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## Biometric prediction of live body weight using morphometric traits in Nigerian local turkey (*Meleagris gallopavo*)

<sup>1</sup>Adeoye, A.A. \*, <sup>2</sup>Oladebo, A.D. and <sup>3</sup>Udoh, J.E.

<sup>1</sup>Department of Animal Production and Health, Ondo State University of Science and Technology, Okitipupa, Nigeria

<sup>2</sup>Department of Agricultural Science, Adeyemi College of Education, Ondo State, Nigeria

<sup>3</sup>Animal Science Department, University of Uyo, Uyo, Nigeria

\* Corresponding author (Email:adeomoh@yahoo.com)

### ABSTRACT

Data on morphometric traits collected from one hundred and twenty-four (124) Nigerian local turkeys at the age of six months were used to predict the live body weight of the turkey and determine the effect of sex on body weight, shank length, thigh length, body length, wing length, wing span and breast girth. Sex had a 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. Coefficient of determination was highest (0.584) with body length and followed by breast girth (0.581) in simple linear regression. The coefficient of determination among the multiple regression models ranged between 0.584 and 0.756. Body weight of six months old Nigerian indigenous turkey could be predicted using simple and multiple linear regressions.

**Keywords:** Nigerian local turkey, Sex, morphometric traits

### INTRODUCTION

Turkey is a good source of protein and one of the most valued poultry especially in USA where it is highly priced during the Thanksgiving periods (FGN and UNICEF, 1990). It is not common among poultry growers in Nigeria: a number of farms are beginning to breed 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. The fast growth in the industry requires an intensive research approach to boost its production especially considering the potentials associated with it.

Biometric traits in various livestock animals at different ages and locations have been used by many researchers in predicting live weight of the animals (Ewuola, *et al.*, 2014; Adeniji and Ayorinde, 1990; Sowande and Sobola, 2008; Momoh and Kershima, 2008 and Afolayan, *et al.*, 2006). Body weight being an important economic trait in the selection of animals demands an accurate estimation to enhance livestock breeding and production. Furthermore, knowledge of animal live weight is an important tool for farmers in making decisions, such as estimation of market prices, determining correct dosages in drug administration, determining animal's feed requirements for growth, maintenance, and production (Mahieu *et al.*, 2011). The modern method of estimating live weight is the use of weighing scale/ balance. However, many farmers under field condition where turkeys are kept for commercial purposes, scales are not in use partly due to cost, labour and technicality involved in the use of weighing scales. This has led to difficulty in live animal marketing in relation to price setting. Nevertheless, there is need to estimate live weight of animals especially turkey from simple and easily measurable morphological traits such as linear body measurements means that local turkeys are sold live in Nigeria. Therefore, the objective of this work was to determine which of the linear measurements will be the best in predicting live body weight of turkey at six months of age.

## MATERIALS AND METHODS

The experiment was carried out in a 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 *adlibitum*. 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 analysis of variance to determine the summary statistics and sex effect on the growth traits using SAS (1999). Pearson correlation was used to determine the correlation coefficients among the traits on sex basis. Stepwise multiple regression analysis was used by including the different linear measurements individually and collectively, to identify the best predictor variables for estimating the body weight. Body weight and regression equation were compared based on coefficient of determination.

The full regression model of the measurements (all the six linear body measurements) was defined as:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6$$

Where,  $Y$  = dependent variable (body weight),  $a$  = intercept,  $b$ 's = regression coefficients,  $X$ 's = independent variables (WL, WS, SL, TL, BL AND CC).

## RESULTS

Table 1 shows the summary statistics of the body weight and linear body measurements on the basis of sex. Sex had significant effect ( $p < 0.05$ ) on all the variables considered. Higher values were recorded in favour of male.

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

The correlation coefficients between the body weight and linear measurements for male and female were shown on 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 in the two sexes but not significant

with wing length. However, it was not significant with shank length (0.263), thigh length (0.228) in the female. 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.

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

The simple and multiple linear regression equations, residual mean squares and coefficient of determinations are shown in Table 3. Coefficient of determination was highest (0.584) when body length was included in the model and this was followed by breast girth (0.581) and thigh length (0.521). The coefficients of determination for shank length, wing spine and wing length were 0.469, 0.453 and 0.389 respectively. The residual mean squares

were observed to be increasing as the coefficients of determination decreased. When two variables were fitted in the model, the variables BG and SL had the highest coefficient of determination (0.736), followed by BG and BL of 0.735. As the number of variables increased in the model the coefficient of determination also increased. Similarly, the higher the coefficient of determination the lower the residual mean square.

Table 3: Regression equations for predicting live weight from morphometric traits in Nigerian local turkey

	Intercept		regression coefficient								
Prediction equations	a	b1	b2	b3	b4	b5	b6	MSE	R2	p-value	
Y = a+b1BL	-2.236	0.094						0.393	0.584		
Y= a+b2BG	-1.303		0.122					0.395	0.581		
Y= a+b3TL	-0.535			0.196				0.422	0.521		
Y= a+b4SL	0.252				0.380			0.444	0.469		
Y= a+b5WS	-1.115					0.065		0.451	0.453		
Y= a+b6WL	-0.448						0.125	0.477	0.389		
Y=a+b1BL+ b2BG	-3.093	0.059	0.076					0.316	0.735		
Y = a+b1BL+ b3TL	-2.007	0.068		0.068				0.388	0.601		
Y = a+b1BL+ b4SL	-1.959	0.074			0.115			0.388	0.599		
Y = a+b1BL+ b5WS	-2.333	0.079				0.014		0.392	0.591		
Y = a+b1BL+ b6WL	-2.244	0.091					0.007	0.396	0.584		
Y= a+b2BG+ b3TL	-2.363		0.086	0.124				0.313	0.739		
Y= a+b2BG+ b4SL	-1.928		0.089		0.229			0.329	0.711		
Y= a+b2BG+ b1BL+ b3TL	-2.855	0.031	0.077	0.073				0.306	0.754		
Y= a+ b1BL b2BG + b3TL+ b4SL+ b5WS+ b6WL	-2.816	0.027	0.076	0.055	0.048	0.005	0.005	0.311	0.756		

Sl = shank length, Tl = thigh length, Bl = body length, Wl = wing length, Ws = wing span, Bg = breast girth

Table 4 shows the actual body weight and the predicted body weight. The models with the asterisk predicted body weight best predicted the body weight. This implies that

model with one variable, two variables and four variables were best in predicting the body weight.

**Table 4:** Actual body weight and the predicted weight of Nigerian local Turkey

Actual body weight (kg)	Predicted body weight (kg)
3.29	3.27
3.29	3.31
3.29	3.29*
3.29	3.29*
3.29	3.28
3.29	3.30
3.29	3.23
3.29	3.29*
3.29	3.29*
3.29	3.23
3.29	3.30
3.29	3.31
3.29	3.26
3.29	3.29*
3.29	3.57

\*Either of these could be used to predict the body weight

## 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 on all the variables. The higher values observed in the males indicate sexual dimorphism. This is in agreement with the observation of Ogah (2011) who reported body weight of  $3.38 \pm 0.07$  kg for male and  $2.65 \pm 0.02$  kg for female in Nigerian indigenous turkey at five month of age. The  $3.80 \pm 0.06$  kg for male and  $2.93 \pm 0.06$  kg for female observed in this study are 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. 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 Ogah (2011) and Bachev (1990). As the coefficient of determination increased in each regression model residual mean square increased. This observation is in consonance with the finding of Sam, *et al.* (2016) and Alade, *et al.* (2008).

In regression model with one variable, body length had the highest coefficient of determination (0.584) which means that 58.4% change in body weight could be attributed to change in body length. This in

line with the report of Ewuola (2014), who reported highest coefficient of determination for body length in duck. Higher coefficient of determinations observed in this study among multiple regression models shows that the actual weight is better predicted by multiple models. This is in line with the observation of Sam, *et al.* (2016). In conclusion, the live body weight in Nigerian indigenous turkey could be better predicted by simple model and multiple regression models.

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