

Evaluation Of Growth Performance Traits In Three Strains Of Broiler Chickens Reared In Semi Arid Zone Of Nigeria

Ilyasu Abdullahi Ahmed

Head of Department and Senior Lecturer, Department of Animal Health and Husbandry, Audu Bako College of Agriculture, Dambatta, Kano State, Nigeria, Dambatta and obtained B.Sc. in Animal Science from University of Maiduguri, Borno State, Nigeria and M.Sc. in Animal Breeding and Genetics from Ahmadu Bello University, Zaria, Kaduna State, Nigeria

Professor Isaac Adetunji Adeyinka

Professor of Animal Breeding and Genetics, Head, Data Processing Unit and Coordinator, Computer and Internet Facilities, National Animal Production Research Institute (NAPRI), Ahmadu Bello University, Zaria, Kaduna State, Nigeria

Dr. Muhammad Kabir

Associate professor of Animal Breeding and Genetics and Head, Department of Animal Science, Ahmadu Bello University, Zaria, Kaduna State, Nigeria

Dr. Aisha Balarabe Muhammad

DVM., Lecturer III, Department of Animal Health and Husbandry, Audu Bako College of Agriculture, Dambatta, Kano State, Nigeria

Ibrahim Sani

Nasir Mu'azu Galadima

B. Agric. Hons., M.Sc. Animal Science (in-view), Lecturer III, Department of Animal Health and Husbandry, Audu Bako College of Agriculture, Dambatta, Kano State, Nigeria

Dr. Junaidu Yakubu Muhammad

DVM., M.Sc. Biostatistics and epidemiology, Lecturer II, Department of Animal Health and Husbandry, Audu Bako College of Agriculture, Dambatta, Kano State, Nigeria

Abstract: The objective of the study was to evaluate some growth performance traits of Marshall, Ross and NAPRI-X strains of broiler chickens in the semi-arid zone of Nigeria. The study used 315 strains that were brooded with the aid of kerosene stove 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 up to 4 weeks of age. Thereafter, the birds were given broiler finisher diet containing 19.95% CP and 3,102.00 MEKcal/kg up to 8 weeks based on the standard of National Research Council (NRC, 2004). The experiment was conducted in a Complete Randomized Design (CRD). Treatments were replicated seven times with fifteen birds per pen. Daily feed intake and body weight of the birds were measured on daily and weekly basis respectively. Feed conversion ratio was calculated as feed intake divided by weight gain in grams and phenotypic correlation coefficients of each strain of broiler was also calculated. The data collected on each strain were subjected to General Linear Model (GLM) and Pearson Moment Product Correlation. The results show that a highly significant ($p < 0.001$) differences were observed among the three strains of broilers in the initial body weight (IBW) at 4 weeks and at the final body weight (FBW) at 8 weeks of age. Marshall broiler was heavier at 4 weeks of age compared to NAPRI-X and Ross whereas at 8 weeks of age, Marshall attained an average body weight of 1,870.69g which was higher than NAPRI-X and Ross (1,530.58 and 1,588.69g) respectively. The implication is that Marshall Strain has high genetic potentials than Napri-X and Ross respectively. However, the correlations among growth traits revealed positive and perfect correlations between final body weight (FBW), daily weight gain (DWG), total weight gain (TWG), daily feed intake (DFI) and total feed intake (TFI) in all the three strains at 4 weeks of age. At 8 weeks of age, positive and highly significant ($p < 0.01$) correlations were observed between initial body weight (IBW) and final body weight (FBW) in Ross strain and also between final body weight (FBW), daily weight gain (DWG) and total weight gain (TWG) in all the three strains as well as between daily feed intake (DFI) and total feed intake (TFI) in NAPRI-X and Marshall strains. Therefore, it is concluded that with regular feed intake Marshall will reach its maximum performance than all other strains and therefore was superior for growth performance traits at 4 and 8 weeks of age followed by NAPRI-X and Ross strains. It is therefore, recommended that for high profitability, poultry farmers should consider Marshall than the other strains. Also further study should be carried out to map the genes that make Marshall the best strain in growth traits.

Keywords: Strains, NAPRI-X, Marshall, Ross, Performance, feed intake.

I. INTRODUCTION

The contribution of poultry to animal protein supply cannot be overemphasized (Ahmed 2014). FAO (2008)

estimated the world poultry population as 137, 679, 000, out of this number, 115, 880, 864 representing 84% is backyard poultry, while 21, 798,079 representing 16% is exotic poultry. Poultry contributes immensely as major source of animal

protein for human consumption in Nigeria, as they contributed about 10% of the total national livestock production (Ojedapo *et al.*, 2010).

There has been a rapid increase in the number of farmers owning broiler parent and grandparent stocks leading to an increase in the population of meat type chicken in Nigeria (Adebambo *et al.*, 2005). These farms hatch and sell strains of broilers using different brand names. The broiler parents are usually imported from the temperate region of the world. The performance of these birds is influenced by genotype and environment. The use of unsuitable genotype in hot regions results in decreased growth rate, reduced protein gain and high mortality (Yalcin *et al.*, 1997). The implication is that broiler farmers should select the strains that are adaptable to the Nigerian environment with good performance. Improvement in health, nutrition and environmental management has also contributed to improved performance, but the majority of the changes have been attributed to genetic improvement (McKay 2009). However, Havenstein *et al.* (2003a, b) estimated that at least 85% of the improvement in performance is attributed to genetic changes, while Yakubu and Salako (2009) argued that growth is a complex and dynamic physiological process that exists from conception until maturity. Growth in any organism is a result of the genetic potential of the individual and genetic x environment interaction (Kor *et al.*, 2006). The objective of this study was to assess the performance characteristics of three strains of broilers.

II. MATERIALS AND METHODS

The experiment was conducted at the poultry unit of teaching and research farm, Department of Animal Health and Husbandry, Audu Bako College of Agriculture, Dambatta (ABCOAD). ABCOAD is located between latitude 12° 20.260' North and longitude 8° 31.567' East. The College possesses a tropical climate with annual rainfall of 600mm which lasts for four months (between June and October) and the mean annual temperature is 38°C with highest temperature occurring in April to May (41°C) and lowest in January to February (30°C) (Abdulrashid *et al.*, 2011). The relative humidity ranges from 22 to 52% as recorded by KNARDA, (2011).

The experiment lasted for 8 weeks and a total of 315 day old broiler strains, comprising 105 each of NAPRI-X, Marshall and Ross were used in the study. The NAPRI-X strain was purchased from National Animal Production Research Institute (NAPRI) whereas Marshall and Ross strains were procured from Obasanjo farms in Abeokuta, Ogun State. Each strain was identified by wing tag, randomized and allotted to pens in a brooder house with floor covered using wood shavings which was kept dry throughout the experimental period by replacing the litter regularly conforming to standard management procedures as described by (Oluyemi and Roberts 1979). The birds 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 up to 4 weeks of age. Thereafter the birds were

given broiler finisher diet containing 19.95% CP and 3,102.00 MEKcal/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 and when due. The experiment was conducted in a Completely Randomized Design (CRD). Treatments were replicated seven times with fifteen birds per pen. The body weight of the birds was measured weekly. Feed intake was taken on daily basis. Feed conversion ratio was calculated as feed intake divided by weight gain. The data on growth traits collected on each strain were subjected to General Linear Model (GLM) procedure of analysis of variance using Statistical package for social science SPSS (2011) version 20. Means were separated using Duncan multiple range test procedure (Duncan, 1955) of the same package. The coefficient of relationship between growth performance traits in each of the strain was assessed using Pearson Moment Correlation of Statistical Package for Social Sciences SPSS (2011) version 20. The following statistical model was used in the analysis:

$$Y_{ij} = \mu + C_i + e_{ij}$$

Where, Y_{ij} = Observation (body weight, feed intake, feed conversion ration) made on the j^{th} individual belonging to the i^{th} strain of broilers

μ = Overall estimate of the population mean

C_i = the effect of i^{th} strain of broiler ($i=1, 2$ and 3)

e_{ij} = Random error associated with each measurement

III. RESULTS

Table 1 presents the mean performance values for the three strains of broiler chicken.

A very highly significant ($p<0.001$) differences were observed among the three strains of broilers in the initial body weight at 4 weeks and at the final body weight at 8 weeks of age. Marshall broiler was heavier at 4 weeks of age compared to NAPRI-X and Ross. At 8 weeks of age, Marshall attained an average body weight of 1870.69g which was higher than NAPRI-X and Rose (1530.58 and 1588.69g) respectively.

Table 4.1.2 presents the correlated relationship between growth performance of NAPRI-X, Marshall and Ross strains at 4 weeks of age. The results demonstrate that positive and perfect correlations were found between FBW, DWG and TWG ($r = 1.00$; $P<0.01$) in NAPRI-X, Marshall and Ross strains, indicating that DWG is a function of TWG; with higher DWG leading to higher FWG. Similarly, negative and highly significant correlations of FBW and FCR were observed ($r = -0.91$; $P<0.01$) and ($r = -0.85$; $P<0.05$) in Marshall and Ross strains, respectively; indicating that as FBW increases, FCR decreases, portraying inverse relationships. Moreover, positive and perfect correlation was found between DWG and TWG ($r = 1.00$; $P<0.01$) in all the three strains, depicting that DWG contributes substantially to TWG. In addition, negative and highly significant correlations were observed between DWG and FCR ($r = -0.92$; $P<0.01$) and ($r = -0.86$; $P < 0.05$) as well as between TWG and FCR ($r = -0.92$; $P<0.01$) and ($r = -0.86$; $P < 0.05$) in Marshall and Ross strains, portraying that as DWG and TWG increase, the better the FCR becomes.

In another relationship, DFI and TFI were positive and perfectly correlated ($r = 1.00, P < 0.01$) in the three strains, demonstrating that TFI is a function of the DFI. Similarly, strong positive and highly significant correlations were observed between DFI and FCR ($r = .77, P < 0.05$) and ($r = 0.76; P < 0.05$) in NAPRI-X and Ross strains respectively, indicating that DFI influences FCR in the strains. Moreover, strong positive and highly significant correlations were also observed between TFI and FCR ($r = 0.77, P < 0.05$) and ($r = 0.76, P < 0.05$) in NAPRI-X and Ross strains, indicating that the TFI influences FCR in the strains.

Traits	Treatments				LOS
	NAPRI-X	Marshall	Rose	SEM	
Initial Body Weight at 4 weeks (g)	446.28 ^b	548.01 ^a	472.13 ^b	12.26	***
Final Body Weight at 8 weeks (g)	1530.58 ^b	1870.69 ^a	1588.69 ^b	45.87	**
Daily Weight Gain (g/bird)	38.72 ^b	47.24 ^a	39.88 ^b	1.25	**
Total Weight Gain (g/bird)	1084.29 ^b	1322.69 ^a	1116.56 ^b	35.07	**
Daily Feed Intake (g/bird)	109.96 ^c	125.85 ^a	116.86 ^b	1.91	***
Total Feed Intake (g/bird)	3078.92 ^b	3523.67 ^a	3229.18 ^b	52.35	***
Feed Conversion Ratio	2.89	2.67	3.01	0.08	NS
Mortality (%)	3.00	2.57	2.86	0.24	NS

(g) = grams, LOS = Level of significance, SEM = Standard error of mean, *** = very highly significant ($P < 0.001$), ** = highly significant ($p < 0.01$), NS = Not significant.

Table 1: Mean performance values for three broiler chicken

Traits	IBW	FBW	DWG	TWG	DFI	TFI	FCR
NAPRI-X							
FBW	0.19	-					
DWG	0.18	1.00**	-				
TWG	0.18	1.00**	1.00**	-			
DFI	-0.26	-0.09	-0.08	-0.08	-		
TFI	-0.26	-0.09	-0.08	-0.08	1.00**	-	
FCR	-0.27	-0.70	-0.69	-0.69	0.77*	0.77*	-
MTLY	0.53	-0.04	-0.04	-0.04	-0.19	-0.19	-0.11
MARSHALL							
FBW	0.68	-					
DWG	0.67	1.00**	-				
TWG	0.68	1.00**	1.00**	-			
DFI	0.26	0.24	0.24	0.24	-		
TFI	0.26	0.24	0.24	0.24	1.00**	-	
FCR	-0.56	-0.91**	-0.92**	-0.92**	0.77	0.17	-
MTLY	-0.14	0.26	0.26	0.26	0.12	0.12	-0.26
ROSS							
FBW	0.42	-					
DWG	0.41	1.00**	-				
TWG	0.41	1.00**	1.00**	-			
DFI	0.15	-0.31	-0.31	-0.31	-		
TFI	0.15	-0.31	-0.31	-0.31	1.00**	-	
FCR	-0.23	-0.85*	-0.86*	-0.86*	0.76*	0.76*	-
MTLY	0.39	0.01	0.00	0.00	-0.03	-0.03	0.00

IBW = Initial body weight, FBW = Final body weight, DWG = Daily weight gain, TWG = Total weight gain, DFI = Daily feed intake, TFI = Total feed intake, FCR = Feed conversion ratio, MTLY = Mortality, * = significant ($P < 0.05$), ** = highly significant ($P < 0.01$), (g) = grams

Table 2: Correlated relationship between growth performance (g) of NAPRI-X, Marshall and Ross broiler strains at 4 weeks of age

IV. DISCUSSION

The findings indicated that the strains significantly differ in initial body weight at 4 and 8 weeks respectively. The study is consistent with findings of Akanno *et al.* (2007) who recorded varying average body weights of 1, 610.00, 1, 758.21 and 1, 468.21 g at 8 weeks of age for Anak, Arbor Acre and

Ross broilers respectively. The study reveals that when strains are subjected to the standard conditions, there is every tendency to have varying weights being that the birds have different characters.

The findings involving total weight gain and total feed intake, demonstrated that Marshall Strain was superior to the other strains. Body weight gain at 8 weeks of age were similar among NAPRI-X and Ross but significantly ($p > 0.01$) lower than the values for Marshall. This implies that Marshall Broiler has greater genetic potential for growth compared with NAPRI-X and Ross. Total feed intake (g/bird) was similar in NAPRI-X and Ross but higher in Marshall indicating that Marshall consumed more feed than NAPRI-X and Ross strains.

The reports are inconsistent with findings of Amao *et al.* (2011) who indicated that average daily feed intake and weight gain were significantly ($p < 0.05$) higher in Ross than Anak and Marshall strains in the derived savanna environment. This could be due to environmental differences.

On the other hand, no significant ($P > 0.05$) difference was found in feed conversion ratio and mortality among the strains. Ross broilers were the poorest feed converters as they consumed more feed and gained less weight when compared with Marshall Strains even though there were no significant ($p > 0.001$) differences in feed conversion ratio among the three strains. This is contrary to the report of Amao *et al.* (2011) who stated that better ($p < 0.05$) feed conversion ratio was observed in Ross than in Anak and Marshall Strains. On the other hand, NAPRI-X recorded the highest mortality, followed by Ross and Marshall strains, even though they did not differ significantly ($p > 0.001$). The findings are similar to the report of Iqbal, *et al.* (2012) who stated that mortality in Hubbard strain was very low as compared to Arbor Acres and Ross 308. He further however reported that the differences were not significant ($p > 0.05$).

The high positive and non significant ($P > 0.05$) correlations between various traits observed in this work was synonymous with the report of Ogah (2011) who recorded negative highly and non significant ($P > 0.05$) correlations between keel length (KL) and chest circumference (CC) ($r = -0.72; p > 0.05$), wing length (WN) and chest circumference (CC) ($r = -0.52; P > 0.05$), neck length (NL) and chest circumference (CC) ($r = -0.54; P > 0.05$), keel length (KL) and neck length (NL) ($r = -0.43; P > 0.05$) in male and female turkeys. The findings show that FBW was positively and perfectly correlated with DWG and TWG in the three strains. The finding is similar to the report of Amao *et al.* (2011), who discovered that body weight is positively and significantly correlated to DWG. In the same vein, Amao *et al.* (2011) reported that daily gain, feed intake and feed conversion ratio showed high, significant ($P < 0.01$) and positively correlated against body weight. However, negative and significant ($P < 0.05$) correlations were obtained between FBW and FCR in Marshall and Ross strains, respectively, indicating inverse relationship that as FBW increases FCR decreases. The findings is contrary to the report of Amao *et al.* (2011) who recorded that body weight was high, significant ($P < 0.01$) and positively correlated with feed conversion ratio in Ross, Anak and Marshall strains.

Similarly, DWG and TWG were positively and perfectly ($P < 0.01$) correlated in NAPRI-X, Ross and Marshall strains. This is consistent with the findings of Amao *et al.*, (2011) who reported highly, significant ($P < 0.01$) and positive correlations between body weight and daily gain, feed intake and feed conversion ratio (FCR). In addition, high, negative and significant ($P < 0.01 - 0.05$) correlation was observed between DWG and FCR in Marshall and Ross strains, respectively. The finding is contrary to the findings of Ajayi and Ayorinde (2000) who revealed that phenotypic correlations coefficient were very high for feed conversion ratio over other growth traits measured. Moreover, the correlation of TWG and FCR was high, negative and significantly ($P > 0.01$) and ($P > 0.05$) correlated in Marshall and Ross strain respectively.

However, positive and perfect correlation between DFI and TFI was observed in NAPRI-X, Marshall and Ross strains. Beside that, a high, positive and significant ($P < 0.05$) correlation was observed between DFI and FCR respectively in NAPRI-X and Ross strains. This was contrary to the report of Amao *et al.* (2011) who reported that FCR against FI were positively and significantly highly correlated. In the same vein, significant ($P < 0.05$) correlations was found between TFI and FCR respectively in NAPRI-X and Marshall strains. The findings is consistent with the results of Amao *et al.* (2011) who reported feed intake against daily gain and feed conversion ratio were high ($P < 0.01$) and positively correlated.

V. CONCLUSION

The three strains used for this study showed significant variations for growth, conformation and morphological traits and thus these traits can be used as basis for selection to develop direct lines for (rapid growth and or early maturing) these traits and other correlated traits. The correlations observed ranges from low to high positive and negative among the three strains at 4 and 8 weeks of age which is an indication of pleiotropic effect, reflecting the effect of some set of genes for the traits. It is therefore, recommended that traits that were significantly correlated (IBW, FBW, DWG, TWG, DFI, TFI, FCR, NEL, BKL, THL, BDL, WNL, SHL, CBL, CBW, OCL, OCW, BEL, CBW, ELL, ELW) should be given priority in selection due to their high tendency of influencing body weight of the strains as they may likely tend to have more economic value.

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