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Genetic Differences in Performance of Five Chicken Genotypes reared in Five Sub-National Zones in Nigeria

W.A. Hassan[1*], A. Yakubu[2], F.O. Ajayi[3], U.E. Ogundu[4], O. Alabi[5], O. Bamidele[6], E.B. Sonaiya[6] and O.A. Adebambo[7]
[1]Department of Animal Science, Usmanu Danfodiyo University, Sokoto, State; [2]Department of Animal Science, Faculty of Agriculture, Nasarawa State University, Keffi, Shabu-Lafia Campus, Lafia, Nasarawa State; [3]Department of Animal Science, University of Port-Harcourt, Rivers State; [4]Department of Animal Science, Federal University of Technology, Owerri, Imo State; [5]Department of Animal Science, Landmark University, Omu-Aran, Kwara State; [6]African Chicken Genetic Gains (ACGG) Project National Secretariat, Department of Animal Science, Obafemi Awolowo University, Ile-Ife, Osun State; [7]Department of Animal Breeding and Genetics, Federal University of Agriculture, Abeokuta, Ogun State
Corresponding author: E-mail address: hassanakinola@gmail.com

Abstract

Evaluation of the brooding performance of two imported tropically-adapted chicken (Kuroiler and Sasso) and Nigerian indigenous FUNAAB alpha, Shika Brown and Fulani birds was carried out in five sub-national zones in Nigeria. Fifty-three thousand, nine hundred and twenty-three (53,923) day-old chicks were covered. The birds were reared on deep litter from day-old to six weeks of age. Performance characteristics considered were initial body weight (IBW), final body weight (FBW), feed intake (FI), weekly body weight (WBW), body weight gain (BWG), feed conversion ratio (FCR), weekly mortality number (WMN) and percentage mortality (PM). Data were analysed using the General Linear Model (GLM) procedure to determine the fixed effects of genotype and sub-national zone as well as their interaction on the performance characteristics. Body weight (BW) was also predicted from genotype and sub-national zone using automatic linear modeling (ALM), classification and regression tree (CRT), chi-square automatic interaction detection (CHAID) and Exhaustive CHAID data mining algorithms. With the exception of FCR and average weekly number of mortalities (P>0.05) under sub-national zone, every other characteristic was significantly (P<0.05) influenced by the two factors. Sasso birds appeared to be better considering their average weekly body weight (304.35±26.57 g) and average weekly mortality (1.67±0.53 %). Birds reared in Kwara State also tended to have a comparative advantage. There was significant (P>0.05) genotype by zone interaction effect on final BW. The regression models collectively revealed that the genotype of birds was the paramount factor to estimate BW. Sasso chickens appear promising in boosting poultry production provided they are able to repeat their good performance at the level of the smallholder farmers in Nigeria.

Keywords: Tropically-adapted chicken, performance, algorithms, sub-national zones, Nigeria

Introduction

There is diversity in the use and benefits of chickens in developing countries (Padhi, 2016). However, the low productivity of scavenger chickens in the developing world is a source of major concern (Pauwel *et al.*, 2015). The situation in Nigeria, sub-Saharan is worsened by unimproved genetic make-up of the birds, low-input and limited technical know-how on the part of the farmers and the vagaries of climatic factors. Genetics and breeding are among the sciences that have shaped the development of innovation in smallholder poultry in the last three decades (Sonaiya, 2016) to address the problems of slow-growing, low meat yield, small size/number of eggs and high mortality (Dessie, 2017). Identification of appropriate breeds of chicken that suit a particular environment, therefore, is needed for the growth and development of the poultry industry, especially at the smallholder level. Kuroiler and Sasso are dual-purpose birds newly introduced into the Nigerian environment to boost chicken production and productivity of smallholder farmers. These tropically- adapted birds have been tested in Ghana and Tanzania where they were able to exhibit their genetic potential in terms of egg and meat production.

The aim of this study, therefore, was to assess the performance during the brooding stage of Kuroiler and Sasso birds alongside the newly developed Nigerian indigenous FUNAAB alpha as well as ShikaBrown and Fulani chicken in five sub-national zones of Nigeria.

Materials and Methods

Fifty-three thousand, nine hundred and twenty-three (53,923) day-old chicks were utilized in five sub-national zones corresponding to five sub-national zones in Nigeria under the African Chicken Genetic Gains (ACGG) project. They were distributed as follows: Kwara State: Sasso = 3,277, Kuroiler = 3,326, Fulani = 640, ShikaBrown = 2,860 and FUNAAB alpha = 1,368; Rivers State: Sasso = 2,900, Kuroiler = 2,950, Fulani = 834, ShikaBrown = 2,950 and FUNAAB alpha = 1,530; Imo State: Sasso = 3,123, Kuroiler = 3,067, Fulani = 847, ShikaBrown = 2,930 and FUNAAB alpha = 1,000; Nasarawa State: Sasso = 3,009, Kuroiler = 2,907, Fulani = 1,020, ShikaBrown = 3,483 and FUNAAB alpha = 1,583 and Kebbi State: Sasso = 3,111, Kuroiler = 2,958, Fulani = 687 and FUNAAB alpha = 1,563. The birds were managed intensively on deep litter in privately-owned poultry farms in all the five zones. The same farm in each zone was used for the rearing of all the five chicken genetic groups in

order to minimize error due to management. As a result of the differences in a sample size of each genotype in each zone, the number of replications varied.

The birds were subjected to similar conventional methods of chicken rearing from week 1 to six-weeks of age in terms of feeding, vaccination and medication. Standard biosecurity measures were also strictly taken in line with the recommendations of the ACGG project. Performance characteristics considered were initial body weight (IBW), final body weight (FBW), weekly feed intake (WFI), weekly body weight (WBW), body weight gain (BWG), feed conversion ratio (FCR), weekly mortality number (WMN) and percentage mortality (PM). Data were analysed using the General Linear Model (GLM) procedure of SPSS (2015) to determine the fixed effects of genotype and sub-national zone as well as their interaction on all the eight performance characteristics. Being a trait of paramount importance in poultry production, average WBW was predicted from genotype and sub-national zone, to know which of the two factors exerted more influence on its expression.

The automatic linear modeling (ALM) procedure and the non-parametric classification and regression tree (CRT), chi-square automatic interaction detection (CHAID) and Exhaustive CHAID data mining algorithms were employed.

Results and Discussion

There was significant ($p<0.05$) effect of genotype on all the characteristics investigated. Kuroiler birds had significantly ($p<0.05$) higher FBW followed by Sasso and FUNAAB alpha chicken (Table 1). Feed consumption was also higher ($P<0.05$) in Kuroiler compared to their indigenous counterparts. Fulani had significantly ($p<0.05$) higher FCR, an indication of poor feed utilization. Average weekly PM was lower ($p<0.05$) in Sasso followed by Fulani, FUNAAB alpha and Shika Brown chicken. It has been reported that exotic chickens tend to consume more feed (Gebremariam *et al.*, 2017) and have higher BW and BWG than their indigenous counterparts. However, the relatively small BW of Shika Brown might not be unconnected with its genetic potential for egg production compared to meat yield while that of Fulani birds may be an adaptive mechanism to survive under the resource-poor scavenging conditions in tropical environments.

Table 1: Means and standard errors for some performance characteristics of five genotypes of chickens during brooding

Performance characteristic	Chicken genotype				
	Sasso	Kuroiler	Fulani	ShikaBrown*	FUNAAB alpha
Initial body weight	43.83±0.26[a]	43.07±0.26[b]	26.85±0.26[e]	31.03±0.26[d]	33.73±0.26[c]
Final body weight	524.16±1.84[b]	582.85±1.84[a]	242.58±1.84[e]	328.71±2.06[d]	423.62±1.84[c]
Average weekly feed intake (g)	238.23±21.47[ab]	274.85±21.47[a]	198.74±21.47[b]	188.07±24.01[b]	211.87±21.47[b]
Average weekly body weight (g)	305.18±26.47[a]	331.20±26.47[a]	132.38±26.47[c]	182.20±29.60[bc]	209.50±26.47[b]
Avg weekly body wt gain (g)	80.08±7.40[ab]	90.10±7.40[a]	36.02±7.40[d]	49.59±8.27[cd]	67.30±7.40[bc]
Feed conversion ratio	4.49±1.22[b]	3.97±1.22[b]	10.75±1.22[a]	4.28±1.22[b]	5.05±1.22[b]
Average weekly mortality (No.)	48.63±15.04[bc]	145.23±15.04[a]	15.1±15.04[c]	78.63±16.82[b]	29.50±15.04[c]
Average weekly mortality (%)	1.67±0.53[b]	5.40±0.53[a]	1.87±0.53[b]	2.62±0.60[b]	2.33±0.53[b]

*Estimates for ShikaBrown were based on modified population marginal mean. S.E.: Standard error of means;
[abcd]Means within the same row carrying different superscripts are significantly different ($P < 0.05$).

The present findings revealed that the introduced birds, especially Sasso, considering jointly its BW and PM could thrive under the hot-humid tropical conditions of Nigeria. This is more so that its potential for high BW (total average WBW of birds on deep litter was 3.38 ± 0.12 kg from week 31- 52) goes beyond the brooding stage as reported by Yakubu and Madaki (2017). This is a pointer to the possible selection of elite birds of this genotype to improve the production and productivity of the indigenous stock. The present findings are congruous to the submission of Getiso *et al.* (2017), that Sasso chicken showed good performance under village production system in Ethiopia. All the characteristics were significantly ($p<0.05$) affected by sub-national zone, except FCR and average WMN (Table 2). Birds reared in Kwara State appeared to perform better than others. Only BW was affected ($p<0.05$) by genotype × sub-national zone interaction.

Out of the two independent variables fitted into the ALM, the effect of genotype on BW was more important compared with that of sub-national zone (82.2 versus 17.8 %; R^2 = 24.1%). CRT, CHAID and Exhaustive CHAID algorithms also predicted genotype to be the factor of utmost importance to assess the BW of the birds (R^2 = 20.0% in all cases). In these models, Sasso and Kuroiler were significantly ($P<0.01$) forecast to be better than others, which is similar to what was obtained under the GLM procedure.

Table 2. Means and standard errors for some performance characteristics of five chicken genotypes during brooding in five sub-national zones of Nigeria

Performance characteristic	Sub-National Zone (SNZ)				
	SNZ 1 (Kwara)	SNZ 2 (Rivers)	SNZ 3 (Imo)	SNZ 4 (Nasarawa)	SNZ 5 (Kebbi)*
Initial body weight	36.35±0.26[a]	36.00±0.26[ab]	35.46±0.26[bc]	35.18±0.26[cd]	34.51±0.26[d]
Final body weight	582.99±1.84[a]	352.28±1.84[d]	399.80±1.84[b]	377.12±1.84[c]	405.00±2.06[b]
Avg weekly feed intake (g)	256.90±21.47[a]	176.70±21.47[b]	261.70±21.47[a]	216.56±21.47[ab]	202.86±24.01[ab]
Avg weekly body weight (g)	301.00±26.47[a]	181.35±26.47[b]	214.68±26.47[b]	237.83±26.47[ab]	234.07±29.60[ab]
Avg weekly body wt gain (g)	91.41±7.40[a]	57.35±7.40[b]	68.14±7.40[b]	57.06±7.40[b]	66.70±8.27[b]
Feed conversion ratio	4.59±1.22[a]	5.75±1.22[a]	5.73±1.22[a]	6.40±1.22[a]	6.50±1.37[a]
Avg weekly mortality (No.)	41.83±15.04[a]	65.10±15.04[a]	52.63±15.04[a]	95.03±15.04[a]	58.46±16.82[a]
Average weekly mortality (%)	1.69±0.53[b]	3.17±0.53[ab]	2.53±0.53[b]	4.12±0.53[a]	2.32±0.60[b]

*Estimates for SNZ 5 were based on modified population marginal means. S.E.: Standard error of means;
[ab] Means within the same row carrying different superscripts are significantly different (P <0.05)

Conclusion

The present study revealed that Sasso birds appeared better than their Kuroiler, FUNAAB alpha, Shika Brown and Fulani counterparts at six-week brooding stage. The effect of sub-national zone did not follow a definite pattern. However, the ANN, CRT, CHAID and Exhaustive CHAID algorithms showed that genotype was more significant in assessing the BW of the birds. The implication of this study is that Sasso birds, apart from being reared side by side with the indigenous stock, could be used genetically to improve the latter for increased production. However, their adoption is subject to their subsequent better performance as the genotype of preference at the smallholder level.

Acknowledgements

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