GROWTH PERFORMANCE AND PHENOTYPIC CORRELATIONS OF ARBOR ACRES PLUS AND MARSHALL CHICKEN STRAINS REARED IN NASARAWA STATE

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ABSTRACT
A study was conducted to determine the growth performance and phenotypic correlations between body weight and linear body traits of Arbor Acres Plus and Marshall chicken strains. The birds were reared under two management systems (without access or with access to pasture) in Nasarawa State, Nigeria in an 8-week trial. A total of two hundred (200) day-old chicks (DOC) comprising equal number of Arbor Acres Plus (Amo Brand) (100) and Marshall broilers (100) were used for the experiment. Arbor Acres Plus was sourced from Amo Farms, Awe, Oyo State, while Marshall Strain was purchased at Zartech Farm, Ibadan, Nigeria. One hundred (100) randomly selected birds were kept indoors without access to pasture while 100 birds were kept indoors but had access to pasture (Mucuna pruriens). A 2x2 factorial experiment in a completely randomized design (CRD) was adopted. Each treatment group was replicated two times. There were 25 birds per replicate. The birds were randomly allocated to the experimental pens in a completely randomized design based on their strain and housing condition. Analysis of variance (ANOVA) procedure was used to analyse the data on growth traits and linear body parameters using SPSS (2020) analytical package.. Results obtained showed that positive and significant phenotypic correlations were observed between linear body traits and body weight of Arbor Acres and Marshall studied, which indicates that an improvement in one trait could lead to a simultaneous improvement in the other provided the environmental factors are negligible. Body weight (BW) and Linear body measurements (body length, wing length, drumstick length, breast width, shank length, keel length and neck length) had a significant increase as age (weeks) increased for the Arbor Acres and Marshall Chicken respectively. Final body weights for Arbor Acres (1750) and Marshall Chicken (1895) differed significantly (P<0.05) across the weeks. Positive phenotypic correlations of body weight and linear body traits ranged from 0.437 – 0.960 (week 4, 8) and for Arbor Acres broiler strain and 0.532 – 0.951 (week 4, 8).
Keywords: Growth Performance, Phenotypic, Correlation, Arbor Acres, Marshall

INTRODUCTION
In the tropics, poultry production possesses the quickest potential to bridge the protein supply-demand gap (Yakubu *et al*., 2010) and plays a formidable role in employment generation and as a source of revenue to both farmers and government. The modern commercial lines of broiler chickens have become more demanding in terms of housing, feeding, and handling conditions. This is due to the very rapid weight gains and very good feed conversion per kilogram weight gain (Sanchez-Casanova *et al*., 2021). Recently, Nigeria has witnessed an upsurge in the population of meat type chickens arising from increased numbers of poultry farmers now owing broiler parent and grandparent stocks. These broiler strains are sold using various brand names. The parent stocks are imported strains from the temperate regions of the world. The performance of these birds is thus, influenced by genotype x environment interactions. The implication is that farmers need to select the strains that are adaptable to the Nigeria environment with good performance (Udeh *et al*., 2011). Correlation coefficients are useful in animal breeding as a means of predicting potential response to, or progress from selection (Ige, 2013). According to Assan (2015), positive genetic and phenotypic correlations indicate that improvement in body measurements both at the genetic and phenotypic levels is expected through selection. Correlation of traits in domestic poultry is high. Many characters in different strains of poultry are found to associate with one another such that the improvement of one may lead to the improvement or otherwise of the other (Ilori *et al*., 2010). This means that improvement in the body measurements will invariably lead

to a corresponding improvement in the body weight of the indigenous poultry specie especially if the correlation is positive as was observed by Ojedapo and Amao (2015). There is limited information on

Phenotypic correlations and growth performance of Arbor acres plus and Marshall chicken strains reared in Nasarawa State, hence the need for this study.

MATERIALS AND METHODS

Location of Study

The experiment was carried out at the Livestock Unit of the Teaching and Research Farm of the Faculty of Agriculture, Shabu-Lafia Campus, Nasarawa State University, Keffi (NSUK), Nasarawa State, North Central Nigeria. The Farm is located within the Nasarawa South agro-ecological zone of the State. The geographical coordinates of the Farm are 8 29' 30" North, 8 31' 0" East, respectively. In the Guinee Savanna zone of North central. It is found in latitude 08 – 33 E. The mean monthly minimum and maximum temperatures are 20.16oC and 35.06oC respectively while the mean monthly relative humidity and rainfall are 74.7% and 168-190mm respectively between July and September (NIMET, 2021).

Management of Experimental Birds

A total of two hundred (200) day-old chicks (DOC) comprising equal number of Arbor Acres Plus (Amo Brand) (100) and Marshall broilers (100) were used for the experiment. While Arbor Acres Plus was sourced from Amo Farms, Awe, Oyo State, Marshall Strain was purchased at Zartech Farm, Ibadan, Nigeria. One hundred (100) randomly selected birds were kept indoors without access to pasture while 100 birds were kept indoor but had access to pasture (Mucuna pruriens). Housing was in two forms: A standard poultry house without a run and standard poultry house with a run area. A 2x2 factorial experiment in a completely randomized design (CRD) was adopted. Each treatment group was replicated two times. There were 25 birds per replicate. The birds were randomly allocated to the experimental pens (14.3 birds/m2) in a completely randomized design based on their strain and housing condition.

All the birds in each system of housing were tagged individually and assigned an identification number. The initial weight of each bird that was housed on deep litter was taken. From day-old to 4 weeks of age, the birds were raised on starter ration (22.00% crude protein, 2,800 kcal/ kgME, 8.50% fat, 5.00% crude fiber, 1.20% calcium, and 0.45% phosphorus). From weeks 4 to 8 weeks, the birds were fed commercial broiler finisher ration, (20.00% crude protein, 2,900 kcal/kg ME, 8.60% fat, 5.40% crude fiber, 1.20% calcium, and 0.41% phosphorus). However, from week 5 to week 8, birds in the standard poultry house with a run had access to pasture. Routine vaccination and other management practices were strictly adhered to. There was also administration of antibiotics, vitamins and coccidiostat (Amprolium) in the drinking water when appropriate. Standard biosecurity measures were also strictly taken. The trial lasted eight (8) weeks.

Parameters Measured

Body weight (BWT), Average daily feed intake (ADFI), Brooding mortality (BM), Body length (BDL), Shank length (SL), Keel length (KL), Wing length (WL), Breast width (BW), Drumstick length (DL) and Neck Length (NL). All parameters except BWT were measured weekly using a tailor's tape calibrated in cm. Phenotypic correlations between body weight and each of the linear body traits were determined for the different phenotypic classes using Pearson's Product-Moment Correlation Coefficient (r) as described by Snedecor and Cochran (1980).

Statistical Analysis

Analysis of variance (ANOVA) procedure was used to analyse the data on growth traits and linear body parameters using SPSS (2020) analytical package. Duncan's new multiple range test (Duncan, 1955) was used to compare significant means of the two strains.

RESULTS AND DISCUSSION

Body weight (g) of the Arbor Acres and Marshall Broilers Strain at age 2 to 8 weeks

The body weight (g) of the Arbor Acres and Marshall at age 2 to 8 weeks is indicated in Table 1. There were no significant ($P>0.05$) differences in weeks 2, 4 and 6 among the Arbor Acres and Marshall. However, significant ($P<0.05$) differences were observed at week 8 with the Marshall strain having better performance than their Arbor Acres counterparts. The significant increase in the mean

body weight of Arbor Acres and Marshall Broiler strains suggests that the broiler strain studied may have potentials for fast growth. This increase in body weight as age increased was probably due to high genetic potentials for growth in the progeny as they attain sexual maturity age (Peters *et al.,* 2007). The

significant differences observed in growth rate of Arbor Acre and Marshall Strain in this study implied that the strains have different genetic potentials for growth. Body weight ranged from 488 – 1750g and 495 – 1895g for Arbor Acre and Marshall Strain, respectively. This affirms the report of Turner (2005) that broiler chickens attain market weight of 1300 to 2000 g at 8 weeks of age. In line with the present finding, Taha *et al*. (2010) reported that broiler strains differed in growth rate and weight gain at different ages.

Table 1. Body weight (g) of the Arbor Acres and Marshall Strain at age 2 to 8 weeks

Weeks	Arbo Acres	Marshall
2	488 (21.08)	495(23.41)
4	954 (23.11)[a]	980 (28.05)[a]
6	1200 (31.20)[a]	1250 (40.11)[a]
8	1750 (56.33)[b]	1895 (58.32)[a]

[ab] means in the same row with different superscripts are significantly different (P<0.05).
*S.E.M in Parenthesis.

The phenotypic correlations of growth traits of Arbor Acres strain are shown in Table 2. There were positive and significant correlations in both weeks 4 and 8 among the growth traits measured. The result is similar to the findings of Obike *et al.* (2016b) who reported significant (P<0.05; P<0.01) and positive phenotypic correlations of body weight and linear traits which ranged from 0.515 – 0.778 (week 6) and 0.770 – 0.981 (week 8) for Anak broiler strain. Similarly, Ali *et al*. (2003) and Oyetade (2011) reported significant (P<0.05, 0.01) positive phenotypic correlations between body weight and linear body measurements at various ages of purebred and crossbred broiler chicken in their study which is also in line with results obtained in this study. Therefore, positive and significant phenotypic relationships between linear body parameters and body weight indicates that an improvement in one trait could lead to a concomitant improvement in the other, if environmental factors are negligible.

Table 2: Phenotypic correlations of growth traits of Arbor Acres strain.

	BW	BL	WL	BRW	DS	SL	KL	NL
WK 4								
BW	1							
BL	0.716**	1						
WL	0.833**	0.437**	1					
BRW	0.805**	0.739**	0.636**	1				
DS	0.624**	0.764**	0.557**	0.673**	1			
SL	0.514**	0.659**	0.644**	0.750**	0.651**	1		
KL	0.808**	0.690**	0.650**	0.464*	0.449*	0.781**	1	
NL	0.712**	0.748**	0.456**	0.633**	0.567*	0.475*	0.658**	1
WK 8								
BW	1							
BL	0.844**	1						
WL	0.633**	0.516*	1					
BRW	0.824**	0.901**	0.723**	1				
DS	0.939**	0.928**	0.765**	0.911**	1			
SL	0.877**	0.724**	0.614**	0.805**	0.741**	1		
KL	0.851**	0.831**	0.732**	0.430*	0.911**	0.622*	1	
NL	0.828**	0.960**	0.720**	0.915**	0.636*	0.734**	0.844**	1

*= correlation is significant at the 0.05 level i.e P<0.05; **=P<0.01, BW= body weight, SL = shank length, NL = neck length, BRW = Breast width, BL = body length, KL = keel length, WL = wing length and DS = drum stick.

Phenotypic correlations of Growth Traits of Marshall

The phenotypic correlations of Growth Traits of Marshall is presented in Table 3. There were positive and significant correlations in both weeks 4 and 8 among the growth traits measured.BW (0.889, WL 0.753, BRW 0.860, DS 0.749, SL 0.853, KL 0.913,NL 0.811) while at week 8, BW had correlation

with BW (1BW 1, BL 0.819, WL 0.653, BRW 0.811,NL 0.817, DS 0.901, SL 0.840, KL 0.884) The result is similar to the findings of Obike *et al.* (2016b) who reported significant (P<0.05; P<0.01) and positive phenotypic correlations of body weight and linear traits which ranged from 0.515 – 0.778 (week 6) and 0.770 – 0.981 (week 8) for Anak broiler strain. Ojedapo and Amao (2015) also reported significant (P<0.05) positive correlations between body weight and body length, breast girth and drumstick with high correlation values of 0.69-0.93 on three phenotypes of Exotic turkey in the first and second weeks of age. Similarly, Ali *et al*. (2003) and Oyetade (2011) reported significant (P<0.05, 0.01) positive phenotypic correlations between body weight and linear body measurements at various ages of purebred and crossbred broiler chicken in their study which is also in line with results obtained in this study.

Table 3: Phenotypic correlations of growth traits of Marshall strain

	BW	BL	WL	BRW	DS	SL	KL	NL
WK 4								
BW	1							
BL	0.889**	1						
WL	0.753**	0.728**	1					
BRW	0.860**	0.922**	0.758**	1				
DS	0.749**	0.945**	0.711	0.901**	1			
SL	0.853**	0.937	0.687**	0.841**	0.737**	1		
KL	0.913**	0.654**	0.647**	0.358*	0.950**	0.532*	1	
NL	0.811**	0.943**	0.723**	0.932**	0.577*	0.951**	0.841**	1
WK 8								
BW	1							
BL	0.819**	1						
WL	0.653**	0.669**	1					
BRW	0.811**	0.942**	0.763**	1				
DS	0.901**	0.932**	0.779**	0.921**	1			
SL	0.840**	0.789**	0.601**	0.831**	0.792**	1		
KL	0.884**	0.847**	0.763**	0.368*	0.968**	0.678*	1	
NL	0.817**	0.935**	0.717**	0.942**	0.633*	0.774**	0.893**	1

*= correlation is significant at the 0.05 level i.e P<0.05; **=P<0.01, BW= body weight, SL = shank length, NL = neck length, BRW = Breast width, BL = body length, KL = keel length, WL = wing length and DS = drum stick.

CONCLUSION AND RECOMMENDATION

Positive and significant phenotypic correlations were observed between linear body parameters and body weight of Arbor Acres and Marshall Broiler Chicken Strain studied, which indicates that an improvement in one trait could lead to a simultaneous improvement in the other, if environmental factors are negligible. Body weight (BW) and Linear body measurements (body length, wing length, drumstick length, breast width, shank length, keel length and neck length) had a significant increase as age (weeks) increased for the Arbor Acres and Marshall Broiler chicken Strain studied. Final body weights for Arbor Acres strain (1750g) and Marshall strain (1895g) differed significantly (P<0.05) across the weeks.

It is recommended that further studies should be carried out to ascertain the genotypic correlation between the two strains in other have more information available.

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