RELATIONSHIP BETWEEN BODY WEIGHT AND MORPHOMETRIC TRAITS OF FULANI ECOTYPE CHICKENS IN SOUTH WESTERN NIGERIA

O. J. OGUNSHOLA*, S. A. DARAMOLA, O. I. BAKI, O. G. NWEKE-OKOROCHA AND C. A. CHINEKE

Department of Animal Production and Health, Federal University of Technology, Akure, Nigeria.
Correspondence:olawaleogunshola@gmail.com;08032321183

ABSTRACT

The experiment was performed to establish the relationship among body weight and morphometric traits of thirty six Fulani Ecotype chickens raised for 25 weeks. Body weights were collected per bird and the morphometric traits (Body Length, Drumstick length, Drumstick circumference, Breast Girth, Nose to Shoulder, Shoulder to Tail and Height at withers) were measured with tape rule on weekly basis. The measured parameters were subjected to correlation and regression analyses. Analysis showed that positive and high significant correlation existed between body weight and morphometric traits ($P < 0.01$). The result showed that accuracy of prediction was attained with linear and quadratic models but quadratic model had theoretical advantage over the linear model with respect to its goodness of fit to the data. This means that an increase in growth rate of the body parts would correspondingly cause an increase in live weight gain of the bird. In conclusion, body weight and morphometric traits could be used to separate males and females Fulani Ecotype chicken at 17 weeks old. At this age, males appeared bigger than the females and their combs were well pronounced, this would help both sexes to grow uniformly, prevent indiscriminate mating before attaining the age of sexual maturity and help in selection of Fulani Ecotype chicken for improvement in meat and egg production.

Keywords: Relationship, body weight, Fulani Ecotype, morphometric trait.

INTRODUCTION

The native chickens constitute about 80 percent of the 120 million poultry birds found in Nigeria (FMA and RD, 2006). These animals are also known for their adaptation superiority in terms of their resistance to endemic diseases and other harsh environmental conditions (Nwakpu *et al.*, 1999). Fayeye *et al.* (2005) described local chicken as a pool of heterogeneous individuals which differ in adult body weight and plumage. The indigenous poultry species represent valuable resources for livestock development because of their extensive genetic diversity which allowed for rearing of poultry under varied environmental conditions.

There have been reports on the characterisation of the local chicken in Nigeria and its potential for egg and meat production (Adebambo, 2005). Olawoyin (2006) concluded that genetic improvement of Nigerian indigenous cockerels could help to alleviate the problems of animal protein shortage especially in the rural areas. Although they are generally less productive when compared to the exotic species, indigenous chickens play a vital role in the socio-economic life of those keeping them (Alabi *et al.*, 2012). It is important to have knowledge of the variation of morphometric traits in local genetic resources as such measurements have been discovered to be very useful in comparing body size and by implication, shape of animals (Latshaw and Bishop, 2001).

MATERIALS AND METHODS

Experimental site: The experiment was carried out at the Teaching and Research Farm, Livestock section (Poultry unit) of the Federal University of Technology Akure, Ondo State, Nigeria. Akure is located on latitude 7°18"N and longitude 5°10"E. The site is within the hot, wet equatorial climate with high rainfall as 1,500mm and relative humidity above 75% all the year round with a mean annual temperature of about 27°C.

Experimental Birds: Thirty-six Fulani ecotype chickens were used for the study. At 17 weeks, the birds were wing banded and taped with marked paper tape for back-up and easy identification,weighed and distributed into different rearing system, male and female were into different cell of five (5) to three (3) per group. Eighteen (18) were reared under cage system while Eighteen (18) were reared under deep litter system. All the experimental birds were fed with the best commercial feeds to 25 weeks old and also provided with fresh water.

Data Collection and Analysis: Measurements of body weight and morphometric traits were carried out on weekly basis. The body weight was measured in gram using Scout II electronic sensitive scale and top loading Balance (20 kg capacity) while the morphometric traits were measured using a measuring tape graduated in centimeters. Data collected were subjected to correlation and regression analyses using linear and quadratic model of the Statistical Analysis System (SAS, 2008) Version 9.2 software package. Regression equations were determined for each variable. The coefficient of determination (R^2) was used to compare the accuracy of prediction. Measurements obtained from each morphometric traits were regressed against live body weights at weeks 17 and 25.

The regression models used are:

$Y = a + bX$ .... (Linear regression model)

$Y=a+bX+CX^2$ ......(Quadratic regression model)

Where Y=dependent variable (body weight)

X=independent variables (morphometric traits), b=slopes, a=intercept and C=constant.

RESULTS AND DISCUSSION

Table 1 shows simple genetic and phenotypic correlations of body weight and morphometric traits of the experimental birds.

Diagonally, the right up indicated the genetic correlations while left down indicated phenotypic correlations. Very strong and highly significant ($P<0.01$) existed for body weights and morphometric traits of Fulani Ecotype chickens. All the body parameters analyzed had significant ($P<0.01$) direct relationship with the body weight. Body length and height at withers were genetically high and significantly ($P<0.01$) correlated with body weight while breast girth was phenotypically high and significantly ($P<0.01$) correlatedwith body weight. All the morphometric traits were statistically significant ($P<0.01$) and have strong inter relationship with body weights. This was in agreement with (Ajayi *et al.*, 2012).

Table 2 shows body weight predictive equation, root mean standard error and coefficient of determination for the fitted linear and quadratic models from morphometric traits. All the morphometric traits were statistically highly significant ($P<0.0001$) for both models and have strong existing inter relationship with body weights except for shoulder to tail that is not significant for week 17. All the morphometric traits for both weeks had positive values for regression coefficient (R^2) which ranges from 52-80% except for shoulder to tail at week 17 that had the lowest R^2 value as 8.23 and 8.83 for linear and quadratic model respectively. At week 25, shoulder to tail was highly significant ($P<0.0001$) with R^2 value of 54.81% and 55.91% for both models.The highest R^2 value was observed in breast girth for quadratic model (73.61%, 80.28%) and linear model (70.64%, 79.16%) in week 17 and 25 respectively. This indicated that drumstick circumference with the combination of breast girth, nose to shoulder, shoulder to tail, and height at withers can be used to predict the value of body weight at 25 weeks of age with the exception of shoulder to tail at week 17. The quadratic model had theoretical advantage over the linear model with respect to its goodness of fit to the data. The properties of the model and the data should be examined and appropriate model be chosen (Oni *et al.*, 2001).

CONCLUSION

From this study, positive relationships exist between body weights and morphometric traits. Therefore, morphometric traits like drumstick length, drumstick circumference with the combination of breast girth, nose to shoulder, shoulder to tail, body length and height at withers can be used to predict the value of body weight at any period range from 17- 25 weeks old of Fulani Ecotype chicken. Quadratic model is hereby recommended for body weight prediction and week 17 is recommended for sexing of Fulani ecotype chickens because this would help both sexes to grow uniformly, prevent indiscriminate mating before attaining the age of sexual maturity and help in selection of the chickens for improvement in meat and egg production.

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Table 1: Simple genetic and phenotypic correlations analysis of body weight and morphometric traits

Traits	BW	BL	DL	DC	BG	NT	STT	HW
BW(g)		0.82**	0.78**	0.76**	0.67**	0.44**	0.61**	0.83**
BL(cm)	0.79**		0.80**	0.72**	0.63**	0.49**	0.58**	0.82**
DL(cm)	0.72**	0.75**		0.62**	0.56**	0.48**	0.43**	0.91**
DC(cm)	0.75**	0.67**	0.56**		0.62**	0.37**	0.50**	0.64**
BG(cm)	0.85**	0.75**	0.67**	0.77**		0.46**	0.42**	0.66**
NT(cm)	0.66**	0.73**	0.68**	0.58**	0.55**		0.49**	0.39**
STT(cm)	0.50**	0.55**	0.48**	0.48**	0.38**	0.53**		0.52**
HW(cm)	0.75**	0.78**	0.83**	0.55**	0.72**	0.63**	0.59**	

*** Significantly ($P<0.01$) different*

BW=Body weight, BL=Body length, DL=Drumstick length, DC=Drumstick circumference, BG=Breast Girth, NT=Nose to shoulder, STT=Shoulder to tail and HW=Height at withers.

Table 2: Estimation of body weight from morphometric traits

Week	Traits		Predictive equations	RMSE	R^2	Significance
17	DL(cm)	L	$Y=-385.88+122.50DL$	103.64	61.36	<0.0001***
		Q	$Y=-2234.82+433.12DL+12.94DL^2$	104.13	62.34	<0.0001***
	DC(cm)	L	$Y=-431.08+143.97DC$	115.01	62.12	<0.0001***
		Q	$Y=5438.03-844.01DC+41.23DC^2$	108.92	67.02	<0.0001***
	NT(cm)	L	$Y=-998.98+112.09NS$	102.87	61.93	<0.0001***
		Q	$Y=2490.26-263.54NS+10.07NS^2$	103.84	62.55	<0.0001***
	STT(cm)	L	$Y=-434.75+64.64ST$	159.73	08.23	<0.12^{ns}
		Q	$Y=-10.35+930.27ST-18.89ST^2$	162.02	08.83	<0.27^{ns}
	HW(cm)	L	$Y=-747.26+47.53HW$	80.56	76.66	<0.0001***
		Q	$Y=1653.78-76.94HW+1.60HW^2$	80.17	77.69	<0.0001***
	BG(cm)	L	$Y=-1187.32+84.55BG$	90.34	70.64	<0.0001***
		Q	$Y=4984.54-372.92BG+8.44BG^2$	87.16	73.61	<0.0001***
	BL(cm)	L	$Y=-1174.87+50.02BL$	115.93	51.65	<0.0001***
		Q	$Y=2413.20-110.90BL+1.80BL^2$	117.40	52.13	<0.0001***
25	DL(cm)	L	$Y=-277.30+127.01DL$	99.26	71.78	<0.0001***
		Q	$Y=1366.18-139.59DL+10.68DL^2$	98.99	72.76	<0.0001***
	DC(cm)	L	$Y=-431.08+143.97DC$	115.01	62.12	<0.0001***
		Q	$Y=5438.03-844.01DC+41.23DC^2$	108.92	67.02	<0.0001***
	NT(cm)	L	$Y=-499.56+89.94NS$	116.53	61.11	<0.0001***
		Q	$Y=888.08-50.66NS-3.53NS^2$	117.93	61.34	<0.0001***
	STT(cm)	L	$Y=-1719.51+124.61ST$	125.61	54.81	<0.0001***
		Q	$Y=6193.83-540.64ST+13.95ST^2$	125.94	55.91	<0.0001***
	HW(cm)	L	$Y=-531.32+46.35HW$	87.86	77.89	<0.0001***
		Q	$Y=1876.65-76.09HW+1.54HW^2$	86.67	79.92	<0.0001***
	BG(cm)	L	$Y=-1640.62+99.63BG$	85.31	79.16	<0.0001***
		Q	$Y=3526.51-256.46BG+6.11BG^2$	84.23	80.28	<0.0001***
	BL(cm)	L	$Y=-950.86+46.83BL$	110.10	55.29	<0.0001***
		Q	$Y=4123.19-166.99BL+2.24BL^2$	119.50	66.67	<0.0001***

****=Significant ($p<0.0001$), ns= not significant, L=linear regression model, Q=Quadratic regression model, Y=body weight, RMSE= Root Mean Standard Error, R^2=Coefficient of determination, BW=Body weight, BL=Body length, DL=Drumstick length, DC=Drumstick circumference, BG=Breast Girth, NT=Nose to shoulder, STT=Shoulder to tail and HW=Height at withers.*