Comparative Growth Performance of Kuroiler and Nigerian Indigenous Naked Neck Chickens Kept in a Tropical Environment

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Abstract

Chicken production is an essential venture for steady household income generation, poverty alleviation and provision of quality nutritional aids. This study was conducted to compare growth performance of Kuroiler and Nigerian indigenous naked neck chickens reared in the tropics. A total of 538 birds comprising 345 indigenous Nigerian naked neck and 193 Kuroiler chickens genotypes were sampled. Body weight and linear body measurements were observed at 2, 4, 6, 8 and 10th week. Data obtained were subjected to 2-way analysis of variance using GLM procedure of SAS. There exist significant variations in chicken genotype with growth performance. Kuroiler birds significantly showed heavier mean body weight ($p < 0.05$) at various critical growth stages observed than the Nigerian indigenous naked neck chickens reared under same conditions. The influence of genotype and sex on mean body weight and breast girth measures of chickens remain insignificant throughout early growth stages. However, at 6th, 8th and 10th week of age, Kuroiler breeds demonstrated superior growth rate and performance response compared to Nigerian indigenous naked neck fowls. Both chicken breeds exhibited differential growth patterns and sexual dimorphism in favour of male populations. Introduction and crossing of Kuroiler strains with Nigerian indigenous naked neck birds might result in better performance and adaptability.

Introduction

Chicken constitute a unique and vital component of the global animal genetic resources. Chicken production has become a globally accepted practice appraised for regular household income generation, rural poverty alleviation and provision of quality nutritional aids for human needs, sustenance and industrial uses. The current demand for available animal-based protein sources will double progressively in the coming years due to rising human population. Poultry products especially chicken derivatives are common and the most affordable animal protein sources in developed and developing regions worldwide. Chickens are recognized as valuable component of global genetic resources (Ogbu, 2021), and the most widely distributed avian specie in the Nigerian poultry production industry with a total population size of 180 million birds (FAOSTAT, 2019). Several studies have x-rayed growth and compared the growth performance of different indigenous and exotic farm animal species including chickens (Malpotra *et al.*, 2018; Mueller *et al.*, 2020), rabbits (Gasco *et al.*, 2019), sheep and goats (Yashim, *et al.*, 2016; Worku *et al.*, 2019) and Cattle, (Denis *et al.*, 2019).

According to Lawrence and Fowler, (2002) growth describes an increase in the number of cells or body size per unit time. Growth in chicken is a complex trait believed to be influenced by genetic and non-genetic factors as: genotype, sex, breeds, nutrition, adaptability and management profile. Indigenous fowls unlike the exotic breed exhibits sigmoid growth (Ismail, 1997). This growth pattern is also associated with Nigerian indigenous naked neck chickens.

The naked neck chickens represent a breed of birds naturally devoid of feather coverage on the neck and vent region. Naked neck trait results from an autosomal gene in chicken (Warren, 1933) and controlled by

an incompletely dominant allele located near the middle of chromosome 3 (Duodo, 2013). Indigenous Nigeria naked neck chickens are possess robust adaptability and can thrive efficiently in the tropics and hot humid zones. They are distributed in rural areas, reared by the majority of the rural poor (Ogbu, 2021). Keeping naked neck birds under warm and hot humid areas support the attainment of bird's growth potential, body weight and egg production (Galal and Fathi, 2001). The growth rate and production level of Nigerian indigenous chickens are quite slow relative to exotic strains under similar conditions. An insight into understanding the genetic variation of these useful breeds becomes imperative to identify populations with superior merit. This study therefore focus on comparative evaluation of growth performance of Kuroiler and Nigerian indigenous naked neck chickens.

Methodology

This study was carried out at the Programme for Emerging Agricultural Research Leadership poultry building unit of the Directorate of University Farms of Federal University of Agriculture Abeokuta, Nigeria. Characterized by tropical rainforest vegetation, mean temperature of 33.7°C, relative humidity of 80%, rainfall of about 1037mm and altitude 76 mm above sea, the area lies within latitude 7° 13', 49° 46' N, longitude 3° 26', 11° 98' E (Goggle Earth, 2018). Eggs from parent stock Kuroiler and naked neck chickens were collected at the poultry breeding unit and hatched for this experiment. A total of 538 birds comprising 345 Nigerian indigenous naked neck and 193 Kuroiler chickens genotypes were sampled. Body weight and linear body measurements (breast girth) were observed at 2nd, 4th, 6th, 8th and 10th week using sensitive weighing scale (grams) and graduated measuring tapes (centimeters) respectively. Data obtained on body weight and morphometric trait was subjected to two way analysis of variance (ANOVA) using general linear model (GLM) procedure of SAS 9.2 software (SAS, 2010, SAS Institute Inc. Cary, North Carolina, USA). Significant differences were separated using turkey-Kramer.

Results And Discussion

Effect of genotype on chicken growth trait

Table 1 shows the effect of chicken genotypes on growth traits. There exist significant variations in genotype with chicken growth. Kuroiler birds sustain significantly higher mean body weight ($p<0.05$) at various critical growth stages than naked neck chicken reared under same conditions. At 10th week of growth, Kuroiler birds attain highest (959.72 ± 0.07^a) mean body weight compared to Nigerian indigenous naked neck chicken (623.69 ± 12.32^b) at same age. The influence of chicken genotype on breast girth remains insignificant during early growth stages. However, as birds approaches 10th week, Kuroiler showed significantly higher mean breast girth (26.80 ± 0.23^a) than naked neck chicken (20.51 ± 0.18^b).

Table1. Effect of chicken genotype on growth trait

Wk	N	Genotype	BG (cm)	BWT (g)
2	532	KLR	18.95±3.98	154.42±2.0 ^a
		NKN	11.64±0.11	127.65±6.21 ^b
4	529	KLR	17.46±0.15 ^a	396.45±5.60 ^a
		NKN	14.37±0.12 ^b	220.27±7.48 ^b
6	512	KLR	20.97±0.16 ^a	614.19±8.26 ^a
		NKN	15.66±0.16 ^b	356.95±9.68 ^b
8	503	KLR	23.65±0.20 ^a	800.57±19.50 ^a
		NKN	18.53±0.15 ^b	499.85±9.80 ^b
10	496	KLR	26.80±0.23 ^a	959.72±0.07 ^a
		NKN	20.51±0.18 ^b	623.69±12.32 ^b

^{abc} Mean with different superscripts on the same column are significantly different (p<0.05).

Wk=week, KLR=Kuroiler, NKN=Nigerian indigenous Naked neck, BG=Breast girth, BWT=body weight, N=Number of observations, g=grams and Cm= Centimeter.

Effect of sex on chicken growth trait

Table 2 presents the effect of sex on chicken growth parameters. Sex did not have significant effect on chicken growth traits at 2nd and 4th week. However, at 6th, 8th and 10th week of age, the males were generally superior (p<0.05) to females of both Kuroiler and Nigerian indigenous naked neck chickens in mean body weight and average breast girth measures subjected to same management profile.

Table2. Effect of sex on chicken growth trait

Wk	N	sex	BG (Cm)	BWT (g)
2	532	♂	12.38±0.11	143.99±2.38
		♀	18.20±4.40	138.08±5.19
4	529	♂	16.03±0.17	315.44±7.23
		♀	15.82±0.16	301.27±8.60
6	512	♂	18.65±0.21 ^a	502.99±10.85 ^a
		♀	17.98±0.23 ^b	468.15±11.84 ^b
8	503	♂	21.58±0.22 ^a	691.05±18.97 ^a
		♀	20.60±0.24 ^b	609.38±18.61 ^b
10	496	♂	24.49±0.27 ^a	849.42±14.56 ^a
		♀	22.82±0.29 ^b	733.99±15.33 ^b

^{abc} Mean with different superscripts on the same column are significantly different (p<0.05).

Wk=week, ♂=male, ♀=female, BG=breast girth, BWT=body weight, N=Number of observations, g=grams and Cm= Centimeter.

Effect of Sex and Genotype interaction on chicken growth traits

Table 3 show the effect of genotype and sex interaction on chicken growth parameters. Sex and chicken genotype combination showed no significance on early birds growth traits. When compared with respect to genotype and sex interactions, Kuroiler sexes differ significantly in breast size and body weight from naked neck sexes only at 8th and 10th weeks. At 8th week, mean breast girth of Kuroiler sexes were statistically alike (23.76 ± 0.23^a and 23.54 ± 0.37^a), similar observation was recorded for their mean body weight (809.41 ± 21.76^a and 791.74 ± 39.75^a). Also, at 10th week, both Kuroiler sexes weighed similar values (982.60 ± 14.22^a and 936.85 ± 16.57^a) but significantly heavier than naked neck male and females.

Table 3. Effect of sex and genotype interaction on chicken growth traits

Wk	N	Genotype	Sex	BG (Cm)	BWT (g)
2	532	KLR	♂	12.94 ± 0.13	154.43 ± 2.62
			♀	24.97 ± 12.23	154.40 ± 3.28
		NKN	♂	11.83 ± 0.15	133.54 ± 4.94
			♀	11.44 ± 0.13	121.75 ± 7.76
4	529	KLR	♂	17.55 ± 0.22	399.07 ± 6.92
			♀	17.37 ± 0.19	393.82 ± 9.52
		NKN	♂	14.69 ± 0.18	323.81 ± 10.89
			♀	14.09 ± 0.15	208.72 ± 9.02
6	512	KLR	♂	21.05 ± 0.20	632.46 ± 10.46
			♀	20.89 ± 0.27	604.93 ± 13.21
		NKN	♂	16.25 ± 0.34	382.52 ± 16.03
			♀	15.08 ± 0.18	331.38 ± 11.41
8	503	KLR	♂	23.76 ± 0.23^a	809.41 ± 21.76^a
			♀	23.54 ± 0.37^a	791.74 ± 39.75^a
		NKN	♂	19.41 ± 0.24^b	572.69 ± 22.11^b
			♀	17.67 ± 0.17^{bc}	427.02 ± 9.62^{bc}
10	496	KLR	♂	27.35 ± 0.26	982.60 ± 14.22^a
			♀	26.26 ± 0.47	936.85 ± 16.57^a
		NKN	♂	21.63 ± 0.34	716.25 ± 29.49^b
			♀	19.38 ± 0.19	531.15 ± 11.71^{bc}

^{abc} Mean with different superscripts on the same column are significantly different ($p < 0.05$).

Wk=week, KLR=Kuroiler, NKN = Nigerian indigenous Naked neck, ♂=male, ♀=female, BG=Breast girth, BWT=body weight and N= number of observations, g=grams and Cm= Centimeter.

Growth in farm animals reflects a biological increase in an animal's size or mass over its lifetime. Superior growth performance of Kuroiler chicken breeds compared to Nigerian indigenous naked neck fowls observed in this study might be attributed to better genetic potential that exotic breeds have acquired over series of selection and multiple cross breeding have genetically improved their growth rate and production potentials. This reveals that the genetic constitution of Nigerian indigenous naked neck chickens is still intact has not yet undergone full gene mixing with exotic lines (Islam, 2009). The significant sex effect to on body weight and linear measurements at 6th to 10th week is in agreement with literature (Ajayi and Ejiofor, 2009). Heavier weight of male to female birds in this study is consistent with Odah *et al.* (2019) who also reported differential growth rate among indigenous chicken population of Bekwarra, Southern Nigeria. This result also agree favorably with previous reports of variation in growth pattern within species (Deeb and Lamont, 2002) and comparable with the findings of Ajayi and Ejiofor, (2009) for Ross and Anak Broiler Strains reared in the high rainforest zone of Nigeria and Madilindi *et al.*, (2018) for broiler chickens kept in subtropical South Africa environment. Superior male weights in this report might resulted from better feed consumption abilities and high level of testosterone secretions in males' which influence growth dynamics of body parts not directly associated with muscles mass, reproduction and sexual development (Lawrence and Fowler, 2002).

Sexual dimorphism in favour of males observed in both genotypes in this report is consistent with Adeleke, (2005) and Isidahomen *et al.*, (2012) who also revealed differential growth pattern in chickens. The difference observed in growth rate for Kuroiler and Nigerian indigenous naked neck chicken is an indication that there exist variation in their growth pattern, attributed to strain differences and birds genetics. High significant difference in genotype and sex interaction of Kuroiler breeds and Nigerian indigenous naked neck fowls agreed is inline with the reports of (Ajayi and Ejiofor, 2009; Razuki *et al.*, 2011) who also observed significant genotype and sex interaction on body weight of Ross and Anak Broiler Strains. This however differ from the results of Ojedapo *et al.* (2008) who showed no significance in genotype and sex interaction on chicken body weight. The variations in mean body weight and breast girth measurements of chicken genotypes with age in this study can be attributed to genetic make-up, sexual dimorphism, age and bird physiology because organs and tissue functions determines general body development Adedeji *et al.* (2006).

In conclusion, the chickens exhibited differential growth patterns, attributable to genetic composition and strain differences. Kuroiler revealed superior growth rate and performance relative to Nigerian indigenous naked neck chickens. Introduction of Kuroiler strains and subsequent crossbreeding with Nigerian indigenous naked neck birds might improve their performance and adaptability.

Declarations

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Authors contribution; Author **WM** and **AAO** conceived and designed the study, **OEO**, **OHT** and **OFG** were involved in investigation, data collection and manuscript writing. Author **AOA** provided facilities, supports in data analysis and revising the manuscript.

Statement of Animal Rights; Protocols for the conduct of this research were approved by the Animal Care and Use Committee of the Federal University of Agriculture, Abeokuta, Nigeria.

Competing Interest: The authors have declared that no competing interest exists.

Availability of data and material; all relevant data and materials for this research shall be made available on reasonable request.

Compliance with ethical standards; the manuscript does not contain clinical studies or patient data.

Consent to participate; not applicable.

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Figures

Figure 1

Nigerian indigenous naked neck cock and hen

Figure 2

Nigerian indigenous naked neck hens

Figure 3

Kuroiler cocks.

Figure 4

Kuroiler hens.