

EVALUATION OF INDIVIDUAL BODY WEIGHT IN ROSS 308 MALE AND ARBOR ACRES MALE BROILER USING GROWTH CURVE MODEL

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ABSTRACT

Understanding of animal growth is important for the improvement of management and feeding practices. Thus, this study was carried out to determine the appropriate growth curve of Arbor acre and Ross 308. In the study, the individual growth weight of 50 males each of Arbor acre and Ross 308 chicken, using Gompertz mode were evaluated. The weight of each bird was taken. Estimate asymmetric weight (a) ranged from 6073.7 for Ross male and from 4341.8 for Arbor male, respectively. The age at the inflection point was estimated from 16.0 weeks for arbor acres and 20.0 weeks for Ross respectively. In conclusion the Ross 308 has more growth curve. The parameter obtain from growth models could help define feeding programs to meet nutritional needs from hatching to the age of maximum growth, reproduction programs and marketing strategies.

Key words:Body weight, Growth curve model, Arbor Acres, Ross 308

INTRODUCTION

The knowledge of animal growth is important for the improvement of management and feeding practices in order to maximize the profit of livestock industry (Narinc *et al.*, 2017; Do and Miar, 2020). Mathematical models have characterized growth patterns and visualized the shape of growth over time. Among these models, nonlinear models are the most applied models as they allow the interpretation and understanding of growth patterns underlying growth periods. Other non-linear models are Gompertz, Logistic, Bridges etc are widely used to describe the growth curve (Kaplan and Gurcan, 2018). Growing the Ross and Arbor arch broiler according to the target growth curve will ensures that males and females achieve optimum lifetime performance and well-being. Therefore, this study was performed to determine the most appropriate model for describing the growth curve of broiler.

MATERIALS AND METHODS

Experimental study area

The study was carried out at the Research and Demonstration Farm, Department of Agricultural Technology, Faculty of Industrial Technology, Akanu Ibiam Federal Polytechnic – Unwana, located in Afikpo North L.G.A Ebonyi State Nigeria

Duration

The experiment lasted for tight (8) weeks.

Data collection

Data was collected on weekly bases with the use of sensitive scale.

Book and pen were used to note the individual weight of the birds.

Experimental design

The birds were label and were weighed according to their label and appropriate record was taken.

Experimental Analysis

Data were analysed using Gompertz model, for the individual growth curves (a total of 100 curves fitted).

RESULTS AND DISCUSSION

Gompertz model equation

Model point	Equation	Age at inflection point	Weight at inflection
Gompertz	$a \cdot \exp(-b \cdot \exp(-k \cdot t))$	in (b/k)	a/e

a is the asymptotic (final or mature) weight; b is the scale parameter or integration constant, measuring the rate of gain in body weight between hatch and maturity; k is the maturity rate;

Goodness of fit used: Means Square Error (MSE). A model with low RMSE for a growth data is considered the best (Keskin and Dag, 2006; Keskin and Daskiran, 2007; Sahin *et al.*, 2014).

Table 1: Weight comparison with Gompertz Model for Ross male

Parameter	Estimate	Std Error	Limits	
a	6073.7	1907.7	1169.7	10977.7
b	4.1099	0.2272	3.5258	4.6941
k	0.2054	0.0486	0.0806	0.3302

a = final weight, b = rate of weight gain, k = maturity rate, SE= standard error, Mean Square Error (MSE): 7535.4

From table 1, Ross male parameter is compared with gompertz model, which is a three parameter model, a , b and k . These parameters were used to compare the breed. a = 6073.7 g, which is the maximum weight that a Ross male can attain in this population. b =4.1099, which is the rate of gain, k = 0.2054 which is the maturity weight rate.

Table 2: Body Weight Prediction for Ross male

No	Age	ABW	predicted	Residual
1	1	171.63	213.78	-42.159
2	2	317.42	397.99	-80.569
3	3	800	660.15	139.847
4	4	1031.25	996.81	34.441
5	5	1310.42	1394.27	-83.854
6	6	1810.42	1832.4	-21.987
7	7	2322.92	2289.07	33.848
8	8	2741.67	2743.8	-2.132

ABW= average body weight, predicted weight, residual weight.

Table 2; shows the age of the Ross 308, ABW and the predicted with the gompertz model. At week 1 the ABW =171.63, while the predicted body weight from the model is 213.78, at week 2 the ABW=317.42, while the predicted is 397.99, at week 3 the ABW=800, while the predicted is 660.15, at week 4 the ABW=1031.25, while the predicted is 996.81, at week 5 the ABW=1310.42, while the predicted is 1394.27, at week 6 the ABW=1810.42 while the predicted is 1832.4, at week 7 the ABW=2322.92, while the predicted is 2289.07, at week 8 the ABW=2741.67 while the predicted is 2743.8.

Table 1: weight comparison with Gompertz Model for Arbor arca male

Parameter	Estimate	Approx Std Error	Approximate 95% Confidence Limits	
a	4341.8	838	2187.7	6495.9
b	4.1059	0.3171	3.2907	4.9211
k	0.2555	0.048	0.1322	0.3787

MSE: 6134.7

From table 1, Arbor arca male parameter is compared with gompertz model, which is a three parameter model, a , b and k . These parameters were used to compare the breed. a = 4341.8 g, which is the maximum weight that a Ross male can attain in this population. b =4.1059, which is the rate of gain, k = 0.2555 which is the maturity weight rate.

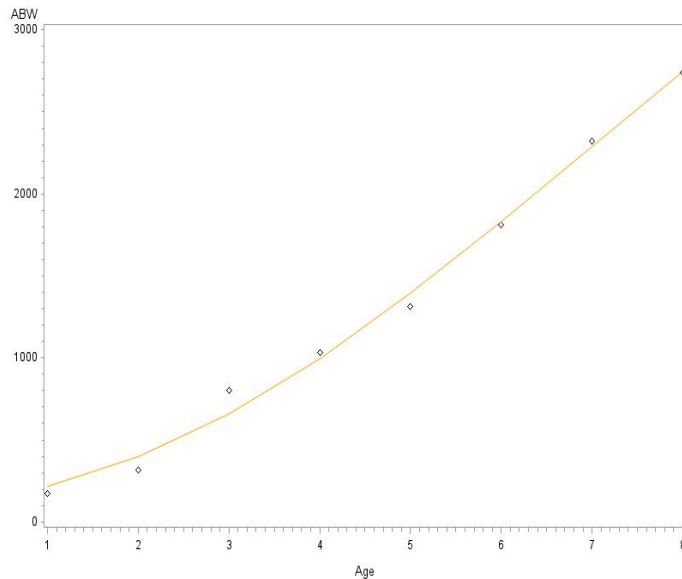


Figure1: The fitness curve of the Gompertz growth model for between the average body weight (ABW) and age of Ross Male chicken

Table 4.2: Body Weight Prediction for Arbor arca male

No	Age	ABW	predicted	Residual
1	1	177.71	180.51	-2.801
2	2	282.08	369.71	-87.627
3	3	775	644.22	130.784
4	4	979.17	990.45	-11.287
5	5	1316.67	1382.05	-65.388
6	6	1791.67	1788.95	2.717
7	7	2220.83	2184.77	36.061
8	8	2537.5	2550.61	-13.114

ABW= average body weight, Predicted weight, Residual weight

Table 2: shows the age of the Arbor arca, ABW and the predicted with the gompertz model. At week 1, the ABW =177.71, while the predicted body weight from the model is 180.51, at week 2 the ABV=282.08, while the predicted is 369.71, at week 3 the ABW=775 while the predicted is 644.22, at week 4 the ABW=979.17 while the predicted is 990.45, at week 5 the ABW=1316.67 while the predicted is 1382.05, at week 6 the ABW=1791.67 while the predicted is 1788.95, at week 7 the ABW=2220.83 while the predicted is 2184.77, at week 8 the ABW=2537.5 while the predicted is 2550.61.

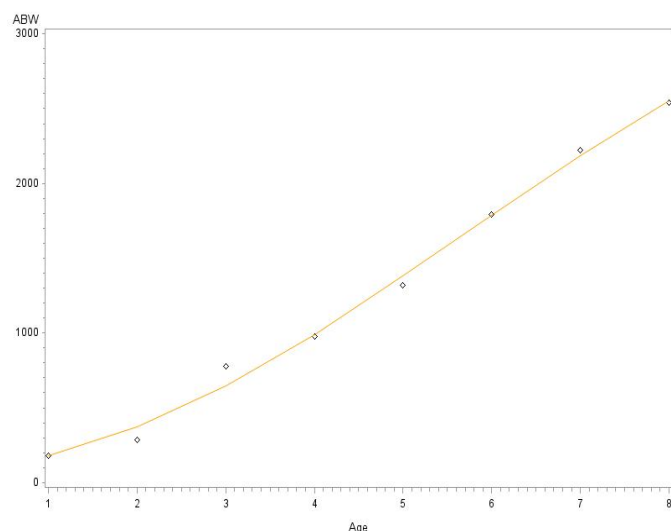


Figure2: The fitness curve of the Gompertz growth model for between the average body weight (ABW) and age of Arbor acre Male chicken

CONCLUSION

The Ross 308 and Arbor acre using Gompertz function gave different estimate growth data. The Gompertz parameter derived from the early growing period were not sufficient to describe the growth of commercial broilers, these could be attributed to effect of breeds and environment condition. Parameters of Arbor acre form were considered more related to the maturity growth since they rely on the maturity growth data rather than the early weight.

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