



## DETERMINATION OF THE RELATIONSHIP AMONG BODY WEIGHT AND BODY CONFORMATION TRAITS OF TWO BROILER STRAINS IN THE NORTHERN GUINEA SAVANNA

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### ABSTRACT

The aim of this study was to determine the body weight and conformation traits and their correlations of two broiler strains in the northern guinea savanna. Two hundred broiler strains comprising of 100 Arboracre and 100 Hubbard strains were used to evaluate body weight and body conformation from day old to 8 weeks of age and their correlation. Body weight and body conformation (morphometric) traits (shank length, breast width, back length, neck, thigh length and keel length) were taken on weekly basis. Results obtained shows that Hubbard broiler strain had body weight of  $0.298 \pm 0.0287$ ,  $1.0083 \pm 0.0123$ ,  $2.063 \pm 0.0219$  and  $3.079 \pm 0.02$  kg while Arboracre strain had body weight of  $0.2603 \pm 0.0587$ ,  $0.8125 \pm 0.0185$ ,  $1.7100 \pm 0.0287$  and  $2.604 \pm 0.0219$  kg, respectively at 2, 4, 6 and 8 weeks of age. The body conformation measurements of Hubbard strain were significantly higher than that of Arboracre strain ( $p < 0.05$ ) at 8 weeks of age for all traits studied. In the Hubbard strain, the correlation coefficients were high ( $p < 0.05$ ) and positive between body weight and the morphometric traits ranging from 0.882 to 0.981. Correlation between neck length and shank length (0.970), thigh length (0.900), keel length (0.905), breast width (0.974) and back length (0.977) were also positive and high ( $p < 0.05$ ). For the Arboracre, the correlation coefficients were also high ( $p < 0.05$ ) and positive between body weight and the morphometric traits ranging from 0.861 to 0.977. Correlation between neck length and shank length (0.849), thigh length (0.847), keel length (0.821), breast width (0.922) and back length (0.939), were high and positive. This is a good indicator that body conformation can be used in selection programme for improved body weight.

**Keywords:** Arboracre, Body Conformations, Body Weight, Broiler, Correlation, Hubbard

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### INTRODUCTION

Acute shortage of meat protein is one of the major nutritional problems facing African countries. Breeders of meat type of chicken have become interested in adult body weight, the trend being towards a big bodied weight at early age in order to attract better price at market [1]. Body weight in poultry is one of the most economic traits which is influenced by genetic make-up, as well as by environmental factors [2]. Increased body weight is highly correlated with feed consumption; hence a fast-growing chicken would be a good feed converter for growth. Apart from body weight, a number of conformation traits such as shank length, back length, keel length, breast width, thigh length are known to be good indicators of body growth and market value of broiler chickens.

Genetic improvement programmes depend on access to morphometric and genetic variations. Morphometric traits are quantitative traits that describe the shape and form of an animal [3]. Phenotypic correlations may be defined as the gross observed correlations that include genetic and environmental factors. Environmental factors encompass all physical conditions that affect the animals. Phenotypic correlations are important because they directly indicate the size of selection differential expected in a population, if selection is

done. Traits with very high or high positive phenotypic correlations indicate that large correlated responses are expected with selection, while medium and weak phenotypic correlations indicate little correlated responses are expected with selection [4] for such traits.

A number of conformation traits are known to be good indicators of body growth and market value of broiler apart from body weight [5]. Poultry breeders have tried to establish the relationship that exist between body weight and body conformations such as shank length, breast width, keel length, neck length, back length and thigh length as this information reflect on the feed efficiency as well as the performance of the broiler birds. Besides, this will help the breeders to organize the breeding programme in order to achieve an optimum combination of body weights and good conformation for maximum economic return [6]. They also reported that inter relationships among body measurement can be applied speedily in the selection and breeding, especially when focused on economic traits [5]. The implication is that the broiler producer should select stock which have the genetic potential for fast growth rate and the attainment of market weight early enough under the existing climatic conditions [7]. This study was aimed at determining body weight and conformation traits and their correlations in Arboracre and Hubbard broiler strains in the northern guinea savanna.

## MATERIALS AND METHODS

The experiment was conducted at the poultry section of Department of Applied Science, Kaduna Polytechnic, Tudun Wada, Kaduna South Local Government Area, Kaduna State, Nigeria. Kaduna State is located between latitude  $10^{\circ} 60'31''N$  and longitude  $7^{\circ} 42'50''E$  [8]. The climate is tropical comprising of dry harmattan, hot humid and raining seasons. The seasons vary with cool to hot season being longer than the raining seasons [9].

### Experimental plan

A total of two hundred days old broiler chicks comprising of one hundred Hubbard and one hundred Arboracre strain used in this study were purchased from a local distributor in Kaduna town. The birds were individually weighed and wing tagged for ease of identification in subsequent body measurements. The two broiler strains were allocated to separate pens and reared on deep litter system. The birds were fed *ad libitum* with the commercial broiler starter ration containing 23% crude protein for the first five weeks of experiment. This was followed by the finisher mash containing 20% crude protein. Clean cold water was made available constantly. Routine medication and vaccination were administered at the appropriate time.

### Data collection

Body weight and linear body measurements were obtained from each bird on a weekly basis. Body weight measurements were obtained using a manual scale (Avery scale, 20 kg) calibrated in kilograms and grams. The linear body measurements taken were neck length, back length, thigh length, keel length, breast width and shank length and are taken weekly using a tape rule calibrated in centimeter. Neck length was measured from the axial skeleton, including the first neck bone after the skull and the last cervical vertebrae at the shoulder point. Back length was measured from the nadir of the curve to the base of the tail. Thigh length was measured from the hock to the hinge of the joint. Keel length was measured from the V joint of the keel bone to the end of the sternum. Breast width was measured from the left wing to the right wing by passing the tape rule under the wings and anterior to the legs while the chicken was held on its back. Shank length was measured from the hock joint to the base of the tarso metatarsus.

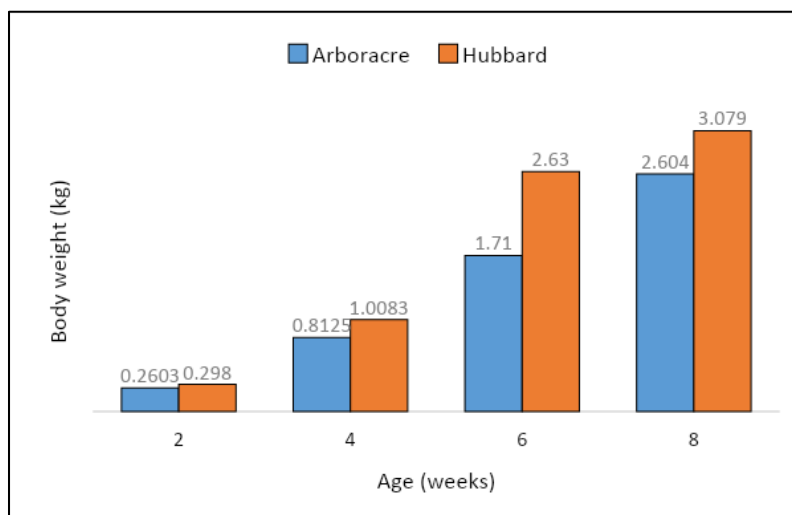
### Statistical analysis

The data collected were subjected to statistical analysis using the Statistical Package for the Social Science (SPSS) version 17.0 [20]. The independent sample test by Gusset [10] each at the 5% level of significance was used to compare the key variables of growth between the two strains. The statistical package was used to compute the means of the data

collected for the two broiler strains. Correlation between body weight and body linear measurement was determined using the independent sample test by Pearson [11].

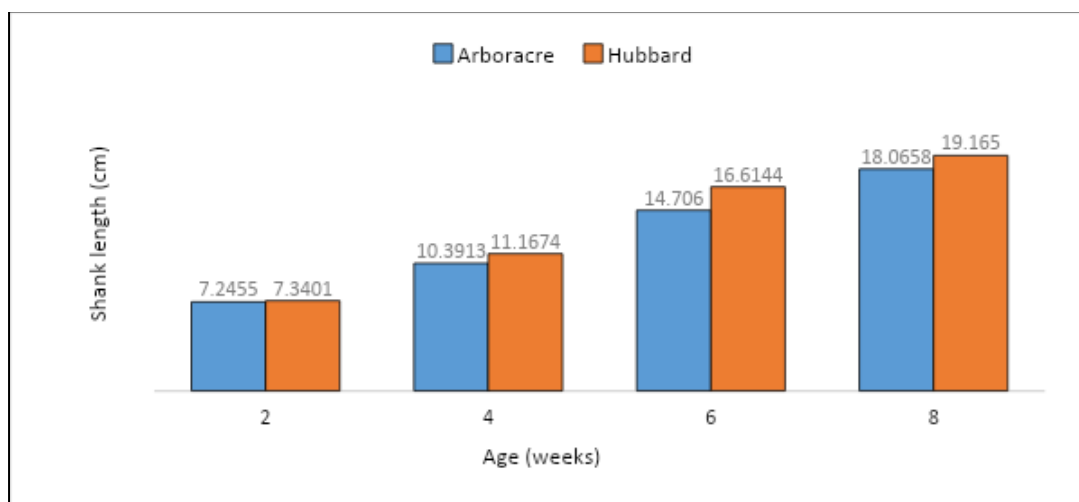
## RESULTS AND DISCUSSION

Figure 1 shows the body weight changes of Arboracre and Hubbard chickens. Hubbard broiler strain had body weight of  $0.298 \pm 0.0287$ ,  $1.0083 \pm 0.0123$ ,  $2.063 \pm 0.0219$  and  $3.079 \pm 0.02$  kg while Arboracre strain had body weight of  $0.2603 \pm 0.0587$ ,  $0.8125 \pm 0.0185$ ,  $1.7100 \pm 0.0287$  and  $2.604 \pm 0.0219$  kg, respectively all at 2, 4, 6 and 8 weeks of age. Body weight of both strains showed Hubbard birds had increased body weight of 0.038 kg, 0.196 kg, 0.920 kg and 0.475 kg respectively over Arboracre in weeks 2, 4, 6 and 8. This indicates that the Hubbard strain was growing faster than Arboracre at these ages and therefore, is early maturing than Arboracre. However increased body weight gain of Arboracre birds in the 8<sup>th</sup> week, shown by the small difference in body weights (0.475 kg), indicates the birds have started growing faster at this age indicating that they are late maturing than Hubbard broilers. The implication of this is that farmers can make their choice of these broilers based on their production goals either to go for a fast growing and early maturing strain that would attain market weight faster or go for a slower growing and late maturing strain, they can keep longer for later markets. It is true that broilers are raised to attain market weight faster at early ages of 6 weeks or 8 weeks, but it is also true from experience that there are many Nigerian consumers who prefer older broilers for consumption. These groups can therefore be catered for by rearing late maturing birds like the Arboracre strain. The mean body weights obtained from this study are higher than those reported for Lohman Brown and Anak strains at 2, 4, 6 and 8 weeks of age [7], and Ross strain at 6 weeks of age [12]. Weights obtained for Hubbard in this study are higher than  $960.68 \pm 83.49$  at 4 weeks,  $1874.20 \pm 90.24$  at 6 weeks,  $2795.38 \pm 32.32$  at 8 weeks, except  $360.05 \pm 40.35$  at 2 weeks for Cobbs or  $270.41 \pm 38.47$  at 2 weeks,  $885.35 \pm 87.32$  at 4 weeks,  $1630.60 \pm 88.82$  at 6 weeks,  $2505.12 \pm 40.49$  at 8 weeks age for Marshall reported by Amao *et al.* [13]. However, weights obtained for Arboracre fall below those of Cobb but are close to those of Marshall in all the ages. However, Okoudu *et al.* [14] and Jahan *et al.* [15], obtained higher body weights for Hubbard and Arboracre strains at 2, 4, 6 and 8 weeks of age compared to this study. This might have to do with differences in management and environment where the birds were raised. Okon *et al.* [6] reported that differences obtained in studies of this sort could be due to differences in feed composition, environmental condition or management system.

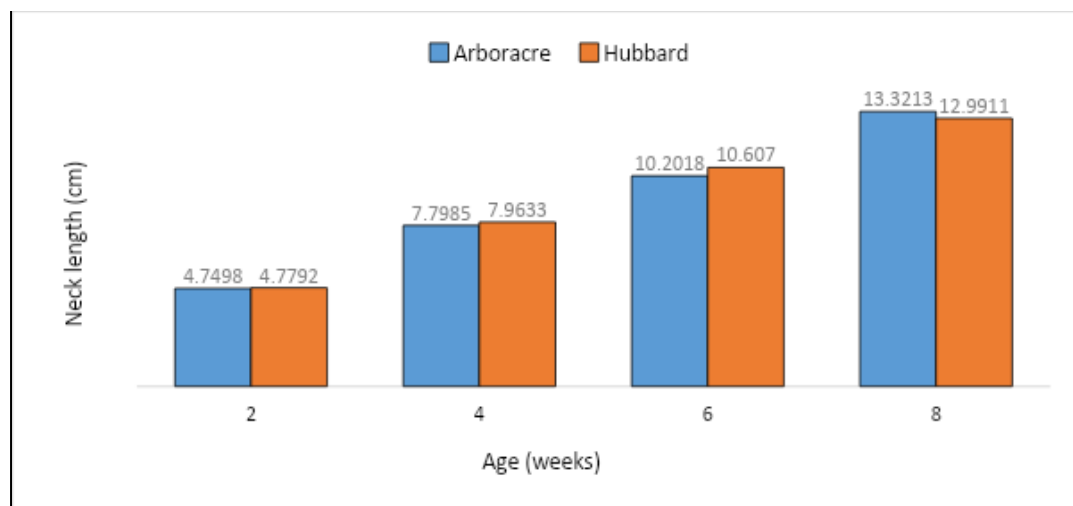


**Figure 1:** Body weight changes of Arboacre and Hubbard strains of broiler chickens.

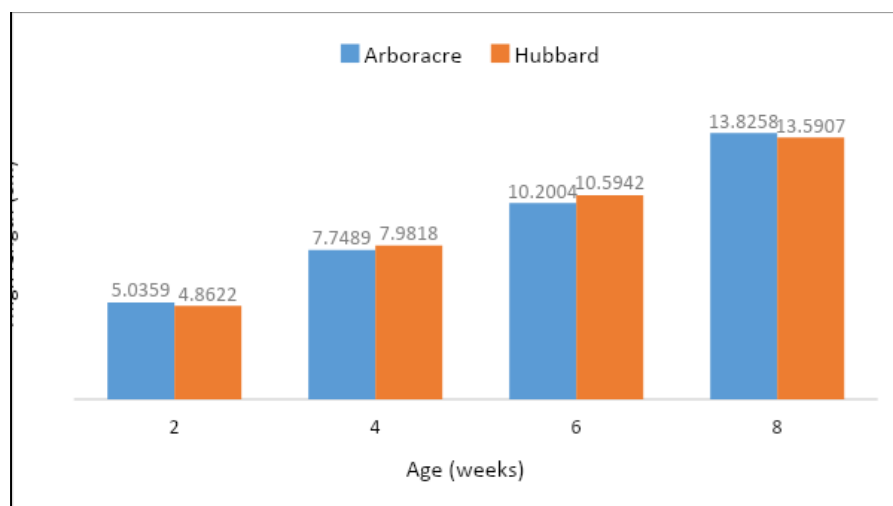
Shank length was consistently longer for Hubbard birds than Arboracre birds in all the weeks of study (Figure 2) while for neck length this trend holds true up to week 6. The trend was reversed in week 8 when Arboracre birds had longer neck than Hubbard birds (Figure 3). Figure 4 shows the thigh length while Figure 5 shows the breast width of Arboracre and Hubbard broiler birds. Thigh length was slightly longer for Arboracre in weeks 2 and 8 and longer for Hubbard birds in weeks 4 and 6 of age. For breast width, Arboracre had bigger breast width than Hubbard birds in weeks 2, 6 and 8. Figure 6 shows the keel while Figure 7 shows the back lengths of the birds. Keel and back lengths were consistently slightly lower in Arboracre than Hubbard in all the weeks.



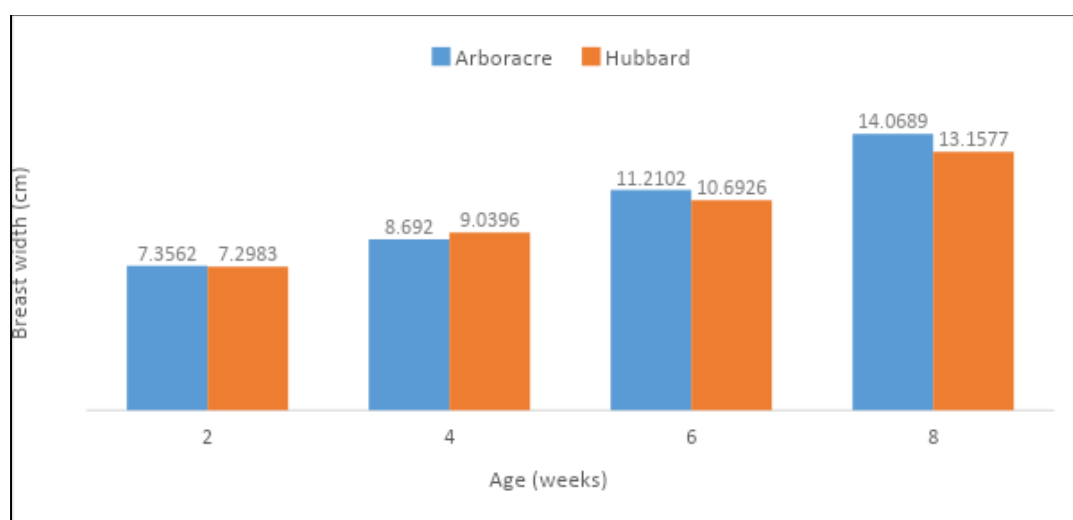
**Figure 2:** Shank length of Arboacre and Hubbard strains of broiler chickens under the same feeding and management.



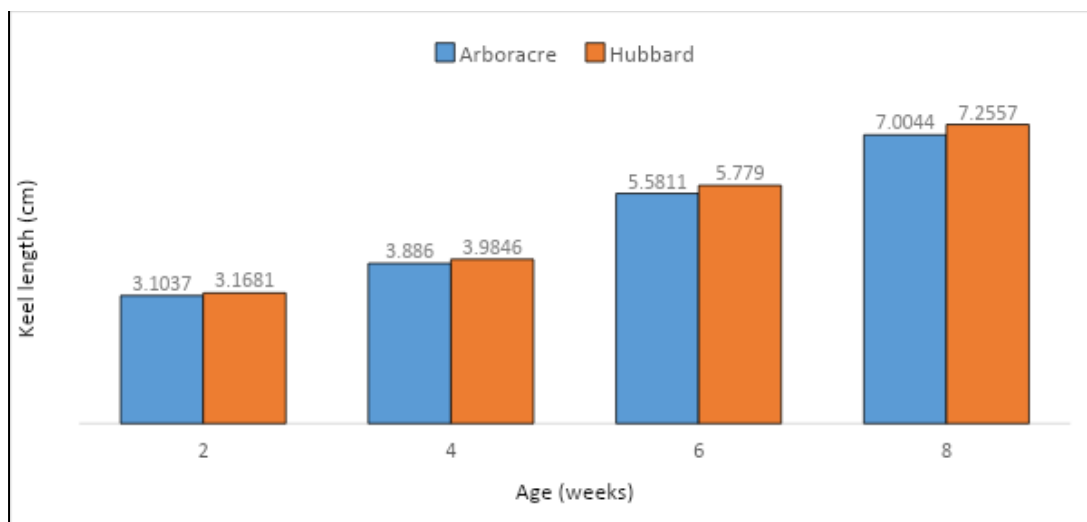
**Figure 3:** Neck length of Arboacre and Hubbard strains of broiler chickens under the same feeding and management.



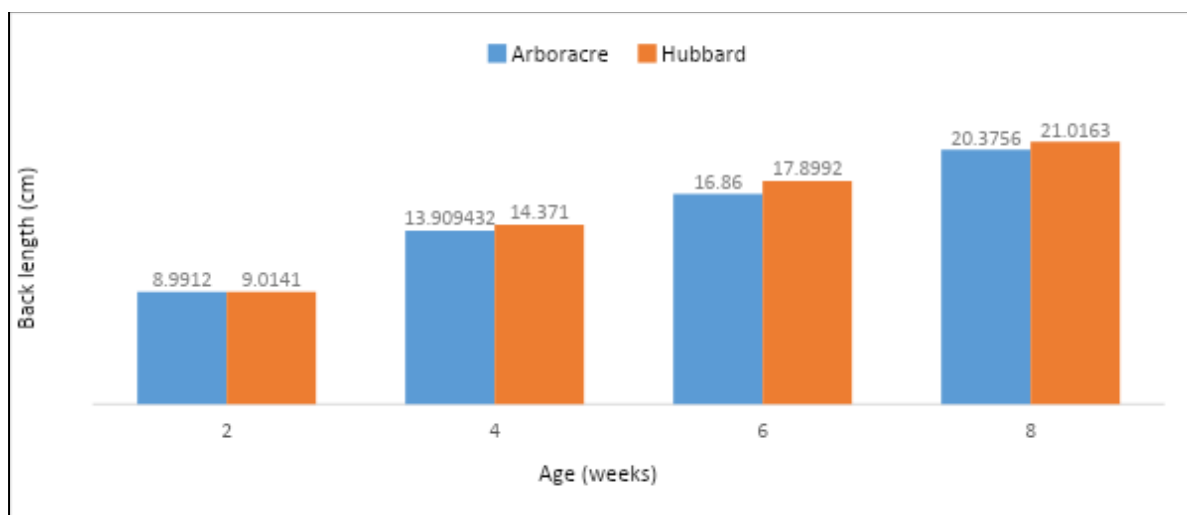
**Figure 4:** Thigh length of Arboacre and Hubbard strains of broiler chickens under the same feeding and management.



**Figure 5:** Breast width of Arboacre and Hubbard strains of broiler chickens under the same feeding and management.



**Figure 6:** Keel length of Arboacre and Hubbard strains of broiler chickens under the same feeding and management.



**Figure 7:** Back lengths of Arboacre and Hubbard strains of broiler chickens under the same feeding and management.

Correlation between body weight and morphometric traits of Hubbard strain is shown in Table 1. The correlation coefficients were high ( $p < 0.05$ ) and positive between body weight and the morphometric traits (neck length, shank length, thigh length, keel length, breast width and back length) ranging from 0.882 to 0.981. Correlation between neck length and shank length (0.970), thigh length (0.900), keel length (0.905), breast width (0.974) and back length (0.977) were also positive and high ( $p < 0.05$ ). Correlation between shank length and the other linear traits ranged from 0.873 to 0.973, while for thigh length and other morphometric traits, it ranged from 0.844 to 0.900. Similar high ( $p < 0.05$ ) positive correlations were observed between keel length, breast width and back length with other morphometric traits.

Correlation between body weight and morphometric traits of Arboracre strain is shown in Table 2. The correlation coefficients were high ( $p < 0.05$ ) and positive between body weight and the morphometric traits ranging from 0.861 to 0.977. Correlation between neck length and shank length (0.849), thigh length (0.847), keel length (0.821), breast width (0.922) and back length (0.939), were high ( $p < 0.05$ ) and positive. Correlation between shank length and the other linear traits ranged from 0.795 to 0.895, while for thigh length and other morphometric traits, it ranged from 0.780 to 0.877. Similar high ( $p < 0.05$ ) positive correlations were observed between keel length, breast width and back length with other morphometric traits. The correlations obtained in this study were higher than those obtained by Adeyinka *et al.* [8] using Anak strain and Bello [16] using Marshall Strain. This may be attributed to strain differences of the birds used. It is indeed true that strains vary in growth rate as can be seen in the difference in growth

between the Hubbard and Arboracre strains in this study.

These high correlations indicate a strong relationship exists between the traits, which therefore implies that an improvement in body weight or these morphometric measurements would highly likely result in an improvement in the other traits. Ogunshola *et al.* [17] reported that body length and height at withers were genetically high and significantly ( $p < 0.01$ ) correlated with body weight while breast girth was phenotypically high and significantly ( $p < 0.01$ ) correlated with body weight. Similarly, Udoh [4] reported similar high positive (0.539 to 0.917), phenotypic correlations between body weight and morphometric traits of rabbits. However, Henry *et al.* [18] reported low, moderate, high, negative,

positive and significant ( $p < 0.05$ ) correlation between body weight and other morphometric traits. Correlations between body weight and body length (0.35), neck length (0.53), they obtained are lower than was obtained in this study with broiler chickens. This indicates the variability in response of animals to changes in body weight. Positive correlation between traits signifies that they might be controlled by the same gene and the similarity is an indication that any of these body dimensions could serve as a predictor of body weight. Phenotypic correlations express the relationships between phenotypic values of animals, seen in their performance, because, final body weight is a reflection of the sum total of the weight of all its component parts [4].

**Table 1:** Correlation between body weight and linear body measurement of Hubbard Broiler Chicken

	Body weight	Neck length	Shank length	Thigh length	Keel length	Breast width
<b>Body weight</b>						
<b>Neck length</b>	0.967					
<b>Shank length</b>	0.974	0.970				
<b>Thigh length</b>	0.882	0.900	0.873			
<b>Keel length</b>	0.935	0.905	0.902	0.844		
<b>Breast width</b>	0.981	0.974	0.973	0.886	0.932	
<b>Back length</b>	0.969	0.977	0.968	0.891	0.911	0.959

**Table 2:** Correlation between body weight and linear body measurement of Arboracre Broiler Chicken

	Body weight	Neck length	Shank length	Thigh length	Keel length	Breast width
<b>Body weight</b>						
<b>Neck length</b>	0.916					
<b>Shank length</b>	0.894	0.849				
<b>Thigh length</b>	0.861	0.847	0.795			
<b>Keel length</b>	0.897	0.821	0.815	0.780		
<b>Breast width</b>	0.977	0.922	0.886	0.876	0.889	
<b>Back length</b>	0.963	0.939	0.895	0.877	0.863	0.966

High positive correlation values of 0.795, 0.815, 0.88 and 0.895 (Table 1) was obtained between shank length and thigh length, keel length, breast width and back length for Hubbard strain, while for Arboracre strain the correlation values were 0.873, 0.902, 0.973 and 0.968 (Table 2). The relatively higher correlation obtained for both shank lengths could lead to an improvement in other traits. This may be a good indicator of body conformation. The results agree with the finding of Adeyinka *et al.* [8] using Anak strain.

Positive and high correlation values of 0.780, 0.876 and 0.877 respectively obtained between thigh length and keel length, breast width and back length for Hubbard strain, and values of 0.844, 0.886 and 0.968 respectively for Arboracre strain, indicates that an improvement in thigh length could lead to an improvement in these parameters also. These results are higher than the finding of Bello [15] and Adeyinka

*et al.* [8] using Anak and Marshall strain. This may be attributed to strain differences.

Correlation values of 0.932 obtained between keel length and breast width and of 0.911 obtained between keel length and back length for Arboracre strain, corresponding values of 0.889 and 0.863 for Hubbard strain, indicates possibility of co-improvement in these traits. This is so because they are all influenced by growth of the animal and are therefore determined by the same gene that controls growth in animals. This same argument holds true for breast width and back length. Morphometric or conformation traits are important in predicting body weight of animals, in addition to being good indicators of good growth and market value of broiler; combination of body weight and morphometric traits can be used to predict production indicators and economic returns of poultry [19].

## CONCLUSION

In conclusion, the higher body weights of Hubbard over Arboracre in weeks 2 to 8, indicates that they are earlier maturing than Arboracre. Also, positive correlation obtained between body weight and the morphometric traits in this study indicate that an improvement in body conformation traits might lead to an improvement in body weight. This is a good indicator that body conformation can be used in selection programme for improved body weight.

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