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Effects of plumage colour, sex and correlation on bodyweight and linear body measurements in the Nigerian local turkey

SOLA-OJO, FE, AYORINDE, KL, FAYEYE, TR, AHUTU, IA and OBADARE, AR.

Department of Animal Production, University of Ilorin
*mofesola1@yahoo.com, tomjay217@yahoo.com.

Abstract

One hundred (100) sixteen (16) weeks old Nigerian local turkeys (55 males and 45 females) consisting of 43 lavender, 36 white and 21 black plumage turkeys were used to evaluate the effect of plumage colour and sex on growth traits (body weight and linear body measurements). Correlations between body weight and the linear body measurements were also evaluated. The black male turkey numerically had highest values for the growth traits measured, except the body length which was higher in the lavender, followed by the lavender male, while the white plumage turkey had the lowest value. In the female turkey, the lavender numerically had higher values for all the parameters measured except the keel length which was higher in the black plumage female turkey; the white female turkey had lowest value as well. The effect of sex on body weight and linear body measurements was significant ($p < 0.05$). The male turkey had significantly ($p < 0.05$) higher growth traits values than the female. Linear body measurements were highly correlated ($p < 0.01$), positive and significant with body weight in Nigerian local turkey, ranging from 0.47 obtained for keel length to 0.95 for body length in male, and 0.60 obtained for keel length to 0.92 for body length in female. However, the shank diameter had a low (0.20) correlation value with the body weight in male Nigerian local turkey. This study shows that the black male and lavender female turkey had higher value for body weight and linear body measurement. Male Nigerian local turkey had significantly higher values for growth traits, while positive and significant correlation existed between some linear body measurements and body weight in the Nigerian local turkey.

Key words: Plumage colour, sex, linear body measurements, correlation, Nigerian local turkey

Introduction

Poultry production has undergone rapid changes since 1940 when modern intensive production methods were introduced together with new breeds, improved biosecurity, and preventive health measures (Permin and Pedersen, 2000). Poultry is now by far the largest livestock species worldwide (FAO, 2000), accounting for more than 30% of all animal protein. Turkey is of the family *Meleagridinae* (Order *Galliformes*), the best known is the common turkey (*Meleagris gallopavo*), a native game bird of North America but widely domesticated for the table. Local or indigenous birds constitute more than 80 percent of the poultry birds in the country. Unfortunately, there has been very little attention from government and researchers to improve the contribution of the local poultry to the national GDP and total animal protein intake.

The main purpose of animal breeding practices is to

improve traits of economic important (Mendes *et al.*, 2004). Traits of economic importance have close association with explanatory variables such as age, breed and morphological characters (Yakubu *et al.*, 2005). Estimating genetic parameters for various livestock traits has been a main topic of animal breeding during the past half century (Sang, 2003) and the live body weight including the linear body measurements contribute significantly to the lifetime performance of the animal (Chineke, 2005). Turkey production is an important and profitable venture in the agricultural industry, with a rising global demand for its products (Case *et al.*, 2010, Ironkwe and Akinola, 2010, Anandahl *et al.*, 2012, Yakubu *et al.*, 2013). There are only 1.05 million turkeys in Nigeria and the number is small compared with other poultry species (FAOSTAT, 2010). The local turkey is the fastest growing indigenous poultry and it has the prospect of

making more contribution to the Nigerian GDP than any other poultry specie. Recent global restriction in poultry imports accentuated by the threat of avian influenza suggests a renewed interest in indigenous stock. Kallah and Nwagu (1999) suggest the need to develop robust national poultry breeding and development programme. The Food and Agricultural Organization of the UN recognizes rural poultry as an important tool for poverty alleviation in Africa. Low turkey production is due to the sensitivity of this animal to infectious diseases and the difficulty to cope in an endemic environment (Marchewka *et al.*, 2013) and also due to the low reproductive performance (Zahraddeen *et al.*, 2005). Since the indigenous breed has the advantage of high disease resistance and adaptability to the climate of the tropics, estimating their growth traits and upgrading them with high performing meat type exotic turkey will contribute significantly to available protein and be of high economic value. This research was therefore designed to contribute to available data on the Nigerian local turkey through determination of the effect of plumage colour and sex on growth traits, as well as estimation of correlation between body weight and linear body measurements of the Nigeria local turkey. This will assist in identification of the types that can be used in any improvement programme design for the Nigerian local turkey.

Materials and Methods

Study Location: The experiment was carried out at the Teaching and Research Farm of the Faculty of Agriculture, University of Ilorin, Ilorin, Kwara State, Nigeria.

Experimental Animals: One hundred adults Nigerian local turkey raised intensively in a partitioned deep litter pens under the same management condition from day old were used for the study. At the sixteenth week, when there was a clear distinction between male and female turkey, and before the onset of the turkey sexual maturity, data on growth traits were collected from 55 males and 45 females Nigerian local turkey, consisting of 43 lavender, 36 white and 21 black plumage colour. Traits measured were Body weight and some linear body measurements.

Traits Measured: Body Weight (BW) was taken in gram using a sensitive weighing scale recorded in grams. The Body Length (BL), Body Girth (BG), Thigh Length (TL), Shank Length (SL), Keel

Length (KL) and Wing Length (WL) were measured, with the aid of a measuring instrument. The Shank Diameter (SD) was measured with a pair of Vernier caliper as described by Sola-Ojo and Ayorinde (2009). BL was measured as the length of the body from the base of the comb to the base of the tail around the uropigial gland. BG was measured as the region of the largest girth expansion while the bird was positioned vertically. SL was measured using a flexible tape rule as the distance from the hock joint to the tarsometatarsal digit-3 joint. SD was measured using a Vernier caliper at the middle of the left shank of each bird. TL was taken as the distance between the hock joint and the pelvic joint. KL was taken as the length of the cartilaginous keel bone from the cranial to the caudal terminals of the metacarpals using a tape rule. WL was measured with the aid of a tape rule with the wing stretched as the measurement taken from the humerus-coxal junction to tip of the digit.

Statistical Analysis: Data obtained were subjected to analysis of variance, using the General Linear Model procedure of SPSS. The model used was of the form:

$$Y_{ij} = \mu + a_i + b_j + e_{ij}$$

Where Y_{ij} = Measurements of i^{th} and j^{th} parameters

μ = overall mean

a_i = effect of i^{th} (sex)

b_j = effect of j^{th} (plumage colour)

e_{ij} = random residual error.

Significantly different means ($p < 0.05$) were separated by use of the Duncan's multiple range Test (Duncan, 1955). The relationship between body weight and morphometric traits were determined using Pearson correlation analysis.

Results and Discussion

The growth traits of the male indigenous turkey with respect to their plumage colour are presented in Table 1. The results indicated that there were significantly ($p > 0.05$) different values for body weight and linear body measurements of the Nigerian local turkey irrespective of their plumage types studied. The black male turkey recorded the highest values for all the body parameters measured, except in the body length where the lavender male had 80.25 ± 0.48 cm, which was the highest value, but not significantly different from others. The black male turkey

Table 1: Effect of plumage colour on the Body Weight (g) and Linear Measurements (cm) of the Indigenous male Turkey

Plumage colour	Black Male	White Male	Lavender Male
Growth Traits			
BW	3012.00±71.75	2966.00±50.74	2925.00±58.59
BL	80.20±0.59	79.95±0.42	80.25±0.48
BG	38.51±0.29	38.18±0.21	37.91±0.24
SL	11.43±0.21	11.16±0.15	11.26±0.17
SD	1.29±0.03	1.19±0.02	1.23±0.02
TL	22.74±0.19	22.50±0.13	22.63±0.15
KL	12.46±0.19	12.33±0.13	12.40±0.15
WL	30.60±0.27	29.90±0.19	30.35±0.22

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

body weight of 3012.00±71.75g, followed by the white male turkey (2966.00±50.74g) and the lavender male had the lowest value (2925.00±58.59). The black male turkey also had the highest body girth value of 38.51±0.29cm followed by the white male turkey (38.18±0.21cm) and the lavender male (37.91±0.24 cm). The black male turkey numerically had the highest values for shank length, shank diameter, thigh length, keel length and wing length followed by the lavender male turkey, while the white male turkey had the lowest values for these body parameters. This result revealed the difference in body parameters measured in the Nigerian local turkey categorize based on plumage colour type. The obtained values for the body weight and other linear body parameters showed that the black male turkey was bigger and had highest values for linear body

measurements except the body length which was longer in the lavender. The differences and superiority exhibited by the black male turkey in some growth parameters studied suggested that they have a better growth traits potential than the lavender and white local turkey plumage type. The results of growth traits measured in the Nigerian female local turkey studied is presented in Table 2. It shows that the lavender female turkey had the highest values for all the body parameters except the keel length which was of highest value in the black female turkey. However, there were no significant differences ($p>0.05$) in all the parameters measured. The lavender female had a body weight value of 2600.00±40.59g followed by black female turkey (2517.00±82.85g), and the white female turkey (2600.00±40.59g). Also, the lavender female turkey had the highest values for

Table 2: Effect of plumage colour on the Body Weight (g) and Linear Measurements (cm) of the indigenous female Turkey

Plumage colour	Black Female	White Female	Lavender Female
Growth traits			
BW	2517.00±82.85	2489.00±54.24	2600.00±40.59
BL	76.68±0.68	76.59±0.45	77.31±0.33
BG	36.72±0.34	36.52±0.23	37.03±0.17
SL	10.08±0.24	10.16±0.16	10.46±0.12
SD	1.12±0.03	1.12±0.02	1.18±0.02
TL	21.70±0.22	21.58±0.14	21.95±0.11
KL	11.80±0.22	11.56±0.14	11.72±0.11
WL	28.83±0.32	29.04±0.21	29.52±0.15

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

body length, body girth and thigh length followed by the black female turkey. It also had the highest values for shank length and wing length, followed by the white female turkey. The black female turkey had the highest value for keel length (11.80±0.22cm) followed by the lavender female turkey (11.72±0.11cm), the white female turkey had the lowest value (11.56±0.14cm). The lavender female turkey had the highest value for shank diameter with a value of 1.18±0.02cm, while both the black and white female turkey had the same value. The results showed that, black male turkey was bigger in size than its contemporary, while the lavender female turkey was also numerically bigger in size and of higher linear body measurements than the black and white female turkey.

Table 3 shows the effect of plumage colour on the body weight and linear body measurements of the indigenous turkey irrespective of the sex. Similar values existed in three colour types for all the parameters measured except the shank diameter that was significantly ($p < 0.05$) different. The black feathered turkey had the highest values for body weight, body girth, and keel length (2765.00±54.80g, 37.62±0.23cm, 12.13±0.14cm, respectively), while the lavender turkey had similar ($p > 0.05$) values for those traits (2762.00±35.64g, 37.47±0.15cm, 12.06±0.09cm, respectively). The lavender turkey had non-significantly ($p > 0.05$) higher values for body length, shank length, shank diameter, thigh and wing length (78.78±0.29cm, 10.86±0.11cm, 1.21±0.02cm, 22.29±0.09cm,

29.94±0.14cm respectively) compared to black turkey values (78.44±0.45cm, 10.75±0.16cm, 1.20±0.02cm, 22.22±0.14cm, 29.72±0.21cm) for the same respective parameters. The white plumage turkey had similar but non-significantly ($p > 0.05$) different values for all parameters measured except the shank diameter that was significantly ($p < 0.05$) different (1.15±0.02cm) compared to black plumage turkey (1.20±0.02cm) and lavender (1.21±0.02cm) turkey shank diameter values. The effect of plumage colour on body weight and other growth traits showed that irrespective of the sex, the black turkey numerically had the highest values for body weight, body girth and keel length, while the lavender turkey numerically had the highest values for body length, shank length, shank diameter, thigh length and wing length, however, significantly ($p < 0.05$) different values were obtained only for the shank diameter in the Nigerian local turkey type studied.

The effect of sex on body weight and linear body parameters irrespective of the plumage colour studied is as shown in Table 4. The results indicated that, Nigerian local male turkey had significantly ($p < 0.05$) higher values for all growth traits measured compared to the female. This finding corresponds with the reports of Garcia et al. (1991); Ikeobi et al. (1995) and Ojo et al. (2011) that sexual dimorphism was in favour of male, as males were reported to have higher growth traits values compared to the female.

Table 3: Effect of the Plumage colour on the Body Weight (g) and Linear Measurements (cm) of the local Turkey irrespective of sex.

Plumage colour (Male and Female)	Black	White	Lavender
	Growth traits		
BW	2765.00±54.80	2727.00±37.14	2762.00±35.64
BL	78.44±0.45	78.27±0.31	78.78±0.29
BG	37.62±0.23	37.35±0.15	37.47±0.15
SL	10.75±0.16	10.66±0.11	10.86±0.11
SD	1.20±0.02 ^b	1.15±0.02 ^c	1.21±0.02 ^a
TL	22.22±0.14	22.04±0.09	22.29±0.09
KL	12.13±0.14	11.95±0.09	12.06±0.09
WL	29.72±0.21	29.47±0.14	29.94±0.14

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

Means on the same rows with different superscripts (a-c) are significantly different ($p < 0.05$).

Table 4: Effect of sex on the Body weight (g) and linear body measurements (cm) of the local Turkey irrespective of the plumage colour.

Sex	Male	Female
Growth Traits		
BW	2968.00±35.21 ^a	2535.00±35.66 ^b
BL	80.13±0.29 ^a	76.86±0.29 ^b
BG	38.19±0.15 ^a	36.76±0.15 ^b
SL	11.28±0.10 ^a	10.23±0.11 ^b
SD	1.24±0.01 ^a	1.14±0.02 ^b
TL	22.62±0.09 ^a	21.74±0.09 ^b
KL	12.39±0.09 ^a	11.70±0.09 ^b
WL	30.28±0.13 ^a	29.13±0.14 ^b

BW=Body weight, BL=Body length, BG=Body girth, SL=Shank length, SD=Shank diameter, TL=Thigh length, KL=Keel length, WL=Wing length.
Means on the same rows with different superscripts (a-b) are significantly different (p<0.05)

in the type of poultry studied. Fayeye et al. (2006) attributed this difference to genetic effect of sex which arises from the male physiological activities. It was also reported by Ibe and Nwosu (1999) that sex differences were usually due to differences in hormonal profile, aggressiveness and dominance especially when both sexes are reared together. The pair wise correlation between body weight and linear body measurements of the male Nigerian local turkey is presented in Table 5. The results showed that body weight was positively and significantly correlated (p<0.01) with other linear body parameters measured ranging from 0.47 for keel length to 0.95 in body length, but the shank diameter had a lower correlation value (0.20) with the body weight. Table 6 shows the pair wise correlation between body weight and linear body

parameters of the Nigerian female local turkey studied, and the results also indicated that body weight was highly correlated (p<0.01) with other linear body parameter measured significantly, ranging from a value of 0.60 for keel length to 0.92 in body length and body girth. High and significantly correlated values obtained shows that the linear body measurement had a positive contribution to the overall body weight, thus an increase in the value of these linear body measurement will results in an increase in the overall body weight in the Nigeria local turkey type irrespective of their sexes, and the values of the linear body measurements can be used to predict the value of body weight in both sexes of the local turkey type studied. Ogah (2011) and Bachev and Lalev (1990) recorded similar trend

Table 5: Correlation between Body weight and Linear body measurements of the Nigerian local male turkey

Traits	BW	BL	BG	SL	SD	TL	KL	WL
BW	1							
BL	0.88**	1						
BG	0.75**	0.75**	1					
SL	0.67**	0.66**	0.59**	1				
SD	0.20	0.19	0.17	0.17	1			
TL	0.63**	0.56**	0.80**	0.49**	0.34*	1		
KL	0.57**	0.44**	0.33*	0.57**	0.19	0.54**	1	
WL	0.50**	0.63**	0.66**	0.33*	0.47**	0.62**	0.04	1

BW=Body weight, BL=Body length, BG=Body girth, SL=Shank length, SD=Shank diameter, TL=Thigh length, KL=Keel length, WL=Wing length.
** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 6: Correlation between Body weight and Linear body measurements of the Nigerian local female turkey

Traits	BW	BL	BG	SL	SD	TL	KL	WL
BW	1							
BL	0.92**							
BG	0.92**	0.89**						
SL	0.75**	0.84**	0.76**					
SD	0.82**	0.77**	0.84**	0.68**				
TL	0.80**	0.82**	0.77**	0.77**	0.68**			
KL	0.60**	0.58**	0.46**	0.52**	0.43**	0.59**		
WL	0.84**	0.88**	0.85**	0.88**	0.80**	0.86**	0.55**	

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

** Correlation is significant at the 0.01 level (2-tailed).

between body weight and principal body measurements in turkey. The authors stated 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 turkey are working additively. In this study, it could be said positive development of the body parameters measured will contribute significantly to overall increase in body weight of the Nigerian local turkey studied.

Conclusion

This study showed that plumage colour has an influence in the body weight and linear body parameters in the Nigerian local turkey with the black male and lavender female turkey having a numerically higher value for body weight. The black plumage colour turkey should be considered in male and the lavender plumage colour should be considered in female in any improvement programme design for the Nigerian local turkey. Nigerian local male turkeys were significantly bigger than female and they should be utilized if sex is to be taken into consideration in improvement of body weight of the Nigerian local turkey. In both sexes of turkey studied irrespective of the plumage colour, most of the body parameters measured (body length, body girth, wing length, shank length, keel length and length) were positive and significantly correlated with body weight, and this is an indication that increment in their value will lead to overall increase in body weight of the Nigerian local turkey.

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