medium to moderate and significant ($p < 0.01$), except for wing length which was not significant ($p > 0.05$) in male. In female, the relationship was positive but significant with body length, wing span and breast girth. The correlations among the linear measurements in the male ranged between -0.057 and 0.559 while in the female were between 0.050 and 0.779.

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Table 1: Summary statistics of body weight and linear measurements of Nigerian local turkey

SEX	VARIABLE	MEANS	STD.DEV.	N	NIN.	MAX.	CV
FEMALE	BWT	2.93±0.06 ^b	0.46	81	1.5	3.5	15.74
	SL	7.27±0.11 ^b	0.78	81	6.0	9.0	10.76
	TL	17.96±0.19 ^b	1.33	81	16.0	22.0	7.38
	BL	55.37±0.44 ^b	3.17	81	47.0	63.0	5.73
	WL	28.18±0.28 ^b	1.99	81	24.0	34.0	7.09
	WS	63.92±0.51 ^b	3.65	81	56.0	73.0	5.71
	BG	36.14±0.48 ^b	3.40	81	28.0	42.0	9.41
MALE	BWT	3.80±0.06 ^a	0.38	43	3.0	4.5	9.95
	SL	9.01±0.08 ^a	0.49	43	8.0	10.0	5.38
	TL	21.68±0.19 ^a	1.18	43	19.0	24.0	5.43
	BL	63.00±0.52 ^a	3.12	43	57.0	70.0	4.95
	WL	32.44±0.40 ^a	2.42	43	25.0	36.0	7.46
	WS	72.86±0.90 ^a	5.41	43	57.0	80.0	7.42
	BG	40.17±0.51 ^a	3.05	43	34.0	45.0	7.59

Bwt-body weight,SL-shank length,TL-thigh length; BL-body length;WL-wing length;Ws-wing span;Bg-breast girth

Table 2: Phenotypic correlation between body weight and linear measurements

	BWT	SL	TL	BL	WL	WS	BG
BWT	1.000	0.366*	0.561**	0.466**	0.291	0.397*	0.516**
SL	0.263	1.000	0.470**	0.387*	0.506**	0.431**	0.008
TL	0.228	0.637***	1.000	0.673***	0.562**	0.559**	0.266
BL	0.495**	0.545***	0.588***	1.000	0.504**	0.588**	0.153
WL	0.233	0.467**	0.531***	0.633***	1.000	0.749***	-0.057
WS	0.325*	0.445	0.562***	0.639***	0.779***	1.000	0.09
BG	0.721***	0.188	0.050	0.447**	0.205	0.338*	1.000

Bwt-body weight,SL -shank length,TL -thigh length; BL -body length;WL-wing length;Ws -wing span;Bg -breast girth

Discussion

The significant effect of sex on the body weight and other variables considered in this study was in favour of male which had higher values in all the variables. The higher values observed in the males indicate sexual dimorphism. This is in agreement with the observation of Ogah (2011) on body weight of 3.38±0.07 kg for male and 2.65±0.02 kg for female in Nigerian indigenous turkey at five month of age. The 3.80±0.06 kg for male and 2.93±0.06 kg for female observed in this study were lower than 6.01 kg and 3.97 kg reported by Kodinetz (1940) and Muzic (1990) from Zagorje turkey at five month of age. The higher values observed in the variables compared with the values reported by Ogah (2011) for the same breed could be attributed to age differences. Non -

significant and higher values were reported by Adeoye and Oladepo (2018) for exotic turkey in Nigeria. The higher values could be attributed to the improved nature of exotic breed compared to the Nigerian indigenous turkey. The relatively low body weight in the present study compared to the respective traits found in temperate region may be due to the unfavourable environmental conditions such as temperature, feed supply and unselective nature of tropical animal genetic resources. The positive correlations between body weight and other body measurements observed in both male and female turkey indicate that improvement in any of the variables correspond to improvement in body weight which could be explain by pleiotropy. Similar observations were

reported by Bachev (1990), Ogah (2011) and Adeoye and Oladepo (2018).

Conclusion

This study demonstrated a positive relationship between body weight and body measurements in turkey and that an increase in the growth rate of any of the components will increase live weight gain. Body weight of turkey could be determined accurately using body measurements such as body length, breast girth etc. Selecting and improving these traits will impact positively on the body weight of turkey. It could also be concluded that at sixth month of age of Nigerian local turkey, male weigh higher than the female.

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