# PHENOTYPIC CORRELATION OF GROWTH TRAITS IN INDIGENOUS NORMAL FEATHERED CHICKENS OF NIGERIA

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## ABSTRACT
A study was conducted to determine the relationships between body weight and linear body measurements: Chest girth (CG), body length (BL), thigh length (THL), shank length (SL) shank circumference (SC), wing length (WL) and keel length (KL) of indigenous normal feathered chicken progenies. One hundred and thirty eight (138) birds comprising of eighty one (81) males and fifty seven (57) females from the foundation stock were used. Phenotypic correlations between body weight and linear body measurements, simple and multiple regressions were carried out using Statistical Analysis System (SAS, Version 9.1). The phenotypic correlation coefficients among growth traits were positive, high and significant ($P<0.01$) in both sexes. Highest correlations between BW and CG (0.897) and between BW and THL (0.843) were observed in both males and females, respectively. Prediction equations obtained for both sexes indicated that values for coefficient of determination ($R^2$) were highest for CG and SC (0.80) in males and SL (0.63) was the best predictor in females. The study concluded that bodyweight could be predicted with high degree of accuracy using linear body measurements.
**Keywords:** Correlation, Normal feathered, Body weight, Linear body Measurements, Regression

## INTRODUCTION
Nigeria has an estimated 175 million highly heterogeneous chicken population of which indigenous chicken 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, and are capable to thrive on little inputs in terms of feed, medication and shelter (Ajayi, 2010). They are categorized in to varieties such as the normal feathered, frizzled feather and necked neck, and studies have shown that normal feathered are the most prominent (Ajayi, 2010). Body weight is usually used as a measure of growth in farm animals however, numerous studies have shown that other growth traits relating to body morphometric measurements such as body length, shank length and chest girth can serve as good indicators of growth (Yunusa and Adeoti, 2014). This study was designed to assess the relationship between body weight and linear body measurements of Normal feathered chickens and use the information for body weight prediction.

## MATERIALS AND METHODS
**Experimental Site:** The study was carried out at the Poultry Production Unit (PPU) in Potiskum local Government Area, Yobe State. Potiskum is located on an altitude of 475m above sea level and is situated on latitude $11.71^0$N and longitude $11.07^0$E. The area falls within the Northern Sudan Savannah having an average rainfall of 713 mm/annum (Bunmi *et al*., 2016).
**Experimental Birds and Management:** A total of 60 indigenous normal feathered chickens comprising of 50 hens and 10 cocks of breeding age were used as parent stock to generate progenies for the experiment. After quarantine, the foundation stocks were replicated in to ten breeding groups with each group containing six birds per replicate. They were randomly assigned to a deep litter floor pens at 1:5 mating ratio. Laying boxes were provided for each pen for natural incubation. Eggs laid from each mating group of sire and dams were identified. Feed and water were provided *ad libitum*. Chicks hatched from each mating group were properly identified (wing tagged) and brooded artificially during which chick mash diet containing 20% crude protein and 2780 kcal ME/kg was fed. Grower mash that supplied 16.8% crude protein, 2600 kcal ME/kg was fed at growing phase. Layers

mash diet with 18% crude protein and 2650 kcal ME/kg was fed at the laying phase. Sanitary and routine practices as well as vaccination were maintained.

**Data Collection:** Body weight (BW) and linear body measurements such as body length (BL), chest girth (CG), shank length (SL), shank circumference (SC), keel length (KL), wing length (WL) and thigh length (THL) were measured for each bird from 2 to 24 weeks of age. The body weight of each chicken was recorded individually using a weighing balance and linear body measurements were carried out using a simple tape rule calibrated in centimeters as described by (Adeleke *et al*., 2011).

**Statistical Analysis:** The phenotypic correlations between pairs of traits were determined using the expression given by Becker (1984) with aid of SAS (Version 9.1). Regression of body weight on body linear traits were performed using the same package. The correlation and regression equations were:

$$r_p = \frac{COV_w + COV_s}{\sqrt{\left(\sigma^2_{w(x)} + \sigma^2_{s(x)}\right)\left(\sigma^2_{w(y)} + \sigma^2_{s(y)}\right)}}$$

Where; $r_p$ = Phenotypic correlation, $COV_w$ = within sire covariance components, $COV_S$ = sire covariance components, $\sigma^2{}_{W(X)}$ = within variance component for trait x, $\sigma^2{}_{W(Y)}$ = within variance component for trait y, $\sigma^2{}_{S(X)}$ = sire variance component for trait x

$Y_1 = B_o + B_1X_1$ …………………………………… Single trait regression model

$Y_2 = B_o + B_1X_1 + B_2X_2 + B_3X_3 …….. + B_nX_n$ ……. Multiple traits regression model

Where; $Y_i$ = dependent variable (body weight), $B_o$ = the intercept, $B_1$, $B_2$ and $B_3$ = the regression coefficients associated with independent variables

## RESULTS AND DISCUSSION

Table 1 shows the phenotypic correlation coefficients for body weight and linear body measurements in male (upper diagonal) and female (lower diagonal) chickens. There were very high significant positive correlations ($P < 0.01$) between body weight and chest girth, body length, thigh length, shank length, shank circumference, wing length and keel length in both sexes. Similar trends ($P < 0.01$) were observed among all the traits studied in both sexes. The higher values of phenotypic correlation recorded in indigenous chickens indicate that body weight and linear body measurements are under similar physiological and genetic mechanism. Thus selection for any of these linear body traits will cause direct improvement in body weight. This also reveals adaptability of breed to favourable environmental condition of the study area and hence selection of these traits will lead to an increase in response to selection. The values obtained in this study are within the range obtained by Oleforuh-Okoleh *et al*. (2017) (0.62 to 0.94). This study corroborates the findings of Haunshi *et al*. (2012) and Egena *et al*. (2014) who reported higher values for indigenous chickens.

Table 2 shows the models used to predict body weight of chickens from linear body measurements and their coefficients of determination ($R^2$). The values observed in this study ranged from 0.25 to 0.80 in males and 0.32 to 0.63 in females. Based on $R^2$ values in males, chest girth and shank circumference (0.80) were the best body linear parameters that predicted body weight followed shank length (0.74), keel length (0.59), thigh length (0.58), body length (0.51) and wing length (0.25), respectively. The use of multiple linear body parameters to predict body weight has increased the prediction accuracy to (0.87). In females, shank length was the best body linear parameter that predicted body weight with highest accuracy (0.63), followed by shank circumference (0.57), chest girth (0.50), thigh length (0.42), keel length (0.37), wing length (0.35) and body length (0.32) in decreasing order. The introduction of multiple linear body parameters in body weight prediction has yielded higher prediction accuracy (0.70) than any single linear body measurement among females. Higher value for the prediction accuracy implies a better variance that the dependent variable is explained by independent variable. Chest girth, shank length and shank circumference could be used to predict body weight with high precision. These results are similar to the finding of Dahloum *et al*. (2016) who reported significant relationship between body weight and linear body traits and observed chest circumference and shank length as the best predictors of live weight in the village chickens of Sri lanka. The high $R^2$ obtained indicates that these traits could be used to predict body weight with high precision.

**Table 1: Phenotypic correlation coefficients between body weight and linear body measurements of normal feathered chickens for males (upper diagonal) and females (lower diagonal)**

| | BW | CG | BL | THL | SL | SC | WL | KL |
|---|---|---|---|---|---|---|---|---|
| BW | | 0.897** | 0.711** | 0.762** | 0.857** | 0.895** | 0.504** | 0.770** |
| CG | 0.706** | | 0.760** | 0.793** | 0.882** | 0.891** | 0.645** | 0.797** |
| BL | 0.567** | 0.746** | | 0.711** | 0.756** | 0.891** | 0.587** | 0.652** |
| THL | 0.648** | 0.698** | 0.843** | | 0.722** | 0.748** | 0.649** | 0.689** |
| SL | 0.793** | 0.793** | 0.732** | 0.820** | | 0.887** | 0.670** | 0.827** |
| SC | 0.755** | 0.736** | 0.692** | 0.762** | 0.791** | | 0.536** | 0.759** |
| WL | 0.594** | 0.733** | 0.731** | 0.794** | 0.795** | 0.679** | | 0.672** |
| KL | 0.607** | 0.747** | 0.829** | 0.823** | 0.777** | 0.742** | 0.763** | |

**= P<0.01, BW= Body weight, CG= Chest girth, BL= Body length, THL= Thigh length, SL= Shank length, SC=Shank circumference, WL= Wing length, KL= Keel length

**Table 2: Body weight prediction using linear body measurements of normal feathered chickens**

| Predictor | Equation | $R^2$ |
|---|---|---|
| **Males** | | |
| CG | BW= -2260.96 + 143.66CG | 0.80 |
| BL | BW= -523.13 + 58.35BL | 0.51 |
| THL | BW= -1693.56 + 155.99THL | 0.58 |
| SHL | BW= -2134.14 + 332.22SL | 0.74 |
| SC | BW= -1718.02 + 627.90SC | 0.80 |
| WL | BW= -1306.40 + 137.07WL | 0.25 |
| KL | BW= -4421.12 + 420.45KL | 0.59 |
| CG, BL, THL, SL, SC, WL, KL | BW= -2347.59 + 60.90CG + 4.56BL + 27.85 THL + 59.65SL + 211.37SC – 56.74WL + 66.23KL | 0.87 |
| **Females** | | |
| CG | BW= -1480.85 + 109.92CG | 0.50 |
| BL | BW= -531.25 + 55.19BL | 0.32 |
| THL | BW= -511.24 + 86.11THL | 0.42 |
| SL | BW= -2134.14 + 239.95SL | 0.63 |
| SC | BW= -2022.14 + 689.19SC | 0.57 |
| WL | BW= -1067.64 + 116.19WL | 0.35 |
| KL | BW= -281.45 + 281.45KL | 0.37 |
| CG, BL, THL, SL, SC, WL, KL | BW= -1552.02 + 35.49CG -11.41BL + 6.07 THL + 173.57SL + 320.44SC – 27.42WL – 47.19KL | 0.70 |

$R^2$= Coefficient of determination, BW= Body weight, CG= Chest girth, BL= Body length, THL=Thigh length, SL= Shank length, SC=Shank circumference, WL= Wing length, KL= Keel length

## CONCLUSION

The study shows that body weight is highly associated with linear body measurements. Thus implies a high chance of arriving at correlated response when selection is applied on a single trait of the chicken. Body weight can be predicted using linear body measurements especially chest girth, shank length and shank circumference. Therefore, 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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