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The Growth Performance, Carcass and Economy of Production of Different Strains of Broiler Chicken Fed a Single Type Diet

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Abstract

One hundred and forty-four (144) broiler chicken were purchased for an experiment to determine the influence of strain on growth performance, carcass and economy of production of Cobb 500, Ross 308 and Marshall strains of broiler chicken. Forty-eight (48) broiler chicken each per strain were allocated into three treatments (T_1, T_2, T_3) and three (3) replicates with sixteen (16) birds per replicate in a completely randomized design (CRD). The were fed ad-libitum and all necessary routine management practices were strictly adhered to throughout the period of the study. Data were collected on the initial body weight, final body weight, daily feed intake, feed conversion ratio and mortality for growth performance. A total of nine birds, one per replicate was selected based on the average weight and slaughtered for carcass and organ parameters. The following parameters were weighed; Live weight, dressed weight, dressing percentage, thigh, drum stick, back cut, wing cut, breast cut, organs parameters, heart, liver, gizzard and kidney. The experiment lasted between October 19, 2024 and December 13, 2024 (56 days). The economy of production was also calculated based on the cost of the feed formulated and the cost of broilers per kg. The data obtain were subjected to analysis of variance and the means separated using Duncan multiple tests. Results showed significant difference ($P<0.05$) in all the growth parameters measured. Ross 308 showed a significant ($p<0.05$) effect on body weight, feed intake, weight gain and feed conversion ratio than Cobb 500 and Marshall. The result also indicated that strain had significant ($p<0.05$) influence on the cost/kg weight gain, cost of production, revenue and gross margin. The carcass parameters showed significant differences ($p<0.05$) in the live weights and dressed weights but no significant difference ($p>0.05$) in the dressing percentage. T_1 (cobb 500) and T_2 (Ross 308) were statistically the same but significantly higher ($p<0.05$) than T_3 (Marshall). Based on the results of this study, it was concluded that Ross 500 had an optimal body weight gain, feed conversion ratio, and economics of production compared to Cobb 500 and Marshall. Therefore, Ross 308 strain of broiler chicken could be recommended to broiler farmers for increase productivity in the study area.

Keywords: Broiler strains, growth performance, carcass parameters, economy of production.

Introduction: Poor growth performance is amongst the most important factors limiting the expansion of the poultry industry. Growth in animals is a function of time, nutrition, breed, husbandry system and health management practices among other variables, and different strains of animals have different live weights which provide reliable and informative measures of selection (Udeh *et al.,* 2015). Body weights of live animals are the most reliable measure of growth performance. However different strains of broiler chicken have different growth trends. Poultry farmers are equally faced with the problem of ascertaining strain with rapid growth performance for sustainable production. Poultry industry in Nigeria has over the years witnessed the introduction of different broiler strains as ways of meeting the increasing demand for poultry products (Olawumi *et al.,* 2012). The growth performance of broiler chicken is of primary concern to the producers and consumers (Ukpanah, *et al.,* 2024). Most growth traits are strain dependent; therefore, poultry farmers have to select broiler strains that will reach market weight at a reasonable age in order to maximize profit (Olawumi *et al.,* 2012), Growth is one of the major characteristics of all living organisms. It involves dynamic physiological changes which commence when the zygote is formed at the moment of fertilization, and continues till maturity. However, the success of poultry production has been strongly related to the improvements in economy of production, growth performance and carcass yield. Broiler producers are now focusing on growth performance and Carcass characteristics especially with the major component parts such as breast, thigh and drumstick (Shafey *et al.,* 2013). This implies that poultry producers need to select stock which has the genetic potential for fast growth and early attainment of market weight under the existing climatic condition of the given environment. According to Yahaya *et al.,* (2012), body weight and a number of carcass traits such as thigh, drum stick, back cut, wing cut, breast cut, organs parameters, heart, liver, gizzard and kidney are good indicator of body growth and market value in broilers. It is necessary to evaluate this trait to provide dependable information that serves as a guide to both researchers and farmers on choice of broiler strain to

procure for increased growth, meat production and optimum profit.

Ross 308 is a crossbreed recognized globally for its consistent performance. It has high growth rates, manageable feed efficiency and robust performance. It is reputed to have powerful muscle mass than other broilers with white, large breasts and large strong legs which are formed at a very early stage and is highly resistant to diseases (Bessi, 2016). Cobb 500 is the most productive in the world and has the lowest feed conversion, high growth rate and a better ability to grow well on cheaper low-density feeds. They have white feathers and genetically yellow skin, when compared with other crosses broiler, Cobb 500 stands higher productivity and less growth of the fattening period (Bessi, 2016). Marshall is one of the very few basic poultry breeding companies in Asia. In a short period of time, Marshall broiler strains have firmly established themselves as leaders in efficient chicken meat production taking intensive commercial broiler growing to a whole new level of productivity (FAO, 2010). There is need to update the information on strain of broiler that grows faster and with a better feed conversion ratio which could have provided a reliable and informative measure of selection. Hence the need to examine the effect of strain on growth performance, carcass weights and economy of production of different strains of broiler chicken (Ross 308, Cobb 500 and Marshall) fed a single type diet.

Materials and Methods: Location of the Experiment: This study was carried out at the Teaching and Research Farm, Department of Animal Science, Faculty of Agriculture, Akwa Ibom State University Obio Akpa Campus. Akwa Ibom State, Nigeria. Obio Akpa is located between latitudes 5º17ˈN and 5º27ˈN and between longitudes 7º27ˈN and 7º58ˈE. The area is characterized with an annual rainfall ranging from 3500mm – 5000mm and average monthly temperature of 25^0C, Akwa Ibom State is a coastal state lying between latitudes 4º28ˈN and 5º3ˈN and between longitudes 7º27ˈE and 8º20ˈE, with a relative humidity between 60-90%. It is in the tropical rainforest zone of Nigeria (AKSU-MET (2021).

Experimental Birds and Management: Three strains of broiler chicken (Cobb 500, Ross 308 and Marshall) were purchased from local dealers in Akwa Ibom State for the research. Forty-eight (48) each of the strains were allocated into three treatments, T_1 (Cobb 500), T_2 (Ross 308), T_3 (Marshall). Each had three (3) replicates with 16 birds per replicate in a completely randomized design (CRD). The birds were housed in a deep litter pen. They were fed *ad libitum*, clean drinking water was provided, all necessary routine management practices and the recommended vaccination schedule for broiler birds were strictly followed throughout the period of the study.

Experimental Diet: The composition of the experimental diet is presented in table 1.

Data Collection: Growth performance: The initial body weight was taken, thereafter, the weekly body weight, daily feed intake and feed conversion ratio. Daily feed intake (DFI) was obtained as the difference between the quantity of feed offered and the quantity not consumed after 12 hours. The total weight gain (TWG) was obtained by subtracting the initial weight from the final body weight gain. Mortality was also recorded.

Carcass and organ evaluation: One broiler per replicate was selected based on the average weight, fasted overnight and slaughtered by severing the jugular vein. After scalding in warm water for two minutes, the feathers were manually plucked, each bird was cut into parts for carcass and organ evaluation. The following parameters were weighed; Live weight, dressed weight, dressing percentage, thigh, drum stick, back cut, wing cut, breast cut, organs parameters, heart, liver, gizzard and kidney.

Economics of Production: Economy of production was estimated according to the method described by Ojewola *et al*. (2005). The cost/kg of feed, as the total cost of producing 100kg of feed/ 100. The cost of feed consumed (₦) was calculated as cost/kg of feed × total feed consumed. The cost/kg weight gain (N/g) was calculated as the cost of feed consumed/ total weight gain. The cost of production (₦) was calculated cost/kg weight gain × mean weight gain. Revenue (₦) was calculated as the price of 1kg of meat (₦) × mean weight gain(g). The gross margin (₦) was calculated as revenue (₦) - cost of production (₦)

Statistical Analysis: The data obtained were subjected to analysis of variance (ANOVA) using General Linear Model Procedure of SPSS version 20 (2000). Means with significant differences were separated using Duncan's Multiple Range Test.

Results and Discussion: Growth Performance: The result of the growth performance of different strains of broiler chicken is presented in table 2. There were no significant ($P>0.05$) differences in the final body weight gains at 8 weeks of age. T_1 (cobb 500) (2900.33g), T_2 (Ross 308) (3243.67g) and T_3 (Marshall) (2401g). This result differs from the result reported by Amao *et al.* (2011), that Ross 308 had superior final body weight to other strains of birds used in his experiment. However, Sam *et al* (2022) in their study reported that Cobb 500 had the most superior body weight, feed intake, weight gain and feed conversion ratio. Ejiofor (2001) and Razuki *et al.* (2011) in their study also reported significant ($P<0.05$) strain differences in the weights of broiler chicken at 8 weeks. The average daily weight gain revealed a corresponding significant ($P>0.05$) difference with the weight gain. The values were T_1 (cobb 500) (82.98g), T_2 (Ross 308) (93.65g) and T_3 (Marshall) (65.13g). These values are within the optimal average daily weight gain for broiler chicken from 1-8 weeks of age (NRC, 1994). However, the differences in the daily weight gain could be as a result of the differences in the corresponding weight gain, which could also be attributed to the variation in the breed's/strain's genotype.

Result showed that the total feed intake was significantly ($P<0.05$) influenced by the strains of broiler chicken. T_1 (cobb 500) (5262.33g) and T_3 (Marshall) (5220.67) were statistically the same but higher ($P< 0.05$) than T_2 (Ross 308) (4514.67g). This is reflected in the feed conversion ratio as Ross 308 (1.76) was significantly ($P<0.05$) lower than the other two strains indicating its superiority in feed conversion. This result agreed with that of Amao *et al.* (2011), who reported that Ross 308 broiler had a better feed conversion ratio than other strains in their study. Feed

conversion ratio is one of the major criteria used in defining the performance of broilers. The lower the feed conversion ratio, the better the performance, indicating that Ross 308 in this study had the optimal feed conversion ratio (FCR). However, FCR obtained in this study for the three strains were within the normal range for broiler chicken (Udeh *et al.*, 2018)

Carcass and organ parameters: The results of the **c**arcass and organ parameters of different strains of broiler chicken fed a single type diet is presented in table 3. Results showed that there were significant differences ($p<0.05$) in the live weights and dressed weights but no significant difference ($p>0.05$) in the dressing percentage. T_1 (cobb 500) and T_2 (Ross 308) were statistically similar in live weight and dressed weight but significantly higher ($p<0.05$) than T_3 (Marshall). Sam and Okon (2002), also reported significant differences ($p<0.05$) in the live weight and dressed weight amongst Arbor Acre, Ross 308 and Cobb 500. The organs weights (heart, liver, gizzard, and kidney) of the different strains of broiler finisher chickens in this experiment were not significantly ($p>0.05$) different.

The economy of production: The result of the economy of production of three strains of broiler chicken is presented in table 4. The result showed that there were no significant differences ($P>0.05$) in the cost per kg of feed and total feed intake. There were significant differences ($P<0.05$) in the cost /kg weight gain, cost of production, cost of feed consumed, revenue and gross margin. T_2 (Ross 308) had an optimal gross margin of ₦4,258.00, whereas T_1 and T_3 had ₦2,529.00 and ₦1,073.00 respectively. This result agreed with the report of Ajeromy *et al.*, (2019), who reported higher gross profit of producing Ross 308 broiler chicken compared to Cobb 500.

Conclusion and Recommendation: Ross 308 and Cobb 500 were highly comparable in their optimal growth performances, carcass parameters and economy of production. These strains of broilers are therefore recommended for farmers who wish to achieve optimally in terms of body weight gain, feed conversion ratio, carcass weight and economy of production to raise within the study area.

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Table 1: Composition of experimental diet

Ingredients	Composition
Maize	55.00
Soyabean meal	20.00
Full fat soya	10.00
Fish meal	5.00
Wheat offal	6.10
Limestone	1.50
Bonemeal	1.50
Common Salt	0.25
Vitamin /mineral premix	0.25
Lysine	0.20
Methionine	0.20
Total	**100.00**
Calculated analysis	
Crude protein (%)	22.00
Crude fibre (%)	3.60
Ash	6.66
Calcium	1.12
Phosphorous	0.48
Metabolizable energy (Kcal/kg)	2925.40

Vitamin /mineral premix = vitamin A, D3, E, K, B1, B2, B6, B12, Nacin, Patothemic acid, Folic acid, Biotin, Choline Chloride, Manganese, Zinc, iron, Copper, iodine, selenium and cobalt

Table 2: Growth Performance of Different Strains of Broiler Chicken

Parameters	T_1 (Cobb 500)	T_2(Ross308)	T_3(Marshall)	SEM
Initial weight(g)	117.00	161.33	117.33	6.67
Final weight (g)	2900.33^{ab}	3243.67^{a}	2401.00^{b}	14.69
Total weight gain (g)	2783.33^{ab}	3082.34^{a}	2283.67^{b}	14.06
Daily weight gain (g)	82.98^{ab}	93.653^{a}	65.13^{b}	5.02
Feed intake (g)	5262.33^{a}	4514.67^{b}	5220.67^{a}	13.69
Daily feed intake (g)	93.97^{a}	80.62^{b}	93.23^{a}	2.90
Mortality (%)	0.01	0.01	0.02	0.00
FCR	2.26^{b}	1.72^{c}	2.86^{a}	0.17

^{abc} means on the same row with different superscripts are significantly different. FCR= Feed conversion ratio.

Table 3 Carcass and organ parameters of different strains of broiler chicken fed a single type diet

Parameters	T_1 (Cobb 500)	T_2 (Ross 308)	T_3 (Marshell)	SEM
Live Weight (g/bird)	2433.33^{a}	2443.33^{a}	2001.67^{b}	80.57
Dressed Weight (g/bird)	1714.67^{a}	1799.00^{a}	1332.67^{b}	77.45
Dressing percentage (%)	70.50	72.65	66.61	1.29
Thigh	285.33^{a}	303.67^{a}	222.67^{b}	13.07
Drum stick	246.67^{b}	301.67^{a}	191.33^{c}	17.13
Back cut	323.00^{b}	361.00^{a}	207.33^{c}	20.31
Wing cut	195.00^{a}	203.00^{a}	145.00^{b}	9.43

Breast cut	639.33[a]	669.67[a]	487.67[b]	29.51
Heart	0.35	0.38	0.32	0.34
Liver	3.28	2.18	2.15	0.13
Gizzard	1.51	1.60	1.56	0.03
Kidney	0.13	0.18	0.15	0.01

Table 4: Economy of production of three strains of broiler chicken using a single type diet.

Parameters	T_1 (Cobb 500)	T_2 (Ross308)	T_3 (Marshall)	SEM
Cost/kg of feed (₦)	1104.82	1104.82	1104.82	0.03
Total feed intake(kg)	5.26	4.51	5.22	1.06
Cost of feed consumed (₦)	5811.35[a]	4982.74[c]	5767.16[b]	0.30
Total weight gain (kg)	2.78	3.08	2.28	0.06
Cost/kg weight gain(₦)	2090.41[b]	1617.77[c]	2529.46[a]	1.61
Cost of production(₦)	5811.35[a]	4982.74[c]	5767.16[b]	0.30
Revenue(₦)	8,340.00[b]	9,240.00[a]	6,840.00[c]	0.30
Gross margin(₦)	2,529.00[b]	4,258.00[a]	1,073.00[c]	0.78