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HERITABILITY ESTIMATES OF SOME GROWTH TRAITS IN NIGERIAN HEAVY ECOTYPE LOCAL CHICKENS

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ABSTRACT

Growth qualities are important indicators of an animal's ability to grow, develop and improve. This study was carried out to estimate the genetic parameters of some growth traits in the Nigerian Heavy Local Chicken Ecotype (NHLCE) generated via artificial insemination. The NHLCE is a dual-purpose breed of chicken bred for both meat and eggs. The chicks used for this study were 306 in number and were generated from the Generation 8 Parent Stock of the NHLCE existing in the Teaching and Research Farm, Department of Animal Science, UNN. The results showed that the means for the growth traits such as Body weight (BW), Body Length (BL), Body Girth (BG), and Shank Length (SL) at week 8 were 567.57(g), 27.19(cm), 24.58(cm), and 11.81(cm) respectively. The heritability estimates for body weight ranged from 0.03 at day old to 0.42 at week 6, while the highest heritability estimate for body girth was 0.59 at week 6 and the lowest for body girth was 0.08 at day old. The heritability estimate for body length varied from 0.15 at day old to 0.49 at week 6 while that of shank length ranged from 0.45 at day old to 0.60 at week 6. The high heritability estimates recorded at week 6 indicated that breeding and selection decisions taken on the population week 6 will result in the highest predictive accuracy of high heritability and a successive advancement in the genetic improvement of the indigenous heavy ecotype chickens.

Keywords: Growth traits, heritability, body measurements, descriptive statistics, and NHLCE.

INTRODUCTION

The Nigerian Heavy Local Chicken Ecotype (NHLCE) is a fast-growing breed of local chickens developed at the Department of Animal Science, Teaching and Research Farm, University of Nigeria, Nsukka (Udeh *et al.*, 2021). These birds, according to Udeh *et al.* (2018), are dual-purpose chickens developed to produce both meat and eggs. Growth is a fundamental characteristic of living things and it can be defined as an increase in the number of cells in the body and elongation in size per unit of time (Schulze *et al.*, 2001). Growth qualities are important indicators of an animal's ability to grow, develop, and improve. According to Chineke (2005), growth characteristics assessment is important for studying interactions between genetics and environment. As a result, constant assessment and evaluation of the Nigerian local chicken's growth and production is highly required. In animal production, body weight is important for any selection and breeding program, as well as feeding, vaccination and drug dosage application (Tyasi *et al.*, 2020). The application of artificial selection, which will result in genetic improvement using proper breeding plans, requires a thorough understanding of the genetic characteristics of the traits of interest (Adeleke *et al.*, 2011). The term heritability is the proportion of the phenotypic variance attributable to genetic differences (Tenesa and Haley, 2013). Heritability is important for natural selection to estimate progress and setbacks in different traits that a breeder expects from breeding. Whereas there are several reports on heritability estimates on body weight for most local breeds of chicken across Africa, there is limited information on the genetic parameter (heritability) estimate of growth traits of the NHLCE. Therefore, this study aimed at determining the heritability estimate of some growth traits of the Nigerian Heavy Local Chicken Ecotype.

MATERIALS AND METHODS

Location and Duration of Study

The study was carried out at the Poultry Unit, Department of Animal Science Farm, University of Nigeria, Nsukka. Nsukka is located in Enugu State, Nigeria. This study lasted for eight (8) weeks.



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Management of Experimental Birds

The experimental birds used for this research comprised of a total number of 306 mixed sexes birds which were generated from the Generation 8 Parent Stock of the NHLCE existing in the Teaching and Research Farm, Department of Animal Science UNN. The birds were obtained through artificial insemination at a mating ratio of one cock to ten females (1:10). Six matured cocks and 60 matured hens were used to generate the chicks used for the study. Semen was collected from the cocks and inseminated to the hens. The birds were housed in cages according to their breeding groups to monitor for egg laying. The insemination process was repeated at alternate days for one week. Fertile eggs were collected and set in an automated electric incubator for chick production. Wood shaving was used as the bedding material for the chicks and it was changed routinely. The experimental birds were fed *ad-libitum* with chick starter mash from day old to 8 weeks of age. Water was provided at all times and the birds were vaccinated routinely with Lasota, Gumboro and Coccidiostats.

Data Collection

Data from the experimental birds were collected bi-weekly. The body weight of the birds was measured using a weighing scale calibrated in grams (g). A measuring tape was used to measure the morphological traits in centimeters (cm). The body length was taken as a distance from the tip of the beak over the neck, through the body trunk to the tail. Body girth was determined as the circumference of the breast region. Shank length was taken as the length of the tarso-metatarsus from the hock joint to the metatarsal pad.

Statistical Analysis & Experimental Design

The data collected from body weight, body length, body girth, and shank length parameters were subjected to paternal half-sib analysis. They were analyzed using Statistical Analytic Software (SAS). Completely Randomized Design (CRD) was used to derive the variance and covariance components of all the traits under study.

The Model; $X_{ij} = \mu + T_i + \Sigma_{ij}$

Where X_{ij} = Individual observation,

μ = Overall population mean;

T_i = Sire effect;

Σ_{ij} = Experimental random error

RESULTS AND DISCUSSION

The result of the descriptive statistics and heritability estimates of some growth traits measured in the Nigeria Heavy Local Chicken Ecotype is presented in table 1.

The mean body weight, body length, body girth and shank length increased with age. The body weight varied from 37.90g at day old to 567.56g at 8 weeks of age. This was in agreement with Ojo *et al.* (2014) who reported that there was a gradual increase in body weight with age. The observed mean body weight of 567.56g in this study at week 8 was higher than the report of Udeh *et al.* (2021) who recorded a mean body weight of 400.21g at 8 weeks of age. This difference could be attributed to environmental factors such as quality and quantity of feed supplied, as well as management practices employed.

At 8 weeks, shank length ranged from 10.16cm to 13.46cm, with an average of 11.81cm. The mean shank length was higher than 8.58cm reported by Ukwu *et al.*, (2014). Body length had a mean of 27.19cm at week 8. This result was lower than 37.69cm (male) and 34.32cm (female) of Ethiopian indigenous chicken reported by Negash (2021). This could be as a result of breed differences. At week 8, body girth varied from 21.84cm to 28.19cm, with a mean of 24.58cm. These values were slightly lower than the report of Fayeye *et al.* (2006) who recorded 26.7cm, 26.9cm, and 27.5cm for frizzle, naked neck, and normal feathered Nigerian local chickens, respectively. Semakula *et al.* (2011) in their findings noted that all body linear measurements increased with increasing age and stagnated at maturity. He further noted that linear measurements reflect structural growth and thus, are not expected to change much after maturity. Gambo *et al.* (2014) also supported the findings of Semakula *et al.* (2011) that age has high significant effect on all the linear body parameters.



The heritability estimates for body weight ranged from 0.03 at day old to 0.16 at week 8 of age, except at week 6 which had heritability estimate of 0.42, and was the highest value for body weight.

Table 1: Descriptive Statistics and Heritability Estimates of Growth Traits in Nigeria Heavy Local Chicken Ecotype

Age	Parameters	Mean±SE	Std. Dev.	Minimum	Maximum	CoV	h^2
Day-old	BW (g)	37.90±0.33	1.48	35.00	40.00	3.91	0.03
	BL (cm)	10.82±0.53	2.39	8.38	20.41	22.11	0.15
	BG (cm)	8.49±0.13	0.59	7.87	9.65	6.96	0.08
	SL (cm)	4.04±0.08	0.37	3.56	5.08	9.32	0.45
Week 2	BW (g)	113.65±2.26	10.09	98.00	132.00	8.87	0.18
	BL (cm)	15.62±0.18	0.79	13.72	17.02	5.04	0.21
	BG (cm)	12.69±0.30	1.33	11.18	14.99	10.30	0.47
	SL (cm)	6.45±0.12	0.53	5.59	7.62	8.21	0.35
Week 4	BW (g)	235.20±5.25	23.48	193.00	270.00	9.98	0.10
	BL (cm)	21.26±0.26	1.17	19.56	23.62	5.52	0.21
	BG (cm)	18.25±0.39	1.73	15.24	23.11	9.46	0.44
	SL (cm)	9.14±0.15	0.65	8.13	9.20	7.16	0.02
Week 6	BW (g)	430.40±8.80	39.33	331.00	470.00	9.14	0.42
	BL (cm)	24.87±0.43	1.92	21.84	28.70	7.71	0.49
	BG (cm)	21.93±0.34	1.52	19.05	24.89	6.93	0.59
	SL (cm)	10.67±0.17	0.75	9.40	12.45	7.00	0.60
Week 8	BW (g)	567.56±10.67	47.71	492.00	640.00	8.41	0.16
	BL (cm)	27.19±0.50	2.23	23.62	30.73	8.21	0.46
	BG (cm)	24.58±0.44	1.98	21.84	28.19	8.05	0.32
	SL (cm)	11.81±0.23	1.05	10.16	13.46	8.89	0.51

BW = Body weight, BL = Body Length, BG = Body Girth, SL = Shank Length, CoV = Coefficient of Variation, h^2 = heritability estimates.

The heritability estimate at week 6 was higher than the values obtained by Adeleke *et al.* (2011) who reported that heritability estimate of body weight of pure and crossbred indigenous chicken were 0.20 and 0.39 at week 4 and week 8, respectively. Similarly, Ndofor-Foleng *et al.* (2006) reported heritability estimate for body weight of local chicken ecotypes to be 0.40 and 0.37 for light and heavy ecotype chickens, respectively. These values were slightly lower than the value recorded at week 6 in this but higher than values obtained for body weight at week 0, 2, 4 and 8, respectively. In another study, Rotimi *et al.* (2016) reported a heritability estimate of the Nigerian local chicken strains (normal feathered, frizzle feathered, and naked neck chicken) at 8 weeks to be 0.28, 0.40, and 0.31, respectively. These values were higher than values obtained in this study at week 8. The heritability estimate for body length increased gradually from 0.15 at day old to 0.21, 0.21, 0.49 and 0.46 at week 2, 4, 6 and week 8 respectively. The highest value was recorded at week 6 while that of week 2 and 4 were the same. On the body girth, heritability estimate was low at day old with the value 0.08 but then increased at week 6 and 4 with values of 0.59 and 0.44, respectively. The values obtained at week 8 (0.46) was higher than the report of Ohagenyi *et al.* (2012) who recorded 0.27 at week 8 for body length. The heritability estimate for shank length in this study ranged from 0.45 at day old to 0.51 at week 8 with a highest value of 0.60 obtained at week 6. The heritability estimate of shank length obtained at week 4 (0.02) agrees with the findings of Udeh *et al.* (2018) who reported a low heritability estimate of 0.03 for shank length at week 4 for



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the Nigerian heavy local chicken ecotype. These values were lower than 0.92 reported by Adeleke *et al.* (2011) on shank length of the progenies of the Nigerian indigenous chickens, at week 4. These differences in the heritability estimate with other studies could be attributed to genetic and environmental factors. Also, the higher heritability estimates recorded at week 6 implies that additive genetic variance made a greater contribution to the total phenotypic variance compared to environmental variance. In addition, mass selection for any of the growth traits at week 6 of age will result in improved genetic performance.

CONCLUSION

From the study, the high heritability estimates recorded at week 6 suggest that breeding and selection decisions taken at week 6 will result into higher predictive accuracy and successive advancement in the genetic improvement of the Nigerian heavy local chicken ecotype.

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