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Morphometric traits of turkey (*Meleagris gallopavo*) as affected by genotype and sex

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Abstract

Morphometric traits have been found useful in quantifying body size and shape and scientific information on them would be required for genetic improvement of turkeys. This study was carried out to evaluate the effect of sex and genotype on morphometric traits of turkey (Meleagris gallopavo). Linear body measurements were taken on 70 exotic turkeys (20 males and 50 females) and 80 locally adapted turkeys (30 males and 50 females) randomly selected from the Turkey Unit at Obafemi Awolowo University Teaching and Research Farm. The linear body measurements taken and recorded were the beak length, head length, neck length, body length, keel length, wing span, wing length, drumstick, Shank length, toe length, tail length and body girth all taken in centimeters (cm) using a measuring tape. Data were analyzed with the GLM procedure of SAS and Duncan Multiple Range Test was used to detect differences among means. There were significant differences ($p < 0.05$) between male and female turkeys with male turkeys having higher values as an expression of sexual dimorphism for all studied traits. Further, the male was found to be significantly higher ($p < 0.05$) than the females for all the morphometric traits measured both for the local and exotic type. The exotic type was found to be significantly ($p < 0.05$) higher than the local type for all the morphometric traits measured. There were significant ($p < 0.05$) interactions between sex and genotype with the male exotic having higher values of all the morphometric traits observed. It was concluded that turkeys are sexually dimorphic and that exotic type had higher body conformation and morphology than their locally adapted counterpart.

Keywords: Morphometric traits, Sex, Genotype, Exotic type, Local type.

Introduction

Turkey production is an important and profitable agricultural industry, with rising global demand for its products (Case *et al.,* 2010). Turkeys are about 1.05 million in Nigeria, though still relatively small when compared with other poultry species such as chickens (160 million), guinea fowls (8.3 millions) and ducks (1.7 millions) (FAOSTAT, 2011). A key constraint to the rearing of turkey in Nigeria could be linked to paucity of scientific information on its production potential, body conformation and lack of coherent and definitive government policy that would outlaw turkey importation (Mbanasor and Samson, 2004). It has also been reported that imported turkeys formed about 60% of the total turkeys in Nigeria market (Thear and Fraser, 1986). Morphometric measurements have been used to evaluate the characteristics of various breeds of animals and could provide useful information on body conformation and on the suitability of animal for selection (Mwacharo *et al.,* 2006; Martins *et al.,* 2009; Yakubu, 2010). Live body weight and linear body measurements contributes significantly to the lifetime performance of an animal and has been found useful in quantifying body size and shape (Ibe and Ezekwe, 1994; Chineke, 2005). The obvious lack of information on specific requirements for turkey production in Nigeria is attributed to low level of research on this birds and low production. As efforts are being made to expand the scope of turkey production in Nigeria, scientific

information on their morphometric traits would be required for genetic improvement of these birds. The objective of this study, therefore, was to evaluate the effect of genotype and sex on the morphometric traits of turkey raised in Nigeria.

Materials and methods

This study was conducted at the Turkey Unit of the Teaching and Research Farm of the Faculty of Agriculture, Obafemi Awolowo University, Ile-Ife, Osun State, Nigeria. The University is located in Ife Central Local Government of Osun State on Latitude 7°31'8.4''N and longitude 4°31'15.96"E. The climate is humid with a mean annual rainfall of 1037mm. The annual mean temperature and humidity are 34°C and 82% respectively (Amujoyegbe *et al*., 2008).

Experimental animals

A total of 150 turkeys were randomly selected from the Turkey Unit were used for the research. The birds were 7 months (27 – 29 weeks) of age. Seventy exotic turkeys of *Nicolas breed* (20 males and 50 females) as well as 80 locally adapted turkeys (30 males and 50 females) were used. The birds were of three colour variants which included black, white and lavender.

Management of experimental animals

The birds were raised under an intensive system of management on deep litter. The breeds (exotic and locally adapted breed) were raised in different pens but were all subjected to the same standard system of management. Daily routine management was put in place to ensure that the birds were fed adequately (*ad libitum*) with commercial feeds. Starter mash containing 28% crude protein (CP) was given to birds at 0-6 week of age, growers mash containing 24% CP was given to birds at 7-16 weeks of age and finisher mash containing 20% CP to birds at 12-28 weeks of age. Adequate sanitation, biosecurity measures and required vaccination protocols were put in place to prevent incidence of diseases.

Data collection

The Linear Body Measurements (LBM) were taken on a total of 150 turkeys which included 70 exotic turkeys (20 males and 50 females) and 80 locally adapted turkeys (30 males and 50 females) at 7 months (27 – 29 weeks) of age. The body weight was also recorded using a table scale (Hana the Big Boss which is a product from China), with a capacity of 20kg and sensitivity of 1g, while the body measurements were taken in centimeters with the use of a measuring tape. The identification of birds that had undergone measurement was done using a paper tape and numbered with permanent maker. The readings and measurements were recorded on a designed capture sheet.

Measured traits

The parameters taken were beak length, head length, neck length, body length keel length, wing span, wing length, drumstick, shank length, toe length, tail length, body girth, body weight. Trait description and measurement followed the guidelines of FAO (2012).

Beak length (BKL) was measured as distance between the rectal apterium to the end of the maxillary nail; i.e. from the end of the fleshy part of the head to the tip of the beak; Head length (HL) was measured from the end of the neck to the start of the beak; Neck length (NL) was considered as the distance between the occipital condyle and the cephalic borders of the caracoids; Body length (BL): was measured as the length of the body from the base of the neck to the base of the tail around the uropigial gland; Keel length (KL) was taken as the length of the cartilaginous keel bone or metasternum; Wing span (WS) was taken from the shoulder joint to the extremity of terminal phalanx; Wing Length (WL) was taken from the shoulder joint to the tip of the longest wing feather; Drumstick (thigh length) was taken from the joint hock to the

pelvic joint; Shank length (SL) was measured from the hock joint to the tarsometarsus digit -3 joints; Toe Length (TL) was taken from the tarsometarsus digit-3 joins to the tip of the toe nail; Tail Length (TLL) serves as a continuation of the back and extends from the top of the anus region; Body Girth (BG) was taken under the wing at the edge of the sternum. It is also known as the body circumference.

Data analysis

The data obtained were analyzed using the General Linear Model of SAS (2002) according to the following model:

Yijk= μ+ Si+ Gj+ (S*G)ij+ Eijk

Yijk = Morphometric trait measured,

μ= Overall means,

Si = Sex of turkey effect (i= male and female),

Aj= Genotype of turkey effect (j = Exotic and local),

(S*A)ij = Interaction between sex and genotype,

Eijk = Random error.

er mean values than the locally adapted turkeys for all the morphometric parameters measured. Morphometric traits of turkeys recorded by sex classification is presented in Table 2. There were significant differences between male and female turkeys with the male having higher values as an expression of sexual dimorphism for all traits studied. Table 3 shows the interaction between sex and genotypic classification. There were significant interactions between sex and genotype ($p<0.01$). Exotic male had significantly ($P<0.05$) higher values than others while local female had the least.

Table 1: Means (±SE) of linear body measurement of turkey by genotype classification

Parameters	Exotic turkey	Locally adapted turkey
Beak length(cm)	5.77± 0.07[a]	5.13±0.34[b]
Head length(cm)	14.39±0.16[a]	11.38±0.18[b]
Neck length(cm)	23.51±0.22[a]	19.21±0.35[b]
Body length(cm)	41.47±0.40[a]	34.31±0.55[b]
Keel length(cm)	20.54±0.21[a]	16.15±0.30[b]
Wing span (cm)	22.59±0.35[a]	20.00±0.33[b]
Wing length(cm)	39.51±0.36[a]	35.48±0.36[b]
Drumstick(cm)	23.39±0.39[a]	19.21±0.27[b]
Shank length (cm)	16.03±0.15[a]	12.60±0.19[b]
Toe length(cm)	8.57±0.15[a]	7.53±0.11[b]
Tail length(cm)	35.04±0.69[a]	29.91±0.38[b]
Body girth(cm)	69.01±0.78[a]	55.23±0.90[b]

[a, b] :Means within each row with different superscript are significantly different ($P< 0.05$); SE-Standard Error

Table 2: Means (±SE) of linear body measurement of turkey by sex classification

Parameters	Male turkey	Female turkey	P value
Beak length (cm)	5.69±0.94 [a]	5.30±0.04 [b]	<.0001
Head length(cm)	13.98±0.31 [a]	12.18±0.18 [b]	<.0001
Neck length(cm)	23.16±0.38 [a]	20.25±0.33 [b]	<.0001
Body length(cm)	40.70±0.71 [a]	36.13±0.52 [b]	<.0001
Keel length(cm)	19.94±0.30 [a]	11.33±0.33 [b]	<.0001
Wing span (cm)	20.42±0.56 [a]	20.60±0.26 [b]	<.0001
Wing length(cm)	39.51±0.43 [a]	36.37±0.36 [b]	<.0001
Drumstick(cm)	23.74±0.55 [a]	19.87±0.24 [b]	<.0001
Shank length (cm)	15.20±0.25 [a]	7.61±0.08 [b]	<.0001
Toe length(cm)	8.88±0.21 [a]	13.70±0.24 [b]	<.0001
Tail length(cm)	33.90±0.85 [a]	31.51±0.48 [b]	<.0001
Body girth(cm)	69.08±0.23 [a]	57.95±0.86 [b]	<.0001

[a, b] Means within the same row having different superscripts differ significantly ($p< 0.05$) between the two sexes.
SE- standard error

Table 3: Means (±SE) of linear body measurement of turkeys based on i nteraction between sex and genotype

	Exotic		Local		
Parameter	Male	Female	Male	Female	P-VALUE
Beak length (cm)	6.33±0.09[a]	5.55±0.07[b]	5.27±0.07[c]	5.05±0.02[d]	<.0001
Neck length (cm)	25.00±0.28[a]	22.92±0.24[b]	21.93±0.49[b]	17.58±0.31[c]	<.0001
Body length (cm)	43.90±0.79[a]	40.50±0.39[b]	38.57±0.85[c]	31.76±0.41[d]	<.0001
Keel length (cm)	21.20±0.32[a]	20.28±0.26[b]	19.10±0.38[c]	14.88±0.13[d]	<.0001
Drumstick (cm)	27.10±0.79[a]	21.90±0.19[b]	21.80±0.38[b]	17.84±0.17[c]	<.0001
Shank length (cm)	16.20±0.22[a]	15.76±0.18[b]	14.20±0.26[c]	11.64±0.13[d]	<.0001
Toe length (cm)	9.95±0.27[a]	8.17±0.12[b]	8.02±0.21[b]	7.20±0.08[c]	<.0001

M± E S: Mean± standard errror. [a, b, c, d] Means within the same row having different superscripts differ significantly ($p< 0.05$). SE-Standard error

Discussion

Results from this study showed a large variation in morphometric traits between the different genotypes. This agreed with previous report in Ethiopia (Dana *et al*., 2010) and Nigeria (Ilori *et al*., 2010) in the tropics. The differences and superiority exhibited by the exotic turkey suggested that it had better growth performance potential than its local counterparts. This was due to the fact that the breed had gone through intense and structured selection for higher growth rate over many generations. The lower growth rate of the local turkey genotype could be that they are yet to be genetically improved and might have gone through natural selection for survival in the tropical climate rather than artificial selection for improved productivity (Ibe, 1998). Each breed has a determined morpho-structure, an expression of its quantitative morpho-structure that responds to a particular environment to which it is adapted or being raised. The indigenous turkeys represented a pool of heterogeneous and unimproved individuals unlike their exotic counterparts that have undergone directional selection for high growth rate (Yakubu *et al.,* 2012). The difference in morphometric traits might also be attributed to the difference in the geographical origin of the two genetic groups since the indigenous birds are more adaptable to the hot and humid tropical environment while

the exotic birds were from the temperate region (Yakubu *et al.,* 2011). According to Mulyono *et al.* (2009), differences of the origin distinguished the phenotypic response based on the potential for additive genes controlling the body measurements of each bird's genotype to the nature of growth, development and osteogenesis. These results revealed that males generally had higher values in body parameters which is in accordance with the report of Garcia *et al*. (1991) and Ikeobi *et al*. (1995) that sexual dimorphism was in favour of males in the performance of strains of birds studied. The wide variations between the sexes might be connected with differences in growth rates, metabolic rates and nutrient requirement. According to Baeza *et al*. (2001), sexual dimorphism is attributable to differing effects of sex hormones on the growth and development process which invariably leads to different growth rates. Similar findings had been reported by other workers (Blondel *et al.,* 2002; Yakubu, 2011).

Conclusion

This study evaluated the effect of genotype, sex and their interaction on morphometric traits of turkey. There were significant differences between local and exotic genotype of turkey. Exotic turkeys had higher body conformation and morphometric traits than the locally adapted turkeys. Further, turkeys were found to be sexually dimorphic regardless of their genotype.

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