PREDICTION OF BODY WEIGHT OF NIGERIA INDIGENOUS TURKEY USING MORPHOMETRIC TRAIT MEASUREMENTS AT EIGHTEEN WEEKS OF AGE

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ABSTRACT
Turkey is one of the species in poultry which has numerous attributes that can be used to provide protein in the meals of Nigerians. However, turkey production has not received the needed attention when compared to other poultry (chicken) species, partly due to the paucity of documented information on them. The aim of study was to estimate body weight of eighteen weeks old Nigerian indigenous turkey using three mathematical functions (linear, quadratic and cubic) from morphometric trait measurements. The morphometric traits studied were body length (BL), breast girth (BG), keel length (KL) and shank length (SL). Data were collected on the birds from day old to eighteen weeks of age. Body measurements were regressed against body weight at 18 weeks of age using simple linear and non-linear (quadratic and cubic) regression analyses. The correlation coefficients (r) between body weight and morphometric trait measurements were highly significant ($p<0.001$), with a range of 0.565 - 0.876. The coefficient of determination R^2 varied from 33.10 to 31.90%, 57.00 to 73.20%, 74.80 to 76.70% and 56.70 to 60.60% for body length, breast girth, keel length and shank length respectively. The relationship was better described by quadratic and cubic functions. It was concluded that body weight in Nigerian indigenous turkey could be predicted by farmers from any given value of the four morphometric trait measurements

Key words: Indigenous turkey, Prediction of body weight, Morphometric traits

INTRODUCTION

Poultry production contributes significantly to the economy of Nigeria especially in the provision of food (meat and egg) for the rapidly increasing population. It is a source of employment for the youth and women in the population, it also contributes to foreign earnings. (Sam *et al.*, 2010; Alphonsus *et al*., 2012).

Turkey is one of the species in poultry, which has numerous attributes that can be used to provide protein in the meals of Nigerians. Turkey production has not received the needed attention when compared to other poultry (chicken) species, partly due to the paucity of documented information on them (Okoroafor *et al*., 2020). Body weight and morphometric traits measurements has been used by animal breeders as parameters for selection in breeding program (Ajayi *et al*., 2008). Local sellers and buyers of poultry species also use body weight and morphometric traits as criteria for selection and purchase. For breeders to be able to plan and implement successful breeding program, there is need to establish the relationship that exist between body weight and morphometric traits (Ayaji *et al.,* 2008; Sam *et al.,* 2019). If this is properly done, an efficient production and maximum economic returns could be achieved. In the absence of measuring scale which is the situation in local markets, prediction models could be used to obtain predicted body weight of the animal (Sam *et al.,* 2019). This study was carried out to assess the ability of morphometric traits to predict live body weight of turkey at eighteen weeks using three regression models.

MATERIALS AND METHODS

Experimental site

The experiment was conducted at the Poultry Research and Teaching Farm of the Department of Animal Science,, Akwa Ibom State University, Obio Akpa Campus. Obio Akpa is located between latitudes 4□30□N and 5□00N and longitudes 70□30□E and 80□00E. The area is characterized with an annual rainfall ranging from 3500 – 5000mm and average monthly temperature of 250C, and relative humidity between 60 – 90 %. It is in the tropical rainforest zone of Nigeria. The people in the study areas depend on livestock and crop production (AKSG, 2022).

Management of experimental turkey

A total of 60 day-old poults were purchased from a reputable vendor at Uyo, Akwa Ibom State. The poults were brooded for three weeks in the restricted brooding section of the Teaching and Research Farm of Department of Animal Science, Akwa Ibom State University. Electric bulb and charcoal stoves were used as source of heat. After brooding poults were transferred to the rearing house for another fifteen weeks. All necessary routine management practices and the recommended vaccination schedule were strictly observed throughout the period of the study. Turkeys were raised in deep litter pens and fed poults starter mash (0-6 weeks) and growers' mash (7-18 weeks) containing 28% and 24% crude protein with 2900 ME and 3300 ME respectively. Feed and water were supplied *ad libitum.*

Data collection

The traits measured were Body Weight (BW), Body Length (BL), Brest Girth (BG), Keel Length (KL) and Shank Length (SL). These characteristics were measured according to FAO (2012) guidelines. Body weight of individual birds was taken using Camry measuring scale in kg.

The BL, BG, KL and SL were measured using a tailor's tape in centimeters.

Statistical Analysis

Morphometric traits measurements (BL, BG, KL and SL) were regressed against BW using SPSS (2007). The functions used are as follows:

$Y_1 = b_0 + b_1x + e_1$ ……..…Linear function

$Y_2 = b_0 + b_1 x + b_2 x^2 + e_1$ ……. Quadratic function

$Y_3= b_0 + b_1 x + b_2x^2 + b x + e_1$ ……Cubic function

Where:

Y_1, Y_2, Y_3 = dependent variables (BW) for each of the functions,

x = independent variables (BL, BG, KL and SL)

b_0 = intercept,

b_1, b_2, b_3 = regression coefficients associated with independent variables

e_1 = random residual error.

The experimental design and the model of the present study were as reported by Durosaro *et al.,* 2013

RESULTS AND DISCUSSION

Body weight and morphometric traits of Nigerian indigenous turkey at eighteen weeks of age.

The descriptive statistics showing means ± standard error, minimum, maximum, standard deviation and coefficient of variation is shown in table 1. The results indicated that the BWT, BL, BG, KL and SL were 3.89 ± 0.11kg, 34.50 ± 0.43cm, 43.37 ± 0.87, 19.51 ± 0.63cm and 13.99 ± 0.19cm respectively. The values obtained in this study were higher than values reported by Ogah (2011) for Nigerian indigenous turkey, the differences could be attributed to the environmental factors such as feed, management system as well as the climatic condition of the study area. The coefficient of variations was low to moderate, which ranged from 3.97% in BL to 10.25% in KL. The moderate coefficient of variation in KL indicate that this trait could be improved through proper selection.

Table: Mean values of body weight and morphometric traits of Nigerian indigenous turkey at eighteen weeks of age.

Traits	Mean ±SE	Minimum	Maximum	SD	CV (%)
BWT (kg)	3.89 ± 0.11	3.50	4.50	0.37	9.51
BL (cm)	34.50 ± 0.43	32.00	36.70	1.37	3.97
BG (cm)	43.37 ± 0.87	40.10	48.20	2.77	6.38
KL (cm)	19.51± 0.63	17.00	23.40	2.00	10.25
SL (cm)	13.99± 0.19	13.00	15.20	0.59	4.21

SE=standard error, SD= standard deviation, CV= coefficient of determination, BWT= body weight, BG= breast girth, KL= keel length, SL= shank length

The regression equation, standard error of estimate, correlation coefficient and coefficient of determination for the fitted functions (linear, quadratic and cubic) are presented in table 2. The results showed that the morphometric traits measured were positive and significantly ($p<0.01$) correlated with body weight. The correlation coefficient ranged from 0.565 in BL to 0.876 in KL. The

relationship between morphometric traits measured (BL, BG, KL and SL) with body weight is in line with the reports of Ogah (2011) and Adeleke *et al*. (2004), the high and significant correlation coefficient values obtained between body weight and morphometric traits measurements indicate high predictability between these traits. This implies that selection for body weight would lead to improvement in these other morphometric traits. Positive correlation between traits indicates that similar genes control both traits under consideration, thus making them express similar actions (Ogah, 2011).

The coefficient of determination varied from 31.90% to 87.60% and the level of the coefficient determination for each trait in the regression models indicate the relative contribution of each morphometric trait to the body weight of turkey. The value of R^2 obtained in this study is similar to the reports of Ogah (2011) but lower than the reports of Adeleke *et al*. (2004) and Amao *et al.* (2011) who reported 73.91% to 97.91% and 82% to 92% respectively. The differences observed between R^2 values in this study and that of the previous study by the researchers could be due to differences in the type of species used, type of functions, breed as well as the ages of the birds.

The proportion of the coefficient of determination for each morphometric trait in the regression model indicate the relative contribution of each morphometric trait to the body weight. In the present study R^2 was above 50% in all the function used in the different morphometric traits studied except in BL. This result suggests the possibility of prediction of body weight from morphometric traits in turkey. This result is in consonance with the reports of Adeniji and Ayorinde (1990) and Ogah (2011). The R^2 values obtained for quadratic and cubic function were similar and higher than what was obtained in linear model. This implies that the relationship between body weight, breast girth, keel length and shank length at 18 weeks were better described by quadratic and cubic function than linear function. The best accuracy of prediction was obtained with keel length and this is in agreement with the reports of Amao *et al*. (2011) who also obtained the best accuracy of prediction with keel length. In the contrary, this report is not in consonance with the reports of Adeleke *et al.* (2004) and Ogah (2011) who documented breast girth as the best predictor of body weight.

Table 2: Estimates of parameters in linear, quadratic and cubic functions fitted for body weight and morphometric traits

Traits	Equations	SEE	R	R^2
BL	$Y_1 = 1.405 + 0.153(x)$	0.326	0.565	0.319
	$Y_2 = 38.11 + 2.327x - 0.032x^2$	0.346	0.575	0.331
	$Y_3 = -25.934 + 1.244x + 0.01x^2 + 0.001x^2$	0.345	0.575	0.331
BG	$Y_1 = 1.4446 + 0.056x$	0.369	0.755	0.570
	$Y_2 = 14.674 – 0.549x + 0.007x^2$	0.380	0.856	0.732
	$Y_3 = 7.094 – 0.001 - 0.006x^2 + 0.001x^2$	0.379	0.856	0.732
KL	$Y_1 = 3.334 + 0.029X$	0.390	0.865	0.748
	$Y_2 = -15.506 + 1.897X - 0.046X^2$	0.373	0.876	0.767
	$Y_3 = -15.506 + 1.897x – 0.046x^2 + 0.001x^2$	0.373	0.876	0.767
SL	$Y_1 = 7.755 – 0.276X$	0.355	0.753	0.567
	$Y_2 = 64.557 – 8.350X - 0.286X^2$	0.355	0.779	0.606
	$Y_3 = 64.557 – 8.360x + 0.286x^2 + 0.001x^2$	0.355	0.779	0.606

SEE= Standard error of estimate, R= Correlation coefficient, R^2 = Coefficient of determination, BL= Body length, BG= Brest girth, KL= Keel length, SL= Shank length

CONCLUSION

The study showed that body weight of turkey at eighteen weeks had positive and highly significant correlation with body length, breast girth, keel length and shank length.

Also, body weight of turkey could be predicted by any of the morphometric traits measured (Body length, breast girth, keel length and shank length), though keel length gave the best accuracy of prediction from quadratic and cubic functions

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