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PREDICTION OF FINAL BODY WEIGHT OF ROSS 308 AND ARBOR ACRE CHICKEN USING EARLY GROWTH CURVE

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Abstract

Apart from body weight, a number of conformation traits are known to be good indicators of good and market value of broiler. The objective of this study is to determine the relationship between body weights of Arbor acre plus and Ross 308 using a model of fit.120 broiler chicken was used in this experiment, 60 Arbor-acre plus and 60 Ross 308. Regression techniques dependent variable, which is the weight of the bird and the independent variables, which are the morphometric traits, were used to establish a Relationship using linear regression model. The result shows that final weight of Ross 308 can be predicted from the morphometric traits as it can significantly ($p < 0.05$) fit the growth curve. The regression Coefficient of 0.79 is relatively high while the R- square of 0.62 showed a relatively high significant ($p< 0.05$) goodness of fit in all equations. The regression equations for all the morphometric traits considered in Arbor acre plus chickens showed that only body height and body length can significantly ($p< 0.05$) predict the growth curve of Arbor acre plus chickens. The regression Coefficient is high (0.91), likewise the R- square (0.82), the equations can fit the growth curve of Arbor acre plus. Prediction of final body weights using early growth curve is preferably with Ross 308 to Arbor acre plus chickens because almost all the parameters considered were significantly ($p< 0.05$) fit the growth curve.

Keywords: Morphometric, growth, Broiler, Chicken

Introduction

Growth is a key characteristic of animals and can be defined as any change in body size per time unit, and is influenced by genotype and environment. Mathematical functions called 'growth models' have been used to explain the growth patterns of poultry species. Mathematical modelling is useful for optimizing growth rate, livestock performance, slaughter age, appropriate feeding and selection (Sariyel et al., 2017). A useful growth model should be parsimonious and contain parameters that have biological and physical meaning (France et al., 1996). The age–weight relationship has been described by many mathematical models such as logistic model (Grossman and Bohren 1985; Tsoularis & Wallace 2002), Richard model (Knizetova et al., 1991) and Gompertz model (Barbato 1991; N'dri et al.2006). rowth curves are used to describe the changes in body mass or length or number of cells overtime. Modelling of growth curves is particularly useful because it provides means for visualizing growth patterns over time, and the generated equations can be used to predict the expected weight of group of animals at specific age. The shape of growth curve can be used in the selective breeding programs. In animal species, growth parameters were shown to be heritable and responsive to the selection programs. These non-linear models allow the interpretation and understanding of growth patterns and metabolism underlying growth periods. Few studies have been devoted to model the growth curve in broilers, such as the comparison of non linear model to describe the growth in the andalusian turkey breed (Arando et al 2021) such as the comparison of non linear model to describe the growth in the andalusian turkey breed (Arando et al 2021)

In many studies of Japanese quail growth data, Gompertz, logistic or von Bertalanffy growth models were used (Tzend & Becker 1981; Akbaş & Oğuz 1998; Alkan et al., 2009; Narinç et al., 2010; Narinç & Aygün 2010; Alkan et al., 2010). A common characteristic of these models is the fixed inflection point. The body weight at the inflection point is identified as 37% of the asymptotic weight in both the Gompertz and von Bertalanffy models and 50% in the logistic model. In fixed growth models, the genetic variations of asymptotic weight and point of inflection weight are equal, which constitute a problem for genetic improvement (Darmani et al., 2010.

Tremendous improvement in commercial broiler performance has taken place since the early 1950s. This growth combined with improved environmental factors affecting broiler performance, such as nutrition and housing (Prescott et al, Havestein et al., 2015a). Because most of the published studies are of birds from 42 to 70 days of age, little information is available beyond this age on the overall growth potential of today's broiler chicken. Growth curve functions are the most adequate means for describing the growth pattern of body were body parts, because they summarise the information into a few parameters that may be interpreted biologically. Several growth functions are available for the description of growth such as Brody's, Logistic, Gompertz, Von. Bertalanffy, and the four parameter Richards function, which summaries all the above growth functions into one. Apart from body weight a number of conformation traits are known to be good indicators of good growth and market value of broiler (Ibe, 2012). (Amao et al., 2010) reported that most of the linear body measurements reflect primarily the long bones of the animals. Such conformation traits include shank length, breast width, breast length, wing length, height, body length. (Ojo et al., 2018). Body weight and body conformations traits are important parameters for measuring growth in the broiler chickens. Prediction of the body weight with morphometry traits in broilers is therefore important.

Analyses of broiler growth data using the Gompertz growth models result in a single sigmoidal curve (Wang et al., 2004; Strathe et al.2010). Santos et al. 2005) used the Gompertz model to analyse growth in two slow-growing broiler lines housed in two different systems. Dourado et al. 2009) used the Gompertz model to examine the growth of slow-growing broilers reared in the free-range system. Gompertz, logistic and Richard models were used by Norris et al. 2007) to analyse the body weight of indigenous Venda and Naked Neck chickens of South Africa and growth curve parameters were estimated and compared.

Materials and Methods

Experimental site

The experiment was carried out at the teaching, research and demonstration farm of the Department of Agricultural Technology, Akanu Ibiam Federal Polytechnic Unwana in Afikpo North Local Government Area of Ebonyi State, Nigeria. Afikpo is located within the rain forest agro-ecological zone of Nigeria. Afikpo North lies between latitude 5° 53 35'' N and longitude 7° 56'' 14'' E. It has an annual rainfall, temperature and humidity ranging from 1,500mm to 2022mm, 33° and 54%; wind 6km/h, precipitate 0% (mapnet, 2021)..

Experimental birds

A total of 120 broilers were used, 60 Arbor acre plus and 60 Ross 308 were reared in a well-ventilated pen. They were fed commercial feed for 4 weeks ad libitum for the duration of the study. Water was equally provided. Body weights were taken using a sensitive scale at day 0, 7, 14, 21, and 28. Morphology traits which included; Breast length, breast width, muscle thigh, drumstick, wing length, shank length, was taken using a measuring tape.

Data collection

Parameters measured include:

Wing length**:** This was measured by stretching the wing and measuring from the armpit of the bird to the end of the wing using measuring tape.

Shank length**:** The shank length was taken from the hock joint to the metatarsal pad using measuring tape.

Drumstick: This is the measurement of the length of the Femur bone.

Body weight: Measured as the distance between the base of the neck and the cloaca.

Height: The height of the bird was recorded from the back of the bird to the feet as the animal is standing.

Head length: This was measured as the distance between the insertion of the back and the end of head (occiput)

Data collected were subjected to linear regression procedures of Statistical Analysis System (SAS 2003).
The regression equation was:
Y = a + bx where
Y = body weight (dependent variable)
a = the regression constant
b= intercept on the y axis
x = traits of interest (independent variable)

Result and Discussion
The regression equation for each of the morphometric traits considered for Ross 308 are presented in Table 1. The result in the table showed that final weight of Ross 308 can be predicted from all the parameters considered as it significantly (P<0.05) fits the growth curve except for breast length, breast width, drumstick and thigh length. The results further showed that breast parameters are not good predictive parameters for Ross 308 chickens. The regression coefficient of 0.79 is relatively high while the R-square of 0.62 showed a relatively high significant (P<0.05) goodness of fit for all the equations.

Table 1. Regression parameters for early growth prediction in Ross 308

Parameters	Regression equation	SE	P value
Body height	BW = 285 – 77.7(BH)	14.01	0.00*
Body length	BW = 285 + 76.2(BL)	14.87	0.00*
Breast length	BW = 285 – 23.7(BRL)	39.16	0.54
Breast width	BW = 285 + 15.1(BRW)	22.50	0.50
Drumstick	BW = 285 – 25.0(DSK)	34.51	0.47
Shank length	BW = 285 – 87.5(SL)	31.31	0.01*
Thigh length	BW = 285 – 6.8(TL)	37.30	0.86
Wing length	BW = 285 + 68.7(WL)	13.42	0.00*
R	0.79	223.66	
R^2	0.62		
Regression equation fitness			0.00

*P<0.05
BW = Body weight; BH = Body height; BL = Body length; BRL = Breast length;
BRW = Breast width; DSK = Drumstick; SL = Shank length; TL = Thigh length

Table 2 showed the regression equations for all the morphometric traits considered in Arbor acre chickens. From the table it could be seen that only body height and body length can significantly (P<0.05) predict the growth curve of Arbor acre chickens. The regression coefficient is high (0.91), likewise the R-square (0.82), showing that the equations can fit the growth curve of Arbor acre chickens.

Table 2. Regression parameters for early growth prediction in Arbor acre

Parameters	Regression equation	SE	P value
Body height	BW = -58.2 – 24.5(BH)	7.72	0.02*
Body length	BW = -58.2 + 30.3(BL)	5.39	0.00*
Breast length	BW = -58.2 + 20.0(BRL)	9.88	0.05

Breast width	BW = -58.2 + 15.8(BRW)	10.37	0.13
Drumstick	BW = -58.2 + 8.9(DSK)	15.65	0.57
Shank length	BW = -58.2 + 6.5(SL)	18.68	0.73
Thigh length	BW = -58.2 + 34.3(TL)	20.62	0.10
Wing length	BW = -58.2 + 14.6(WL)	10.36	0.16
R	0.91	124.91	
R-squared	0.82		
Regression equation fitness			0.00

*P<0.05
BW = Body weight; BH = Body height; BL = Body length; BRL = Breast length;
BRW = Breast width; DSK = Drumstick; SL = Shank length; TL = Thigh length

For Rose308, the regression analysis developed model for each morphological traits and the findings indicated that, the regression equation for BH [BW= 285 - 77.7BH] has a p value of 0.00 and BL [BW=285+76.2BL] has a p value of 0.00, SL [BW= 285 - 87.5 SL] has a p value of 0.01 and wing length WL[BW= 285 - 68.7WL] has a p value of 0.00 are highly significant and can be used to predict the body weight of Ross 308 at the early stage. However, the Breath length BRL [BW= 285 - 23.7BRL] has a p value of 0.54 and the Drum stick [BW= 285 - 25.0DSK] has a p value of 0.47, Breast width BRW [BW= 285 - 15.1BRW] has a p value of 0.50 and Thigh length TL [BW= 285 - 68TL] has a p value of 0.86 shows very insignificant, low value of fit. It is therefore encouraged that BH, BL, SL and WL with p value of 0.00, 0.00, 0.01 and 0.00 should be used as predictive morphological parameters for body weight in early broilers of Ross 308.

For Arbo arca the regression analysis developed model for each morphological traits and the findings indicated that, the regression equation for BH [BW= -58.2 - 24.5BH] has a p value of 0.02 and BL [BW= -5.82 + 30.3BL] has a p value of 0.00 are highly significant and can be used to predict he body weight of Arbor acre at the early stage. However, the Breath length BRL [BW= -58.2 + 20.0BRL] has a p value of 0.05, the Drum stick [BW= -58.2 + 8.9DSK] has a p value of 0.57, Breast width BRW [BW= - 58.2 + 15.8BRW] has a p value of 0.13, SL [BW= -58.2 + 6.5SL] has a p value of 0.73 and wing length WL[BW= -58.2 + 14.6WL] has a p value of 0.16 and Thigh length TL[BW= +58.2 + 34.3TL] with p value of 0.10.

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Conclusion and Recommendation

The final body weight of Ross 308 can be predicted from all the parameters (BL, Bh, BW, DSK, SL, TL and WL) considered except for breast length, breast width, drumstick and thigh length. Final body weight of Arbor acre plus can be predicted from only the body height and body length. Prediction of final body weight of broilers using early growth curve is preferably to use Ross 308 to Arbor acre plus chickens because almost all the parameters considered were fit for growth curve except for breast length, breast width, drumstick and thigh length. While in Arbor acre plus only the body height and body length were fit for growth curve. Investigation should be made on Arbor acre on the best way that it body weight can be predicted.

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