# REGRESSION EQUATIONS FOR THE ESTIMATION OF BODY WEIGHT IN FUNAAB ALPHA BROILER CHICKEN

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## ABSTRACT

The objective of this study was to predict the bodyweight of FUNAAB Alpha broiler line of three genotypes (Normal feather, frizzle feather and necked neck) using linear body measurements. Bodyweight and three body measurements namely breast girth, shank length, and keel lengths were measured at weeks 2, 4, 6, 8, and 10. The birds were intensively raised, fed ad-libitum. PROG REG was used to generate regression equations for predicting bodyweight with other body measurement for each week and coefficient of determination ($R^2$) was used to determine the best fit equation in predicting body weight with linear measurements. The genotype (frizzle feather) had the highest value (93.28%) of $R^2$ followed by naked neck (93.18%) and normal respectively which means as they increased in weight gain, and also male had the highest growth performance when compared with female. We can conclude that all three ecotypes of FUNAAB Alpha broiler line of chickens increased in body weight gain as the weeks increased; however, FUNAAB Alpha broiler line of frizzle feather has the highest weight gain from week 2 to week 10.

**Key words:** Regression, FUNAAB chicken, body weight.

## DESCRIPTION OF PROBLEM

Poultry production in developing countries is a fast-growing sub-sector of agriculture that is quick in terms of shorter production cycles (1). Products from poultry are one of the most popular options available in Nigeria in reducing protein deficiency and malnutrition in the populace diet (2). There has been a call for substantial increase in the intake of protein of animal origin in developing countries like Nigeria. This can be achieved through the production of broiler that have fast growth and attain market weight timely. However, body weight and body conformations are important parameters for measuring growth in domestic chicken.

Apart from body weight, a number of conformation traits are known to be good indicators of good growth and market value of broiler (3). Assan (4) reportedthat most of the linear body measurements reflect primarily the long bones of the animals. Such conformation traits include shank length, breast width, kneel length, wing span, chicken height, body length, and head circumference (5). The knowledge of interrelationships among body measurements can be applied in selection and breeding (4). Moreso, the importance of determining interrelationships of linear body parameters in poultry depends on extent they can predict of traits such as body weight.

Accurate and proper assessment of body weight is difficult under field conditions (6), as it mostly estimated by visual appreciation, a method which is widely inaccurate (7), especially when it is done by different evaluators. Thus, reliable and easy to apply methods have been developed to estimate body weight on farm where weighing scales are not usually available. Several authors have found strong association between body weight and linear body parts and have developed body weight prediction models (both linear and non-linear) using the linear body components (8,9). However, the effectiveness of the models depends on the linear body measurements under consideration (4). Regression models have majorly been estimating body weight from body traits. (10) noted multiple regressions as the best predictor of body weight from linear body components in relation to quadratic and exponential functions. Hence this research was conducted to predict bodyweight using biometric traits in FUNAAB Alpha broiler line.

### Materials and Methods

The research was conducted at poultry unit of the directorate, university farms Federal

university of Agriculture Abeokuta Ogun state. A total number of 100-day old FUNAAB Alpha chicks comprising of the genotype (Normal feather, frizzle feather and Naked neck were used in the study. They were brooded with the aid of electric bulb and charcoal as heat source and reared on deep litter from day old to eight 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 ME Kcal/kg up to 4 weeks of age; thereafter the birds were given broiler finisher diet containing 19.95%CP and 3,102.00ME Kcal/kg up to 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 when due.

**Data collection**

Parameter was collected from 100 birds at the beginning of the study, which is the hatching weight and two weeks ranges and the following measurements was taken namely; body weight, body girth, shank length, and keel length. The body weights of the birds were determined using a sensitive scale in gram. Linear body measurements were taken with the aid of a measuring tale. The body measurements of interest include shank length, breast girth, and keel length.

Statistical analysis of data collected from the experiment was performed using Proc. regression in statistical analysis software (SAS, 2002). Body weight was regressed on body measurements by forward, backward, stepwise and full model regression analysis as described by (14)

**Results**

Table 1 shows Estimate of Parameter using forward method of multiple regression for prediction of Bodyweight from Biometric Measurements. They include Forward method of multiple regression equation of FUNAAB Alpha broiler chicken (male and female) for the effect of sex on body weight and linear measurement and their coefficient of determination $R^2$, residual mean square errors, Akaike information criterion (AIC) and P-value , BG, SHL, KL was inserted female had the highest R, (91.62%) compared to that of male (90.12%). The RMSE of the female had the lowest value when multiple body measurement was included in the model. All model is significant (P<0.001).

**Table 1: Estimate of Parameter using forward method of multiple regression for prediction of Bodyweight from Biometric Measurement**

| Model | Equation (BG) | $R^2$ | RMSE | AIC | P-Values |
|---|---|---|---|---|---|
| **Male** | | | | | |
| Forward step 1 | -611.99 + 140.37BG | 89.21% | 21213 | 4761.75 | *** |
| Forward step2 | -650.42 + 70.82SHL+ 103.24BG | 90.09% | 19540 | 4714.12 | *** |
| Forward step3 | 646.63 +61.17SHL + 13.57KL +98.06BG | 90.12% | 19524 | 4703.7 | *** |
| **Female** | | | | | |
| Forward step 1 | -524.75 + 126.29BG | 91.10% | 11676 | 4827.72 | *** |
| Forward step 2 | -522.75 + 37.36KL + 97.34BG | 91.57% | 11089 | 4797.93 | *** |
| Forward step 3 | 534.43 + 93.08BG + 27.74KL + 22.08SHL | 91.57% | 11043 | 4792.95 | *** |

Table 2 shows the backward methods of multiple regression equation for both male and female chickens respectively. For the male, the equation with four variables is observed to be the best fit with the coefficient of determination (90.12%) and residual mean square error (19524). The best fit backward regression model for female is the equation with four variables with four variables is observed to be the best fit with coefficient of determination of (91.62%). The table also showed the backward methods of multiple regression equations for the three genotypes (normal, frizzle and naked neck feathers).

Table 3 shows the full model of multiple regression (male) having four variables with coefficient of determination (90.12%), residual mean square error and Akaike information criterion (406.309). While the female having six variables with coefficient of determination (91.62%), residual mean square error (45672) and Akaike information criterion (359.64). the P-value is not suitable for comparing the models as individual model is significant at 0.001. Also, the effect of genotype and observed that frizzle feather had the highest

coefficient of determination, followed by naked neck and normal feather.

**Table 2: Estimate of parameter using backward method of multiple regression for prediction of bodyweight from biometric measurement**

| Model | Equation (BG) | $R^2$ | RMSE | AIC | P-Values |
|---|---|---|---|---|---|
| **Sex** | | | | | |
| Backward(A) | 646.63 + 61.16SHL + 13.56KL + 98.06BG | 90.12% | 19524 | 4792.9 | *** |
| Backward(B) | 534.43+22.08SHL+27.73KL+93.08BG | 91.62% | 11043 | 4912.7 | *** |
| **GENOTYPE** | | | | | |
| Backward step(MAL) | 589.14+48.61SHL+17.09KL+93.72BG | 88.48% | 111487 | 4104.7 | *** |
| Backward step(FF) | 591.90+57.81SHL+8.29KL+96.47BG | 93.28% | 11524 | 4413.57 | *** |
| Backward step(AK) | 653.99+19.32SHL+40.84KL+102.31BG | 93.18% | 14432 | 49127 | *** |

**Table 3: Full method of multiple regression equation of FUNAAB Alpha broiler chicken using bodyweight and linear measurement and their coefficient of determination ($R^2$), residual mean square errors, Akaike information criterion (AIC) P-values.**

| Model | Equation (BG) | $R^2$ | RMSE | AIC | P-Values |
|---|---|---|---|---|---|
| SEX | | | | | |
| Full (B) | 534.43+22.08SHL+27.74KL+93.08BG | 91.62% | 11043 | 4703.71 | *** |
| Full (A) | 640.63+61.17SHL+13.57KL+98.06BG | 90.12% | 19524 | 4792.95 | *** |
| GENOTYPE | | | | | |
| Full (AK) | 653.99+1932SHL+40.84KL+102.31BG | 93.18% | 14432 | 4104.78 | *** |
| Full (FF) | 591.99+57.82SHL+8.29KL+96.47BG | 93.28% | 11524 | 4413.57 | *** |
| Full (MAL) | 589.14+48.61SHL+17.09KL+93.73BG | 88.48% | 18136 | 4912.70 | *** |

**Discussion**

The variance of the AIC may increase as the number of parameters increases. Thus, the model with the most parameters tend to make AIC the smallest, and so the AIC often selects the model with the most parameters as the best model. The equation: BW = 646.63 + 61.16SHL + 13.56KL + 98.06BG and BW = –534.43 + 22.08SHL + 27.73KL + 93.08BGwere found to be the best for estimating the body weight in male and female chicken respectively. For backward method: BW = –229.73 + 28.25SL + 21.26BG + 59.97BL + 90.12KL and BW = 1608.61 + 13.21WL + 20.51BG + 69.57BL were considered to be the best for estimating the body weight in male and female NIC respectively. The report of (11) that regression model with lowest AIC and RMSE estimates are considered the most appropriate model corroborates the result obtained for this experiment. For predicting body weight using stepwise method of multiple regression: BW = 646.63 + 98.06BG + 61.16SHL + 13.56KL for male and BW = –534.43 + 93.08BG + 22.08SHL + 27.73KL for female were considered the best for predicting body weight of FUNAAB Alpha chickens. These results are similar to the report of (12) who described that the larger the $R^2$ and smaller the RSME produce better goodness of fit. The full model consists all the linear measurements in predicting body weight of FUNAAB Alpha broiler chicken: BW = –2323.06 + 3.61WL + 3.34WS + 30.99SL + 8.59DS + 16.89BG + 57.73BL + 78.07KL for male and BW = –1707.05 + 14.45WL + 4.49WS + 4.22SL – 0.44DS + 18.66BG + 68.02BL for female. The forward multiple regression model with the highest $R^2$, minimum RMSE and AIC (BW= -646.63+61.17SHL+13.57KL+98.06BG model for predicting body weight of Nigerian indigenous cock at 10 weeks of age. This is in consonant with the submission of (13). The best fitted regression model for predicting body weight of FUNAAB Alpha broiler was observed in both full and backward regression methods (BW= 46.63+61.17SHL+13.57KL+98.06BG). This selection was based on the model meeting all the criteria or two out of the three criteria ($R^2$, RMSE, AIC), since all the models are significant at 0.001.

**Conclusions and Application**

All three ecotypes of FUNAAB Alpha broiler line of chickens increased in body weight gain as the weeks increased; however, FUNAAB Alpha broiler line of frizzle feather has the highest weight gain from week 2 to week 10. Based on the results, it is recommended that multiple regression equation which made use of more body measurements should be used in predicting the body weight in FUNAAB Alpha broiler chicken line of frizzle feather in absence of measuring scale.

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