

EFFECT OF SEASONAL CHANGES ON THE GROWTH CURVE PARAMETERS OF MALE AND FEMALE CHICKENS

O. S ABE¹, B. M. ILORI¹, S. O. PETERS², I. O. DANIEL³, M. O. OZOJE¹

¹Department of Animal Breeding and Genetics, Federal University of Agriculture, Abeokuta, Nigeria.

²Department of Animal Science, Berry College, Georgia Athens, USA.

³Department of Plant Breeding and Seed Technology, Federal University of Agriculture Abeokuta, Nigeria.

Correspondence: abeolugbenga@gmail.com

ABSTRACT

Weekly body weight data of 417 chickens were fitted to Gompertz growth model to study the seasonal variation on the predicted growth curve parameters of male and female genotypes of chicken (naked neck-NN, FUNNAB Alpha-BA and Giriraja-GR chickens). The growth data were collected during late dry season of January-March and early wet season of April-June. The data were transformed to a heavy-tailed distribution and analyzed using Bayesian approach. The result of the study showed that early wet season as predicted by the model supported high weight gain in all the genotypes. Giriraja however, among the three genotypes was superior in weight gain followed by NN and BA. During late dry season, exponential profitability is achieved at 10-13 weeks and 12-14 weeks during early wet season.

Keywords: Giriraja, heavy-tailed distribution, FUNAAB Alpha chicken, Bayesian approach.

INTRODUCTION

As research advances, it's becoming clearer that utilization of major genes in tropical climate, either pure or as crosses, has been found to be associated with improved heat tolerance as in the case of Naked neck chickens (Yahav *et al.*, 1998) without negatively affecting growth rate. Dual purpose chicken like Giriraja are popular in tropical countries and are used massively for backyard rearing (Neupane, 2014) because it has good adaptability, resistance to common diseases, thrive well and perform better even in scavenging management. However, due to the differential growth of the body parts of any poultry breed, one cannot measure continuously most of the growth processes that take place for comparison purpose. Likewise, growth rate and meat yield are significantly affected by natural heat stress (Yalcin *et al.*, 1997) making it essential to study these genotypes under different seasons. Thus, it is preferable to model increase in body weight with respect to time (age) using a non-linear growth models which can best described the sigmoid shaped pattern of growth. With any non-linear growth model, the minimal parameter components describe the chicken initial weight, maturing rate and the final (asymptotic) weight as time approaches infinity. The objective of this study was to investigate the

effect of seasonal changes on the growth pattern of male and female chickens as modeled Gompertz growth function.

MATERIALS AND METHODS

Individual weekly body weight data of 105 locally adapted exotic Giriraja chickens, 197 indigenous Naked neck chickens and 115 improved indigenous FUNAAB Alpha chicken (4th generation crossbred) were used for the analysis. Gompertz growth model used in this study is given by the function

$$BW_{ij} = A_i \cdot \exp[-B_i \cdot \exp(-k_i t_{ij})]$$

Where BW_{ij} is the body weight of chicken at age (week) t_{ij} ; A is an estimation of mature weight as age approaches infinity ($t_i \rightarrow \infty$); B is the integration constant defining the degree of maturity at $t_i = 0$; k is the rate of maturing and refers to growth rate relative to mature weight.

Time to inflection point (t_{inf}) and weight at inflection point (W_{inf}) for the growth model was also estimated using the following functions;

$$t_{inf} = -\log(B_i)/k_i \quad W_{inf} = A/2.7182$$

The growth curve parameters (A , B , k) for the model was estimated using WinBUGS to read the model, priors and data, and run the Markov Chain Monte Carlo simulation (MCMC). The t_{inf} and W_{inf} for the model was calculated by using estimated growth curve parameters. Then, the

arithmetic mean and standard error of arithmetic mean values of the estimates of growth curve parameters including the t_{inf} and W_{inf} were calculated by using R statistical package.

RESULTS AND DISCUSSION

Male Giriraja (GR) chickens performed better than the improved indigenous (FUNAAB Alpha chicken-BA) and Naked neck (NN) as shown in Figure 1 during late dry season. The BA chicken being an improved indigenous genotype had slightly higher 20-week body weight compared to NN. The BA chicken performed better than NN despite being able to tolerate heat. Yalcin (1997) reported weight reduction resulting from natural heat stress.

In Table 1, NN and GR reached t_{inf} at the same time (9.2 weeks) faster than BA (11.0 weeks) even though it did not translate into same W_{inf} for NN and GR. This shows that for maximum rate of returns on carcass yield, NN and GR can be reared for 9 weeks while BA can go till 11 weeks. Furthermore, BA was able to perform better than NN despite being able to save on the amount of protein required for feather for meat tissue (Ajanget al., 1993).

The performance of female chickens during late dry season was lower compared to their male counterpart during the same season as shown in Figure 2 and figure 1 respectively. However, in Figure 2 the growth pattern of BA was slightly higher than that of NN being an improved indigenous breed while GR was better compared to NN and BA.

Point of inflection was reached at an older age (13 weeks) in GR. This translated to heavier W_{inf} (1045.0g) followed by 12.2 weeks in NN (532.4g) and 11.1 weeks in BA (516.3g). This shows that 37% of Ain Gompertz function is achieved at inflection point (Galeano-Vasco et al., 2014).

In Figure 3, GR being an improved exotic dual purpose genotype performs better followed by NN and BA. The higher weight gain in NN over BA may be due to better feed conversion and reduced heat stress for more meat tissue than feather. As shown in Table 3, BA recorded higher A compared to NN as time reaches infinity. This may be due to the fact that NN reached t_{inf} (10.9 weeks) earlier than BA (12.5 weeks). GR achieved longer exponential growth

(15.4 weeks), higher W_{inf} (1368.0g) and A (3719.0) (Table 3).

All the three genotypes during early wet season as shown in Figure 4 recorded relatively close growth pattern with GR finishing with the highest weight followed by NN and BA.

The t_{inf} is longest in GR (13.6 weeks). Despite BA having a longer t_{inf} , NN recorded the higher W_{inf} (559.8g) and heavier A (1522.0g) after GR. This is because it has been established that higher W_{inf} will produce higher A (Kizilkaya et al., 2006).

CONCLUSION

The result of the study revealed that male genotype performed better than their female counterpart irrespective of season. Giriraja chickens perform better than the indigenous and the improved indigenous. The predicted productivity of all the genotypes irrespective of sex was better during early wet season.

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Table 1. Estimated means of curve parameters

Curve parameters	NN	BA	GR
$t_{inf}(\text{weeks})$	9.2	11.0	9.2
$W_{inf}(\text{g})$	460.0	580.5	912.2
$A(\text{g})$	1252.0	1578.0	2840.0

EBW = Estimated Body Weight, NN=Naked Neck, BA= FUNAAB Alpha and GR=Giriraja
 t_{inf} = Age of the chicken at inflection point, W_{inf} = weight of the chicken at inflection point,
 A = Asymptotic final weight

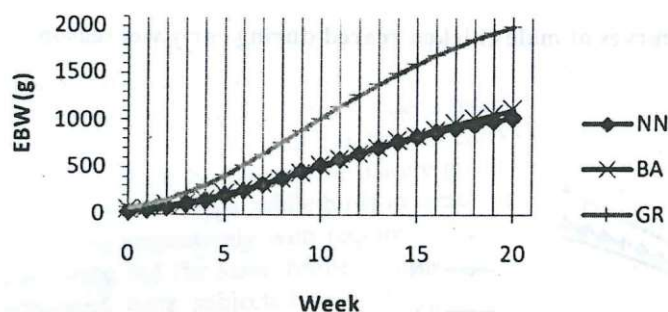


Figure 1. Predicted 20-week growth curves of male chickens reared during late dry season

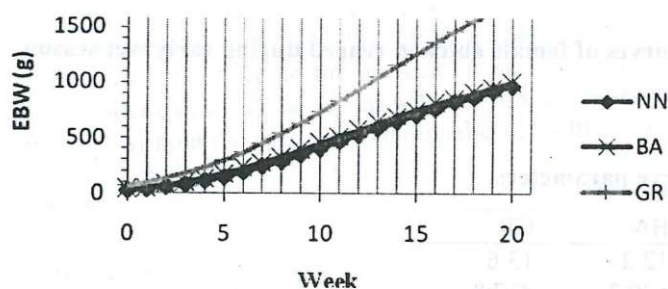


Figure 2. Predicted 20-week growth curves of female chicken reared during late dry season

Table 2 Estimated means of curve parameters

Curve parameters	NN	BA	GR
$t_{inf}(\text{weeks})$	12.2	11.1	13.0
$W_{inf}(\text{g})$	532.4	516.3	1045.0
$A(\text{g})$	1447.0	1403.0	2841.0

Table 3 Estimated means of some curve parameters

Curve parameters	NN	BA	GR
$t_{inf}(\text{weeks})$	10.9	12.5	15.4
$W_{inf}(\text{g})$	657.3	613.3	1368.0
$A(\text{g})$	1678.0	1776.0	3719.0

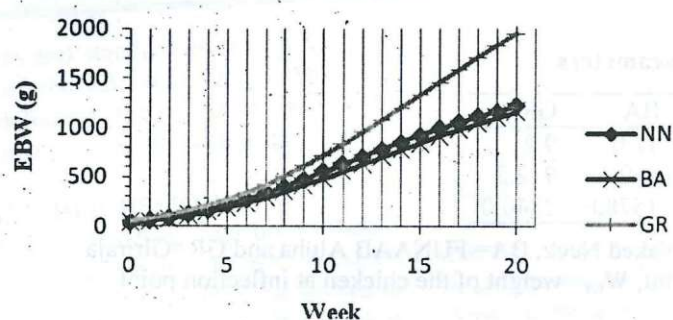


Figure 3. Predicted 20-week growth curves of male chicken reared during early wet season

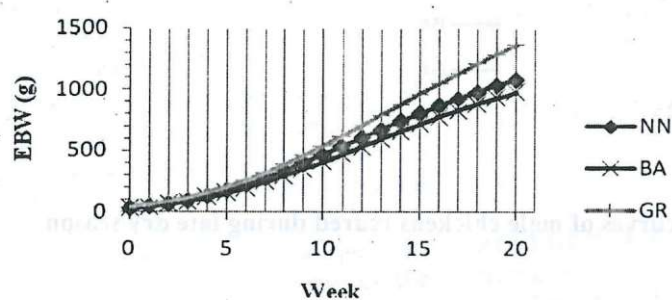


Figure 4 Predicted 20-week growth curves of female chicken reared during early wet season

Table 4 Estimated means of some curve parameters

Curve Parameters	NN	BA	GR
$t_{inf}(\text{weeks})$	11.4	12.2	13.6
$W_{inf}(\text{g})$	559.8	539.3	837.8
$A(\text{g})$	1522.0	1466.0	2277.0