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Interrelationships Between Body Weight And Linear Body Measurements In Marshall Commercial Broilers Reared In Semi-Arid Zone Of Nigreia

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Abstract: ***A total of 105 Marshall broiler Strains were used in the experiment and indices comprising of Body Weight (BW), Neck Length (NEL), Back Length (BKL), Thigh Length (THL), Shank Length (SHL), Breast Width (BRW), Body Length (BDL) and Wing Length (WNL) were measured. The predictors of body weight include NEL, BDL, SHL, BKL, THL and BRW. The results show that highly significant ($p<0.001$) and very good estimators were found (R^2= 0.95, 0.95, 0.92, 0.91, 0.91, 0.90 and 0.88, respectively), demonstrating strong interrelationships between dependents and independent variables. The coefficient of determination (R^2) ranges from 0.88 to 0.95. Pearson Product Moment Correlation was used to determine the relationship between Body Weight and other Linear Body Measurements. Body weight was positive and significantly correlated ($p<0.001$).***

Keywords: Interrelationship, body weight, linear body measurements, Marshall, Strain

I. INTRODUCTION

Poultry breeders have tried to establish the relationship that exists between body weight and physical characteristics (body conformation) comprising of shank length, breast width, breast angle, keel length, neck length, back length, and thigh length as this information reflect on the feed efficiency as well as performance of the broiler birds (Kabir *et al.*, 2008); beside this, will help breeders to organize their breeding program in order to achieve an optimum combination of body weight and good conformation for maximum economic returns (Okon *et al.*, 1997). They also reported that the interrelationships

among body measurements can be applied speedily in selection and breeding. Breeders of meat-type chickens have become interested in adult bodyweight, the trend being towards a big-bodied weight at early age in order to attract better price at marketing (Malik *et al.*, 1997).

Amao *et al.* (2011) reported that there are many reports on the genetic parameter estimates for broiler growth traits. However, there is need to generate these estimates as baseline data for future improvement efforts (Amao *et al.*, 2009, Ojedapo *et al.*, 2008, and Oluyemi and Roberts 2000). The development of suitable strains of broiler chickens for the tropical environment is a research of interest which has engaged the attention of a number of poultry geneticists and breeders for the past two decades (Nargish *et al.*, 2010). The aim of this experiment was to evaluate the relationship of body weight and linear body measurement using regression function in Marshall strain of commercial broilers.

II. MATERIALS AND METHODS

EXPERIMENTAL SITE

The research was conducted at the Poultry unit of Teaching and Research farm of the Department of Animal Health and Husbandry, Audu Bako College of Agriculture, Dambatta; located at the Northern part of Kano State and positioned on latitude 12^{o} 20.260´ North-East of the equator and longitude 8^{o} 31.567´ East of the Greenwich Meridian (Ahmed, 2014). The College possesses a tropical climate with mean annual rainfall of 600mm which last for four months (between May and September) and the mean annual temperature is 38^{o}C with highest temperature occurring in April/May (41^{0}C) and lowest in January/February (30^{0}C) (Abdulrashid *et al.*, 2012). The relative humidity ranged from 22 to 52% as recorded by (KNARDA, 2011).

EXPERIMENTAL BIRDS

A total of 105 day-old Marshall commercial broiler chick strains were used for this study. The birds were randomized and allotted to pens in a brooder house. They were brooded with the aid of kerosene stoves and charcoal as heat source and reared on deep litter from day-old to 8 weeks of age. All the chicks were fed *ad libitum* with a broiler starter feed containing 23.75% Crude Protein (CP) and 3,038.64 MEKcal/kg upto 4 weeks of age; thereafter the birds were given broiler finisher diet containing 19.95% CP and 3,102.00 MEKcal/kg upto 8 weeks in accordance with NRC (1994) nutrient standard for broiler birds. Fresh, cool drinking water was also given *ad libitum.* Vaccination and other routine medication were carried out as at and when due. The birds were weighed at the beginning of the experiment and thereafter at weekly intervals. Weight of birds were measured individually by using a sensitive digital electronic balance scale in gram, other linear body measurements were measured using tape rule in centimeter.

DATA COLLECTION

During the period of 8 weeks, records were kept on Body weight (BDW), this was measured using digital electronic weighing balance of 3,000g capacity. The neck was gently straightened out and the length was measured with a tape rule as Neck Length (NEL). Back Length (BKL) was measured from the base of the neck to the uropygial gland at the base of the tail, including the cape and saddle parts. Thigh Length (THL) was taken from the hock joint to the hinge joint. The tarso-metatarsus (Shank Length) (SHL) was obtained by measuring from the hock joint to the base of the three toes. Breast Width (BRW) was measured across the keel bones from the left armpit to the right armpit. Body Length (BDL) was measured as the distance between the base of the neck to the cloaca. Wing Length (WNL) was measured from the shoulder joint to the extremity of terminal phalanx. To ensure accuracy, each measurement was taken twice. All the measurements were taken on weekly basis by the same person using tape rule calibrated in centimeters (cm) up to 8 weeks of age.

DATA ANALYSIS

Correlation analysis for the linear body measurements was carried out using Pearson Moment Correlation of Statistical Package for Social Sciences SPSS (2011) version 20.

Records of linear body measurements at 8 weeks were regressed against body weight using simple linear regression analysis procedure of SAS (2008) version 9.0

Model Function

Linear $Y = a + b_{X\,(X1\ldots\ldots\ldots\ldots Xi)}$

Where:

Y = the dependent variable (live body weight)

a = the intercept of regression curve on y-axis and was the value of the dependent variable Y when all independent variables were zero.

b = partial regression coefficient associated with respective independent variable X_1

x = independent variables (body measurements).

The regression assumed that: Independent variables have no measurement error

The errors about the regression line were equal.

The relationship between body weight and each of the traits were also assessed and the coefficient of determination (R^2) was used to compare the accuracy of prediction.

III. RESULTS AND DISCUSSION

Table 1 shows simple linear regression analysis to determine how linear body measurements influenced precision of live weight predictions at 8 weeks. It was found that NEL, BDL, SHL, THL, BKL, WNL and BRW were highly significant ($P<0.001$) and are very good estimators (R^2 = 0.95, 0.95, 0.92, 0.91, 0.91, 0.90 and 0.88,) respectively of body weight, though NEL and BDL were found to be the best predictors (R^2 = 0.95 each) of body weight at 8 weeks. This agreed with the report of Udeh *et al.* (2011) who reported that

the regression analysis were highly significant (P<0.001) in Anak, Arbor Acre, Ross and Marshall Strains and the R^2 (coefficient of determination) values were more than 50% in most of the groups. Ojo *et al.* (2010) reported that chest circumference, chicken height and back length were all highly significant ($p < 0.01$) and very good estimators ($R^2 = 0.78,0.85$ and 0.85, respectively) of body weight. In addition, the R^2 values showed the contribution of each trait to the body weight development. Moreover, the findings indicated that linear body measurements are very good predictors for body weight in broilers. Therefore, in the rural area where scale is not available, any of these linear measurements could be used to predict body weight of broiler chicken especially (NEL and BDL).

Table 2 indicated the results of correlated relationship between linear body measurements of Marshall Strain at 8 weeks. Positive and high significant correlation was observed between IBW and FBW in Marshall (r = 0.82; P<0.05). The findings indicated that IBW influences FBW. The positive, highly and non significant correlations existed in this work agreed with the report of Yakubu and Ayoade (2009) who reported positive, highly and non significant correlations between body length (BL) and body weight (BW) (r = 0.74; P>0.05), heart girth (HG) and body weight (BW) (r = 0.91; P>0.05). Also the negative, non significant correlations found in this work agreed with the findings of Ogah (2011) who reported negative, high and non significant correlations between Shank Length (SL) and Chest Circumference (CC) (r = -0.53; P>0.05), beak length (BKL) and Chest Circumference (CC) (r = -0.50; P>0.05), respectively.

IV. CONCLUSION

The results from the study demonstrated that the regression analysis model is a good tool for predicting body weight, indicating that body weight of the birds could easily be predicted from any given values of the body measurements (conformation traits). Significant body weight and some linear body measurements as well as the high correlations imply that they could be included in the model designed for genetic evaluation of the broiler breeders especially for selection purpose. In addition, the Low to high positive and negative correlations observed in this strain at 8 weeks of age is an indication of pleiotropic effect, reflecting the effect of some set of genes for the traits.

Traits Measured	Prediction equation	R^2%	Significance
NEL	Y = 4.89+0.18NEL	0.95	***
BKL	Y = 9.62+0.27BKL	0.91	***
THL	Y = 5.26+0.23THL	0.91	***
SHL	Y = 3.60+0.17SHL	0.92	***
BRW	Y = 8.31+0.30BRW	0.88	***
BDL	Y = 10.66+0.26BDL	0.95	***
WNL	Y = 8.05+0.31WNL	0.90	***

*NEL = Neck length, BKL = Back length, THL = Thigh length, SHL = Shank length, BRW = Breast width, BDL = Body length, WNL = Wing length, Y = Final body weight, *** = very highly significant (P<0.001), (g) = grams, (cm) = centimeter, R^2% = Coefficient of determination.*

Table 1: Prediction equations for 8 weeks body weight (g) of Marshall broiler strains using linear body measurements (cm)

Traits	IBW	FBW	NEL	BKL	THL	SHL	BRW	BDL	WNL
FBW(g)	0.82*	-							
NEL	-0.15	-0.54	-						
BKL	0.42	-0.09	0.46	-					
THL	-0.39	-0.29	-0.49	-0.01	-				
SHL	-0.35	0.04	-0.54	-0.47	0.42	-			
BRW	0.05	-0.04	0.66	0.11	-0.57	0.00	-		
BDL	0.70	0.72	-0.32	-0.20	-0.29	-0.25	0.01	-	
WNL	0.20	-0.07	0.45	-0.04	-0.57	-0.61	0.28	0.54	-

*IBW = Initial body weight, FBW = Final body weight, NEL = Neck length, BKL = Back length, THL = Thigh length, SHL = Shank length, BRW = Breast width, BDL = Body length, WNL = Wing length, * = Significant (P<0.05), (g) = grams, (cm) = centimeters.*

Table 2: Correlated relationship of body weight and linear body measurements (cm) of Marshall Broiler strains at 8 weeks of age

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