Heritability Estimates For Growth Of Different Ecotypes Of Indigenous Chicken Reared Intensively

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Introduction

Indigenous chicken (IC) possesses high genetic diversity for many traits and are therefore valuable genetic resources both for the present and future generations. They are known to be adapted to the harsh scavenging conditions, poor nutrition and disease and parasite challenges (Tadelle, D., Alemu, Y., Peters, K. et al. (2000)) and hence an avenue of shielding farmers against the effects of climate variability and change. However, performance of IC in traits of economic importance has continued to be comparatively low due to lack of genetic improvement programme that require accurate estimates of genetic parameters. It is important to estimate genetic parameters for traits of different IC ecotypes for subsequent genetic improvement. The objective of the study was to estimate heritabilities for growth traits of four ecotypes of IC to determine the possibilities for applying genetic interventions to improving productivity.

Material and methods

The study site. This study was carried out at the National Animal Husbandry Research Centre of Kenya Agricultural Research Institute (KARI), Naivasha, Kenya. KARI, Naivasha is located on latitude 0° 45' S and longitude 36° 26' East (Ilatsia, D., Muasya, K., Muhuyi, B. (2007)).

The experimental birds. The foundation flocks were established through eggs collected from Kakamega, Bondo, Narok and Bomet regions which were chosen because there has been minimum exotic genetic dilution in the regions. Five hundred eggs were collected from each area to represent an ecotype in this study. A total of twenty six cocks and 378 hens from Bomet, Bondo, Kakamega and Narok ecotypes were randomly selected from the foundation stock. Cocks were raised in individual deep litter pens and mated to randomly chosen unrelated hens of their own ecotype. Mating ratio was kept from 5 to 10 hens per cock.

Management of experimental birds. Eggs were collected each day, indentified and marked before incubation in order to established and track pedigree file. Eggs were simultaneously incubated but separated according to ecotype within the incubator. A total of 404 pedigree hatched chicks were produced from 3 batches of hatchings. At hatching, each chick was weighed (Hatching weight-HW) and wing tagged with an identification number. Brooding was from hatching (day old) to 6 weeks. Brooding of chicks from each ecotype was separated in deep litter brooders using infra-red electric bulbs. The population density was 12 birds/square metre. At the beginning of the 7th week, chicks were transferred to randomly

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selected deep litter rearing pens within the same house. Sex was determined by phenotypic appearance. The birds were fed *ad libitum* on a starter diet from 0 to 6 weeks of age, a growing diet from 7^{th} week to the 20^{th} week and a laying diet thereafter. These were commercial formulated feeds forhybrids. Clean water was provided daily *ad libitum.* Disinfection of brooding and rearing pens were done procedurally. All birds were vaccinated against Marek's, Gumboro, Fowl Typhoid, Newcastle and Infectious Bronchitis as per recommendations of the veterinarian. Any other incidence of disease condition was treated promptly by resident veterinarian.

Body weight traits. The identified and marked eggs were weighed individually before incubation using a digital weighing scale calibrated to the nearest 1 gram to obtain egg weight (EW). At hatching, each chick was weighed and subsequent body weights collected bi-weekly until 20 weeks of age. A total of 4,444 body weight records from 404 chicks were available for analysis.

Statistical analysis. The PROC GLM of SAS (1998) was used to indentify significant fixed effects. The significant fixed effects consisted of ecotype and sex. The DFREML program (Meyer, 1997) was used to estimate heritabilities for body weight at 2, (BW_2), 8 (BW_8) and 20 (BW_{20}) weeks as:

$$h^2 = \frac{4\sigma_s^2}{\sigma_s^2 + \sigma_\varepsilon^2}$$

where σ^2_s and σ^2_ε are the sire and residual variances, respectively.

Results and discussion

Heritability estimates for BW_2, BW_8 and BW_{20}, for the ecotypes are presented in Table 1. The heritability estimates were moderate in all the ecotypes for BW_2. The heritability estimates for BW_8 were low for Bomet ecotype (0.16±0.1), high for Narok (0.66±0.7), Kakamega (0.52±0.3) and Bondo (0.67±0.3) ecotypes. For BW_{20}, heritability were moderate for Bomet (0.33±0.02) and Bondo (0.30±0.3) ecotypes, high for Narok (0.56±0.6) and Kakamega (0.60±0.4) ecotypes.

Genetic improvement in growth of poultry has traditionally proceeded via selection for body weight at a fixed age (Barbato (1991)). In a number of studies, growth parameters have been found to be highly heritable and have been successfully used in selection programs. Moderate (0.35 to 0.46) heritabilities for body weights in different types of poultry have been reported in a number of other studies (Nestor, E., Noble, O., Zhu, J. et al. (1996); Resende, O., Martins, N., Georg, C. et al. (2005)) which is consistent with findings of this study. This was expected as body weights are normally highly heritable (Adeyinka, A., Oni, O., Nwagu, I. et al. (2006)). The moderate heritabilities estimated in this study suggest that selection at 2^{nd} week of age will result in genetic progress.

Table 1: Heritability estimates with standard errors for body weight in weeks 2, 8 and 20

	Ecotypes			
Trait	Bomet	Narok	Kakamega	Bondo
BW_2	0.27±0.2	0.31±0.5	0.31±0.2	0.25±0.4
BW_8	0.16±0.1	0.66±0.7	0.52±0.3	0.67±0.8
BW_{20}	0.33±0.4	0.56±0.6	0.60±0.4	0.30±0.4

High heritabilities for body weights in different types of poultry have been reported by Resende, O., Martins, N., Georg, C. et al. (2005) which is consistent with findings of this study. The high heritability estimates for the Narok (0.66±0.7), Kakamega (0.52±0.3) and Bondo ecotypes (0.67±0.3) at 8^{th} week was in agreement with the observation in Nigeria (Momoh and Nsowu (2008)). The high heritability estimates indicate that response to selection will be high if selection is done at the 8^{th} and 20^{th} week of age. Mignon-Grasteau, S., Piles, M., Varona, L. et al. (2000) established that, selection on body weight at 8^{th} week modified the whole growth curve, as all the parameters describing the growth curve evolved with selection. The genetic programme to improve IC ecotypes should focus more on BW_8 as the selection criterion for Narok and Bondo ecotypes and on BW_{20} for Kakamega and Bomet ecotypes. The high heritability for Bondo ecotype at the 8^{th} week indicate higher suitability for meat production.The Bondo, Narok and Kakamega ecotypes have dual potential to be selected as meat type or egg-type birds because 8^{th} and 20^{th} week of age are broiler and layer ages respectively (Momoh and Nsowu (2008)).

Conclusion

The heritability differences among the ecotypes reflected genetic influences which presents potential for genetic improvement for commercial purposes. Although, the data used were limited, the moderate to high heritabilities suggest that selection at any age will result in genetic progress. The moderate to high heritability estimates for BW_8 and BW_{20} for Bondo, Narok and Kakamega ecotypes indicated that the ecotypes have dual potential to be selected for meat and egg production.

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