

STATISTICAL MODELING OF BODY WEIGHT AND BODY DIMENSIONS IN CHI BIRDS

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ABSTRACT

In an event of unavailability of weighing scale, linear body measurements are used to predict the body weight of animals' on-market and during selection for breeding. The aim of this study was to explore the relationship between body weight and body dimensions in CHI broilers. A total of 400 (Four hundred) day old CHI birds were used. Body dimensions - shank length, thigh length, neck length, chest circumference, beak length and body length and wing length were taken using a tape rule at the end of 8 (eight) weeks. Descriptive statistics, correlations and regression analysis were used to analyze the data obtained. Results showed that there exist a significant ($P < 0.01$) positive correlation between body weight and all the body measurements studied. The values of the coefficients of determination (R^2) ranged from 10% - 99.9% with neck length showing the highest value (99.9%). This implies that neck length could be the best predictor of body weight in CHI birds. Furthermore, the predictive equations showed that there was a significant ($P < 0.01$) relationship between body weight and body linear measurements. R^2 values obtained shows that the predictive equations could be used to predict body weight accurately using the simple regression model.

Keywords: CHI birds, prediction, statistical models, body dimensions, regression

INTRODUCTION

In an effort to speed up selection and improve breeding programs in animals, breeders have tried to establish a relationship between body weight and some linear body measurements in animals Ikeh, and Okwesili.,(2021), Muh. Akramullah *et al.*, (2021), Negash, (2021 , Ukwu *et al.*, (2014), Tsegaye *et al.*, (2013), Machebe and Ezekwe, (2010). Body weight represents one of the most important attributes of farm animals because it helps in evaluation of growth performance, feed efficiency and the market price. In an event of unavailability of the weighing scale, linear body measurements are being used in determining the weight of farm animals. The major purpose of this study is to establish a relationship between body weight and body dimensions in CHI birds.

CHI birds are commercial Arbor Acres Plus broiler strain birds that have a fast –growing and high-quality commercial meat birds with excellent body conformation. This broiler strain accounts for over 70% of commercial broiler birds in Nigeria Essien and Adeyemi, (2009). They are able to reach market weight of 2kg at 6 -8 weeks which informs the high market demand by producers and consumers.

MATERIALS AND METHODS

A total of four hundred (400) day-old CHI chicks were procured. The chicks were brooded on deep litter. Prior to arrival of the birds, the house was cleaned and disinfected and left for two (2) weeks. Upon arrival, the birds were given anti-stress (Vitalyte) through drinking water. Two hundred and fifty (250) watts electric lamp was used as the source of heat with hover. Fresh water and commercial feed with crude protein: 19.8%; fat: 3.6%; crude fiber: 4.2%; calcium: 4.2%; available phosphorus: 0.5%; methionine: 0.45%; lysine: 0.85% and metabolizable energy of 2880 kCal kg⁻¹ were given *ad libitum* throughout the experiment. Coccidiostat and other prophylactic treatments and medications were administered as at when due. At the fifth week, the birds were dewormed against possible endoparasites as cleaning and litter change was routinely carried out. At the eight week of study, the body weights of birds were taken by placing the birds on a digital sensitive scale. Body linear measurements; shank length, thigh length, neck length, chest circumference, beak length, drum stick length, body length and wing length were measured using a flexible tape rule graduated in centimeters. The linear body measurements were taken as described by Fayeye *et al.*, (2006). Data obtained were analyzed using descriptive statistics such as mean and standard error using Minitab 18.

The relationship between body weight and body linear measurements of the birds was determined using correlation analysis. The relationship among body weight and linear body measurements was determined using Pearson's product moment correlation coefficient. Linear body measurements - BKL, BL, CC, NL, WL, THL, DSL, SL were regressed against body weight using simple linear regression analysis and comparison of regression equations were based on the coefficient of determination. (R^2).

$Y = B + \beta X_s$ Simple regression model

Where Y = dependent variable (body weight) X_s = independent variables (BKL, BL, CC, NL, WL, THL, DSL, SL) B = the intercept β = the slopes

RESULTS AND DISCUSSION

The results of the body weight and linear body parameters of CHI bird are presented in Table 1. Body weight ranged between 1.75 to 2.87kg. This is in line with (Hagan *et al.*, 2021) who reported a 1.88kg, 1.76kg, 1.89kg, and 1.92kg body weights in Ross 308, Cobb 500, Hydro and Cobb 700 broiler birds respectively. Furthermore, Shank length, body length and drumstick length were 6.75-16.21cm, 12.72-31.15cm and 6.05-17.25cm respectively. Table 2 shows the correlation coefficients between body weight and linear body parameters of CHI birds. The table reveals that apart from wing length and drum stick length, beak length, body length, chest circumference, neck length, thigh length and shank length were positively correlated to the body weight of the birds. This further implies that improvement on body weight of birds will lead to a subsequent increase in the linear body parameters. This is in tandem with Ezzeldin *et al.*, (1994) and Ojedapo *et al.*, (2012) who reported medium to high correlation coefficients in body weight and body measurements in pure bred chickens. Table 3 shows the predictor equations relating for body weight and linear body measurement in CHI birds. The predictive equations showed that there were significant relationships between body weight and the linear body measurement. It further reveals that Neck length had the highest coefficient of determination among all linear body measurements taken. This implies that neck length could be the best predictor of body weight of CHI birds. This is in contradiction with Nosike *et al.*, 2017 and Udeh and Ogbu (2011) who reported a 100% accuracy in prediction of body weight using shank length at 6 weeks of age. This difference could be attributed to the differences in age of the broiler birds as Ubani *et al.*, (2010) reporting in their separate findings that breast length recorded the highest R^2 value among Arbor Acre broiler strain between 3-5 weeks. The predictive equations showed that there were significant relationships between body weight and linear body measurements. According Ukwu *et al.*, (2014) high R^2 values show that the predictive equations could be used to predict body weight accurately

Table 1: Body weight and linear body parameters of Chi birds

Parameters	Minimum	Maximum	Mean $\pm$ SE
BW (Kg)	1.75	2.87	2.45 $\pm$ 0.03
BKL (cm)	3.05	3.80	3.49 $\pm$ 0.23
BL (cm)	12.72	31.15	25.42 $\pm$ 0.39
CC (cm)	30.75	39.10	35.67 $\pm$ 0.19
NL (cm)	7.10	9.15	8.49 $\pm$ 0.05
WL (cm)	13.85	31.05	22.86 $\pm$ 2.19
THL (cm)	8.10	10.25	9.62 $\pm$ 0.471
DSL (cm)	6.05	17.25	11.05 $\pm$ 0.69
SL (cm)	6.75	16.21	9.46 $\pm$ 0.90

BW- Body weight, WL- Wing length, THL- Thigh length, NL- Neck length, CC- Chest circumference, BL- Body length, DSL- Drum stick length and BKL- Beak length, SL- Shank length, Min- Minimum, Max- Maximum, SE- Standard error.

Table 2: Correlation coefficients between BW and Linear Body parameters

	BW	BKL	BL	CC	NL	WL	THL	BKL
BKL	0.40							
BL	0.23	-2.237						
CC	0.425	0.153	-0.203					

NL	0.447	0.39	0.315	0.276				
WL	-0.61	-0.34	0.315	0.276	0.283			
THL	0.102	-0.09	0.41	0.02	0.185	0.387		
DSL	-0.182	-0.02	0.27	0.151	0.27	0.200	-0.15	
SL	0.65	-0.28	-0.95	-0.108	0.51	0.88	-0.16	-0.35

BW- Body weight, WL- Wing length, THL- Thigh length, NL- Neck length, CC- Chest circumference, BL- Body length, DSL- Drum stick length and BKL- Beak length, SL- Shank length.

Table 3: Predictor equation for BW from linear body measurements

Linear Measurement	Body	Predictor Equation	R ² (%)	LS
BKL		BW=2.43+0.0044BKL	20	**
BL		BW=2.41+0.00147BL	10	**
CC		BW=0.552+0.0532CC	80	**
NL		BW=0.713+0.205NL	99.9	**
WL		BW=2.47-0.00070WL	40	**
THL		BW=2.40+0.00539THL	10	**
DSL		BW=2.52-0.00650DSL	33	**
SL		BW=2.43+0.0180SL	40	**

BW- Body weight, WL- Wing length, THL- Thigh length, NL- Neck length, CC- Chest circumference, BL- Body length, DSL- Drum stick length and BKL- Beak length, SL- Shank length. ** Significant

CONCLUSION AND RECOMMENDATION

This study indicates that there are high positive correlation between linear body measurement and body weight. This finding also reveals that improvement in body weight could lead to improvement in linear body measurement which could have a resultant beneficial effect during on market visual appraisal. Under smallholder management conditions, where the weighing balance may not be readily available, a simple tape rule can be used to estimate body weight of CHI birds using the developed prediction equations.

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