



GENETIC PARAMETER OF SOME LINEAR GROWTH TRAITS IN THE NIGRIAN LOCAL CHICKEN HEAVY ECOTYPE

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ABSTRACT

The world record on poultry production, consumption and income generated from it buttresses the fact that while the Europe, America and Asia have for over a century been milking great income from their developed poultry breeds and other developed natural resources, Africa including Nigeria has been losing so much due to many technical, socio-economic, organizational, constitutional and institutional problems. 200 chicks were generated from like to like mating of the parent stock. One hundred chicks each was raised in two batches. Data gotten from body lengths at ages of 0 (day old)-week, 4-weeks, 8-weeks, 12-weeks, 16-weeks and 20-weeks of age were subjected to analysis of variance (ANOVA) in a nested or hierarchical design in a paternal half sib analysis, all data generated were analyzed using SAS (2004) statistical procedure. At 0, 4, 8 and 16 weeks of age, sire had no effect on body length of progeny. Sire had significant ($P < 0.05$) effects on body length at 12 and 20 weeks of age. Heritability estimates of body length at 0, 4, 8, 12, 16 and 20 weeks of age were 0.80, - 0.06, 0.27, 0.74, 0.01 and 0.38 respectively. Heritability estimates were low at 4, and 16 weeks; moderate at 8 and 20 week and high at 0; and 12 weeks of age. Body length at 0 week had no r_G with shank length, shank colour and beak colour at 0 week of age. However there was a negative r_P between body weight and these other traits at 0 week of age. At 20 weeks of age the correlation between body weight and body length; body length and shank length had both positive r_G and r_P . The results obtained in this study formed a basis for the following conclusion. The body length data of the heavy ecotype at 0, 4, 8, 12, 16 and 20 weeks of age indicate that the heavy ecotype could form a foundation stock for breed development.

KEYWORDS: Growth traits, linear growth, heavy ecotype, Nigrian Chicken *etc.*

INTRODUCTION

The records of numerous poultry breeds genetically developed in other continents as far back as the nineteenth century is equally interesting. According to the New Encyclopedia Britannica (1995) the Barred Plymouth Rock, the American breed of importance today which was developed in 1865 by crossing Dominique with the Black Cochon, has grayish plumage crossed with and white dark bars. The Wyandotte (an America breed) developed from five or more strains and breeds have eight varieties. Rhode Island Red (RIR) developed in 1857 was from red Malay game fowl crossed with reddish colored shanghais with some brown leghorn, Cornish, Wyandotte and Brahma blood. It is good for meat production and one of the top meat breeds for the production of egg. It has bright red feather. New Hampshire was developed in US in 1930 from Rhode Island Red. It's a meat and early maturing breed. The white Leghorn especially developed in the USA, is one of the 12 varieties of Leghorn breed which originated in Italy, a Mediterranean breed. The white Leghorn is the leading egg producer of the world. Cornish, an English breed, developed for crossbreeding programmes for broiler production was developed in England before 1893. It is a poor egg producer. The white Plymouth was registered in USA in 1888. Brahma is the

only Asiatic breed of significance today developed in India. It has three varieties.

However, the trend is not the same with Nigeria, where one indigenous breed, the shika brown breed has been developed in NAPRI, Shika, Zaria. That means there is no African class of chicken. This buttresses the fact that while the Europe, America and Asia have for over a century been milking great income from their developed poultry breeds and other developed natural resources, Africa including Nigeria has been losing so much due to many technical, socio-economic, organizational, constitutional and institutional problems. These considerations pose some urgency on animal scientists and the entire nation of the need to put into motion every programme and action that will make it possible for our nation, Nigeria, to consolidate its claim as the "giant of Africa". The objective of this study it to determine the genetic parameters of the heavy ecotype chicken through pure breeding, where by mating is carried out between relatives (Pirchner, 1969). According to Pirchner (1969) the genetic parameter would determine whether selection, inbreeding or crossing would be the best tools for improvement.

MATERIAL AND METHODS

This research was carried out at the local chicken unit of the poultry farm of the Department of Animal Science, University of Nigeria, Nsukka. Nsukka is located on latitude 05° 22' North and longitude 07° 24' East with annual rainfall ranging from 986-2098mm (Asadu 2002).

Multiplication of birds Using the Backward Integration Method of Momoh (2005)

The experimental birds were replicated into 5 deep litter pens in the ratio of 1 cock:10 hens. The birds were randomly grouped into 5 pens according to the feather-colours such as black and white spots; gold; black; then black colours combined with brown spots. Random mating was allowed to take place in each pen, so as to generate fertile eggs. The birds were fed formulated layers mash containing 16% crude protein and 2800Kcal/kg of feed, water was given ad libitum. Fertile eggs were hatched locally using backward integration method as described by Momoh *et al* (2005). 200 chicks were generated from like to like mating of the parent stock. One hundred chicks each was raised in two batches. Both batches of birds (purebred) were tested separately and independently based on each sire.

Statistical methods

Data gotten from body lengths at ages of 0 (day old)-week, 4-weeks, 8-weeks, 12-weeks, 16-weeks and 20-weeks of age were subjected to analysis of variance (ANOVA) in a nested or hierarchical design in a paternal half sib analysis, all data generated were analyzed using SAS (2004) statistical procedure

The nested design or model of the SAS (2004) statistical procedure derived variance and covariance components of all the traits under study.

$$\text{MODEL } y_{ijk} = \mu + \alpha_i + \beta_{ij} + e_{ijk}$$

Where:

y_{ijk} = the record of Body lengths of individual progeny of the j^{th} dam mated to i^{th} sire;

μ = overall mean; α_i = the random effect of i^{th} sire; β_{ij} is the effect of the j^{th} dam mated to the i^{th} sire

e_{ijk} = the uncontrolled environmental and genetic deviations attributable to individual progeny (chick) within each sire group.

All effects are random, normal and independent with expectations equal to zero.

Heritability and correlation

$$\frac{4 \times \text{sire variance component}}{\text{Variance total}} = h^2_s$$

$$\frac{2 \times \text{sire} + \text{dam variance component}}{\text{Variance total}} = h^2_{s+D}$$

These variance components were tabulated and submitted with these expressions using the SAS "Proc Print" procedure statement or commands of the SAS 2004 statistical procedure for h^2_s and h^2_D for each trait to be analysed.

$$r_{G \text{ sire}} = \frac{\text{COV } s}{\sqrt{\sigma^2_{s(x)} \sigma^2_{s(y)}}$$

RESULTS

The analysis of variance and the Duncans mean effect showing the effect of sire on body length at day old to 20 weeks of age are presented on Table 1a and 1b.

TABLE 1a

Trait	Age	Source	Df	Ms	CV	Prob	Means ± sd
BL	0	B/w sire	4	0.1084	8.50	0.5938 NS	5.19±0.03
	0	W/n dam	45	0.1541			
	0	Error	100	0.0691			
	4	B/w sire	4	3.0373	15.37	0.5477 NS	8.72±0.12
	4	W/n dam	45	3.9227			
	4	Error	150	1.1597			
	8	B/w sire	4	11.6933	14.76	0.0547 NS	12.15±0.28
	8	W/n dam	45	4.6519			
	8	Error	100	2.5667			
	12	B/w sire	4	25.19	12.83		13.23±0.41
	12	W/n dam	45	5.8119			
	12	Error	100	1.52			
	16	B/w sire	4	5.8433	11.75	0.4084 NS	15.78±0.2
	16	W/n dam	45	5.7415			
	16	Error	100	2.4			
	20	B/w sire	4	19.9667	11.15	0.0369 *	17.93±0.36
	20	W/n dam	45	7.1289			
	20	Error	100	2.5867			

LEGENDS

BL - Body length 0, 4, 8, to 20 – number of weeks or age in weeks

TABLE 1B: Effect of duncans separation of means \pm sd of various traits (0 to 20 weeks) of progeny in five genetic groups of local chicken raised intensively

TRAITS	AGE (WEEKS)	NO. OF BIRDS	COCKS				
			1	2	3	4	5
BL (CM)	0	30	5.33 ^a	5.17 ^a	5.27 ^a	5.27 ^a	5.17 ^a
	4	30	NS	NS	NS	NS	NS
	8	30	11.90 ^a	12.63 ^a	12.97 ^a	11.50 ^a	11.73 ^a
	12	30	13.66 ^b	14.57 ^a	12.53 ^c	12.37 ^c	13.03 ^{bc}
	16	30	15.47 ^a	16.43 ^a	15.93 ^a	15.30 ^a	15.77 ^a
	20	30	19.23 ^a	18.07 ^a	17.43 ^b	17.10 ^b	17.83 ^b

Body Length

Table 1a and 1b present the analysis of variance Table and Duncan's mean effect showing the effect of sire on body length of five genetic groups. At 0, 4, 8 and 16 weeks of age, sire had no effect on body length of progeny. Sire had significant ($P < 0.05$) effects on body length at 12 and 20 weeks of age. At 12 weeks of age, half-sib offspring of cock 2 were very superior in body length (14.57cm) than offspring of cocks 1 and 5 (13.66 and 13.03cm) when compared with 12.53 and 12.37 cm, the least performers of progeny of cocks 3 and 4. The differences are highly significant ($P < 0.001$). Progeny of cock 1 distinguished themselves statistically ($p < 0.001$) from progeny of the rest of the cocks in body length. Among the six ages from day old to 20 weeks of age, cocks 4 and 5 progeny did not differ significantly in body length. A breeder needs to assess the biological implication of the performance of the cocks mated randomly to hens in terms of body length with respect to meat production.

GENETIC EVALUATION OF GROWTH RATES

TABLE 2. Heritability estimates of various traits

	Traits	Heritability
1	0BL	0.5090
2	4BL	0.0609
3	8BL	0.2685
4	12BL	0.7437
5	16bl	0.0147
6	20bl	0.3780

Heritability estimates of body length at 0, 4, 8, 12, 16 and 20 weeks of age were 0.80, - 0.06, 0.27, 0.74, 0.01 and 0.38 respectively. Heritability estimates were low at 4, and 16 weeks; moderate at 8 and 20 week and high at 0; and 12 weeks of age.

Genetic (r_G) and Phenotypic (r_P) Correlation

TABLE 3: The components (sire and dam) of Genetic (r_G) and Phenotypic (r_P) Correlation of various traits of Heavy ecotypes of the Nigerian local chickens

Age (Weeks) and Traits	Phenotypic Correlation (r_P)	Genetic Correlation (r_G sire)	Genetic Correlation (r_G dam)	Genetic Correlation (r_{GError})
0BL * 0BW	-0.0354	0	0.2366	-0.1072
0BL * 0SL	-0.1761	0	-0.2454	-0.187
0BL * 0SC	-0.0454	0	0.1257	-0.1139
0BL * 0BC	-0.0642	0	-0.0178	-0.0339
4BL * 4BW	0.31	0	0.5473	0.162
4BL * 4SL	0.2916	0	0.6335	0.1504
8BL * 8BW	0.3688	1.0672	0.7941	0.1181
8BL * 8SL	0.0451	0.6202	0.164	-0.0353
12BL * 12BW	0.1533	1.1785	-0.1317	0.0479
12BL * 12SL	0.0735	0.8602	0.1006	-0.0982
16BL * 16BW	0.0233	0	0.0588	0.0139
16BL * 16SL	0.1844	0	0.9542	0.0198
20BL * 20BW	0.6222	0.9928	0.9312	0.5291
20BL * 20SL	0.6496	1.0194	0.4515	0.7025

DISCUSSION

The body length value (17.87 \pm 0.2) of the progeny at 20 weeks of age agreed with the value reported by Nwosu et al (1985). The body length had a gradual increase until 8 weeks of age, from where it declined to 20 weeks of age. It showed that the growth of body length also experienced inflection earlier at 8 weeks of age than the body weight, which had it at 12 weeks. The coefficient of variation for body length and the significant difference in body weight at 12 weeks of age in the progeny of the five cocks indicate that the heavy ecotype could be developed into a broiler, layer and dual purpose breed. This further

intensifies the argument that 12 weeks of age is very important in the programme of development of a new broiler or layer breed using the heavy ecotype of the Nigerian local chicken.

Heritability Estimates

The heritability at 4 weeks and 16 weeks (-0.06 and 0.01) was low; was 0.27 and 0.38 (moderate) at 8 and 20 weeks; and high at 0 and 12 weeks (0.80 and 0.74). This indicates that the body length of heavy ecotype can be improved through mass selection as a broiler breed at the appropriate age.

Genetic and phenotypic correlation between body length and shank length, shank colour, beak colour.

Body length at 0 week had no r_G with shank length, shank colour and beak colour at 0 week of age. However there was a negative r_P between body weight and these other traits at 0 week of age. No r_G correlation existed between the body length and body weight, shank length at 4 weeks of age, although there was a positive r_P among these traits at 4 weeks of age. There were positive r_G and r_P correlations between body length and body weight, shank length at 8 and 12 weeks of age. At 16 weeks of age there was no r_G correlations between body weight and body length; body length and shank length. While there were positive r_P among these traits at 16 weeks. At 20 weeks of age the correlation between body weight and body length; body length and shank length had both positive r_G and r_P . The breeder who has the goal of developing a broiler or layer breed finds tools for his development programme in the knowledge of the magnitude and direction of genetic correlations among traits.

The positive r_G present among many of the traits under study further indicate that aside from using mass selection to develop heavy ecotype, selection index could be very useful and appropriate for making genetic progress in the heavy ecotype for development of a broiler, layer or dual purpose breed in Nigeria

CONCLUSION

The results obtained in this study formed a basis for the following conclusion.

The body length data of the heavy ecotype at 0, 4, 8, 12, 16 and 20 weeks of age indicate that the heavy ecotype could form a foundation stock for breed development.

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