



Estimation of Body Weight of Nigerian Local Turkeys from Zoometrical Measurements at 4, 8 and 12 Weeks of Age

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Estimation of Body Weight of Nigerian Local Turkeys from Zoometrical Measurements at 4, 8 and 12 Weeks of Age

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Abstract - In Nigerian markets, birds are sold on face value and not by actual body weight which prompted this experiment. This experiment was conducted to predict body weight from zoometrical measurements (body length, breast girth and keel length) in Nigerian local turkeys at different ages. A total of 250 poults were used for the study which lasted for 12 weeks. Measurements of body length, breast girth and keel length were regressed against body weight using linear, quadratic and cubic functions. The coefficient of determination (R^2) obtained varied from 24.62% to 81.93% for the three functions. Cubic function had the highest R^2 values for all the zoometrical measurements, while linear function had the least R^2 values in all the three age groups. The highest R^2 value (81.93%) was obtained at the 8th week. Best accuracy of prediction was obtained with breast girth in all the age groups. From the results obtained in this study, body weight of turkeys can be predicted from any of the body length, keel length and breast girth with best accuracy of prediction obtained with cubic function and breast girth as the regressor.

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I. INTRODUCTION

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 (Fitzhugh, 1976; Olowofeso, 2009). Growth traits are useful to livestock farmers and particularly geneticists in improving the market quality of breeding stocks (Nwachukwu *et al.*, 2011).

Traits of economic importance have close association with explanatory variables such as age, breed and morphological characters (Yakubu *et al.*, 2005). Linear equation is usually used to estimate growth in livestock, however, as the growth of individual varies with time and age, the estimation of body weight at different ages are mostly non-linear (Banerjee, 2011).

Also, breeders need to establish relationships that exist between body weight and zoometrical measurements to organise the breeding programme in order to achieve an optimum combination of body weight and good conformation for efficient production and maximum economic returns (Adeleke *et al.*, 2004). Alternative body measurements and indices estimated from various combinations of conventional and non-conventional body parameters provide superior guide to body weight and are also used as indicators of type and function in domestic animals (Schwabe and Hall, 1989).

Zoometrical measurements have been used in animals to estimate body weight (Topal and Macit, 2004; Yakubu *et al.*, 2005), especially in rural communities where scales are not readily available (Yakubu, 2010). The easiest way to assess an animal's body mass is to weigh the animal but there are no weighing scales in poultry markets and/or villages (Semakula *et al.*, 2011). In Nigerian markets where the marketing system is generally informal and haphazard (Emuron *et al.*, 2010), birds are sold on face value and not by actual body weight. The objective of this study was to develop some simple prediction models for precise estimation of the body weight of Nigerian local turkeys using some zoometrical measurements.

II. MATERIALS AND METHODS

a) Experimental Site

The experiment was carried out at the Turkey Breeding Unit of the Teaching and Research Farm of the Department of Animal Breeding and Genetics, Federal University of Agriculture, Abeokuta, Alabata, Ogun State Nigeria. Alabata (latitude 7°10'N and longitude 3°2'E) is in Odeda Local Government Area of Ogun State, Nigeria.

The area which lies in the South Western part of Nigeria has a prevailing tropical climate with a mean annual rainfall of about 1037mm. The mean ambient temperature ranges from 28°C in December to 36°C in February with a yearly average humidity of about 82%. The vegetation represents an interphase between the tropical rainforest and the derived savannah (Illori *et al.*,

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2010). This study was carried out between February and May 2012.

b) Source, sample size and management of experimental birds

The experimental birds were generated from mating of parent stocks through artificial insemination. 250 poults were used for the experiment which lasted for 12 weeks. The poults were brooded in deep litter pens and all poults were wing-tagged for proper identification and subjected to the same management practices throughout the experimental period of 12 weeks. Commercial feeds and clean water were provided for the birds *ad libitum*. Starter mash containing 28% crude protein and grower mash containing 24% crude protein were fed to the birds from 0-6 and 7-12 weeks of age respectively. Vaccination schedule for turkey was strictly adhered to and adequate sanitation was practised to prevent occurrence of diseases.

c) Data Collection

Traits measured were:

Body weight (BW): Weight of the live bird when placed on measuring balance.

Body length (BL): Length of the body from the base of the snood to the base of the tail around the uropygial gland.

Keel length (KL): Length of the metasternum.

Breast girth (BG): Region of the largest breast expansion when the bird was positioned ventrally.

The zoometrical parameters (body length, keel length and breast girth) were measured in centimeters with tailor's tape rule while the body weight was measured using a balance of 0.05 sensitivity in grammes.

d) Statistical Analysis

Measurements of the zoometrical variables (body length, keel length and breast girth) were regressed against body weight using PROC REG of SAS (1999).

The equations used are depicted as:

$$Y_1 = b_0 + b_1x + e_1 \dots\dots\dots \text{Linear function}$$

$$Y_2 = b_0 + b_1x + b_2x^2 + e_1 \dots\dots\dots \text{Quadratic function}$$

$$Y_3 = b_0 + b_1x + b_2x^2 + b_3x^3 + e_1 \dots\dots\dots \text{Cubic function}$$

Where: Y_1 , Y_2 , Y_3 are dependent variables (body weights) for each of the functions, x represents the independent variables (body length, keel length and breast girth), b_0 is the intercept, b_1 , b_2 , b_3 are regression coefficients associated with independent variables and e_1 is the random residual error. The experimental design and the model of the present study were as reported elsewhere by Ilori *et al.* (2010).

III. RESULTS AND DISCUSSION

Tables 1, 2 and 3 show the equations, estimates of parameters and coefficient of determination (R^2) for the fitted functions at 4th, 8th and 12th week of age respectively. The R^2 varied from 24.62% to 81.93% for the three functions. The value of R^2 obtained in this study was lower than the R^2 values reported by Adeleke *et al.* (2004) and Amao *et al.* (2011), respectively. Adeleke *et al.* (2004) reported R^2 range of 73.91% to 97.91%; while in a similar study by Amao *et al.* (2011), R^2 ranged from 82% to 92%. The differences between R^2 obtained in this study and that of earlier researchers might be attributed to differences in type of species and types of functions used. Adeleke *et al.* (2004) used exponential and double-log functions. Exponential function was not appropriate in this study because Nigerian local turkeys cannot experience exponential growth in the first 12 weeks of life. Cubic function had the highest R^2 values for all the zoometrical measurements (regressors), while linear function had the least R^2 value across the three age groups.

Coefficient of determination is the percentage of variation in the value of dependent variable (y) that can be explained by variations in the value of the independent variable (x) (Mason *et al.*, 1983; Congelosi *et al.*, 1983). Coefficient of determination is the goodness of fit of a regression and the higher the value, the better the variance that the dependent variable is explained by the independent variable. Coefficient of determination technique is a more conservative measure of the relationship between two variables and often preferred by statisticians (Richard, 1990). The magnitude of the coefficient of determination for each zoometrical measurement in the regression equations showed the relative contribution of each zoometrical measurement to the body weight. The possibility of prediction of body weight from zoometrical measurements in turkeys obtained in this study corroborated the findings of Adeniji and Ayorinde (1990), that body weight of birds can easily be predicted from any given value of the zoometrical measurements (body length, body girth, keel length, shank length, drumstick length and shank thickness) in the Cobb broiler strain using linear and stepwise regression equations. The highest R^2 values obtained in the cubic function implies that the relationships between body weight and body length, keel length and breast girth were best described by cubic function. Also, the highest R^2 value (81.93%) obtained at 8th week suggests that body weight can best be predicted at 8th week of life in turkeys. Best accuracy of prediction was obtained with breast girth in all the three age groups and this is in agreement with the findings of Adeleke *et al.* (2004) who reported the same trend in closely related species-chicken. In the contrary, this trend is in disagreement with the report of Amao *et al.* (2011) who obtained the best accuracy of prediction with keel length.

Table 1 : Estimate of parameters in linear, quadratic and cubic functions fitted for body weight-zoometrical measurements relationship at 4th week

Zoometrical measurements	Functions	S.E.	R ²	Sig
BL	$Y_1 = -364.81 + 42.89x$	2.32	70.19	***
	$Y_2 = 501.31 - 63.44x + 3.22x^2$	0.91	72.57	***
	$Y_3 = 2225.03 - 382.92x + 22.73x^2 + 0.39x^3$	0.34	72.82	ns
BG	$Y_1 = -448.12 + 45.49x$	2.06	77.07	***
	$Y_2 = 399.74 - 50.53x + 2.69x^2$	0.79	78.79	***
	$Y_3 = 2107.57 - 34x + 18.86x^2 - 0.29x^3$	0.32	78.92	ns
KL	$Y_1 = -232.51 + 105.23x$	7.71	56.24	***
	$Y_2 = -77.32 + 48.32x + 5.14x^2$	6.95	56.54	ns
	$Y_3 = 2939.69 - 1580.05x + 292.71x^2 - 16.61x^3$	5.3	59.21	*

Table 2 : Estimate of parameters in linear, quadratic and cubic functions fitted for body weight-zoometrical measurements relationship at 8th week

Zoometrical measurements	Functions	S.E	R ²	Sig
BL	$Y_1 = -619.31 + 66.10x$	10.56	24.62	***
	$Y_2 = 991.61 - 57.53x + 2.36x^2$	3.59	24.89	ns
	$Y_3 = 19311 - 2149.55x + 80.29x^2 - 0.95x^3$	0.20	81.93	***
BG	$Y_1 = -1178.06 + 86.71x$	4.29	77.29	***
	$Y_2 = 660.02 - 49.04x + 2.47x^2$	0.91	78.61	*
	$Y_3 = 19311 - 2149.55x + 80.29x^2 - 0.95x^3$	0.20	81.93	***
KL	$Y_1 = -942.15 + 241.51x$	18.14	59.64	***
	$Y_2 = 1850.13 - 412.79x + 37.86x^2$	12.03	62.74	*
	$Y_3 = 12657 - 4299.41x + 497.44x^2 - 17.86x^3$	7.48	64.46	*

Table 3 : Estimate of parameters in linear, quadratic and cubic functions fitted for body weight zoometrical measurements relationship at 12th week

Zoometrical measurements	Functions	S.E	R ²	Sig
BL	$Y_1 = -2325.37 + 129.04x$	15.52	36.36	***
	$Y_2 = 12472 - 758.03x + 14.06x^2$	5.12	40.10	*
	$Y_3 = 2424.25 + 135.37x - 14.49x^2 + 0.29x^3$	1.75	40.11	ns
BG	$Y_1 = -1610.46 + 105.62x$	6.61	68.54	***
	$Y_2 = 6733.64 - 394.71x + 7.43x^2$	1.40	74.53	***
	$Y_3 = 8969.05 - 596.71x + 13.46x^2 - 0.06x^3$	0.42	74.53	ns
KL	$Y_1 = -1668.93 + 332.17x$	19.70	70.14	***
	$Y_2 = 4124.76 - 730.68x + 48.24x^2$	15.19	72.46	***
	$Y_3 = 16894 - 4243.33x + 367.96x^2 - 9.63x^3$	12.83	72.59	ns

*** $P < 0.001$, * $P < 0.05$, ns = Not significant.

Y_1 , Y_2 and Y_3 = Body weight (g), BL = Body length (cm), BG = Breast girth (cm), KL = Keel length (cm), R^2 = Coefficient of Determination (%), S.E. = Standard error, Sig = Level of significance.

IV. CONCLUSION

From the results obtained in this study, body weight of turkeys can be predicted from any of the zoometrical measurements/variables; body length, keel length and breast girth with best accuracy of prediction

obtained with cubic function and the breast girth been used as the regressor. Cubic function can be used in lieu of other mathematical functions when there is need to predict the body weight of Nigerian local turkeys.

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