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Growth Performance Characteristics and Linear Body Measurements of Four-Chicken Genotypes Raised Under Intensive Management System in South-Western Nigeria

Atansuyi, A.J.[*], Lasore, C.O. and Chineke, C.A.

Department of Animal Production and Health, The Federal University of Technology, P.M.B. 704 Akure, Nigeria
*Corresponding author: ajatansuyi@futa.edu.ng

ABSTRACT

This experiment was conducted to evaluate the growth performance characteristics of four-chicken genotypes managed under deep litter rearing system. The study was carried out at the Teaching and Research Farm (Poultry Unit) of the Federal University of Technology, Akure, Ondo State, Nigeria. A total of 240 chicks were used for the study. The chicken genotypes used were all pure breeds of indigenous normal feather, naked neck and frizzled feather while the forth genotype was the Marshal breed, which is an exotic meat-type chicken. Each genotypes had 75 chicks, except for frizzled which was 15 in number. The birds were divided into four groups based on their genotypes which were normal feather, naked neck, frizzle feather and marshal broiler chickens. Results showed that Marshal Broiler had the highest body weight among the four genotypes. The highest final body weight among the indigenous chickens was recorded for naked neck (918.40g) while the lowest value of 583.83g was recorded for normal feather genotype. The feed conversion ratio was best in naked neck (chicken 2.15) and poorest in normal feather chicken (3.59). There were significant differences ($p < 0.05$) in the growth parameters of the experimental birds. Chest girth (CHG) generally had the highest mean value contribution to body weights across the genotypes used in this study. Similarly, the linear body measurements of the chickens' genotypes were significantly different ($p < 0.05$). It can be concluded that growth performance of the experimental birds is dependent on their genotypes. Among the linear body parameters measured, chest girth generally had the highest mean value. Researchers should direct their research efforts towards the improvement of indigenous chicken through better management practices for meat production. Naked neck and frizzled feather chickens can be considered for incorporation into meat producing chicken genotypes in Nigeria.

Key words: Growth, performance, characteristics, indigenous chicken, genotypes

INTRODUCTION

Indigenous chickens in Africa are generally hardy, adaptive to rural environments, survive on little or no inputs and can adjust to fluctuations in feed availability (Gueye, 2003). They are widely distributed in the rural areas of tropical and sub-tropical countries where they are kept by the majority of the rural poor (Gueye, 2003), they are either raised for economic, consumption or for both purposes (Sonaiya, 1990). The productivities of indigenous chickens are generally very poor (Teketel, 1986). These birds are generally managed under extensive and/or semi-intensive system. Recently, they have been raised in intensive system with more efficient output per bird (Saadey *et al*., 2008). Chickens largely dominate flock composition and make up about 98% of the total poultry numbers (chickens, ducks and turkeys) kept in Africa (Gueye, 2003).

Indigenous chicken constitutes 80% of the 120 million poultry birds raised in the rural areas in Nigeria (RIM, 1992; Udoh *et al*., 2012). The indigenous poultry species represent valuable resources for livestock development in Africa because of their extensive genetic diversity which allows for their rearing under varied environmental conditions (Adebambo, 2005).

Low productivity of indigenous chickens may be attributed to lack of improved poultry breeds, the presence of predators, poor feeding, housing and other management factors (Alemu, 1995; Alemu and Tadelle, 1997). Hitherto, little research work has been carried out on indigenous chickens in the area of breed evaluation and supplementary feeding (Brannang and Pearson, 1990; Abebe, 1992; Negussie and Ogle, 2000) despite the fact that they are more numerous than imported chickens (Tadelle and Ogle, 2001). However, studies on these indigenous chickens were not tangible enough to show the relative effect of genetic and non-genetic factors on their performance (Alemu and Tadelle, 1997).

The demand for meat is increasing all over the world due to increase in population growth. To meet up with this increasing demand and to meet the recommended level of 35g of animal source protein per caput per day (FAO, 2006), effort of farmers should not only be geared towards increasing poultry production but also rearing strains/breeds of chickens with some desirable attributes such as disease resistance, adaptability to tropical/harsh environmental conditions, optimum feed consumption at lower cost but with greater out-put. The hardiness of indigenous chickens can be exploited by rearing and breeding them in the most favourable environment, provided improvement are to be made through careful selection of superior genotypes. This has been generally accepted in the temperate zone (Hammond, 1947; Jenkins and Ferrell, 2006). Therefore, this study was conducted to evaluate the growth performance characteristics and linear body measurements of four-chicken genotypes raised on deep litter intensive management system in South-Western, Nigeria.

MATERIALS AND METHODS

Study location

The study was carried out at the Livestock Section (Poultry Unit) of the Teaching and Research Farm of the Federal university of Technology Akure, Ondo State, Nigeria. The University is located in the rain forest zone of South Western part of Nigeria which lies between latitude 7° 16' North and longitude 5° 12' East. The climatic condition typically followed that of South-western Nigeria where the climate is influenced by a unimodal rainfall pattern which starts from April to October with average of 1556mm per annum. The average ambient temperature usually ranged between 28 - 31°C. The mean annual relative humidity also ranged between 80- 88 %.

Source of birds, sample size and experimental layout

A total of 240 day-old chicks were purchased and used for the experiment. Out of this, 165 indigenous chicks were obtained from the Federal University of Agriculture Farm, Abeokuta, Ogun State. This was made up of 75 pure breeds of normal feather, 75 naked neck and Marshall as well as 15 pure breeds of frizzle feather chickens. The remaining 75 day-old broiler chicks (Marshall) were collected from Fore-Sight Hatchery, Ibadan, Oyo State, Nigeria. The study which lasted for 8 weeks was divided into four treatments based on the genotype of the birds with each bird constituting my experimental units. Completely randomized design was adopted for the experiment.

Pre-experimental management

On the farm, all the chicks used for the study were tagged individually on the wings for ease of identification and weighing. The initial weights were obtained and the birds were distributed into four treatments according to their genotypes there were 75 birds in each genotype except frizzle feather birds that were 15 in number.

Experimental diets

The chick's starter mash used for the study was formulated at the Feedmill in the Teaching and Research Farm of the Federal University of Technology, Akure. The diet was formulated to meet the NRC (1994) requirements. The birds were fed experimental diet *ad-libitum*. The gross and proximate compositions of the diet are shown in Tables 1 and 2 respectively.

Table 1: Percentage composition of experimental diets (g/100g)

Ingredients	Mash
Maize	45
Wheat offal	13
Brewery dried grain	7
Groundnut cake	15
Fish meal	5
Soya bean meal	11
Bone meal	2
Oyster shell	0.5
Lysine	0.15
Methionine	0.1
Salt	0.4
Premix	0.35
Total	**100**
Calculated Analysis	
Crude protein (%)	23.2
ME (kcal/kg)	2685.49

ME = Metabolizable Energy

Table 2: Proximate composition of experimental diets (g/100g)

Parameters	Starter mash
Dry matter	80.85
Moisture content	7.23
Digestible energy (Kcal/kg)	2900
Crude protein	22.8
Crude fibre	4.11
Ash	7.89

Data Collection

During the experimental period, birds were individually weighed every week and their weights were recorded accordingly. Likewise, quantities of feed consumed per week per genotype were recorded by deducting the ort from the quantity of feed offered for that week. Weekly feed consumption by the birds, weight gain by the birds and feed conversion ratio (FCR) were calculated.

The formula for calculating the indices above is given as:

FI = FG – WB and FCR = FI/ WG

Where: FI = Feed Intake, FG = Feed given and WB = Weigh back otherwise known as ort and

FCR = Feed conversion ratio, WG = Weight gain.

The linear body dimensions determined were: shank length (SHL), drumstick length (DSL), nose to shoulder length (NTS), trunk length (TRL), shoulder to tail length (STL), chest girth (CHG) and wing length (WGL). The descriptions of the linear body dimensions determined are given below:

- Shank length (SHL): This is the distance from the knee joint to the foot.
- Drum stick length (DSL): This is the distance between the hinge and hock joints.
- Nose to Shoulder (NTS): This is the distance from the nose to the point of the shoulder.
- Trunk length (TRL): This is the longitudinal distance from the point of the shoulder to the tuberosity of the ischium.
- Shoulder to tail length (STL): This is the distance from the point of the shoulder to pin bone or to the end of coccygeal vertebrae.
- Chest girth (CHG): This is measured as the body circumference just behind the wing.
- Wing length (WGL): This is measured on the dorsal midline to the highest point of the wing.

All measurements were made in the morning before feeding the birds. Each bird was gently restrained in an unforced position before taking any measurement. Feed and body weights were measured using (5kg max.) sensitive weighing scale (g) while the linear body measurements were done with metric measuring tape (cm).

Statistical analysis

One-way analysis of variance (ANOVA) was used to analyze all data generated from the field trial. The body weight, body linear dimensions and growth performance of the four chicken genotypes were compared using the ANOVA option of SAS version 13.0 statistical package (SAS, 2008). Separation of significant means was carried out using Duncan Multiple Range Test (DMRT) as outlined in the same statistical package at P<0.05 probability level.

RESULTS AND DISCUSSIONS

The growth performance characteristics of the experimental birds are presented in Table 3. The Table revealed that the highest initial and final body weights of 39.98g and 1221.22g were recorded for Marshall exotic broiler chicken while the lowest initial and final body weights of 28.62g and 584.23g g were recorded for frizzled feather and normal feather indigenous chickens respectively. This corroborates the findings of Nwosu *et al*. (1984) who noted that Nigeria indigenous chickens' possessed small body size and weigh less than their exotic counterparts. Among the indigenous genotypes, naked neck chicken had the highest initial and final body weights of 33.18g and 918.40g, respectively. Some genes such as frizzling and naked genes have been reported to show pronounced effect on the growth performance of indigenous chickens (Ibe, 1992). While Ibe (1992) result supported the high body weight of naked neck birds, it however contradicts the lowest body weight of frizzled feather chickens in this study. This showed that body structure genes such as naked neck or frizzling genes has pronounced effect on growth performance especially the naked neck genes. There were significant differences (p<0.05) between all the growth parameters of the different chicken genotypes investigated in this study. However, the feed conversion ratio of the experimental birds were not significantly different (p>0.05) except for normal feather chicken genotype. As shown in Table 3, there appears to be an over-run in growth performance of frizzled chicken over that of normally feathered chickens. This was reflected in their final body weights where 784.62g and 584.23g were recorded for frizzle and normal feather chicken genotypes respectively. The normal feather chicken showed superiority in feed intake over both the frizzled feather and naked neck genotypes in this study. Ibe (1993) reported similar results of high values for Nigeria indigenous chicken species with mutated body structures in his research on their growth performance. However, his report on body weights of indigenous chicken species contradicts the present findings where frizzle feather had the least body weight (784.62g) but corroborated the higher values of body weights for naked neck (918.40g) than the normal feather genotype (584.23g) at the end of this study. The results obtained in this study agreed with the previous studies conducted by Nwosu *et al*. (1984) that naked neck and frizzled feather chicken genotypes have more advantages over normal feather genotype in the tropical environment because of the greater thermoregulation associated with the frizzled and naked neck genotypes, judging by the values obtained for their body weights at the end of this study.

Table 3: Growth performance characteristics of experimental birds

Genotype	FF	MB	NF	NN
IWT (g)	28.62±0.95[c]	39.98±0.45[a]	29.48±0.39[c]	33.18±0.44[b]
FBW (g)	784.62±77.38[bc]	1221.22±31.14[a]	584.23±16.79[c]	918.40±18.28[b]
TWG (g)	756.00±76.43[bc]	1181.24±30.69[a]	554.75±16.40[c]	885.22±17.84[b]
WWG (g)	94.50±9.55[bc]	147.65±3.84[a]	69.34±2.05[c]	110.65±2.23[b]
TFI (g)	1859.14±56.64[c]	3149.15±16.67[a]	1990.39±29.06[b]	1904.03±0.10[bc]
WFI (g)	232.39±7.08[c]	393.64±2.08[a]	248.80±3.63[b]	238.00±0.10[bc]
FCR	2.46±0.74[b]	2.67±0.54[b]	3.59±1.77[a]	2.15±0.01[b]

[a, b, c d] = means in the same row with different superscripts are significantly different (P< 0.05),
FF= Frizzled feather, MB = Marshal broiler; NF = Normal feather; NN = Naked neck;
IWT = Initial weight; FBW = Final body weight; WWG = Weekly weight gain;
TWG = Total weight gain; WFI = Weekly feed intake; TFI = Total feed intake;
FCR = Feed conversion ratio; g = grammes

Also, there were variation in the values of feed intake and weight gain of the indigenous chicken genotypes used in this study which is corroborated by the findings of Oke *et al*. (2006) who reported differences in these parameters among the breeds. It has also been reported that frizzled and naked neck genes conferred better feed conversion on these genotype when compared to their normal feathered counterpart (Ibe, 1992). This report was similar to our findings in this study where the feed conversion ratio among the indigenous chicken genotypes was best with naked neck (2.15) followed by frizzle feather (2.46) and poorest with normal feather (3.59).

Table 4 shows the body weight and linear body dimensions of the experimental birds. The Table revealed that the body measurements of indigenous chicken genotypes were smaller than the Marshall exotic broiler chicken genotype. These findings agreed with that of Ibe (1993) who had similar report for local and exotic breeds of chickens. The results of this study showed that chicken body weight and linear body dimensions are affected by their genotype. There was superiority among the chicken genotypes in principal body components and conformation. In this study, chicken genotypes with heavier body weight or faster growth rate (i.e Marshall broiler) were distinguished from those with lighter body weight or slower growth rate (i.e the indigenous chickens). This is because of the fact that Marshall broiler had higher growth performance in terms of body weight and linear body dimensions than the indigenous chickens which is in agreement with the findings of Ojedapo *et al*. (2011). The results of the body weight performance of the chicken genotype showed that they increased with the age of the chickens. This result is in line with the report of Sonaiya (1997) who reported that age is the major determining factor in growth and physiological development of poultry birds. In this study, drum stick length was highest at weeks 4 (7.39 and 7.35) and 8 (11.75 and 11.45) for frizzle feather and Marshall broiler chickens respectively. Similar trend was observed at weeks 6 (9.01 and 8.17) and 8 (9.98 and 9.63) for the same genotypes as shown in Tables 4. Generally, chest girth had the highest mean value contribution to body weights of the different chicken genotypes across the various ages considered in this study. Chest girth had 11.15 frizzle feather (FF), 13.39 Marshall (MB), 11.30 normal feather (NF) and 11.97 naked neck (NN); and 20.92 (FF), 27.22 (MB), 20.12(NF) at four weeks of growth and 23.05(NN) at 8 weeks of growth. There were significant differences (p<0.05) in the body weights and linear body dimensions of the different chicken genotypes in this study. The body weights and body linear measurements at various ages indicated that increase in growth rate of any of the body parts would correspondingly lead to an increase in the live weight gain of the birds (Chineke, 2000, Ojedapo *et al*., 2011).

CONCLUSIONS

The present study showed that the body weight and linear body dimensions of indigenous chicken genotypes are smaller than the exotic chicken genotype. Age, breed and feed consumption are the major determinants of growth. The body weights and body linear measurements at various ages indicated that increase in growth rate of any of the body parts would correspondingly lead to an increase in feed consumption and the live weight gain of the birds. The growth parameters of different chicken genotypes revealed variation in weight gain and feed intake. Marshall Broiler had the best growth performance followed by the naked neck and the frizzled feather while the normal feather genotype had the poorest growth performance. In terms of growth performance, naked neck chicken was the best among the indigenous genotypes.

Table 4: Effect of genotype on body weight (g) and linear body measurements (cm) at different growth stages

Weeks	GP	BWT (g)	SHL (cm)	DSL (cm)	NTS (cm)	TRL (cm)	STL (cm)	CHG (cm)	WGL (cm)
2	FF	133.46±12.65^{b}	4.28±0.16^{b}	5.21±0.22^{b}	8.42±0.20^{d}	8.98±0.23^{b}	9.64±0.27^{b}	11.15±0.48^{d}	7.59±0.41^{d}
	MB	188.48± 4.32^{a}	4.64±0.05^{a}	6.46±0.22^{a}	10.24±0.21^{a}	10.21±0.21^{a}	11.37±0.25^{a}	13.39±0.33^{a}	10.21±0.22^{a}
	NF	104.13±2.99^{c}	3.92±0.34^{c}	4.62±0.07^{d}	9.06±0.11^{b}	7.35±0.08^{d}	7.86±0.08^{d}	11.30±0.14^{c}	8.52±0.12^{b}
	NN	68.22 ±1.33^{d}	3.90±0.05^{c}	4.96±0.06^{c}	9.02±0.09^{bc}	8.63±0.09^{c}	9.23±0.10^{c}	11.97±0.10^{b}	8.35±0.11^{c}
4	FF	291.54±28.22^{b}	5.75±0.22^{b}	7.39±0.22^{a}	11.08±0.31^{d}	12.47±0.36^{b}	13.21±0.40^{b}	13.85±0.57^{d}	10.74±0.4^{d}
	MB	400.07±9.51^{a}	7.67±1.46^{a}	7.35±0.06^{a}	13.22±0.17^{a}	13.52±0.16^{a}	14.33±0.17^{a}	17.08±0.18^{a}	13.36±0.11^{a}
	NF	201.00±5.34^{c}	5.14±0.06^{cd}	6.26±0.07^{c}	11.59±0.17^{b}	9.96±0.15^{d}	10.79±0.15^{d}	13.84±0.16^{bc}	11.70±0.13^{c}
	NN	143.68±3.66^{d}	5.43±0.06^{c}	6.55±0.07^{b}	11.39±0.17^{c}	11.63±0.11^{c}	12.42±0.12^{c}	13.98±0.17^{b}	12.13±0.1^{b}
6	FF	415.69±42.77^{bc}	9.01±1.17^{a}	9.34±0.28^{ab}	12.74±0.43^{d}	14.39±0.29^{b}	15.73±0.30^{b}	17.58±0.39^{c}	14.74±0.3^{d}
	MB	776.78±21.82^{a}	8.17±0.07^{ab}	9.50±0.08^{a}	16.04±0.14^{a}	15.96±0.21^{a}	17.26±0.26^{a}	22.61±0.20^{a}	16.36±0.11^{a}
	NF	369.62±9.97^{d}	6.52±0.08^{c}	8.22±0.10^{d}	13.97±0.10^{b}	14.10±0.14^{d}	15.18±0.16^{d}	16.59±0.21^{d}	14.66±0.1^{b}
	NN	426.43±10.41^{b}	6.961±0.08^{c}	8.62±0.10^{c}	13.95±0.17^{bc}	14.27±0.21^{c}	15.24±0.15^{c}	17.91±0.2^{b}	14.61±0.12^{c}
8	FF	784.62±77.38^{c}	9.98±0.2^{a}	11.75±0.20^{a}	14.22±0.22^{d}	16.22±0.29^{d}	17.32±0.3^{d}	20.92±0.42^{c}	15.98±0.27^{d}
	MB	1221.22±31.14^{a}	9.63±0.07^{a}	11.45±0.12^{b}	16.91±0.18^{a}	18.82±0.25^{a}	20.71±0.24^{a}	27.22±0.30^{a}	19.58±0.20^{a}
	NF	584.23±16.79^{d}	8.02±0.14^{ab}	9.68±0.14^{d}	14.97±0.11^{c}	16.39±0.21^{c}	17.51±0.21^{c}	20.12±0.25^{d}	16.60±0.15^{c}
	NN	918.40±18.28^{b}	9.62± 0.14^{a}	11.10±0.15^{c}	16.02±0.15^{b}	18.72±0.26^{b}	19.85±0.2^{b}	23.05±0.25^{b}	18.11±0.15^{b}

Key: a, b, c, d = Means in the same columns bearing different superscripts are significantly different ($P < 0.05$), GP = Genotype,
NF = Normal Feather, NN = Naked neck, MB = Marshall broiler, FF = Frizzle feather, BWT = Body weight, SHL = Shank length, DSL = Drum stick length, NTS = Nose-To-shoulder length, TRL = Trunk length, STL = Shoulder to tail length, CHG = Chest girth, WGL = Wing length, cm = centimeter, g = gram

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