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PREDICTION OF BODY WEIGHT FROM MORPHOMETRIC TRAITS IN INDIGENOUS NORMAL FEATHERED CHICKENS OF NIGERIA

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Abstract

This study was conducted on indigenous normal feathered chickens at the Poultry production unit (PPU) of the Ministry of Animal and Fisheries, Potiskum, Yobe State. Predicting equations for estimating body weight from morphometric traits at different ages were established wth Sixty matured Normal Feathered Chickens (NFC) comprising 50 females and 10 males were used as parent stock to generate progenies for the experiment. After quarantine, the foundation population were divided into ten breeding groups; each group containing six birds of five hens and one cock. The experiment lasted 18 months (between June, 2018 and October, 2019). Performance data of body weight (BW), chest girth (CG), body length (BL), thigh length, (TL), shank length (SL), shank circumference (SC), wing length (WL) and keel length (KL) of 123 progenies generated were taken and analysed using Statistical Analysis System (SAS, Version 9.1). Simple linear regression used to predict body weight from body measurements revealed that, based on coefficient of determination (R^2) values, chest girth had the best prediction of body weight at weeks 4 (R^2 =0.42) and 8 (R^2 =0.64) while shank length had the best prediction at weeks 12 (R^2 =0.74), 16 (R^2 =0.81), 20 (R^2 =0.78) and 24 (R^2 =0.77). The study concluded that body weight could be predicted with high degree of accuracy using chest girth and shank length at early and advanced ages.

Keywords: Normal feathered, Body weight, Morphometric traits, Regression

Introduction

Poultry, particularly chickens are the most widely kept domestic animal in the world and also the most numerous (Perry *et al*., 2002; Moreki *et al*., 2010). Nigeria has an estimated 175 million highly heterogeneous chicken population of which indigenous chickens' accounts for more than 60% (Fayeye, 2011). Indigenous chickens are widely distributed in rural areas of tropical and sub-tropical countries and majority are found with the rural dwellers (Ajayi, 2010) and are capable to thrive on little inputs in terms of feed, medication and shelter. They are categorized into varieties such as the normal feathered, frizzled feather and necked neck. The derivation of body weight from body measurements (i.e. morphometric traits) has been reported to be a practical and easy technique, especially among rural poultry breeders with lack of resources (Semacula *et al*., 2011). Linear equation is commonly used method to to assess body weight at different ages (Raji *et al*., 2009).Typically, body weight is regressed on linear body measurement to determine a weight prediction equation (Assan, 2015). The usefulness of regression models was to allow a fact evaluation of the body weight of an animal and in selection criteria. This study was undertaken to establish predicting equations for estimating body weight from morphometric traits at different ages of indigenous normal feathered chickens.

Materials and Methods

Experimental Site: The study was carried out at the Poultry Production Unit (PPU) in Potiskum Local Government Area, of Yobe State. Potiskum is located between latitudes 11^0 03′ and 11^0 30′ N, longitudes 11^0 50′ and 11^0 51′ E and altitude of 427 m above sea level (Bunmi *et al*., 2016). It falls within the wet and dry Sudano-Sahelian Savannah belt of Nigeria, having an average rainfall of 713 mm/annum.

Experimental Birds and Their Management: A total of 60 matured and healthy indigenous normal feathered chickens comprising of 50 females and 10 males of breeding age were used as parent stock to generate progenies for the experiment. The birds were purchased from households in Potiskum, Yobe

State. Each batch of chickens bought was quarantined for two weeks and fed layers mash containing 18% CP and 2650 ME/kg. Prior to the arrival of the birds, pens were thoroughly cleaned, disinfected, and properly littered with wood shavings. After quarantine, the foundation population was divided in to ten (10) breeding groups; each group containing six (6) birds of five hens and one cock. They were randomly assigned into a deep litter floor pens at 1:5 mating ratio. Laying boxes were provided for each pen for natural incubation. Feed and water were provided *ad libitum*. Eggs laid from each mating group of sire and dams were identified. Chicks hatched from each mating group were properly identified (wing tagged) and brooded artificially. Commercial diets were fed (chick mash 0-8 weeks, grower crumble 9-19 weeks and layer pellets at 20 weeks on ward) containing 20, 16 and 18% CP with 2780, 2600 and 2650 ME/kg respectively. Sanitary and routine practices as well as vaccination were maintained.

Data Collection: Growth traits which include body weight, body length, chest girth, thigh length, shank length, shank circumference, keel length and wing length were taken at four weeks interval (4 to 24 weeks) of age. The body weight of each chicken was taken individually using a weighing balance and body measurements as described by Adeleke *et al*. (2011) were carried out using a simple tape rule calibrated in centimeters.

Statistical Analysis: Regression of body weight on morphometric traits were performed using SAS (Version 9.1). The simple linear regression model is presented as follows: $Y= \mu_{y + byx} (x- \bar{x}) + e$ where; Y= dependent variable, μ_y =overall mean of the population, b_{yx} = regression coefficient, x= independent variable, $\bar{x}$ = mean of independent variable, e = random error

Results and Discussion

Table 1 presents simple linear regression equations for predicting body weights at different ages in normal feathered chickens. Based on their coefficients of determination (R^2), chest girth at weeks 4 (R^2 =0.42) and 8 (R^2 =0.64) chest girth gave the best prediction for body weight. However, at later ages of weeks 12 (R^2 =0.74), 16 (R^2 =0.81), 20 (R^2 =0.78) and 24 (R^2 =0.77), shank length gave the best prediction of body weight. Generally, linear body traits were good in predicting body weight though the efficiency increase with age. In several studies, chest girth and shank length were reported to be the best linear body traits that predicted body weight in different species of domestic animals. Ige *et al*. (2012) observed chest girth (R^2 =0.66) as best predictor of body weight in frizzled and naked neck genotype. Similarly, Abdel-lattif (2019) reported chest girth (R^2 =0.62) and shank length (R^2 =0.65) in white leghorn and chest girth (R^2 =0.45) and shank length (R^2 =0.54) in Coshin chickens had better prediction of body weight. Similarly, Ige *et al*. (2006) reported that higher muscle deposition in breast and thigh created a strong relationship between chest circumference or shank length with live weight. However, Gambo *et al*. (2014) reported shank length the highest mean R^2 value (0.84) for prediction of body weight in Japanese quails of 1 to 6 weeks of age. In a related study, Amao and Ojedapo (2016) observed high R^2 values of 0.71 and 0.75 for chest girth and shank length, respectively at 12 weeks of age in Nigerian local turkey. However, in addition to the two traits (chest girth and shank length), Ukwu *et al*. (2014) reported that high R^2 values of wing length (0.66), thigh length (0.70) and body length (0.79) equally made them predictors of body weight with high precision in Nigerian local chickens. Sadick *et al*. (2020) recorded R^2 for body length (0.59), wing length (0.66) and shank circumference (0.75) in Cobb broiler chickens at 0 to 8 weeks of age. In another study, Oleforuh-Okoleh *et al*. (2017) reported high R^2 (0.89-0.90) for all the linear body traits considered in normal feathered and naked chickens of 4 to 12 weeks of age.

Conclusion

The study shows that body weight can be predicted using morphometric traits especially chest girth, shank length at early and advanced ages in indigenous normal feathered chickens. Therefore, scientists or rural farmers in markets or under field conditions can simply use this tool to estimate body weight. Hence, the present findings could aid management and selection decisions.

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Table 1: Simple linear regression equations for estimating body weight from morphometric traits at different ages in indigenous normal feathered chickens

Age (weeks)	Predictor	Regression equation	Actual values	Predicted Values	Residual	R^2
4	BL	BW = -55.66+15.18BL	90.19	90.22	-0.03	0.33
	CG	BW= -24.05+18.16CG		90.18	0.01	0.42
	KL	BW= 90.47-0.06KL		90.20	-0.01	0.10
	SL	BW= 45.55+14.07SL		90.15	0.04	0.09
	SC	BW= -9.49+45.22SC		90.10	0.09	0.16
	TL	BW= 43.98+7.79TL		90.17	0.02	0.17
	WL	BW= -8.71+15.33WL		90.17	0.02	0.23
8	BL	BW = -548.66+64.46BL	291.56	291.25	0.31	0.55
	CG	BW= -150.13+42.41CG		291.78	-0.22	0.64
	KL	BW= -573.25+134.39KL		291.88	-0.32	0.54
	SL	BW= -78.01+81.04SL		291.53	0.03	0.31
	SC	BW= -459.81+269.87SC		291.43	0.13	0.31
	TL	BW= -171.09+49.42TL		291.49	0.07	0.60
	WL	BW= -157.58+43.45WL		291.70	-0.14	0.41
12	BL	BW = -867.31+82.96BL	506.81	506.51	0.30	0.72
	CG	BW= -891.86+93.12CG		508.15	-1.34	0.65
	KL	BW= -3404.36+501.02KL		508.61	-1.80	0.60
	SL	BW= -641.28+196.28SL		507.00	-0.19	0.74
	SC	BW= -919.22+457.90SC		506.55	-0.04	0.38
	TL	BW= -494.98+84.65TL		506.43	0.38	0.57
	WL	BW= -1294.54+134.61WL		506.54	0.27	0.47
16	BL	BW= -643.24+61.81BL	687.22	686.91	0.31	0.76
	CG	BW= -968.52+94.00CG		687.76	-0.54	0.66
	KL	BW= -4102.56+497.14KL		689.57	-2.25	0.69
	SL	BW= -848.66+217.15SL		687.59	-0.37	0.81
	SC	BW= -1366.72+573.31SC		687.73	-0.51	0.53
	TL	BW= -577.78+88.98TL		687.52	-0.30	0.64
	WL	BW= -1190.74+128.79WL		688.31	-1.09	0.41
20	BL	BW = 396.8+19.85BL	866.78	866.78	0.07	0.12
	CG	BW= -125.73+49.45CG		866.73	-0.05	0.19
	KL	BW= -4971.39+525.61KL		868.14	-1.36	0.67
	SL	BW= -1962.50+343.30SL		866.71	0.07	0.78
	SC	BW= -2310.11+791.17SC		870.39	-3.61	0.69
	TL	BW= -751.61+98.62TL		866.74	0.04	0.62

	WL	BW= -1326.01+132.51WL		867.03	-0.25	0.43
24	BL	BW= -812.12+67.72BL	1060.99	1061.02	-0.03	0.57
	CG	BW= -1121.35+97.17CG		1061.09	-0.10	0.57
	KL	BW= -4563.72+436.57KL		1061.30	-0.31	0.59
	SL	BW= -2138.73+337.65SL		1062.19	-1.20	0.77
	SC	BW= -2468.33+811.26SC		1060.65	0.34	0.76
	TL	BW= -1246.57+131.09TL		1060.60	0.38	0.62
	WL	BW= -1553.20+148.35WL		1060.83	0.16	0.38

BW=body weight, BL=body length, CG=chest girth, KL=keel length, SL=shank length, SC=shank circumference, TL=thigh length, WL=wing length, R^2=coefficient of determination