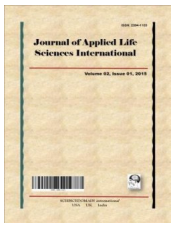

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Heritability Estimates for Growth Traits in the Nigerian Local Chicken

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Authors' contributions

This work was carried out in collaboration between all authors. Author JOE designed the study, managed the literature searches and wrote the first draft of the manuscript. Author EAR wrote the protocol, format and managed the final draft of the manuscript and author OMM managed the experimental process. All authors read and approved the final manuscript.

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ABSTRACT

F_1 pedigreed chicks from a like by like mating of normal feathered (NF), frizzled feathered (FF) and naked neck (Na) Nigerian local chickens were monitored for growth characteristics from hatch to 20 weeks of age. Similarly, heritability estimates from sire variance components were computed 4-weekly to 20 weeks of age of the birds. Heritability estimate ranged from 0.17±0.07 to 0.26±0.19; 0.28±0.16 to 0.40±0.14; 0.42±0.21 to 0.53±0.23; 0.34±0.25 to 0.65±0.16 and 0.52±0.07 to 0.54±0.26 for 4, 8, 12, 16 and 20 weeks of age respectively in the genetic groups. Heritability estimate for body weights from the 8th week of age were moderate to high. Thus, appreciable genetic progress for body weight gain can be achieved in the Nigerian local chicken through concerted selection.

Keywords: Chicken; frizzled feather; heritability; naked neck; normal feather.

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1. INTRODUCTION

The Nigerian local chicken exists as numerically small populations dispersed throughout the ecological zones of the country where, apart from been highly adapted to the prevailing local environmental conditions, form an integral part of the lifestyle of the rural people.

The management of these local chickens has principally been on the free range extensive scavenging system with little or no feed supplementation or provision of elaborate housing [1]. Consequently, their productivity expressed in terms of egg number, growth and survivability of chicks under the rural production system has been reported to be very low [2]. This low productivity has been attributed to lack of improved poultry breeds, the presence of predators, the incidence of chicken diseases, and poor feeding and management factors [3,4]. Thus, they have not been widely accepted at the commercial level because they have not been improved through purposive selection or breeding programme [5]. Genetic progress through selection is largely dependent on the heritability of the trait. The current study overviews the heritability of growth traits in the Nigerian local chicken with the aim of recommending appropriate improvement method(s) for these seemingly indispensable stock in the Nigerian rural setting.

2. MATERIALS AND METHODS

2.1 Description of Study Area

This study was carried out in Makurdi, Benue state, Nigeria. Makurdi lies within the guinea savanna ecological zone of Nigeria. The coordinates, rainfall pattern, relative humidity and temperature regime in Makurdi has already been described [6].

2.2 Experimental Animals and Management

The parent stocks were sourced from the local markets within Makurdi and its environs. Each parental genetic group was separated into breeding groups of 1:10 cock to hen respectively on deep litter.

Eggs were collected; sire identified and incubated in an electric cabinet type incubator. The resulting F_1 chicks were raised on deep litter using conventional farm-mix feed. All standard incubator management practices were observed. Recommended vaccination schedule for the environment was followed.

Selected pullets were raised on deep litter until laying stage. The experimental birds were fed farm compounded rations to meet their requirements at various stages of their growth. Laying boxes were introduced into the pen at 20 weeks of age of the pullets. There was no restriction to water and feed intake in the genetic groups during the experimental period. Management practices were done according to the methods described and adopted [6].

Table 1 shows the mating arrangement for generating experimental chicks.

2.3 Data Collection and Analysis

Data on body weights of the birds were taken 4-weekly to 20 weeks of age using a top loading sensitive digital scale. Sire variance was generated for each point of weight measurement using the general linear model programme software [7].

Heritability was computed from the sire variance components using the equation [8-11];

$$h^2 = \frac{4\delta s^2}{\delta s^2 + \delta e^2}$$

Where,

h^2 = Heritability estimate from paternal half-sib analysis
δs^2 = Cross classified family variance component estimate (sire variance component).
δe^2 = Within family variance component (error variance component).

The standard errors of heritabilities were estimated as described [12].

$$SE\,(hs^2) = \sqrt[4]{\frac{2\,(1-t)^2\,[1+(k-1)\,t]^2}{K\,(k-1)\,(s-1)}}$$

Where,

t = the intraclass correlation,

and $t = \frac{\delta s^2}{\delta s^2 + \delta w^2}$

k = Progeny number within sire
s = Number of sires

Table 1. Mating arrangement for generating experimental chicks

Breeding group	No. of males	No. of females	No. of pens (Replicates)	Mating ratio	Genotypes
NF X NF	1	10	3	1:10	Normal feathered
FF X FF	1	10	3	1:10	Frizzled feathered
Na X Na	1	10	3	1:10	Naked necked

NF = Normal feathered, FF = Frizzle feathered, Na = Naked necked

3. RESULTS AND DISCUSSION

Table 2 present the heritability estimates of body weights at the various ages in the genetic groups using the sire variance components. The results show variations in the heritability estimates (h^2) between the genetic groups in all ages. Heritability estimates ranged from 0.17±0.07 to 0.26±0.19; 0.28±0.16 to 0.40±0.14; 0.42±0.21 to 0.53±0.23; 0.34±0.25 to 0.65±0.16 and 0.52±0.07 to 0.54±0.26 for 4, 8, 12, 16 and 20 weeks of age respectively in the genetic groups.

Heritability estimates of body at week 4 is low indicating that body weight at this age is to a very large extent a function of environmental factors. The low heritability at this age also indicates less genetic variability relative to phenotypic variability among the chicks. The implication of this is that selection for trait of interest may not result in any appreciable improvement.

Table 2. Heritability estimates of body weights from sire variance components obtained at various ages in the breeding groups

Age in weeks	Heritability ($h^{2)}$		
	NF x NF	FF x FF	Na x Na
4	0.17±0.08	0.17±0.07	0.26±0.19
8	0.28±0.16	0.40±0.14	0.31±0.08
12	0.42±0.21	0.53±0.23	0.45±0.22
16	0.34±0.25	0.65±0.16	0.38±0.22
20	*	0.52±0.07	0.54±0.26

**Sire variance redundant.*
NF = Normal feathered, FF = Frizzle feathered, Na = Naked necked

As from week 4, there was a non-consistent increase in the observed heritability estimates, which peaks at week 12. Medium to high heritability estimates is an indication that variability due to additive gene action is probably higher than the non- additive component and by that great genetic progress can be achieved through selection [13]. Selection of breeding stocks for these genetic groups can be carried out at week 12, since highest heritability estimates was obtained at this age.

On the whole, the lower and upper limits of heritability estimate for body weights from 4 to 20 weeks of age in the current study are 0.17±0.07 and 0.65±0.16, respectively. Comparatively, the range of values obtained for heritability estimates in the current study are similar to those reported for Saudi and Iranian native chickens respectively [14,15].

4. CONCLUSION

Apart from the low heritability estimate for body weight observed at 4 weeks of age, moderate to high heritability estimates were observed in subsequent ages. Thus, variability due to additive gene action is probably higher than the non-additive components at these ages. It is therefore indicative that a large proportion of the superiority of parents for body weight could be passed on to the offspring. Selection is therefore a viable tool for genetic progress for body weight gain in the Nigerian local chickens.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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