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Phenotypic and Genetic Correlations between Body Weight and Linear Body Measurements of Nigerian Local and Improved Chickens

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Abstract:- This experiment was carried out with 240 mixed sex of four stains (frizzle feathered, naked neck, normal feathered and Noiler) of chicken to evaluate the phenotypic and genetic correlations between body weight and linear body measurements of Nigerian local and improved chickens raised for sixteen weeks in rivers state, south south region of Nigeria. Body weights and the morphometric traits (Body Length, Drumstick length, Drumstick circumference, Breast Girth, Nose to Shoulder, Shoulder to Tail and Height at withers) were measured per bird on weekly basis. The measured parameters were subjected to correlations analyses. The simple genetic and phenotypic correlation between body weight and linear body measurements of the four strains were positively and highly significant for all parameter. Very strong genetic correlations existed between body weight (BW) and wing length (WGL), breast girth (BG) and shoulder to tail length (STTL). Very strong phenotypic correlation existed between WGL and STTL. The pattern of phenotypic correlations among growth traits of each chicken strain suggested that traits are under the same gene action (pleiotrophism) and good indicator that improvement in one trait in an animal would eventually result in the improvement of the other traits correlated in direct selection

Keywords:- *Correlations, Phenotypic, Genetic, Body weight, Morphometric trait.*

I. INTRODUCTION

An earlier report by Okonkwo and Akubuo (2001) showed that about 10 percent of the Nigerian populations are engaged in poultry production, mostly on subsistence and small or medium-sized farms. Presently, the industry has been adversely affected by stringent economic measure, a measure which had been very pronounced on poultry production due to high level of sensitivities of the industry to management factors and resultant effect on live and productivity of the birds (Adebayo and Adeola, 2005). The phenotypic value (P) of an individual is the combined effect of the genotypic (G) and environmental deviation (E): $V_P = V_G + V_E$, where V_P is the total phenotypic variance, V_G is the genetic variance and V_E is the environmental variance. The genotypic value is the combined effect of all the genetic effects including nuclear genes, mitochondrial genes and interactions between the genes result in phenotypic value (Knap and Bishop, 2003). Although some genes have only an effect on single trait, many genes have effect on various traits. As a result a change in a single gene would have an effect on all those traits. The genetic and phenotypic correlations among characters are important when selecting for net merit involving several traits (Knap and Bishop, 2003). Adeyinka *et al*. (2004) reported a high phenotypic correlation between different ages of Naked neck broiler chicken and some linear measurements.

II. MATERIALS AND METHOD

This research was carried out at the Poultry Unit of the Research and Teaching Farm of the Faculty of Agriculture, University of Port Harcourt, Rivers State. Two hundred and forty (240) indigenous day old chickens comprising Frizzle feathered (60 chicks), Naked neck (60), Normal feathered (60) and Noiler (60 chicks) were collected from FUNAAB and AMO hatcheries in Nigeria and were housed on deep litter in four replicated pens, sixty birds per strain and twenty birds per pen selected from each strain and raised for sixteen weeks. All the experimental birds were fed with the best commercial feeds at ad libitum from day old to 16 weeks old, chick starter mash with 21% crude protein was given to them from day old to 8 weeks and growers mash with 16% crude protein from eight weeks to sixteen weeks, fresh water was also provided at all time. Data were collected on the linear body parameters that defined growth parameters. These include body weight, body length, breast girth, shank length, shank circumference, drumstick length, drumstick circumference, shoulder to tail length, height at withers, nose to shoulder length and wing length. The body weight was measured in gram using Scout II electronic sensitive scale and top loading Balance (20 kg capacity) while the morphometric traits were measured using a measuring tape graduated in centimeters. Breast girth (cm) was taken as the circumference of the breast around the deepest region of the breast and measuring tape was used to take the reading, Height at withers (cm) was taken as standing length from ground to top of their comb. Data on these parameters were collected on weekly basis from day old to 16 weeks of age. Data generated was subjected to correlations analyses using the Pearson's correlation of Statistical Analysis System (SAS, 2008) Version 9.2 software package.

III. RESULTS

Table 1 and 2 presents simple phenotypic and genetic correlations between body weight and linear body measurements of the four strains (Frizzle feathered, Naked neck, Noiler and Normal feathered) of Nigerian local and

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improved chickens from 4 - 16 weeks. Table 1present the simple phenotypic correlations between body weight and linear body measurements of the four Strains of Nigerian local and improved chickens, There were low to very high phenotypic correlations coefficients between body weight and linear body measurements (r= 0.18 - 0.96). It was observed that the correlation coefficients between body weight and linear body measurements were positive and highly significant (p<0.001) for all parameters for phenotypic correlations. The strongest phenotypic correlation existed between WGL and STTL, WGL and BL (r=0.96) respectively followed by DSL and BW, STTL and BL (r=0.95), WGL and DSC, BG and BL, SC and BL(r=0.94) respectively. The weakest phenotypic correlation existed between SL and HAW (r=0.18). Genetic correlation coefficients were low to very high between body weight and linear body measurements of the four Strains of Nigerian local and improved chickens studied (r=0.11-0.99). Positive and significantly very high (p<0.001) correlation coefficients were observed for all parameters for genetic correlations (Table 2)

Table 2 shows that the strongest genetic correlations existed between BW and WGL, HAW and STTL (r=0.99), respectively followed by HAW and NTSL (r=0.97), HAW and WGL, DSC and WGL, BG and DSC (r=0.96) while the weakest correlation existed between NEC and COML, COML and BW, NEC and SL (r=0.11).

Traits	WGL (cm)	SL (cm)	SC (cm)	DSL (cm)	DSC (cm)	NTSL (cm)	STTL (cm)	B L (cm)	HAW (cm)	BG (cm)	BW (g)	COML (cm)	WTL (cm)	NEC (cm).
WGL(cm)		**0.69*****	**0.92*****	**0.94****	**0.90*****	**0.92*****	**0.96*****	**0.92*****	**0.96*****	**0.23*****	**0.91*****	**0.80*****	**0.69*****	**0.80*****
SL(cm)			**0.68*****	**0.70****	**0.66*****	**0.67*****	**0.68*****	**0.64*****	**0.66*****	**0.18*****	**0.68*****	**0.57*****	**0.54*****	**0.63*****
SC(cm)				**0.86*****	**0.84*****	**0.84*****	**0.93*****	**0.89*****	**0.94*****	**0.23*****	**0.85*****	**0.78*****	**0.62*****	**0.68*****
DSL(cm)					**0.90*****	**0.91*****	**0.92*****	**0.87*****	**0.90*****	**0.22*****	**0.95*****	**0.79*****	**0.76*****	**0.92*****
DSC(cm)						**0.90*****	**0.87*****	**0.89*****	**0.89*****	**0.24*****	**0.88*****	**0.80*****	**0.71*****	**0.65*****
NTSL(cm)							**0.91*****	**0.90*****	**0.91*****	**0.24*****	**0.91****	**0.80*****	**0.72*****	**0.65*****
STTL(cm)								**0.92*****	**0.95*****	**0.24*****	**0.89****	**0.77*****	**0.67*****	**0.84*****
BL(cm)									**0.94*****	**0.23*****	**0.88****	**0.79*****	**0.64*****	**0.78*****
HAW(cm)										**0.22*****	**0.77****	**0.76*****	**0.64*****	**0.74*****
BG(cm)											**0.17****	**016*****	**0.73*****	**0.73*****
BW(g)												**0.83*****	**0.79*****	**0.83*****
COML (cm)													**0.84*****	**0.70*****
WTL (cm)														**0.62*****
NEC (cm).														

Table 1: Simple phenotypic correlations between body weight and linear body measurements of Nigerian local and improved chickens.

= high Significant (p<0.01),*= very High Significant (p<0.001). BW= Body weight, WGL= Wing length, SL= Shank length, DSL= Drumstick length, NTSL= Nose to shoulder length, TL= Trunk length, STTL= Shoulder to tail length, BL= Body length, BG= Breast girth, HAW= Height at withers, COML = Comb length, WTL =Wattle length

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Traits	WGL (cm)	SL (cm)	SC (cm)	DSL (cm)	DSC (cm)	NTSL (cm)	STTL (cm)	B L (cm)	HAW (cm)	BG (cm)	BW (g)	COML (cm)	WTL (cm)
WGL(cm)													
SL(cm)	0.95***												
SC(cm)	0.08***	0.06***											
DSL(cm)	0.86***	0.87***	0.58***										
DSC(cm)	0.96***	0.92***	0.62***	0.89***									
NTSL(cm)	0.88***	0.90***	0.59***	0.86***	0.96***								
STTL(cm)	0.86***	0.87***	0.60***	0.79***	0.89***	0.90***							
BL(cm)	0.95***	0.96***	0.66***	0.91***	0.96***	0.92***	0.90***						
HAW(cm)	0.90***	0.94***	0.69***	0.91***	0.91***	0.85***	0.86***	0.90***					
BG(cm)	0.96***	0.95***	0.70***	0.84***	0.93***	0.97***	0.99***	0.92***	0.96***				
BW(g)	0.99***	0.17***	0.15***	0.18***	0.17***	0.16***	0.16***	0.31***	0.16***	0.12***			
COML (cm)	0.86***	0.73***	0.65***	0.73***	0.90***	0.79***	0.78***	0.82***	0.84***	0.75***	0.11***		
WTL (cm)	0.81***	0.74***	0.47***	0.70***	0.79***	0.78***	0.76***	0.52***	0.31***	0.59***	0.08***	0.79***	
NEC (cm).	0.15***	0.11***	0.14***	0.16***	0.18***	0.18***	0.19***	0.30***	0.23***	0.14***	0.979***	0.11***	0.12***

Table 2: Simple genetic correlations between body weight and linear body measurements of Nigerian local and improved chickens.

= high Significant (p<0.01), *= very High Significant (p<0.001). BW= Body weight, WGL= Wing length, SL= Shank length, DSL= Drumstick length, NTSL= Nose to shoulder length, TL= Trunk length, STTL= Shoulder to tail length, BL= Body length, BG= Breast girth, HAW= Height at withers, COML = Comb length, WTL =Wattle length

IV. DISCUSSION

Correlation describes the interrelationships that exist among traits of interest and the estimate of correlation coefficient are therefore very useful in animal breeding as a tool of predicting potential response to or progress made from selection (Obike *et al*. 2016). Correlation permits prediction of the direction and magnitude of change in the dependent traits as a correlated response to direct selection of principal traits (Laxni *et al.* 2002). The extent and direction of correlated selection response are determined by genetic correlation or variance between the concerned traits.

Simple genetic and phenotypic correlations between body weight and linear body measurements (morphometric) of the four Strains (Frizzle feathered, Naked neck, Noiler and Normal feathered) of Nigerian local chickens were positive and highly significant for all parameters which were in accordance with the report of Momoh and Kershima (2008). Yahaya *et al.* (2012) and Alabi *et al*. (2012).There was low to high coefficient of correlations between body weight and linear body measurements in both genetic and phenotypic correlations. The strongest genetic correlations between body weight and wing length, height at withers and shoulder to tail length and the strongest phenotypic correlation existed between wing length and shoulder to tail length, wing length and body length which were in agreement with the work reported by Yakubu *et al.* (2009b). Positive and highly significant phenotypic correlation coefficient was also reported by Okpeku *et al*. (2003), Egna *et al*. (2014), Oleforuh-Okoleh *et al*. (2017) in their various studies on Nigerian indigenous chickens.

Correlation coefficient varied among the four strains of chickens studied and it ranged from low to high for each strain. Strong positive association between body weight and growth traits measured was indication of pleiotrophism (traits are under the same gene action which indicates that improvement in one trait will lead to improvement of the other traits correlated in direct selection) and provides basis for possible genetic manipulation and improvement of Nigerian local chickens (Yakubu *et al.*, 2019a). The genetic and phenotypic correlations in this study were similar to the values reported by Deeb and Laman (2002), Raji *et al.* (2009), Ige (2013) and Ogunshola *et al*. (2017).

V. CONCLUSION

Coefficients of correlation varied among the four strains of chickens studied and ranged from low to high for each Strain. The pattern of phenotypic correlations among growth traits of each chicken strain suggested that traits are under the same gene action (pleiotrophism) and good

indicator that improvement in one trait in an animal would eventually result in the improvement of the other traits correlated in direct selection. Information from this study can be used for improvement of breeding programmes of Nigerian local chickens.

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