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COMPARATIVE STUDY OF EARLY GROWTH PERFORMANCE OF NAKED NECK, NORMAL AND FRIZZLE-FEATHERED NIGERIAN NATIVE CHICKENS REARED UNDER INTENSIVE SYSTEM IN GUINEA SAVANNAH

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ABSTRACT

This study investigated the early growth performance of naked neck, normal and frizzle-feathered Nigerian native chickens, under intensive system. 150 chicks, comprising 50 chicks from each genotype, were used in a 3 X 2 factorial arrangement in a Completely Randomized Design (CRD), with genotype and sex as factors of interest. Data were collected on hatch weight, weekly body weights, and total weight gain. The result showed no significant genotype effect (P>0.05) on hatch weight and body weight at week one. From week 3 to week 8, naked neck and frizzle-feathered chicks had comparable body weights, which differed significantly (P<0.01) from that of the normal feathered chicks. Naked neck genotype had significantly (P<0.05) higher total weight gain than frizzle and normal-feathered Nigerian native chickens, which had comparable total weight gain. Sex had highly significant (p<0.001) influence on hatch weight, body weight from week 1 to week 8, and total weight gain. Genotype X sex interaction had significant (p<0.05) effect on hatch weight, but no significant (p>0.05) effects on body weight of Nigerian indigenous chickens from week 1 to week 8. Naked neck and frizzle-feathered males had comparable total weight gain, which were higher than that of normal feathered males and all females irrespective of genotype. Naked neck females had significantly (P<0.01) higher total weight gain than normal and frizzle-feathered females, which had comparable total weight gain. It could be concluded that the naked neck genotype performed better than the frizzle and normal-feathered Nigerian native chickens under intensive system of management.

Keywords: Genotypes, Growth, Native chicken, Guinea savannah, Body weight

INTRODUCTION

The Nigerian indigenous chickens, often referred to as the native or local chickens are hardy breeds widely reared in rural areas. They are well-adapted to the country's diverse ecological zones and thrive under extensive and semi-intensive systems of management. These chickens play a vital role in rural livelihoods, as they provide meat and egg, as well as income to their owners while requiring minimal inputs. The Nigerian native chickens have been characterized into various genetic groups having verifiable genes that have direct and indirect effects on productive and reproductive traits (Fayeye *et al.*, 2006). It has been reported that the Nigerian native chickens may have adapted in response to combined effects of locally prevailing environmental conditions, uncontrolled breeding, in addition to the forces of natural selection, mutation and random genetic drift (Ukwu *et al.*, 2017). Their ease of rearing under extensive system of management, adaptability to harsh environmental conditions, resistance to diseases, better flavor of meat and eggs make them a good preference by the rural farmers (Ukwu *et al.*, 2017). They exhibit diverse plumage colours. These chickens play major roles not only in rural economies but also contribute substantially to the gross national product (Momoh *et al.*, 2007).

Among the major genes operating in the native chickens found in the Guinea Savannah region of Nigeria are the normal, frizzle-feathered and the naked neck. Consequently, some researchers have grouped the Nigerian native chickens based on major gene into naked neck, normal and frizzle feathered conditions and dwarfism (Ohagenyi, 2009; Daikwo *et al.*, 2015).

The guinea savannah is characterized with high temperature which can affect poultry production. Naked neck and frizzle-feathered chickens are known to have unique genetic traits that enhance heat tolerance (Ibe, 2007). Therefore, studying these chickens alongside normal feathered chickens can provide insights into their adaptability to the local climates and help in identifying the genotypes that may perform better under heat stress.

Again, understanding the growth rates of each genotype can help identify the most productive and sustainable choice for local farmers. This could also provide more information that could be used to develop future breeding programmes aimed at improving resilience, adaptability and productivity in local poultry.

This study, therefore, was designed to evaluate the early growth performance of naked neck, normal and frizzle-feathered Nigerian native chickens reared under intensive system of management in the guinea savannah region of Nigeria.

MATERIALS AND METHODS

The research was conducted at the Poultry Unit of the Livestock Teaching and Research Farm, Joseph Sarwuan Tarka University, Makurdi, Benue State. Makurdi is located between latitude 7º 44′ N – 9º52′N and Longitude 8º 31′ E – 8º41′E. It lies within the Guinea savannah region of the Nigeria vegetative belt located in the Benue valley. The area is warm with minimum temperature range of 29.8-35.6°C. Rain fall is between 508-1016 mm and relative humidity is between 47% -87% (TAC, 2015).

Experimental Animals and Management

The parent stock used were three Nigerian indigenous chicken genotypes (frizzle feathered, normal feathered and naked neck). They comprised fifteen (15) mature hens and two (2) cocks from each genotype. The native chickens sourced locally from the environs of Benue State were used to generate 150 day old chicks (50 chicks from each genotype). The parent stock was housed and fed commercial layer mash

for a period of eight (8) weeks to acclimatize, thereafter fertile eggs were collected and hatched. The hatched chicks were tagged for identification purposes, brooded and managed in a deep litter system and were fed commercial chick mash for a period of eight (8) weeks. Feed and water were provided *ad libitum*, and other management practices observed.

Data Collection and Analysis

Data were collected on weekly body weights of the birds using sensitive weighing balance (Digital Compact Scale (Model: A123, 0.1g to 6kg). Statistical analysis of data was done using the General Linear Model (GLM) procedure of SPSS software version 22.0. Two-way Analysis of Variance (ANOVA) was performed and mean separation was done using the Duncan multiple range test. The ANOVA model is as shown below:

$Y_{ijk} = \mu + S_i + G_{ij} + (GS)_{ij} + e_{ijk}$

Where: Y_{ijk} = Single observation (body weight)

μ= Overall mean

S_i = Fixed effect of the i^{th}Sex (1, 2)

G_{ij}= Fixed effect of the j^{th} Genotype (1, 2, 3)

$(GS)_{ij}$ = Interaction effect

e_{ijk}= Error term.

RESULTS AND DISCUSSION

The main effect of genotype on hatch weight and weekly body weight of the Nigerian native chickens is presented in Table 1. The result showed no significant genotype effect (P>0.05) on hatch weight of the Nigerian native chicks. However, the naked neck genotype had numerically the highest hatch weight, while the normal feathered genotype had the lowest chick weight. There was also no significant genotype effect (P>0.05) on body weight at week one, although naked neck genotype had numerically the highest body weight while normal feathered genotype had the lowest body weight at week one. From week 3 to week 8, it was observed that naked neck and frizzle-feathered chicks had comparable weights, which differed significantly (P<0.01) from that of the normal feathered chicks. The result also showed that the naked neck genotype had significantly (P<0.05) higher total weight gain than frizzle and normal-feathered Nigerian native chickens, which had comparable total weight gain.

Table 1: Main Effect of Genotype on Weekly Body Weight (g) of Nigerian Indigenous Chickens in Guinea Savannah Agro-ecological Zone

Parameters	Normal feathered	Naked neck	Frizzle feathered	P-value
Hatch Weight	29.36±0.56	30.96±0.84	30.83±0.63	0.131
Week 1	41.81±0.95	45.54±1.44	42.82±1.07	0.101
Week 2	70.32±2.17^{b}	81.79±3.29 ^{a}	78.10±2.45 ^{a}	0.006
Week 3	107.85±3.27 ^{b}	127.95±4.95 ^{a}	121.66±3.69 ^{a}	0.001
Week 4	149.32±4.37 ^{b}	179.35±6.62 ^{a}	170.60±4.93 ^{a}	0.000
Week 5	206.29±5.52 ^{b}	244.50±8.37 ^{a}	225.68±6.23 ^{a}	0.001
Week 6	265.46±6.83 ^{b}	309.90±10.34 ^{a}	295.74±7.70 ^{a}	0.001
Week 7	337.97±8.84^{b}	376.50±13.39^{a}	369.44±9.97^{a}	0.017
Week 8	404.56±10.45^{b}	457.04±15.82^{a}	429.13±11.78^{ab}	0.020
TWG	375.20±13.36^{b}	426.08±14.21^{a}	398.30±13.46^{b}	0.031

a,b = means in the same row with different superscripts are significantly different (p<0.05; 0.01); TWG = total weight gain

The main effect of sex on weekly body weight of the Nigerian native chickens in the guinea savannah agro-ecological zone is represented in Table 2 below. The result showed that sex had highly significant (p<0.001) influence on hatch weight, and body weight from week 1 to week 8. It could be observed that the male native chickens of Nigeria had higher body weight than their female counterpart. This trend continued from week 1 to week 8. The total weight gain of male Nigerian native chickens was significantly (P<0.05) higher than that of their female counterparts.

Table 2: Main Effect of Sex on Weekly Body Weight (g) of the Nigerian Indigenous Chickens in Guinea Savannah Agro-ecological Zone

Parameters	Females	Males	P-value
Hatch Weight	29.00±0.51	31.77±0.61	0.001
Week 1	40.69±0.88	46.09±1.04	0.000
Week 2	69.73±2.00	83.75±2.36	0.000
Week 3	107.05±3.01	131.25±3.56	0.000
Week 4	148.35±4.03	184.50±4.75	0.000
Week 5	199.87±5.09	251.11±6.00	0.000
Week 6	258.76±6.29	321.97±7.42	0.000
Week 7	320.52±8.14	402.09±9.61	0.000
Week 8	376.08±9.62	484.41±11.35	0.000
TWG	347.08±8.76	452.64±10.45	0.000

*TWG = total weight gain

The effect of genotype X sex interaction on hatch weight and weekly body weight of the Nigerian indigenous chickens in Guinea Savannah agro-ecological zone is presented in Table 3. Genotype X sex interaction had significant (p<0.05) effect on hatch weight of the Nigerian indigenous chickens. However, there were no significant (p>0.05) effects of genotype X sex interaction on body weight of Nigerian indigenous chickens from week 1 to week 8. The naked neck and frizzle-feathered males had comparable total weight gain, which were higher than that of normal feathered males as well as those of all females irrespective of genotype. Again, naked neck females had significantly (P<0.01) higher total weight gain than normal and frizzle-feathered females, which had comparable total weight gain.

Table 3: Effect of Genotype X Sex Interaction on Weekly Body Weight (g) of Nigerian Indigenous Chickens in Guinea Savannah Agro-ecological Zone

Parameters	Normal Feathered		Naked Neck		Frizzle Feathered		P-value
	Female	Male	Female	Male	Female	Male	
Hatch Weight	27.48±0.75^{c}	31.24±0.82^{ab}	30.67±1.37^{ab}	33.40±0.86^{a}	28.26±0.91^{bc}	31.26±0.99^{ab}	0.024
Week 1	38.53±1.28	45.09±1.41	44.74±1.69	46.83±1.48	38.82±1.56	46.33±2.34	0.196
Week 2	64.03±2.92	76.61±3.22	76.09±3.85	87.50±5.33	69.07±3.56	87.13±3.73	0.627
Week 3	97.95±4.40	117.76±4.84	116.39±5.80	139.50±8.03	106.82±5.35	136.50±5.08	0.604
Week 4	136.53±5.88	162.12±6.48	158.78±7.76	199.92±10.74	149.74±7.16	191.48±6.79	0.404
Week 5	188.73±7.43	223.85±8.18	218.91±9.80	270.08±13.56	191.96±9.04	259.40±8.58	0.155
Week 6	241.43±9.18	289.49±10.10	279.04±12.10	340.75±16.76	255.82±11.17	335.67±10.60	0.306
Week 7	302.83±11.89	373.12±13.09	345.00±15.68	425.13±13.73	313.74±14.47	408.00±21.70	0.215
Week 8	356.85±14.05	452.27±15.47	408.83±18.53	505.25±25.65	362.56±17.10	495.70±16.22	0.445
TWG	329.37±12.36^{d}	421.03±14.21^{b}	378.16±13.54^{c}	471.85±17.32^{a}	334.30±14.21^{d}	464.44±15.34^{a}	0.031

a,b,c,d Means in the same row with different superscripts are significantly different ($p<0.05$); TWG = total weight gain

Discussion

Effect of Genotypes on Weekly Body Weight

The present result showed a significant difference in body weight between the naked neck, frizzle and normal feathered chickens as there was rapid increase in body weight of all genotypes at the chick phase. This significant influence of genotype on body weight in this study suggests that genetic differences exist among the genotypes for growth traits. In line with the values of body weight in this study, El-Dlebshany *et al.* (2009) reported that high body weight chickens had the highest growth rates. The highest body weight recorded by the naked neck genotype in this study as compared to other genotypes affirmed the findings of Islam and Nishibori (2009) who documented that the naked neck chicken had a higher body weight compared to the normal feathered counterpart. This result is also in consonance with the report of Rajkumar *et al.* (2011) who reported higher growth performance in naked neck chicken compared to the other genotypes of the native chickens of India which they studied. This may be due to the fact that the naked neck chickens are larger in size and have heavier muscles as well as longer body parts than the other genotypes. Similar observation was made by Abdulraheem *et al.* (2020) on the three strains of local chickens. However, the higher body weight obtained in naked neck chicken over the normal feathered chicken in this study was contrary to the observation of Adekoya *et al.* (2013) and Oleforuh-Okoleh *et al.* (2017) who reported that normal feathered chicken recorded higher body weight than the naked neck counterpart. Superior body weight and growth traits observed in naked neck over the frizzle and normal feathered chicken in this study also disagreed with the reports of some earlier studies (Norris *et al.*, 2007; De Almeida and Zuber, 2010; Magothe *et al*., 2010) who documented that naked neck chickens possess inferior body weight compared to the normal feathered counterpart. The disparity between this study and theirs may be due to management system and different environments (Magala *et al.*, 2012).

However, the non-significant effect of genotype at hatch and week one in this study may be attributed to inexplicable genetic and non-genetic effects. The progressive increase in the weekly body weight with age in all the genotypes, which is expected, is in line with the results of Lamido *et al.* (2023) who observed progressive increase in body weights of indigenous normal feathered chicken at different ages. Similarly, Olereforuh-Okoleh *et al.* (2017) worked on a population of normal feathered and naked neck genotypes and observed a more rapid weight gain between 4, 8 and 12 weeks of age, indicating body weight increase with age. Ige (2013) recognized that the age of an animal influences its growth pattern. Iraqi *et al.* (2002) concluded that genetic selection at early ages may give rapid improvement in growth of local strains.

Effect of Sex on Body Weight

The results of the effect of sex on body weight in the present study are in agreement with the reports of Kow *et al*. (2015) who observed that the body weight of male Ross and Cobb broiler chicken breeds were superior to their female counterparts during the growth periods in South Africa. Sexual differences in growth traits of local chickens were also observed by Aliyu (2012), Faith *et al*. (2018), Abdulraheem *et al*. (2020) and Lamido *et al*. (2023). According to Zerehdaran *et al.* (2004), the differences between males and females in a trait cannot be attributed to a single factor; factors such as greater competition for feed, aggressive behavior of males, social dominance, difference in nutritional requirements, and impact of hormones for growth and fatness all play a part.

Interactive Effect of Genotype by Sex

The present study which showed a non-significant disparity in the effect of the interaction between genotype and sex on weekly body weight except at hatch weight aligns with the findings of Del Castilho *et al.* (2013) who reported non-significant genotype X sex interaction on body weight gains, feed conversion ratio, and livability in free range broiler chickens in Brazil. The result is also in tandem with the results of Peters *et al.* (2005), Adebambo *et al.* (2009) and Adedeji *et al.* (2008) who worked on different genotypes of Nigerian local chickens. Within genotype, the heavier body weight of male chickens than female chickens in this study might be due to males being better in feed competition, socially dominant over the females, as well as having higher nutrient requirements different from females in hormone for growth (Zerehdaran *et al.* 2004).

The significant genotype X sex interaction effects on body weight at hatch suggest that body weight is controlled jointly by genotype and sex. Significant genotype X sex interactions have been reported by a few authors. Shim *et al.* (2012) and Udeh *et al.* (2015) reported significant sex × strain interaction effects on live body weight, body weight gain, feed conversion ratio, and linear body measurements in broiler chickens.

CONCLUSION

The naked neck genotype performed better than the frizzle and normal-feathered Nigerian native chickens under intensive system of management. The male Nigerian native chickens had better body weight than their female counterpart

from week one to week eight. The interaction of genotype and sex had no significant effect on body weight of Nigerian native chickens during early growth period.

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