ISSN 1682-8356
ansinet.org/ijps

INTERNATIONAL JOURNAL OF

POULTRY SCIENCE

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorijps@gmail.com

International Journal of Poultry Science 12 (6): 358-361, 2013
ISSN 1682-8356

Growth Performance of Australorp x Tswana Crossbred Chickens under an Intensive Management System

Patrick M. Kgwatalala and Phakedi Segokgo
Department of Animal Science and Production, Botswana College of Agriculture,
Private Bag 0027, Gaborone, Botswana

Abstract: Indigenous Tswana chickens are better adapted to prevailing environmental conditions and diseases than their exotic counterparts. They however exhibit slower growth rate and less mature final weight than their exotic counterparts. Crossbreeding of indigenous Tswana chickens with exotic chicken breeds can therefore be used as an alternative strategy to improve growth performance of indigenous Tswana chickens by taking advantage of breed complementarily and heterosis. The current study was therefore aimed at evaluating growth performance of Australorp × indigenous Tswana chickens F1 crossbred progeny relative to purebred indigenous Tswana chickens under an intensive management system. A total of 42 Australorp x Tswana crossbred chickens and 44 purebred indigenous Tswana chickens were evaluated for growth performance (body weight) every fortnight from 4-18 weeks of age. The chickens were raised under a deep litter house system and provided with water and commercial feeds ad libitum. Males of both crossbred and purebred chickens were generally heavier ($p>0.05$) than their age-matched female counterparts at different ages. Body weight was however significantly higher in Australorp x Tswana crossbred males and females than their indigenous purebred counterparts at 18 weeks of age. Growth was also more enhanced in crossbred Australorp x Tswana males than Females. Crossbreeding can therefore be used as a strategy to improve growth performance of indigenous Tswana chickens raised under an intensive management system. The study however needs to be repeated to evaluate growth performance of crossbred chickens under free range system commonly practiced in rural areas of Botswana.

Key words: Blue australorp, F1 crosses, indigenous tswana chicken, body weight

INTRODUCTION

The rearing of indigenous Tswana chickens is very popular in rural areas of Botswana as a means of providing supplementary food in the form of meat and eggs and extra income during occasional sales of live chickens or eggs. The productivity of indigenous Tswana chickens is however generally very low because of lack of selection for productivity, poor nutrition, poor housing and poor health care given to the chickens under the traditional rearing system. Indigenous Tswana chickens are however adapted to the local, usually harsh, environmental conditions in which they have been kept over centuries. Indigenous Tswana chickens survive under stressful environmental conditions including high disease incidence, poor nutrition and high temperatures, all qualities that forms the basis for low-input, sustainable agriculture for the rural and resource-poor communities (FAO, 1998a, b). Exotic chickens on the other hand, produce higher number of eggs and more meat than indigenous chickens but are not adapted to stressful environmental conditions such as high temperatures, diseases and poor nutrition (Ali *et al*., 2000; Islam and Nishibori, 2009).

Increasing the productivity of indigenous Tswana chickens can be achieved by within breed selection (selective breeding) or by crossing indigenous Tswana chickens with exotic chicken breeds. Crossbreeding however has the advantage over selective breeding of achieving the desired productivity levels within a relatively short period of time. The goal with crossbreeding is to develop a hybrid or cross that is resistant to harsh local conditions and at the same time produces a reasonable amount of meat and eggs (Mekki *et al*., 2005). Productivity levels of the resulting hybrids are expected to be better than the average productivity levels of both parents as a result of breed complementarily and hybrid vigor. Growth performance of Exotic x Indigenous Tswana chicken crosses has never been evaluated. The objective of this study was therefore to evaluate growth performance of Blue Australorp x Indigenous Tswana crossbred chickens raised under an intensive management system.

MATERIALS AND METHODS

Study area: The study was conducted at Botswana College of Agriculture, Content Farm, Sebele, Gaborone,

Corresponding Author: Patrick M. Kgwatalala, Botswana College of Agriculture, Private bag 0027, Gaborone, Botswana

in the Southern part of Botswana from beginning of November 2012 to the end of March 2013. During the study period, environmental temperature averaged 32°C and ranged between 15.6 and 38°C.

Experimental animals: A total of thirty females of the normal strain of indigenous Tswana chickens, two males of the normal strain of Tswana chicken and two Blue Australorp males were used as the foundation stock for breeding purposes. Two indigenous Tswana males and fifteen indigenous Tswana females (1:7.5 mating ratio) were housed separately in a deep litter house and fed commercial grower pellets to produce fertile eggs The other fifteen females were housed with the two blue Australorp males in a separate deep litter house to produce fertile eggs. A total of 100 eggs were collected from each of the deep litter houses over a period of five consecutive. Eggs collected each day were individually identified and stored at 18°C. On the fifth day of egg collection, all the eggs were incubated in an automatic egg incubator at 37.5°C and 55% relative humidity. The resulting F1 progeny chickens were used to evaluate growth performance of Australop x Tswana crossbred chickens relative to their age-matched purebred indigenous Tswana chickens under an intensive management system.

Housing and management: A total of 20 Australorp x Tswana crossbred chickens (14 females and 6 males) and 22 purebred indigenous Tswana chickens (11 males and 11 females) were housed together in one deep litter house and the other 22 Australorp x Tswana crossbred chickens (14 females an 8 males) together with 22 purebred indigenous Tswana chickens (12 females and 10 males) were housed in another deep litter house resulting in two replications. The chicks were fed chick starter mash *ad libitum* from day old to 2 weeks of age. At 3 weeks of age, the chicks were individually identified using leg bands and thereafter, fed grower pellets until they were 18 weeks old. Water was provided *ad libitum* during the brooding and growth phases. During the growth phase, chickens were vaccinated against Newcastle disease and Gumboro disease. Chickens were raised under natural light (~12 h light and 12 h dark periods) throughout the study period.

Measurement of growth parameter: Growth performance of the F1 progeny (purebreds and crossbreds) was measured as the increase in body weight of individual chickens from 4-18 weeks of age. Body weights of individual chickens were taken fortnightly from 4-18 weeks of age using an electronic balance.

Statistical analysis: Growth data were analyzed by General Linear Models procedures of Statistical Analysis System (SAS, 2009) version 9.2.1 and the model included fixed effects of breed (Tswana and Australorp x Tswana cross) and sex (male and female) and the interaction between breed and sex. The results are presented as least square means±standard error and means separation was by paired t-test with Scheffe's adjustment to account for the differences in the number of sampling units per replication. The differences between means were declared significantly different at $p \leq 0.05$.

RESULTS AND DISCUSSION

The live body weights at different ages of both males and females of Australorp x Tswana F1 crosses and indigenous Tswana chickens are presented in Table 1. There were no significant sex differences in the weights of Australorp x Tswana F1 crosses from 4-8 weeks of age. However, crossbred males were significantly heavier ($p<0.05$) than their age-matched female counterparts from 10-18 weeks of age. There were no significant sex differences in body weights of purebred Tswana chickens from 4-12 weeks of age. Males of indigenous Tswana chickens were however significantly heavier than their age-matched female counterparts from 14-18 weeks of age.

Gondwe and Wollny (2003) reported sexual dimorphism in body weight in pure Australorp chickens raised under an intensive management system but reported similar body weights between males and females under free-

Table 1: Body weights of males and females of Australorp x Tswana F1 crosses and indigenous Tswana chickens under an intensive management system

Age in weeks	F1 cross		Tswana	
	Male	Female	Male	Female
4	235.14±17.05	225.63±11.16	259.24±12.59	251.60±12.59
6	461.82±24.14	411.15±15.80	438.50±17.83	416.91±17.83
8	727.61±31.89	634.03±20.88	647.50±23.56	610.04±23.56
10	1116.57^{a}±49.07	911.42^{b}±32.12	878.91±36.24	775.11±36.24
12	1438.16^{a}±53.69	1153.12^{b}±35.15	1131.33±39.65	1060.52±39.65
14	1719.17^{a}±60.62	1343.21^{b}±39.69	1403.06^{a}±44.77	1208.57^{b}±44.77
16	2124.65^{a}±73.60	1567.53^{b}±48.21	1660.77^{a}±54.38	1363.14^{b}±54.38
18	2378.00^{a}±73.95	1774.93^{b}±48.41	1897.77^{a}±54.62	1545.14^{b}±54.62

Means with different superscripts within breed at a particular age were significantly different from each other ($p<0.05$)

range system. Bekele *et al*. (2010) reported significantly higher body weights ($p<0.05$) in males than females in the Naked neck x Fayoumi and Netch x Rhode Island Red F1 crosses with indigenous breeds as paternal lines and exotic breeds as maternal lines from 4-8 months of age. The sexual dimorphism in body weight from 14-18 weeks of age in indigenous Tswana chicken is consistent with Kgwatalala *et al*. (2012) who found significantly higher body weights in males than females of the naked neck and normal strains of indigenous Tswana from 14 weeks of age to 20 weeks of age. Momoh *et al*. (2010) reported sexual dimorphism in body weight for the heavy and light Nigerian local chicken ecotypes and their reciprocal crosses from 12-20 weeks of age. The body weights of males and females of the normal strain of indigenous Tswana chicken at different ages reported in the present study are lower than the body weights at similar ages reported by Kgwatalala *et al*. (2012). The Tswana chickens used by Kgwatalala *et al*. (2012) were F1 progeny of the foundation stock purchased from different parts of the country while Tswana chickens used in the current study are the F3 progeny of a closed population of Tswana chickens and inbreeding might therefore explain the disparity in body weights between the studies. The presence of sexual dimorphism in body weight at 10 weeks of age for the Australorp x Tswana F1 cross and at 14 weeks of age for indigenous Tswana chicken indicates early enhanced growth in crossbred males than females probably as a result of enhanced secretion of male sex hormones that promote rapid growth. The positive effects breed complementarily and heterosis on growth in crossbreds is probably more pronounced under the male hormonal environment than under the female hormonal environment.

There were no significant differences in body weight between Australorp x Tswana crossbred males and indigenous Tswana chicken males from 4-8 weeks of age (Table 2). However, Australorp x Tswana crossbred males were significantly heavier ($p<0.05$) than their age-matched indigenous counterparts from 10-18 weeks of age. Significantly higher body weights in crossbred males than their indigenous counterparts from 10-18 weeks of age is consistent with Kadigi *et al*. (1998) who found similar body weights between Black Australorp x Malawian local chicken crossbred males and indigenous chicken males at 8 weeks (0.32±0.15 and 0.26±0.11kg, respectively) but significantly higher body weights in crossbred males than their indigenous counterparts at 20 weeks of age (2.14±0.01 and 1.783±0.03kg, respectively). Adedokun and Sonaiya (2002) also reported significantly higher body weights in Dahlem red x Nigerian native chicken crossbred males than in purebred native chicken males at 8 weeks (508±25.0 and 283±23.1g, respectively) and 20 weeks (1360±60.2 and 1191±40.5g, respectively) of age. Still in Nigeria, Momoh *et al*. (2010) reported significantly higher body weights in heavy local chicken ecotype x light local chicken ecotype crossbred males than in purebred light local chicken ecotype males from 12-20 weeks of age.

In females, there were no significant differences in body weights between Australorp x Tswana F1 crosses and purebred indigenous Tswana chickens from 4-14 weeks of age. However, Australorp x Tswana crossbred females were significantly heavier ($p<0.05$) than their age-matched indigenous counterparts from 16-18 weeks of age. Superiority in growth performance of crossbred females than their indigenous counterparts found in the current study is consistent with Adedokun and Sonaiya (2002) who also reported significantly higher body weights in the Dahlem Red x Nigerian indigenous chicken crossbred females than purebred Nigerian indigenous chicken females at 8 weeks (468±33.1 and 252±29.5g, respectively) and 20 weeks of age (1275±79.6 and 970±32.3g, respectively). Still in Nigeria, Momoh *et al*. (2010) also reported significantly higher body weights in heavy local chicken ecotype x light local chicken ecotype crossbred females than in purebred light local chicken ecotype females from 12-20 weeks of age. Significantly higher body weights in both crossbred males and females than their indigenous counterparts at the end of the study (18 weeks of age) are probably mainly due to breed complementarily (favorable breeding value for growth) as the heritability

Table 2: Body weights of males and females of F1 crosses and indigenous Tswana chickens raised under an intensive management system

Age in weeks	Males		Females	
	F1 Cross	Tswana	F1 cross	Tswana
4	235.14 ±17.05	259.24 ±12.59	225.63 ±11.16	251.60 ±12.59
6	46182 ±24.14	438.50 ±17.83	411.15 ±15.80	416.91 ±17.83
8	727.61 ±31.89	647.50 ±23.56	634.03 ±20.88	610.04 ±23.56
10	1116.57^{a} ±49.07	878.91^{b} ±36.24	911.42 ±32.12	775.11 ±36.24
12	1438.16^{a} ±53.69	1131.33^{b} ±39.65	1153.12 ±35.15	1060.52 ±39.65
14	1719.17^{a} ±60.62	1403.06^{b} ±44.77	1343.21 ±39.69	1208.57 ±44.77
16	2124.65^{a} ±73.60	1660.77^{b} ±54.38	1567.53^{a} ±48.21	1363.14^{b} ±54.38
18	2378.00^{a} ±73.95	1897.77^{b} ±54.62	1774.93^{a} ±48.41	1545.14^{b} ±54.62

Means with different superscripts within sex at a particular age were significantly different from each other ($p<0.05$)

for body weight in chickens is fairly high (0.54-0.62) according to Kadigi *et al.* (1998) and to some extent favorable gene combination value or heterosis. Crossbred males were significantly heavier than their indigenous counterparts from 10 weeks of age while for females it took crossbred females 16 weeks to be significantly heavier than their indigenous counterparts. Crossbred males thus had early enhanced growth compared to their female counterparts probably because of effective male growth hormones compared with female hormones (Singh *et al*., 1982).

Conclusions: Males of both crossbred and purebred chickens were generally heavier ($p>0.05$) than their age-matched female counterparts at different ages. Body weight was however significantly higher in Australorp x Tswana crossbred males and females than their indigenous purebred counterparts at 18 weeks of age. Growth was also more enhanced in crossbred Australorp x Tswana males than Females. Crossbreeding can therefore be used as a strategy to improve growth performance of indigenous Tswana chickens raised under an intensive management system. The study however needs to be repeated to evaluate growth performance of crossbred chickens under free range management system commonly practiced in rural areas of Botswana.

ACKNOWLEDGEMENT

The authors would like to thank Botswana College of Agriculture for funding the study

REFERENCES

Adedokun, S.A. and E. Sonaiya, 2002. Crossbreeding Nigeria Indigenous with the Dahlem Red chickens for improved productivity and adaptability. Arch. Tierz., Dummerstorf, 45: 297-305.

Ali, K.O., A.M. Katule and O. Syrstad, 2000. Genotype x Environment interaction for growing chickens: A comparison of four genetic groups on two rearing systems under tropical condition. Acta Agric. Scandi., 50: 65-71.

Bekele, F., T. Ådnøy, H.M. Gjøen, J. Kathle and G. Abebe, 2010. Production performance of dual purpose crosses of two indigenous with two exotic chicken breeds in sub-tropical environment. Int. J. Poult. Sci., 9: 702-710.

FAO, 1998a. Farm Animal Genetic Resources: Biodiversity for Food and agriculture. Food and Agriculture Organisation of the United Nation.

FAO, 1998b. Local animal breeds still threatened by extinction, No. 4. Food and Agriculture Organisation of the United Nation.

Gondwe, T.N.P. and C.B.A. Wollny, 2003. Comparative Productivity of Black Australorp and Indigenous Chickens under Free ranging Village Conditions in Malawi. Deutscher Tropentag, Conference on International Agricultural Research for Development.

Islam, M.A. and M. Nishibori, 2009. Indigenous naked neck chickens: A valuable genetic resource for Bangladesh. World's Poult. Sci. J., 65: 125-138.

Kadigi, H.J.S., R.K.D.N. Phoya and A.C.L. Safalaoh, 1998. Comparative performance of Black Australorp, Malawian local chicken and their f1 crossbred roasters. Ind. J. Anim. Sci., 68: 366-367.

Kgwatalala, P.M., M. Nogayagae and S.J. Nsoso, 2012. Growth performance of different strains of indigenous Tswana chickens under intensive management system. African J. Agric. Res., 7: 2438-2445.

Mekki, D.M., I.A. Yousif, M.K. Abdel Rahman, J. Wang and H.H. Musa, 2005. Growth performance of indigenous X exotic crosses of chicken and evaluation of general and specific combining ability under Sudan condition. Int. J. Poult. Sci., 4: 468-471.

Momoh, O.M., C.C. Nwosu and I.A. Adeyinka, 2010. Comparative evaluation of two Nigerian local chicken ecotypes and their crosses for growth traits, Int. J. Poult. Sci., 9: 738-743.

SAS Institute, 2009. User's Guide Version, 9.2.1, 2002-2009, SAS Institute Inc., Cary, NC, USA.

Singh, B.P., R.P. Chaudhary, R.V. Singh and S.P.S. Ahlawates, 1982. Diallel crosses in poultry for broiler production estimation of heterosis for various broiler traits. Ind. J., 59: 882-892.