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Evaluation of Body Weight and Other Linear Parameters of Marshall Broiler for Repeatability Estimates

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Abstract

This study was designed to evaluate the body weight and other linear parameters of Marshall Broiler for repeatability estimates. A total of one hundred (100) broiler chickens (Marshall) was used in estimating the repeatability of body weight and linear parameters of day old from 2 to 8 weeks of age. Body weight (BW) and other linear body parameters such as body length (BL), shank length (SL), thigh length (TL), breast girth (BG) and keel length (KL) were taken every two weeks. The mean values for body weight and other linear variables revealed increase for BW (374.78g - 1981.34g), BL (11.63cm - 21.41cm), SL (9.27cm – 13.54cm), TL (6.10cm – 10.97cm), BG (3.47cm – 11.59cm) and KL (9.54cm – 18.14cm) at 2nd and 8th weeks age respectively. The repeatability of body weight (0.332, 0.032, 0.457 and 0.384) was respectively low at 2, 4, 6 and 8 weeks of age with high repeatability values for BL (0.813) at 4th week, SL (0.691) and TL (0.697) at 2nd week respectively and BG (0.759) at 6th week of age with KL (0.695) at 8th week of age, indicating that the tendency for successive records of Marshall Broiler chickens to be more alike is low. Repeatability and variance components over the eight weeks of the study for body weight and other linear parameters revealed high values for BL (0.614) and TL (0.606). Therefore, selection for improvement using any of the traits (body weight, breast girth and keel length) will result in good performance and a significant genetic gain throughout the lifetime of Marshall Broiler chickens.

Keywords: Repeatability, Marshall Broiler, linear body variables,

Introduction

In Nigeria, poultry contributes significantly to the animal protein supply of the populace. The poultry population was put at 114.3 million comprising of 82.4 million chickens (11% of which was commercially raised) and 31.9 million other poultry which include pigeons, ducks, guinea fowls and turkeys (RIM, 1992). Chicken production is increasing due to increased product output per animal, high feed conversion efficiency, improved fertility, hatchability, growth rate, egg yield and meat quality. Poultry keeping requires less land, and most of the poultry species are more prolific than other species of livestock.

Poultry breeders have tried to establish the relationships that exist between body weight and physical characteristics (body conformation) such as body length, shank length, thigh length, breast girth and keel length as this information reflects on the feed efficiency as well as performance

of the broiler birds. Interrelationships among body measurements can be applied speedily in selection and breeding. Besides, this will help the breeders to organize the breeding program in order to achieve an optimum combination for maximum economic return (Okon *et al*., 1997).

Breeders of meat-type chicken have become interested in adult body weight; the trend being towards a big-bodied chicken at early age in order to attract better price at marketing (Malik *et al*., 1997). Body weight is regarded as a function of frame work or size of the animal and its condition. An increase in body weight is highly correlated with feed consumption when selecting for rapid growth under *ad-libitum* feeding, indicating that more energy is available for growth over the maintenance requirement of chickens.

The live body weight of any animal is an important variable that determines the market value of that animal. The exact time at which the animal is ready for slaughter can be accessed on the basis of its body weight and general development (Akanno and Ibe, 2006).

Body weights are shown to be influenced by maternal effect or dominance effects or both, up to maturity as indicated by consistently higher heritability estimates from dam variance components as opposed to those from sire components. Adeyinka *et al*. (2004) reported moderate heritability for body weights for naked neck broilers at various ages, but observed high heritability estimates for body weight at 56 days of age and finally suggested that selection for body weight at this age will improve body weight in subsequent generations.

Chambers (1990) observed that heritability for body weight of broilers tends to increase with age. Selection is usually based on breeding values, and this value for a trait can be measured more than once in an animal's life time. Repeatability is the correlation between two or more measurements on each individual in a given population. It is of great importance in the profitability of the poultry industry. The magnitude of a repeatability estimate gives an indication of the extent to which selection applied at any stage will affect subsequent flock performance (Ibe, 1995). Therefore, the aim of this study was to evaluate body weight and other linear parameters of Marshall broiler for repeatability estimates.

Materials and methods

Experimental site

This study was carried out at the Poultry Research and Production Unit of Teaching and Research Farm, Ladoke Akintola University of Technology, Ogbomoso, Oyo State. Ogbomoso is situated in the derived savanna zone of Nigeria within longitude 4^0 15^1 East of the Greenwich meridian and latitude 8^0 15^1 North East wards of the equator and is about 145 kilometers from Ibadan, the capital of Oyo state. The altitude is between 300 and 600m above the sea level. The annual temperature is about 27^0 C (Amao *et al*., 2010) while that of rainfall is 1247 mm.

Experimental birds and management

A total of 100 day-old chicks of a commercial broiler strain, namely Marshall, were purchased from a reputable farm while all vaccinations and treatments were given to the birds before purchasing. The chicks were managed on deep litter system in pens having natural ventilation via the side and roof shelters. The pens were cleaned, disinfected / fumigated and littered with

wood shavings up to 5cm depth before the arrival of the chicks. Adequate temperature was maintained in the brooding house, clean drinking water and commercial broiler starter mash / finisher were provided *ad-libitum*. They were fed with a standard broiler starter ration containing 24 % crude protein and 2900 kcal / kg ME for four weeks followed by a finisher diet containing 21 % crude protein and 3000kcal/ kg ME from four week to the end of the experiment at eight weeks. Routine vaccinations were appropriately ensured as at when due.

Data collection

Data were collected on body weight, body length, shank length, thigh length, breast girth and keel length for the estimation of the repeatability with the following procedures; body weight was measured with a weighing balance calibrated in grams while body length was measured from the back neck region to the tail region and shank length from the hock joint to the tarsometa tarsus. Breast girth was measured as the circumference of the breast around the deepest region of the breast while thigh length was obtained by measuring from the hock joint to the hinge joint and keel length from the chest bone to the end towards the abdomen region. All body linear measurements were determined using tailor's tape rule (in centimeters) at two week intervals.

Statistical analysis

Data collected were subjected to one way analysis of variance (ANOVA) using general linear model of SAS (2003).

Repeatability (R) was estimated using the expression

$$R = \frac{\sigma_B^2}{(\sigma_B^2 + \sigma_W^2)}$$ (Udeh, 2010)

Where,

$\sigma_{B=}^2$ individual variance component.

$\sigma_w^2 =$ Error.

The standard error was calculated using the formula described by Becker (1984)

$$S.E = \sqrt{\frac{2(1-R^2(1+(k-1)R)^2}{k(k-1)(n-1)}}$$

Where,

k=Number of measurement

n= Number of birds.

R= Repeatability

Increase in accuracy based on repeated records was compared with selection on single record as described by Lush (1945)

$$\left(\frac{k}{1+(k-1)}\right)^{1/2}$$

Where;

k = number of measurement

R = Repeatability

Results

The means ± standard errors in relation to body weight of Marshal Broiler strain and other linear parameters at 2, 4, 6 and 8 weeks of age are presented in Table 1. The mean body weights (BW) ranged from 374.78 g to 1981.34 g , body lengths (BL) varied from 11.63 cm to 21.41 cm, shank lengths (SL) obtained were of the range of 9.27 cm to 13.54 cm while thigh lengths (TL) values were 6.10 cm to 10.97 cm. Range of values obtained for breast girth (BG) were 3.47 cm to 11.59cm while values of 9.54 cm to 18.14 cm were obtained for keel length (KL) at 2 and 8 weeks of rearing period respectively for all parameters. The repeatability estimates of body weight and other linear parameters of Marshall broiler chickens are shown in Table 2. The

repeatability estimates were highest at 4 week of age for BL (0.813) and SL (0.691) while TL (0.697) value was highest at 2nd week of age. Values obtained for BG (0.759) and KL (0.695) were highest at 6th and 8th week of rearing period respectively. Table 3 shows the estimated variance components and repeatability of Marshall broiler chickens over the period of eight weeks. The highest repeatability was obtained for BL (0.614), followed closely by TL (0.606) moderate for BG (0.547) while other measured parameters revealed low repeatability values.

Table 1: Means and standard error for the body weight and other linear parameters at different ages for Marshall Broiler chickens

Age (wk)	BW (g)	BL (cm)	SL (cm)	TL (cm)	BG (cm)	KL(cm)
2	374.78 ± 30.87	11.63 ± 1.82	9.27 ± 1.94	6.10 ± 0.21	3.47 ± 0.01	9.54 ± 0.30
4	785.63 ± 22.57	14.01 ± 0.79	10.69 ± 0.29	8.97 ± 0.41	7.21 ± 0.22	8.341 ± 0.66
6	1525.08 ± 86.51	17.28 ± 2.35	12.83 ± 1.17	8.77 ± 0.44	8.45 ± 0.19	15.85 ± 1.41
8	1981.34± 37.76	21.41 ± 2.35	13.54 ± 0.49	10.97 ± 0.36	11.59 ± 0.39	18.14 ± 0.33

BW = Bodyweight, BL = Body length, SL = Shank length, TL = Thigh length BG =Breast girth, KL = keel length

Table 2: Repeatability estimate for body weight and other linear parameters of Marshall Broiler chickens

Age(wk)	BW (g)	BL (cm)	SL (cm)	TL (cm)	BG (cm)	KL(cm)
2	0.332	0.629	0.691	0.697	0.659	0.447
4	0.032	0.813	0.382	0.386	0.639	0.282
6	0.451	0.741	0.136	0.676	0.759	0.291
8	0.384	0.274	0.359	0.666	0.129	0.695

BW = Body weight, BL = Body length, SL = Shank length, TL = Thigh length BG =Breast girth, KL = Keel length

Table 3: The variance component and Repeatability of Marshall Broiler chickens over eight weeks of age

Variables	R	σ_B^2	σ_W^2	R^2	S.E
BW	0.312	7731.87	12211.42	0.149	0.059
BL	0.614	3.239	1.727	0.406	0.082
SL	0.367	1.224	0.969	0.199	0.066
TL	0.606	0.552	0.288	0.373	0.085
BG	0.547	0.267	0.201	0.348	0.082
KL	0.429	0.362	0.526	0.234	0.074

BW = Body weight, BL = Body length, SL = Shank length, TL = Thigh length , BG = Breast girth, KL = keel length, R = repeatability, σ_B^2 = Individual Variance component, σ_W^2 = Error, R^2 = R-square, S.E = standard error.

Discussion

The results on body weight showed an increase in the live body measurements as the birds matured, indicating a direct positive relationship between body weight and age. The results were at variance with the findings of Ibe (1998) and Akpa *et al.* (2002) for Lohmann Brown and Anak Broiler strains respectively. These authors reported values which were lower than the values obtained in this study. Meanwhile, the results from this study were consistent with the finding of Ikeobi and Peters (1996) for two strains of meat-type chickens. The shank lengths obtained from this present study were in line with the findings of Essiens and Adeyemi (1999) that reported similar values that ranged 9.35cm to 14.03 cm for Lohmann Brown Broiler strain. The reasons for their similar ranges could be due to similar genetic variables. The range of values for breast girth was not in agreement the findings of Kadri *et al*. (2010), whose results were slightly higher (13.89 cm) than the value obtained in this study, indicate possible differences in the non-additive genetic variance in the growth traits. The estimated variance component and repeatability estimate for this present study were in contrast with the reports of Kadri *et al*. (2010) for highly repeatable body weight at 8 week of age; thus indicating that the tendency for successive records of the same strain of broilers to be more alike than those other strain is high. The high repeatability for body length, thigh length and breast girth were consistent with the findings of Kadri *et al.* (2010). These authors reported high repeatability that ranged from 0.88 to 0.98; which was close to unit for these variables. Ubani *et al*.'s (2011) findings were in line with this present study for body length, with thigh length and breast girth having similar ranges of values. These results of this study were also in agreement with the findings of Ibe (1995) that reported lower values for shank length for local chickens at 4 weeks of age.

Conclusion

The repeatability estimates of the six components of body weight and linear measurement in this study were high. Additional records may result in a significantly greater genetic gain than with only records, particularly for SL and KL. However, selection based on these linear parameters, singly, may be useful in improving overall body growth of an animal and such selection may be advocated when it is desired to alter the shape of animals and to shift the greater economic value.

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