I.J.S.N., VOL. 2(2) 2011: 348- 351 ISSN 2229 – 6441

INTERNATIONAL JOURNAL OF SCIENCE AND NATURE

www.scienceandnature.org

GENETIC PARAMETERS OF SOME BIOMETRIC GROWTH TRAITS OF PUREBRED HEAVY ECOTYPE OF THE NIGERIAN LOCAL CHICKEN

[1]Ohagenyi, I. J., [2]Nwosu, C. C., [2]Ndofor-Foleng, H. M.
[1]Federal College of Animal Health & Prod. Tech. NVRI Vom. Plateau State.
[2]Department of Animal Science, University of Nigeria Nsukka, Enugu State.

ABSTRACT
The body weight (BW) and average body weight gain (ABWG) from day old (0 week) to 20 weeks of age of 200 F1progeny of 5 genetic groups (sires) were subjected to a nested design of variance procedure of SAS (2004) to derive the paternal half -sib estimates of variance and covariance components, which were used to estimate heritability, genetic and phenotypic correlations between the pairs of traits. Heritability estimates of ABWG ranged from 0.28 at 4 weeks to 1.16 at 12 weeks of age. The $r_{G\ (sire)}$ correlation ranged was 0 in many traits to 1.10 between 8ABWG and ABWG12. The phenotypic correlation ranged from -0.37 between 4BW andABWG20 to 0.60 between 4ABWG and ABWG20.

KEYWORDS: Biometric, Growth traits, Purebred, Heavy ecotype, Local chicken, Genetic parameters.

INTRODUCTION
Evidence abounds that Nigeria as a Nation is endowed with numerous animal genetic resources that will make her self-sufficient in animal protein production and even become main exporters of all kinds of food items. The fact that some developed countries with far less natural resources can still boast of self sufficiency and their ability to export poultry products call for sober reflection among Nigerians. These considerations pose some urgency on animal scientists and the entire nation of the need to put into motion every programmed and action that will make it possible for our nation, Nigeria, to consolidate its claim as the "giant of Africa".

Pure breeding is a type of inbreeding where by mating is carried out between relatives (Pirchner 1969). Allelemorph A and its alternative allele may be used to describe dominant and recessive alleles on a particular locus. AA x AA and aa x aa represent matings of like homozygotes or incrosses. Purebreeding of the heavy ecotype can be designated as AA x AA, whereas that of the light ecotypes as aa x aa, since Momoh (2005) reported that the heavy ecotype local chicken is genetically different from the light ecotype local chicken. The breeding system was also categorized into seven systems by Burdette (1963). According to Pirchner (1969) the principal tools for improvement are selection, inbreeding and crossing. Which of these combinations to use depends on the species, breeding goal, trait, breeding structure and other considerations. The heavy ecotype local chicken, obtained originally from the rural areas of Obudu, a montane region of South-Eastern Nigeria, and adjourning towns of Vandeikya, Katsina-Ala and Wannume in Benue State, underwent a purebreeding programme in the University of Nigeria Nsukka Poultry Farm from 1997 to 2009 to yield the data used in the following research report.

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. The Nsukka town is located on latitude 05^0 22' North and longitude 07^0 24' East with annual rainfall ranging from 986-2098mm (Asadu 2002).

The experimental birds were multiplied using the backward integration method of Momoh (2005).The 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. F1 chicks were fed chick mash (19.5% crude protein and 3020Kcal/Kg of feed) from 0 – 8 weeks; growers mash (17.95% crude protein and 2700Kcal/Kg of feed) from 9 – 18 weeks; and layers mash containing 17.95% crude protein and 2750Kcal/Kg of feed from 19 to 20 weeks of age. Feed and water were 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.

Average body weight gain (ABWG) of the F1 purebreds in each genetic group were weighed at 4 weekly intervals from hatch (0 week) to 20 weeks of age, using a sensitive 250g capacity spring balance from hatch to 4 weeks of age, and a 10Kg capacity five goat kitchen stove scale from 5 weeks to 20 weeks of age.

Data gotten from body weight gain, 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 and 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, as well as correlations of all the traits under study.

MODEL

$\mathbf{Y_{ijk} = \mu + \alpha_i + \beta_{ij} + e_{ijk}}$

Where:

$\mathbf{Y_{ijk}}$= the record of Average body weight gain of individual progeny of the j^{th} dam nested to i^{th} sire;
$\mathbf{\mu}$ = overall mean;
$\mathbf{\alpha_i}$= the random effect of i^{th} sire;
β_{ij} is the effect of the j^{th} dam nested to the i^{th} sire
$\mathbf{e_{ijk}}$= 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.

For estimation of heritability, the sire and dam variance components were tabulated and submitted with the appropriate expressions using the SAS (2004) statistical procedure for h^2_S, h^2_D and h^2_{S+D} for each trait analysed.

$$r_{G\ sire} = \frac{\mathrm{cov}\ S}{\sqrt{\sigma^2_{s(x)}\ \ \sigma^2_{s(y)}}}$$

RESULTS AND DISCUSSION

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

TABLE 1A Sib analysis of variance, descriptive statisyics of traits and heritability

Trait	Age	Source	DF	MS	CV	Prob	Means ± SD	Heritability
ABWG1	4	B/w sire	4	144.9623		0.8599 NS	91.48±1.7	0.2801
ABWG2	8	B/w sire	4	16485		0.1214 NS	213.2±18.16	0.3413
ABWG3	12	B/w sire	4	49367		0.0018**	249±31.42	1.1580
ABWG4	16	B/w sire	4	14779		0.556 NS	325.88±17.19	0.0955
ABWG5	20	B/w sire	4	15278		0.9269 NS	409.04±17.48	0.3664

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

			COCKS				
Traits ABWG(g)	AGE (weeks)	NO. of birds	1	2	3	4	5
ABWG1	0-4	10	94.56^a	93.72^a	94.17^a	86.05^a	88.88^a
ABWG2	4-8	10	219.30^a	249.40^a	254.60^a	167.50^a	175.20^a
ABWG3	8-12	10	271.60^a	336.60^a	251.40^a	243.20^a	141.90^b
ABWG4	12-16	10	307.40^A	330.60^A	270.00^A	361.00^A	360.40^A
ABWG5	16-20	10	350.30^a	388.30^a	438.90^a	441.20^a	426.50^a

Legend;
4ABWG1- Average body weight gain at 4weeks
8ABWG2 - Average body weight gain at 8 weeks
12ABWG3 - Average body weight gain at 12 weeks
16ABWG4 - Average body weight gain at 16 weeks
20ABWG5 - Average body weight gain at 20 weeks

The analysis of variance and Duncan's separation of means effect on the average body weight gain from 0-4 to 16-20 weeks of age, are shown on Tables 1a and 1b.
Sire had no significant effect on average body weight gain at 0-4, 4-8, 12-16 and 16-20 weeks of age. At 8-12 weeks of age, sire had significant ($P<0.05$) effect on the average body weight gain. Average body weight gain ranges from day old, 86.05g to 94.56g at 4 weeks of age and from 350.30g at 16^{th} week to 441.20g at the 20^{th} week.
At 4, 8, 12, 16 and 20 weeks of age, the heritability estimates were 0.28, 0.34, 1.16, 0.10, 0.37 respectively. Heritability estimates for average body weight gain was low at 16 weeks; average body weight gain at 4, 8, and 20 weeks of age were moderate , but very high at 12 weeks of age. Heritability coefficients obtained at 4, 8, 16 and 20 weeks of age were lower than estimates of Momoh (2005), but the 12 weeks estimate was high than the finding of Momoh (2005). The magnitude of the heritability coefficients obtained in this study from 4 to 20 weeks of age in average body weight gain, except the 16^{th} week coefficient indicate a store of additive genetic variance for average body weight gain improvement in the heavy local chicken.

There were no genetic correlation ($\mathbf{r_{G\ sire}}$) between 4 weeks average body weight gain and average body weight gain 8, 12, 16 and 20 week; however a very high, positive and significant genetic correlation ($\mathbf{r_{G\ sire}}$ = 1.10) existed between 8 weeks average body weight gain and average body weight gain 12 weeks. .
In all the genetic groups, genetic correlation estimates through dam ($\mathbf{r_{G\ dam}}$) between 4 weeks average body weight gain and 12, 20 weeks average body weights gain were high, positive and significant; while no genetic correlation ($\mathbf{r_{G\ dam}} =$ -0.0186; -0.3425) existed between 4 weeks average body weight gain and 8, 16 weeks average body weight gain. Genetic correlation through dam ($\mathbf{r_{G\ dam}}$ -0.0158; -0.0602) did not exist between 8 weeks average body weight gain and 12, 20 weeks average body weight gain, while a positive genetic correlation through dam ($\mathbf{r_{G\ dam}}$) existed between 8 weeks average body weight gain and 16 weeks average body weights gain.
The 4, 8 weeks body weight were positively and genetically correlated with 8, 12, 16 and 20 weeks average body weight gain, but negatively genetic correlation existed between 4 weeks average body weight gain and 4 weeks body weight ($\mathbf{r_{G\ sire}}$ = -0.6631). There were no

genetic correlations both, through the sire and dam components, between 4 weeks body weight and 16 weeks average body weight gain.

Genetic correlation estimates between 8 weeks average body weight gain and subsequent higher age average body weights gain traits demonstrates that the same gene or closely linked genes affect the many traits.

It, therefore, follows that the main cause of genetic correlation is pleiotropy, a condition whereby one gene may affect two or more traits at a time.

TABLE 2. Genetic (r_G) and phenotypic (r_P) correlation between average body weight gains

Age (weeks) and Traits	Phenotypic Correlation ($\mathbf{r_P}$)	Genetic correlation ($\mathbf{r_G}$ sire)	Genetic correlation ($\mathbf{r_G}$ dam)
ABWG1 * ABWG2	0.0542	0	_0.0186
ABW G1 * ABWG3	0.0991	0	0.0484
ABW G1 * ABWG4	_0.3656	0	_0.3425
ABW G1* ABWG5	0.5954	0	0.6316
ABW G2* ABWG3	0.1601	1.0997	_0.0158
ABW G2 * ABWG4	0.0596	0	0.1801
ABW G2 * ABWG5	_0.0745	0	_0.0602
4BW *ABWG1	0.0737	_0.6631	0.5317
4BW * ABWG2	0.1183	0.4446	_0.1662
4BW * ABWG3	0.2026	0.4905	0.0148
4BW * ABWG4	_0.1163	0.9744	_0.4059
4BW * ABWG5	0.2306	0.6347	0.0441
8BW * ABWG2	0.2003	0.4635	0.0647
8BW * ABWG3	0.2328	0.4223	0.2243
8BW * ABWG4	0.4238	1.403	0.2394
8BW * ABWG5	0.1518	0.6259	_0.1353

LEGEND:

4BW - body weight at 4weeks
8BW - body weight at 8 weeks
12BW - body weight at 12 weeks
16BW - body weight at 16 weeks
20BW - body weight at 20 weeks
4ABWG1- Average body weight gain at 4weeks
8ABWG2 - Average body weight gain at 8 weeks
12ABWG3 - Average body weight gain at 12 weeks
16ABWG4 - Average body weight gain at 16 weeks
20ABWG5 - Average body weight gain at 20 weeks

CONCLUSION

Genetic correlation present between 8 weeks average body weight gain and subsequent higher age average body weights gain traits confirms a condition whereby one gene may affects two (8 weeks average body weight gain and 12 weeks average body weight gain traits; 8 weeks average body weight gain and 16 weeks average body weight gain traits; 8 weeks average body weight gain and 20 weeks average body weight gain traits) or more traits at a time.

From the above genetic correlations a breeder who succeeds in improving the eight (8) weeks body weight gain (broiler age in exotic meat birds) will succeed in improving the 12 weeks body weight gain of the heavy ecotype chicken.

Therefore, if the heavy ecotype is selected at 8 weeks of age, a breeder can develop birds that are large body size based merely on mass selection. The magnitude of the positive and significant genetic correlation coefficients between average body weight gain of birds at various ages forms genetic data for creation of meat breeds from one of Nigerian poultry genetic resources.

RECOMMENDATION

Pure breeding followed by selection is recommended as an appropriate breeding structure for developing the Nigerian heavy ecotype local chicken into a broiler breed.

Foreign breeders, working with one of the world reputable exotic breed of poultry should, as a rule, be employed as Directors of this project in Nigeria.

World Organisation should consider supporting the local chicken breeding project in Nigeria as one the best options for achieving food sufficiency and poverty alleviation in Nigeria and Africa.

REFERENCES

Asadu C. L.A. (2002) Fluctuations in the characteristics of an important short tropical season, August Break in Eastern Nigeria. Discovery and Innovation 14(1/2). IITA England.

Burdette W.J. (1963). Methodology In Mammalian Genetics. Holden –Day, INC. U.S.A Pp 5-6.

Crow, J.F. (1954): Breeding Structure of Population. In Falconer D.S (1970) (C). 53, 60, 61, 64, 71.

Duncan, David B. (1955). New Multiple Range Test. Biometrics, 11:1.

Falconer, D.S. (1970): Introduction to quantitative genetics. Ed 2nd. Robert M. and Company, Glasglow. 48 - 103.

Falconer, D.S. (1981): Introduction to quantitative genetics 3rd Ed. London and New York. Longman, pp 351.

Malcolm, B.W. (2001): Dalton's introduction to practical animal breeding. Black Science Ed. MPG Books Ltd, Bodmin, Cornwall, 91-95.

Momoh, O.M. (2005): Genetic and phenotype evaluation of the Nigerian heavy chicken ecotype and its crossbreds with light ecotype. Ph.D thesis, Univ. of Nigeria Nsukka, 41-104.

Pirchner, F. (1969): Population Genetics in Animal Breeding . W.H. Freeman and Comp. USA Americas. 73-83.

SAS (2004) Statistical computing and data analysis wit SAS (V8) module 1, Agricultural Biometrics Unit. IITA

Wright, S. (1922): Coefficient of inbreeding and relationship. Amer. Nat., 56:330-338.