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ALLOMETRIC GROWTH OF DIFFERENT TRAITS IN HEAVY ECOTYPE OF NIGERIAN LOCAL CHICKEN

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ABSTRACT
Every poor household, every poor community, every village and city in Nigeria is adorned with various gene types of local chicken that scavenge for their food with little or no medical assistance of the owners. Failure of governance at the Federal, State and Local level to exploit the genetic resources of these native chickens inspite of its oil reserve and income is another strong evidence that Nigeria as a nation has a curse economy. Two hundred (200) purebred F1 local heavy ecotype Nigerian chickens replicated into 5 deep litter pens in the ratio of 1 cock: 10 hens were used in this study. Data obtained from these traits at 8-weeks, 12-weeks, 16-weeks and 20-weeks of age were subjected to analysis of variance (ANOVA) in the nested design or model of SAS (2004) statistical procedure to derived variance and covariance components of all the traits under study. The objective of the study is to determine the allometric growth coefficients of some organs of the heavy ecotype local chickens.The study observed highly significant ($P < 0.001$) differences in the empty carcass weight, full carcass weight and gizzard weight of heavy local chicken. The observation of the study further reveals that percentage of body weights of empty carcass, full carcass and gizzard of the heavy ecotype local chicken were not equal ($p< 0.05; 0.001$) and could be used as a basis for selection in developing a broiler breed. The 12 weeks percentage body weight would yield faster genetic gain.The findings on the variation in growth coefficients ($p< 0.01; 0.001$) of the local heavy ecotype in carcass weight and the coefficients greater than unity recorded in carcass weight is further confirmation that the heavy ecotype local chicken could be developed into a broiler chicken at a faster rate using the carcass weight record, while mass selection using the gizzard and heart weight record could take a longer length of time to develop a broiler chicken.

KEYWORD: household, village, ecotype, chicken, Local trait etc.

INTRODUCTION

Every poor household, every poor community, every village and city in Nigeria is adorned with various feather colours and gene types of local chicken that scavenge for their food with little or no medical assistance of the owners. This condition present a substantial evidence that Nigeria is endowed with surplus natural resources that will make her self-sufficient in animal protein production and even become main exporters of all kinds of food items. According to Mr. Clinton, the US Secretary of State, Nigeria produces 2 million barrels of oil a day, has the 7th largest oil reserve than any other in the world. But the poverty rate has gone up from 46 percent to 76 percent over the last 13 years. A World Bank study shows that Nigeria's corruption and related problems had cost the country some 300 billion dollars over the past 3 decades (Daily Trust 2009). According to Nigerianet (2003), Nigeria, being the largest geographical unit in West Africa, has a land area of 923, 768 square kilometres. According to Central Bank of Nigeria, CBN (2002), Nigeria population was reported to be about 160 million.

Daily Trust (2009) reported that in a meeting between Mrs. Clinton and President Yar'adua both agreed that the most immediate source of the disconnect between Nigeria's wealth and its poverty is a failure of governance at the Federal, State and Local level. Failure of governance at the Federal, State and Local level to exploit the genetic resources of these native chickens inspite of the oil reserve and output is another strong evidence that Nigeria as a nation has a "curse economy.

MATERIALS AND METHODS

The Study Site

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 in latitude 05^0 22' North and longitude 07^0 24' East with annual rainfall ranging from 986-2098mm (Asadu, 2002). The natural day length for Nsukka is 12-13hours and average annual maximum and minimum temperatures are 29.7^0C and after 21^oC respectively (Ezedimma, 1971 unpublished). The relative humidity ranges from 34% to 78% (Monanu, 1975).

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

The experimental birds were replicated into 5 deep letter 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; black; then black colours combined with brown spots. Random mating was allowed to take place. The fact that the government of Nigeria could not harness the research findings on the carcass growth, genetic potential of our local chicken in other to achieve the bitting need for poultry breed of Nigeria origin that will help to eliminate a major problem of protein malnutrition, despite the billions of dollars

generated annually from oil call for sober reflection. Cocks were allowed to mate hens 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.

Like to like mating of the parent stock birds ensured that about one hundred chicks each in two batches would be raised. The F_1 generation was the purebreds, (that is the offspring of heavy ecotype males mated to heavy ecotype females). Every chick in the F_1 generation was identified according to its sire.

Allometric traits

At eight weeks of age three cocks were selected randomly from each genetic group of the F1 purebred for allometrical trait analysis.

1. Selected cocks were immediately measured to determine their live weights. They were slaughtered by using a sharp knife to cut through the lung and oesophagus into the cervical bone. Dressed with very hot or boiled water depending on their age.
2. Full carcass weight were determine by measuring the dressed chicken after defeathering it and before opening it up using 10kg farm scale.
3. Empty carcass weight was determined by weighing the chicken after removing the heart, lung, digestive system, testes, shanks and the lower arm, using the same scale
4. Gizzard weight was determined first by cutting off the intestines closely from the gizzard then using the G/G electronic weighing scale to measure it.
5. Heart weight: dissecting blade was used to cut off the arteries and lungs just above the oarta. The same electronic weighing scale was used for measurement

QUANTITATIVE MEASUREMENT

Following measurement of 3 cocks, the values were pooled and weight determined:

1. **The percentage body weight** was determined as reported by Ihemelandu and Nwosu, (1986) by dividing each organ weight by their respective body weight and multiplying by 100.
2. Relative growth rate;

i. For body weight. Mean body after 12week, 16 week and 20 week of age divided by mean body weight at 8 week of age.

ii. For each organ = mean organ weights at 12 week 16 week and 20 week of age divided by mean organ weight at 8 weeks of age.

3. **Growth coefficients:** This was determined by dividing the relative growth rate of each organ at 12, 16, 20 week by the relative growth rate for body weight at 12, 16 and 20 week (Goss, 1964)

$$\text{i.e.} = \frac{\text{Relative growth rate of each organ at 12 weeks}}{\text{Relative growth rate for body weight at 12 weeks}}$$

a. Statistical methods

Data obtained from these traits at 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 analysed using SAS (2004) statistical procedure. The nested design or model and the SAS 2004 statistical procedure derived variance and covariance components of all the traits under study.

Model $Y_{ijk} = \mu + \alpha i + \beta_{ij} + e_{ijk}$

Where:

Y_{ijk} = the record of individual progeny of the j^{th} dam mated i^{th} sire:

μ = overall mean;

αi = the random effect of ith sire;

β_{ij} = 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.

RESULTS & DISCUSSION

Allometrical traits

a. Comparison of various organs

In the comparison of various organs, presented in table A. there were highly significant ($p<0.001$) differences is the comparison of empty carcass weight (ECW), full carcass weight (FCW), the gizzard, heart, at 8, 12, 16 and 20 weeks of age. High variability in each organ indicates that the heavy ecotype can be improved into a broiler through mass selection or selection index. At 8 weeks of age the progeny of all five sires were significantly different in ECW ($p<0.01$) and FCW ($p<.0.001$). They were similar in gizzard and heart weight. At 16 weeks of age the ECW, FCW and gizzard ($p<0.001$) were significantly different. The heart weight was similar in all groups.

At 20 weeks of age the ECW, FCW and gizzard weights were superior in some sire progeny. The heart weight was similar in all groups at that age. Ihemeland and Nwosu obtained low growth rates for muscle and hearts weights of Gold-Links and native chicken. These observations on carcass weight and heart of heavy ecotype chicken show late faster growth rate than the exotic breed

b. **Percentage of Body Weight Contributed by Various Organs.**

Table B shows that the sire progeny did not differ ($p>0.05$) at 8 weeks of age in all the organs. There were significant ($p<0.05$) differences among the sire progeny in the percentage of body weight contributed by ECW, FCW, gizzard and lung at 16 weeks. However at 20 weeks of age, sire progeny differed ($p<0.001$) significantly only in ECW, FCW and gizzard, while progeny were similar ($p>0.05$) in heart at that age.

Cock 3 progeny performed significantly higher than progenies of other cocks at 8 weeks in ECW, FCW and gizzard. At 12 weeks, progeny of cock 1 distinguished itself from other cocks in both EW and gizzard percentage weight. At 20 weeks, cock 3 progeny emerged significantly better than progenies of other cocks in all the organs at 20 weeks of age. This great variability in the percentage of body weight as contributed by the various organs agrees with the finding of Ihemelandu and Nwosu (1986).

TABLE A: comparison of various organs

Organ	Age (weeks)	Mean±SD (g)	Pr > F
ECW	8	131.13±15.22**	0.0012
	12	319.20±13.17	
	16	500.60±13.74***	<.0001
	20	754.47±22.94***	<.0001
FCW	8	171.00±7.19***	<.0001
	12	484.07±7.36	
	16	678.53±10.65***	<.0001
	20	1030.80±42.29***	<.0001
Gizzard	8	1.46±0.20 Ns	0.09
	12	26.93±1.32	
	16	43.2±0.20***	<.0001
	20	51.29±0.96***	<.0001
Heart	8	1.08±0.28 Ns	0.12
	12	2.00±0.0	
	16	3.80±0.73 *	0.0288
	20	5.10±1.30 Ns	0.0967

TABLE B: Percentage of Body Weight Contributed by Various Organs

Organ	Age(weeks)	Mean±SD%	Pr>F
ECW	8	50.94±6.84	0.062
	12	76.03±1.65***	0.0009
	16	54.72±1.81*	0.01
	20	49.33±2.86***	0.0004
FCW	8	66.76±5.12	0.0712
	12	79.1612***	0.0001
	16	74.26±3.51*	0.0157
	20	67.42±4.12***	0.0005
Gizzard	8	0.55±0.104	0.3927
	12	0.32±0.0005***	<.0001
	16	0.48±0.02***	0.0004
	20	3.36±0.20***	<.0001
Heart	8	0.45±0.16	0.5658
	12	0.60±0.02***	<.0001
	16	0.42±0.08*	0.0464
	20	0.33±0.09	0.1802

This study has demonstrated early faster growth rate of carcass weight of Nigerian heavy ecotype and reveals that the Nigerian heavy ecotype local chicken is a potential broiler (Obioho, 1983)

c. Growth Coefficients:

TABLE C: Growth Coefficients

Organ	Age(weeks)	Mean±SD%	Pr>F
ECW	12	1.599±0.22	0.1383^{NS}
	16	1.110±0.14	0.0255*
	20	1.71±0.22	0.0068**
FCW	12	0.067±0.004	0.0002**
	16	1.116±0.08	0.0723^{NS}
	20	1.77±0.13	0.0001**
Gizzard	12	0.0584±0.08	0.2121^{NS}
	16	0.849±0.10	0.0787^{NS}
	20	10.37±1.41	0.0018**
Heart	8		
	12	1.806±1.52	0.3359^{NS}
	16	1.135±0.58	0.498^{NS}
	20	1.45±0.27	0.0011**

The ECW growth coefficient of sires 1, 2, 3, and 5 were superior at 20 weeks of age ($p<0.01$). They were similar in all groups at 12 weeks of age. The growth coefficient of FCW were superior ($p<0.001$) in progeny of sire 1 at 12 and 20 weeks of age. They were similar at 16 weeks of age. The growth coefficients of gizzard and heart ($p< 0.01$)

were superior in sire 3. The ECW growth coefficients were higher that values reported on muscles of Gold link between 4-8 weeks. They were however lower than the values reported on the Nigerian native chicken from 4-8 weeks by Ihemelandu and Nwosu (1986). The reduced values of carcass weight in the study may be due to the effect of inbreeding among the heavy ecotype local chicken. The superiority of growth coefficients of some heavy ecotype local chicken at carcass and other organs is a further evidence that its growth pattern favours that of broiler. The high value of growth coefficients greater than unity in the carcass and other organs are similar to observation on gold link reported by Ihemelandu and Nwosu (1986) and coroborates that the growth pattern of heavy ecotype local chicken favours that of broiler. These observations further shows that the ECW, FCW and heart of the Nigerian heavy ecotype chicken grew faster than its live weight at 12, 16 and 20 weeks of age, while gizzard grew faster than live weight only at 20 weeks of age.

CONCLUSION AND RECOMMENDATION

The study observed highly significant differences in the Empty carcass weight, full carcass weight and gizzard weight of heavy local chicken. This reveals that mass selection for weights of ECW and FCW at 8 weeks of age could yield faster genetic progress in developing a broiler breed, although the heart weight would not be a good indices for selection.

The observation of the study further reveals that percentage of body weight of the heavy ecotype local chicken could be used as a basis for selection in developing a broiler breed. The 12 weeks percentage body weight would yield faster genetic gain. The findings on the growth coefficient of the local heavy ecotype in carcass weight and the values greater than unity recorded in carcass weight is further confirmation that the heavy ecotype local chicken could be developed into a broiler chicken faster using the carcass weight record, while mass selection using the gizzard and heart weight record could take a longer of time to develop a broiler chicken.

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