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Conference Paper · April 2015

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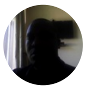

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Preliminary selection results for body weight in indigenous chicken in Kenya

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Abstract

Body weight at 12 weeks of age records of 443 indigenous chicken, progeny of 44 sires were used to estimate preliminary results of selection for growth in indigenous chicken in Kenya after two generations of selection. Estimated breeding values were estimated using a sire model. Mean body weight at 12 weeks (BW12) among males and females was 666.7 and 550.1 g in generation 0, respectively. For generation 1, the respective body weight were 743.7 and 574.3 g. Mean estimated breeding values for both males and females for generation 1 were 177.9 and 17.4 g and were higher than those for generation 0, which were estimated at -1.1 and 1.6 g, respectively. The preliminary results of this study indicate a favourable change in BW12. Further analyses will quantify correlated response in subsequent body weights and egg production to inform the direction of the indigenous chicken genetic improvement programme.

Introduction

The low genetic potential of indigenous chicken (IC) for egg and meat production (Safalao, 2001) limit their potential to improve rural livelihoods through improved nutrition, income generation and employment creation, their low productivity limits the exploitation of this potential. This renders them less competitive compared to exotic and industrial poultry breeds. Egg production of IC is estimated to be 40 to 100 eggs in 3 to 4 clutches per year with an average egg weight of 35-45 g (Ajayi, 2010; Kingori et al., 2010). On the other hand, mature live weights of IC of 0.7 to 2.1 kg for females and 1.2 to 3.2 for males have been reported (Lwelamira and Kifaro, 2010; Ngeno, 2011). There is enormous between and within ecotype variation which can be utilised to improve egg production and growth performance of (Bett et al., 2012).

Nevertheless, there is substantial genetic diversity among IC genetic resources in Kenya (Ngeno, 2011; Magothe, 2013) which can be exploited through selection to improve traits of economic importance. However, there has been an effort to improve the performance of IC through selection. Previous genetic improvement efforts have mainly been through crossbreeding, which apart from resulting in limited improvements, has also been accompanied by new challenges in relation to high cost of production inputs, availability of breeding stock and unavailability of inputs (Bett et al., 2011). In a previous study on IC in Kenya, Magothe et al. (2010) found that body weight at 12 weeks was highly heritable and favourably and highly correlated with subsequent and preceding body weights. This study then recommended use of BW12 to improve growth in IC in Kenya. The objective of this study was therefore to estimate preliminary genetic trend of BW12 for IC in Kenya.

Materials and Methods

Growth data were collected from436 12-week old indigenous chicken birds from the Indigenous Chicken Improvement Project, Egerton University. The records were made between 2012 and 2014. Each bird was individually tagged to facilitate pedigree recording and measurement of individual weights. The feeding and routine management of the birds are described elsewhere (Miyumo et al. 2015)

Additional information included sex, ecotype, cluster and genotype of bird. Pedigree information of each bird was also recorded on the sire line only. The data is summarised in Table 1.

Table 1: Data structure

Generation	Number of Sires	Number of progeny
G_0	20	285
G_1	22	158

Statistical analysis

Significant effects and covariates for subsequent genetic analyses were determined using SAS package (SAS, 2003). Variance-covariance components were estimated and estimated breeding values (EBVs) were calculated using MTDFREML software (Boldman et al., 1993) fitting univariate sire model. BW0 was fitted as a covariate in the analysis of BW12. Other fixed effects included generation, sex of bird and cluster. The model used in matrix notation was as follows:

$$y = Xb + Zs + e$$

where **y** is a vector of observations; **X** and **Z** are known incidence matrices relating records to fixed and random sire effects, respectively; **b** is a vector of fixed effects (generation, sex and cluster and covariates; **s**is a vector of random sire effects; while **e** is a vector of residuals.

Results and discussion

Body weight at 12 weeks of age (BW12) for males and females are given in Table2. Theresults confirm that sexual dimorphism exists for body weight in indigenous chicken. Males were significantly ($P<0.05$) heavier than females. The BW12 for males is similar in Generation 0 is similar to that reported by Magothe et al. (2012) for the same population.

Table 2: Response to selection for body weight (g) ± standard deviation at 12 weeks in Kenyan indigenous chicken

	Body weights, g		
Generation	**All**	**Males**	**Females**
G_0	595.1	666.7	550.1
G_1	662.6	743.7	574.3

G_0=first generation; G_1=second Generation

Response to selection in BW12 in both sexes was positive and was higher in males than in females. This could be attributed to higher selection intensity among males compared to females. Also, most of the females were retained for further evaluation of egg production. Males in G_1 had a mean BW12 that was higher than 668.8 g reported by Magothe et al. (2010) for the same population, indicating that it is possible to improve body weight in indigenous chicken through selection (Magothe et al., 2010).

Mean breeding value and their accuracies are given in Table 3. Mean EBVs for males in G1 was positive and negative in G0, further confirming the positive genetic change in BW. On average males in G_1 were 178 g heavier than those in G_0, indicating an upward trend in BW12

Table 3: Mean estimated breeding values for body weight (g) and mean accuracy for BW12 for Kenyan indigenous chicken

	Estimated breeding values, g					
Generation	All		Males	R_{ti}	Females	R_{ti}
G_0	11.7	67.9	-1.1	68.5	1.8	67.5
G_1	36.4	68.5	177.9	67.5	17.4	69.8

R_{ti}= mean accuracy of estimated breeding value

Females in G_1 were about 16g heavier than those in G_0. The lower genetic change among females can be attributed to the low intensity of selection among females. The accuracies of EBVs were medium and similar for males and females (Table 3). A study by Nicknafs et al. (2013) reported a genetic trend of 4.78 for BW12 in Mazandaran native chicken of Nothern Iran. Larivière et al. (2009) reported an increase of BW11 from 924.70g ±206.84 g to 1443.64 g±145.79 g in males and from 766.51 g ±176.99 g to 1128.99 g (±106.26 g) in females of Ardennaise chicken breed after three selection cycles. Genetic improvement of growth and reproduction traits is accompanied by a concomitant increase in inbreeding (Nicknafs et al., 2013), which has been shown to cause a decline in reproductive performance in chicken (Kamali et al., 2007; Sewalem et al., 1999). Subsequent matings need to consider coancestries among mates to avoid build-up of inbreeding in the population

Conclusion

Preliminary selection process in indigenous chicken in Kenya yielded a favourable genetic change in BW12, implying that this trait can be improve through selection. However, more reliable results will be required by analysing response to selection after a number of generations have been analysed. The effect of improving body weight on reproductive performance also needs to be quantified.

Acknowledgements

The authors acknowledge the Indigenous Chicken Improvement Programme for provision of facilities. INCIP is funded by the European Union through the African Union

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