Repeatability Estimates of Body Weight and Linear Body Measurements of Improved Indigenous and Exotic Meat Type Chickens Reared in the Tropics

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ABSTRACT

Repeatability estimates are strong tools for selection of most phenotypic traits and for quantifying the transmitting ability of a stock and its ability to maintain its performance and ranking with a test group on subsequent generations. The body weight and linear body measurements with their repeatability estimates were studied in a flock of 220 chickens made up of 110 each of improved indigenous (FUNAAB alpha) and exotic (Anak titan).

Weekly body weight and their conformational traits such as breast girth (BG), thigh length (TL), shank length (SL), keel length (KL), body length (BL) and chicken height (CH) were taken over a period of 10 weeks. The mean values for body weight and other conformational traits for the two groups of chicken increased with age with exotic chicken having higher body weights ($p<0.05$) than the improved indigenous chicken in all the weeks of the experiment. The body weight of Anak titan ranged from 47.21g to 2754.55g while that of FUNAAB alpha ranged from 37.00g to 1573.40g. High repeatability estimates (0.99) for body weight at week 2 were obtained in Anak titan and FUNAAB alpha, respectively.

As the age increased, the repeatability estimates for body weight remain constant for both genotypes. Also, high repeatability estimate (0.84 to 0.95) was obtained in Anak titan from weeks 2 to 10, while 0.27 to 0.72 was obtained in FUNAAB alpha. Repeatability estimates ranges for TL (0.68-0.83, 0.93-0.75), SL (0.88-0.68, 0.66-0.23), KL (0.85-0.72, 0.44-0.40), BL (0.54-0.87, 0.52-0.81), CH (0.44-0.60, 0.24-0.61) were obtained for Anak titan and FUNAAB alpha respectively. Although, Anak titan chicken performed better than FUNAAB alpha in terms of body weight and conformational traits considered in this study. However, estimates of repeatability were high in most of the traits for both genotypes. Therefore, both genotypes used in the current study displayed greater ability to repeat their performance in the future generation.

(Keywords: conformational traits, Anak titan, exotic, improved indigenous, FUNAAB alpha repeatability, chicken)

INTRODUCTION

Chicken is the most common of all the population of domestic animals in the tropics and according to FAOSTAT (2013), it constitutes about 207 million of the total poultry population in Nigeria. Chicken production increases in trend nowadays due to increased product output per animal, high conversion efficiency, improved fertility, hatchability, growth rate, body conformation, egg yield, and meat quality.

Those raised specifically for meat are called broilers (meat-type chicken). Broilers have been genetically modified and bred for maximum growth, high meat yield and precision feed program have been developed to utilize the genetic enhancement (Coon, 2002). Poultry breeders have tried to establish the relationship that exists between body weight and physical characteristics such as shank length, breast girth, keel length, body length, thigh length and chicken height. The knowledge of these body measurements had helped the breeders to organize the breeding program in order to achieve an optimum combination of body weight and good conformation for maximum economic returns (Okon et al., 1997).

The evaluation of the inter-relationships between body weight and body size parameters would help livestock farmers when deciding whether to cull animals voluntarily (Olowofeso, 2009). Breeders of meat-type chicken have become interested in adult body weight, the trend being towards a big-body weight at early age in order to attract better price at marketing (Malik et al., 1997). Body weight measurement is an important parameter for growth performance because, it can be used to determine the market value of an animal and the exact time at \which the animal is ready to be slaughtered (Akanno and Ibe, 2006). More so, the performance of an animal is determined by its genotype and environmental factors (Boukwamp et al., 1973). Therefore, selection of better breeds or strains of animal remains the basic approach to any genetic improvement in livestock.

Repeatability is one of the genetic parameters used for selection of better breeds or strains of animals (Badmus et al., 2015). Repeatability is the correlation between two or more measurements on each individual in a given population (Ojedapo, 2013; Ilori et al., 2016). It determines the genetic gain as a result of repeated measurement of trait(s). Repeatability estimates are strong tools for selection of most phenotypic traits and for quantifying the transmitting ability of a stock and its ability to maintain its performance and ranking with a test group on subsequent generations.

This is true because, traits with high repeatability estimates required fewer records to realize a high expected response (Falconer, 1989; Ilori et al., 2016) and verse versa. Also, 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). For instance, Gaya et al. (2006) observed genetic correlation between body weight at different ages and carcass traits in broiler chicken and suggested that direct selection for body weight at 38 and 42 days of age would produce indirect genetic gain for breast muscle, leg and eviscerated body weight.

This study therefore was carried out to evaluate the repeatability estimates of body weight and linear body measurements of improved indigenous and exotic meat type chicken reared in the tropics.

MATERIAL AND METHODS

This study was carried out at the Poultry Breeding Unit of Directorate of University Farms (DUFARMS), Federal University of Agriculture, Abeokuta, Ogun State Nigeria. A total of 220 day-old chicks consisting of commercial broiler strain, Anak Titan (110) and FUNAAB ALPHA (110) were purchased from a reputable farm. The birds were vaccinated against Newcastle disease and Infectious bronchitis at day-old.

The chicks were managed on deep litter system and wing tagged for proper identification. They have access to feed and water *ad libitum*. Routine vaccinations and prophylactic antibiotics were administered. Adequate biosecurity measures were ensured to avoid disease outbreak. All the experimental birds were subjected to the same management practices.

The birds were brooded for four weeks using commercial broiler starter diets containing 22% crude protein and 2900kcal/kg metabolizable energy were provided. Thereafter, they were fed broiler finisher ration containing 21% crude protein and 2875kcal/kg ME from 5-10 weeks. Data collected include body weight, body length, shank length, thigh length, breast girth, keel length and chicken height for the estimation of the repeatability with the following procedures; body weight was the weight of the bird and was measured with a weighing balance calibrated in grams while body length was measured from the base of the neck to the cloaca 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 as the length of the sternum. The chicken height was taken as the distance between the foot and the back. All body linear measurements were determined using tailor's tape rule (in centimeters) at two week intervals. Growth performance data were analyzed using General Linear Model of Statistical Analysis System (SAS, 2002) while significant differences among the means were separated using Duncan Multiple Range Test (Gomez and Gomez, 1984) of the same software. The model is as follows:

$Yij = \mu + Gi + Sj + \varepsilon ijk$

Yij= the parameter of interest
μ = overall mean
Gi = Ith effect of genotype (I= 1, 2)
Sj = effect of jth sex (j= 1, 2)
εijk = random error associated with each record

Repeatability was estimated using the expression:

$$R = \sigma^2 i / (\sigma^2 i + \sigma^2 e)$$

Where; R = Repeatability estimates;
σ^2i = individual variance component;
σ^2e= Variance due to error;

RESULTS AND DISCUSSION

Growth Traits as Affected by Genotype

The least squares means of body weight, breast girth, thigh length, shank length, keel length, body length and chicken height as affected by genotype between week 0 to 10 are presented in Table 1.

The analysis of variance showed that genotype had significant ($p<0.05$) effect on body weight, breast girth, thigh length, shank length, keel length, body length and chicken height in all the weeks of the experiment. The body weight of Anak titan was significantly ($p<0.05$) higher than that of FUNAAB alpha chickens in all the weeks.

The mean body weight ranged from 47.21g to 2754.55 g for exotic, 37.00g to 1573.40g for FUNAAB alpha from day old to 10 weeks of age, respectively. Conformational traits also followed the same trend as the body weight, they increased with the age of the birds. The breast girth of Anak titan ranged from 11.37cm to 29.21cm while that of FUNAAB alpha ranged from 11.76cm to 27.36cm.

Thigh length increased from 5.24cm to 14.05cm in Anak titan and 4.69 to 14.05cm in FUNAAB alpha. Also, the shank length increased from 3.96cm to 18.24cm in Anak titan and 3.39cm to 10.65cm in FUNAAB alpha. The values of keel length ranged from 4.39cm to 19.57cm in Anak titan and 3.58cm to 11.43cm in FUNAAB alpha.

The body length also ranged from 11.85cm to 29.63cm in Anak titan and 12.17cm to 29.28cm in FUNAAB alpha. The chicken height ranged from 9.29cm to 25.73cm in Anak titan, and 9.17cm to 22.83cm in FUNAAB alpha chickens.

Selection for growth traits with the intention of having superior individuals with the best performance has led to rapid transformation in protein supply while the first step before selection is to evaluate their growth performance and their repeatability. The variation in body weight and conformational traits in the two genotypes of chickens used in this study can be attributed to breed differences resulting from variations in genetic composition, and effect of selection especially in the exotic breed. The indigenous breed has only been subjected to natural selection for improved adaptation to tropical environment characterized with heat stress, poor nutrition and management systems.

The result of this study also suggests that Anak titan was superior to FUNAAB alpha in body weight and conformational traits. This can be attributed to rigorous artificial selection for improved growth performance over many generations. The average live weight of FUNAAB alpha genotype is higher than the value reported by Nwosu and Omeje (1985) in Nigerian local chicken.

Growth Traits as Affected by Sex

The effect of sex on the body weight, breast girth, thigh length, shank length, keel length, body length and chicken height as affected by sex between week 0 to 10 are presented in Table 2. The results showed that sex had significant ($p<0.05$) on body weight, breast girth, thigh length, shank length, keel length, body length and chicken height in all the weeks of the experiment.

The male consistently showed higher body weight than the female chickens. The body weight of male ranged from 45.70g to 2804.77g while that of female ranged from 41.70g to 2063.87g. The conformational traits also followed the same trend. Except in body length and breast girth, the male chickens consistently showed higher values in all the conformational traits.

Table 1: Least Squares Means with Standard Error for Body Weight and Conformation Traits from Week 0 to 10.

Strain	Age	Traits BW(g)	BG(cm)	TL(cm)	SL(cm)	KL(cm)	BL(cm)	CH(cm)
AT	0	47.21±0.29^{a}						
FA		37.00±0.43^{b}						
AT	1	127.43±1.52^{a}	11.37±0.04^{b}	5.24±0.04^{a}	3.96±0.04^{a}	4.39±0.04^{a}	11.85±0.08^{b}	9.29±0.04^{a}
FA		121.67±1.98^{b}	11.76±0.14^{a}	4.69±0.14^{b}	3.39±0.04^{b}	3.58±0.04^{b}	12.17±0.10^{a}	9.17±0.10^{a}
AT	2	314.31±3.94^{a}	13.94±0.11^{b}	6.91±0.05^{a}	5.63±0.04^{a}	6.06±0.04^{a}	13.85±0.09^{b}	11.47±0.06^{b}
FA		219.36±3.61^{b}	15.14±0.13^{a}	6.25±0.07^{b}	4.62±0.04^{b}	5.07±0.05^{b}	14.84±0.12^{a}	11.63±0.11^{a}
AT	3	596.90±7.77^{a}	16.06±0.14^{b}	8.62±0.06^{a}	7.01±0.07^{a}	7.75±0.07^{a}	16.05±0.13^{b}	13.49±0.08^{b}
FA		410.09±7.47^{b}	17.35±0.12^{a}	8.01±0.07^{b}	5.75±0.05^{b}	6.69±0.07^{b}	18.82±0.14^{a}	13.90±0.08^{a}
AT	4	873.76±12.95^{a}	18.18±0.19^{b}	10.23±0.09^{a}	8.50±0.10^{a}	9.40±0.08^{a}	18.40±0.18^{b}	15.73±0.12^{a}
FA		573.27±10.80^{b}	20.12±0.17^{a}	8.96±0.07^{b}	6.49±0.04^{b}	7.31±0.07^{b}	21.40±0.17^{a}	15.23±0.09^{b}
AT	5	1093.75±12.48^{a}	20.02±0.21^{b}	12.06±0.11^{a}	9.89±0.13^{a}	10.95±0.11^{a}	20.39±0.20^{b}	17.47±0.11^{a}
FA		726.64±14.62^{b}	21.44±0.16^{a}	10.26±0.10^{b}	7.53±0.06^{b}	8.41±0.08^{b}	22.70±0.19^{a}	16.54±0.12^{b}
AT	6	1381.03±16.84^{a}	21.92±0.22^{b}	13.89±0.13^{a}	11.47±0.15^{a}	12.59±0.13^{a}	22.38±0.23^{b}	19.07±0.11^{a}
FA		886.41±20.05^{b}	23.00±0.20^{a}	11.23±0.10^{b}	8.11±0.07^{b}	9.14±0.09^{b}	24.61±0.23^{a}	17.68±0.15^{b}
AT	7	1637.38±20.21^{a}	23.89±0.26^{b}	15.65±0.17^{a}	13.02±0.19^{a}	^{1}4.30±0.17^{a}	24.38±0.26^{b}	20.78±0.13^{a}
FA		1068.09±23.12^{b}	24.44±0.21^{a}	11.99±0.10^{b}	8.78±0.07^{b}	9.51±0.13^{b}	26.22±0.25^{a}	19.36±0.16^{b}
AT	8	1973.24±24.15^{a}	25.69±0.26^{a}	17.44±0.19^{a}	14.69±0.22^{a}	15.93±0.19^{a}	2629±0.29^{b}	22.47±0.14^{a}
FA		1208.09±25.91^{b}	25.53±0.22^{b}	12.76±0.10^{b}	9.36±0.07^{b}	10.17±0.11^{b}	27.60±0.27^{a}	20.83±0.17^{b}
AT	9	2362.00±26.58^{a}	27.48±0.29^{a}	19.27±0.17^{a}	16.47±0.19^{a}	17.66±0.18^{a}	27.91±0.31^{b}	24.09±0.14^{a}
FA		1342.27±26.63^{b}	26.42±0.23^{b}	13.39±0.10^{b}	9.90±0.07^{b}	10.67±0.11^{b}	28.46±0.29^{a}	21.88±0.19^{b}
AT	10	2754.55±30.29^{a}	29.21±0.30^{a}	21.15±0.17^{a}	18.24±0.19^{a}	19.57±0.19^{a}	29.63±0.31^{a}	25.73±0.14^{a}
FA		1573.40±28.02^{b}	27.36±0.22^{b}	14.05±0.10^{b}	10.65±0.07^{b}	11.43±0.11^{b}	29.28±0.30^{b}	22.83±0.18^{b}

^{ab} Means in the same column within variable group with different superscript are significantly different ($p<0.05$).
AT=Anak titan, FA=FUNAAB ALPHA, BW=body weight, BG=body girth, TL=thigh length, SL=shank length, KL=keel length, BL=body length, CH=chicken height

Table 2: Effect of Sex on the Growth Performance of ANAK TITAN and FUNAAB ALPHA Chickens from Week 0 to 10.

Sex	Week	BW	BG	TL	SL	KL	BL	CH
Male	0	45.90±0.93^{a}						
Female		41.70±0.40^{b}						
Male	1	129.73±2.02^{a}	11.39±0.08^{b}	5.11±0.06^{a}	3.78±0.05^{a}	4.23±0.06^{a}	11.78±0.14^{b}	9.22±0.07^{a}
Female		123.28±1.48^{b}	11.59±0.08^{a}	4.97±0.04^{b}	3.70±0.04^{b}	3.98±0.05^{b}	12.06±0.07^{a}	9.24±0.06^{a}
Male	2	314.62±7.01^{a}	14.13±0.18^{b}	6.85±0.08^{a}	5.45±0.07^{a}	5.92±0.07^{a}	13.87±0.17^{b}	11.56±0.11^{a}
Female		258.94±4.38^{b}	14.57±0.11^{a}	6.55±0.05^{b}	5.11±0.05^{b}	5.54±0.06^{b}	14.42±0.09^{a}	11.54±0.07^{b}
Male	3	603.11±14.76^{a}	16.28±0.22^{b}	8.66±0.08^{a}	6.82±0.10^{a}	7.73±0.09^{a}	16.36±0.24^{b}	13.67±0.13^{b}
Female		486.01±8.40^{b}	16.74±0.12^{a}	8.25±0.06^{b}	6.34±0.70^{b}	7.14±0.07^{b}	17.56±0.15^{a}	13.67±0.07^{a}
Male	4	868.79±25.40^{a}	18.51±0.28^{b}	10.21±0.13^{a}	8.29±0.16^{a}	9.20±0.15^{a}	18.61±0.31^{b}	15.58±0.18^{a}
Female		5700.61±13.41^{b}	19.19±0.16^{a}	9.50±0.08^{b}	7.40±0.10^{b}	8.26±0.10^{b}	20.07±0.17^{a}	15.49±0.09^{b}
Male	5	1107.05±28.18^{a}	20.27±0.29^{b}	11.97±0.17^{a}	9.71±0.21^{a}	10.73±0.19^{a}	20.52±0.30^{b}	17.24±0.18^{a}
Female		875.44±15.20^{b}	20.77±0.16^{a}	11.04±0.11^{b}	8.58±0.12^{b}	9.54±0.12^{b}	21.69±0.18^{a}	17.01±0.10^{b}
Male	6	1426.39±36.35^{a}	22.13±0.33^{b}	13.76±0.21^{a}	11.16±0.26^{a}	12.27±0.24^{a}	22.66±0.38^{b}	18.80±0.21^{a}
Female		1079.16±20.24^{b}	22.47±0.27^{a}	12.39±0.14^{b}	9.63±0.015^{b}	10.70±0.15^{b}	23.58±0.20^{a}	18.36±0.21^{b}
Male	7	1691.69±43.91^{a}	24.10±0.38^{b}	15.40±0.29^{a}	12.49±0.33^{a}	13.72±0.32^{a}	24.46±0.46^{b}	20.52±0.22^{a}
Female		1289.21±23.21^{b}	24.14±0.19^{a}	13.62±0.17^{b}	10.74±0.19^{b}	11.±72.21^{b}	25.42±0.21^{a}	20.05±0.13^{b}
Male	8	2034.31±53.46^{a}	25.98±0.39^{a}	16.97±0.35^{a}	14.05±0.40^{a}	15.28±0.38^{a}	26.36±0.48^{b}	22.20±0.23^{a}
Female		1509.37±29.67^{b}	25.50±0.20^{b}	14.89±0.21^{b}	11.82±0.23^{b}	12.82±0.24^{b}	27.03±0.22^{a}	21.61±0.31^{b}
Male	9	2406.15±65.26^{a}	27.50±0.42^{a}	18.58±0.37^{a}	15.45±0.40^{a}	16.70±0.43^{a}	27.78±0.49^{b}	23.64±0.25^{a}
Female		1756.53±37.36^{b}	26.87±0.22^{b}	16.10±0.24^{b}	13.01±0.27^{b}	13.95±0.28^{b}	28.28±0.24^{a}	22.97±0.16^{b}
Male	10	2804.77±74.79^{a}	29.06±0.41^{a}	20.26±0.41^{a}	17.05±0.44^{a}	18.50±0.48^{a}	29.45±0.50^{a}	25.16±0.27^{a}
Female		2063.87±42.99^{b}	28.21±0.23^{b}	17.42±0.28^{b}	14.35±0.31^{b}	14.31±0.32^{b}	29.49±0.24^{b}	24.28±0.17^{b}

^{ab} Means in the same column within variable group with different superscript are significantly different ($p<0.05$).
BW=body weight, BG=body girth, TL=thigh length, SL=shank length, KL=keel length, BL=body length, CH=chicken height

At week 10, the male chicken had higher ($p<0.05$) values of body girth (29.06cm), thigh length (20.26cm)shank length (17.05cm), keel length (18.50cm) and chicken height (25.16cm), while the female chicken had higher ($p<0.05$) body length (29.49cm).

Sexual dimorphism favored male of both genotypes with respect to body weight and conformational traits. This sexual dimorphic condition had been reported in poultry species (Ilori et al., 2010, Ilori et al., 2017; Ilori et al., 2018) to be partly due to the presence of testosterone in male chickens which affects growth process and developments of body parts and features not directly related to reproduction (Warmick and Legates, 1979). The phenomenon has also been attributed to differences in hormonal profile, aggressiveness and dominance especially when both sexes are raised together (Ibe and Nwosu, 1999; Fayeye et al., 2006; Ilori et al., 2017; 2018).

Repeatability Estimates of Growth Traits and Linear Body Measurements

The results of repeatability estimates for the two genotypes (Anak titan and FUNAAB alpha) are showed in Tables 3, 4, 5, 6 and 7. At week 2, 4, 6, 8 and 10, high repeatability estimates were obtained for body weight in Anak titan (≥0.95), and in FUNAAB alpha (0.99). Also, the repeatability estimates of breast girth was high in all the weeks except in week 2 in which low and moderate repeatability estimates of 0.27 and 0.45 were observed in FUNAAB alpha chicken, respectively.

The two breeds had high repeatability estimates for thigh length at weeks 2, 4, 6, and 10 which ranged from 0.52 to 0.97. With respect to shank length, Anak titian chicken had high repeatability estimates ranged from 0.61 to 0.88 while low values (0.21-0.23) were obtained in FUNAAB alpha. At weeks 2, 4, 6, 8 and 10, FUNAAB alpha chicken had high repeatability estimates for body length in both genotypes.

The high estimate of repeatability recorded in this study especially in exotic implied that the growth performance observed will be repeated in their offspring and hence uniform performance can be observed in exotic chicken genotype. This also suggests that any individual from this population can be selected for those traits with high repeatability estimates to be parent of the next generation.

Table 3: Variance Components and Repeatability Estimates for Growth Traits at 2 Weeks of Age.

Strain	Traits	δ_i^2	δ_e^2	R
AT	BW	2232.06	222.321	0.99
FA		1956.04	17.890	0.99
AT	BG	0.159	0.030	0.84
FA		0.265	0.728	0.27
AT	TL	0.437	0.213	0.67
FA		0.954	0.075	0.93
AT	SL	0.100	0.013	0.88
FA		0.321	0.162	0.66
AT	KL	0.432	0.071	0.85
FA		0.087	0.113	0.44
AT	BL	1.532	1.302	0.54
FA		0.342	0.317	0.52
AT	CH	0.578	0.725	0.44
FA		0.057	0.180	0.24

AT=Anak Titan, FA=FUNAAB Alpha

Table 4: Variance Components and Repeatability Estimates for Growth Traits at 4 Weeks of Age.

Strain	**Traits**	**δ_i^2**	**δ_e^2**	**R**
AT	BW	4296.43	240.867	0.95
FA		1956.18	127.134	0.99
AT	BG	0.196	2.052	0.71
FA		0.657	2.058	0.45
AT	TL	0.235	1.012	0.55
FA		0.755	0.025	0.97
AT	SL	0.344	0.217	0.61
FA		0.448	0.212	0.68
AT	KL	0.497	0.009	0.28
FA		0.286	0.205	0.58
AT	BL	1.924	2.009	0.59
FA		0.292	2.031	0.39
AT	CH	0.235	0.020	0.98
FA		0.898	0.089	0.90

AT=Anak Titan, FA=FUNAAB Alpha

Table 5: Variance Components and Repeatability Estimates for Growth Traits at 6 Weeks of Age.

Strain	**Traits**	**δ_i^2**	**δ_e^2**	**R**
AT	BW	40714.7	407.147	0.99
FA		43785.1	437.856	0.99
AT	BG	6.769	1.068	0.86
FA		4.204	1.042	0.80
AT	TL	2.589	2.026	0.56
FA		1.074	1.011	0.52
AT	SL	3.406	2.034	0.63
FA		0.524	2.005	0.21
AT	KL	2.541	2.025	0.56
FA		0.280	0.282	0.50
AT	BL	7.368	1.074	0.78
FA		5.750	5.058	0.53
AT	CH	1.975	2.020	0.49
FA		1.258	2.320	0.35

AT=Anak Titan, FA=FUNAAB Alpha

On the other hand, the low estimates of repeatability for some traits in exotic chicken genotype emphasized the relative importance of permanent effect of the unfavorable climatic conditions o the humid tropics coupled with infectious disease challenge on the birds, and substandard level of management prevalent in tropical environment compared to the temperate regions where these birds are generated. However, low estimate of repeatability could be improved by selection and/or culling strategies (Khalil et al., 1986), since the magnitude of repeatability estimate gives an indication of the extent to which selection when applied at any stage will affect subsequent flock performance (Ibe, 1995).

Table 6: Variance Components and Repeatability Estimates for Growth Traits at 8 Weeks of Age.

Strain	Traits	δ_i^2	δ_e^2	R
AT	BW	83701.7	837.017	0.99
FA		73122.9	73122.9	0.99
AT	BG	9.908	2.099	0.83
FA		5.275	2.053	0.72
AT	TL	5.059	1.051	0.83
FA		0.063	0.011	0.85
AT	SL	6.692	2.067	0.76
FA		0.559	2.005	0.22
AT	KL	5.170	1.052	0.83
FA		1.385	2.014	0.41
AT	BL	12.258	2.123	0.85
FA		7.742	1.077	0.87
AT	CH	2.623	2.026	0.56
FA		3.154	2.032	0.61

AT=Anak Titan, FA=FUNAAB Alpha

Table 7: Variance Components and Repeatability Estimates for Growth Traits at 10 Weeks of Age.

Strain	Traits	δ_i^2	δ_e^2	R
AT	BW	131698.3	1317.0	0.99
FA		80594.2	805.942	0.99
AT	BG	127.36	7.012	0.95
FA		5.105	2.010	0.72
AT	TL	4.332	2.043	0.68
FA		3.122	1.011	0.75
AT	SL	5.173	2.052	0.72
FA		0.557	2.011	0.23
AT	KL	5.221	2.052	0.72
FA		1.347	2.027	0.40
AT	BL	14.564	2.146	0.87
FA		8.618	2.086	0.81
AT	CH	3.153	2.063	0.60
FA		3.216	2.064	0.61

AT=Anak Titan, FA=FUNAAB Alpha

The high repeatability estimates for body length, thigh length and breast girth were in consistent with the findings of Kadri et al. (2010). These authors reported high repeatability estimates that ranged from 0.88 to 0.98, which was close to maximum unit for these variables. Also, Ubani et al. (2011) findings were in line with the results of this present study for body length, thigh length and breast girth. In the like manner, Ilori et al. (2016) also reported high estimate of repeatability estimates for growth traits in turkey.

CONCLUSION

Anak titan chicken performed better than FUNAAB alpha in terms of body weight and conformational traits considered in this study. However, estimates of repeatability were high in most of the traits for both genotypes. Therefore, both genotypes used in the current study displayed greater ability to repeat their performance in the future generation. Thus, they can be used to establish pure breed line for meat-type chicken.

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SUGGESTED CITATION

Oguntade, D.O., B.M. Ilori, T. Oyeniyi, and S.O. Durosaro. 2020. “Repeatability Estimates of Body Weight and Linear Body Measurements of Improved Indigenous and Exotic Meat Type Chickens Reared in the Tropics”. *Pacific Journal of Science and Technology*. 21(1):230-238.

Pacific Journal of Science and Technology