PHENOTYPIC AND GROWTH EVALUATION OF ROSS 308, ARBOR ACRE AND COBB 500 STRAINS OF BROILER CHICKEN

***Ugwuja, F. C., Halilu, A. and Henry, A. J.**
Department of Animal Science, Faculty of Agriculture, University of Calabar
**E-mail for correspondence: ugwujachukwuemeka1@gmail.com*
Phone No: 08161721482

ABSTRACT
This study assessed the phenotypic traits and growth performance of three broiler strains (Arbor Acre, Cobb 500, and Ross 308) over a 42 day period using deep litter system of management. A total of 180 chicks (60 per strain) were randomly allotted into three replicates, each containing 20 birds. Growth parameters measured included body weight, weight gain, feed intake, and feed conversion ratio (FCR), while linear body measurements were body length, wing length, height, thigh length, shank length, and heart girth. Data analysis showed no significant (p>0.05) differences in growth performance across strains although Cobb 500 had the highest body weight (1713.09 g), followed by Ross 308 (1681.43g) and Arbor Acre (1661.67g). The FCR values also showed no significant (p>0.05) strain effect on this parameter. Cobb 500 exhibited superior height compared to others. Correlation analysis revealed strong positive correlations between body weight and most linear body traits, except for height, which showed a low correlation (p>0.05). Regression analysis identified more independent variables as best predictors of body weight across strains than individual variables. Overall, the study showed that the broiler strains had similar growth patterns.
Keywords: Broiler, Growth, Linear measurement, Phenotype, Strains.

INTRODUCTION

Broiler chicken production is a crucial component of Nigeria's agricultural economy, offering an essential source of animal protein and contributing significantly to economic development. According to Ibiwoye and Sola-Ojo (2021), the increased demand for poultry products, particularly broiler meat, is driven by its high nutritional value, affordability, and preference over other protein sources such as red meat, which is often seen as less healthy. Among the broiler strains prevalent in Nigeria, Cobb 500, Arbor Acre, and Ross 308 are the most frequently reared. This preference is due to their rapid growth rates, efficient feed conversion, and adaptability to various rearing environments, as noted by Sanda *et al*. (2021). To maximize productivity and ensure sustainable broiler production under local conditions, it is vital to evaluate and compare the performance of these strains, as highlighted by Obike *et al*. (2020), to determine their suitability and efficiency in Nigerian poultry farming contexts. Phenotypic evaluation, which involves assessing observable characteristics such as body weight, growth rate, feed conversion efficiency, and carcass yield, is crucial for determining the performance of these broiler strains. Such evaluations help identify which strain is best suited for the prevailing environmental conditions due to climate change, management practices, and market demands in Nigeria. This study, therefore, assessed the phenotypic parameters of three commercial broilers (Ross 308, Arbor Acre and Cobb 500) and a determined best predictors of body weight using the linear body parameters.

MATERIALS AND METHODS

This experiment was conducted at the poultry unit of the Department of Animal Science. University of Calabar Teaching and Research Farm. Calabar is located within the tropical Rain Forest zone of Nigeria on latitude 3'N and longitude 7'E with average maximum Temperature of 38.83'C. A total number of 180-day old broiler chicks comprising 60 birds per three commercial strains (Ross 308, Arbor acre and Cobb 500) were used for this study. Each strain represented a treatment and was further sub-divided into 3 replicates of 20 birds on deep litter system for 42 days. The chicks were brooded for a period of 4 weeks. Vaccination and medication schedule for broiler chickens were adequately followed. Birds were fed "*ad libitum*" using a commercial broiler starter diet containing 21% crude protein (CP) and 2800 kcal/kgME from day old to the 4th week of age followed by a commercial finisher diet containing 18% CP and 2900 kcal/kgME from the 5th to the 6th week of age. Water was provided "*ad libitum*" to the birds throughout the experimental period. Feed intake was recorded daily while live weight was measured weekly using a digital weighing balance to determine weight gain. The average daily feed intake (quantity of feed - left over from the initial quantity offered). Feed intake and weight gain was

used to compute feed conversion ratio (FCR) while linear body measurements (body length, wing length, height, shank length, thigh length, heart girth) were taken weekly using a tailor's tape in centimeters (cm). All data collected were subject to one way analysis of variance in a Completely Randomized Design. Pearson correlation coefficients were registered, while regression analyses were used to predict body weight using SPSS version 2022 statistical package.

RESULTS AND DISCUSSION

The growth performance of the three broiler strains is seen in Table 1 shows that Final body weights were 1713.09g (Cobb 500), 1661.67g (Arbor Acre) and 1681.43g (Ross 308), showing no significant differences ($P > 0.05$). Cobb 500 exhibited the highest daily weight gain (39.82g) and weekly weight gain (238.90g), though differences among strains were minimal. Total feed intake (TFI) was highest for Arbor Acre (585.58g), followed by Cobb 500 (558.65g) and Ross 308 (541.58g). However, despite consuming more feed, Arbor Acre recorded the least efficient feed conversion ratio (FCR = 0.36), while Cobb 500 and Ross 308 both had the best FCR values of 0.33. These results align with findings from Adedokun *et al*. (2022), who highlighted Cobb 500's superior feed efficiency.

Linear body measurements (LBMs) are detailed in Table 2. Body weight and height were significantly influenced by strains of birds. No significant differences ($P > 0.05$) were observed for parameters such as body length (20.32cm for Cobb 500, 19.07cm for Arbor Acre, and 19.43cm for Ross 308) and wing length (16.34cm for Cobb 500, 15.12cm for Arbor Acre, and 15.41cm for Ross 308). Cobb 500 demonstrated the highest values for height (25.37cm) and shank length (12.04cm), while Arbor Acre recorded the least values for height (18.63cm) and shank length (10.92cm). These similarities in traits among strains suggest a shared genetic selection history for growth-related attributes (Obike *et al*., 2020). Heart girth measurements ranged from 25.75 cm (Arbor Acre) to 27.59cm (Cobb 500). As highlighted in Henry (2011), heart girth strongly correlates with body weight and can serve as a reliable predictor for meat yield.

Regression analysis of body weight and linear body measurements revealed significant relationships for each strain (Table 3). The R^2 value of 0.509 – 0.781 was recorded for Cobb 500, 0.340 – 0.798 was recorded for Arbor acre while 0.382 – 0.830 was recorded for Ross 308 broilers. From the coefficient of determination (R^2) obtained, the value of R^2 always increased with the addition of more independent variables to the regression model. The results of this study showed that, some independent factors do not improve R^2 value when added in the mathematical equations like the heart girth in Arbor acre which reduced the R2 from 0.798 to 0.785. These results highlight how different strains may require distinct linear body measurements for accurate prediction, aligning with findings by Nosike *et al*. (2017), who emphasized the importance of strain-specific traits in prediction models. However, when a single predictor is considered, Cobb 500, Arbor acre and Ross 308 can best be predicted from body length.

Table 1: Growth performance of experimental chickens

	Treatments			
Parameters	**Cobb 500**	**Arbor acre**	**Ross 308**	**SEM**
Initial weight (g)	40.80	38.30	45.00	1.95
Final weight (g)	1713.09	1661.67	1681.43	14.98
Daily weight gain (g)	39.82	38.65	38.96	0.35
weekly weight gain (g)	238.90	231.91	233.78	2.09
Total weight gain (g)	1672.29	1623.37	1636.43	14.62
Daily feed intake (g)	13.30	13.94	12.89	0.31
Weekly feed intake (g)	79.81	83.65	77.37	1.83
Total feed intake (g)	558.65	585.58	541.58	12.81
Feed conversion ratio	0.33	0.36	0.33	0.01

SEM = Standard error of mean

Table 2: Body linear measurement of three strains of broiler chicken

	Treatments			
Parameters	**COBB 500**	**ABROR ACRE**	**ROSS 308**	**SEM**
BL (cm)	20.32	19.07	19.43	0.40
WL (cm)	16.34	15.12	15.41	0.31
HT (cm)	25.37[a]	18.63[b]	18.80[b]	2.19
THL (cm)	12.98	11.91	13.02	0.28
SL (cm)	12.04	10.92	11.85	0.29
HG (cm)	27.57	25.75	26.58	0.54

[ab]=mean with different superscripts on the same row differ significantly ($p<0.05$); SEM = standard error of mean, BW = body weight, BL = body length, WL = wing length, HT = height, THL = thigh length SL= shank length, HG=height, CM = centimetres, SEM = standard error of mean

Table 3: Prediction of BW using LBM for Cobb 500, Arbor acre and Ross 308 strains of broiler chicken.

	Relationship	**R^2 Value**	**S.E.E**
COBB 500	Weight = -1478.681+128.317BL	0.509	410.0840
	Weight = -1714.331+59.509BL + 100.009WL	0.554	396.4918
	Weight = -1651.521 + 64.377BL + 93.641WL – 2.273HT	0.568	396.1685
	Weight = -1632.873 + 36.797BL + 26.597WL – 1.823HT + 125.215THL	0.689	341.3342
	Weight = -1649.130 – 9.749BL + 69.765WL – 0.724HT – 24.744THL + 180.723SL	0.780	291.6303
	Weight = -1680.151 – 17.961BL + 70.445WL – 0.752HT – 28.824THL + 177.963SL + 9.928HG	0.781	295.8293
ARBOR ACRE	Weight = -129.928 + 74.903BL	0.340	406.5408
	Weight = -382.690 + 24.567BL + 76.602WL	0.356	401.5980
	Weight = -321.467 – 52.799BL + 56.107WL + 95.436HT	0.463	366.8769
	Weight = -684.356 – 69.739BL + 15.230WL + 75.024HT + 141.371THL	0.681	282.6783
	Weight = -74.119 – 87.548BL – 16.872WL + 72.483HT – 28.979THL + 209.796SL	0.798	225.0993
	Weight = -92.322 - 75.509BL – 18.338WL + 76.833HT – 18.110THL + 203.559SL – 12.895HG	0.785	232.3280
ROSS 308	Weight = -938.684 + 74.903BL	0.382	447.9576
	Weight = -991.837 + 66.438BL + 28.586WL	0.387	455.3311
	Weight = -989.966 + 33.997BL + 23.821WL + 37.341HT	0.408	457.0443
	Weight = -1375.708 – 11.348BL – 44.020WL + 7.542HT + 220.739THL	0.772	290.2375
	Weight = -1365.637 – 11.276BL – 41.262WL + 5.062 HT + 200.829THL + 21.249SL	0.773	296.4405
	Weight= -1651.550 - 119.755BL + 33.631WL – 50.876HT + 176.278THL +5.434SL + 105.282HG	0.830	262.4464

BW = Body weight; LBM = linear body measurement; BL= body length; WL= wing length; HT=height; THL= thigh length; SL= shank length; HG= heart girth

CONCLUSION

Cobb 500 demonstrated the highest growth efficiency and feed conversion, making it suitable for Nigerian poultry farming. Strong correlations between body weight and linear measurements suggest their utility in selection programs. More independent variables best predict body weight across strains than individual variables. Farmers should prioritize the use of Cobb 500 and adopt optimized management practices to maximize productivity.

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