BODY MEASUREMENT, CARCASS AND ORGAN CHARACTERISTICS OF TWO GENOTYPES OF GUINEA FOWL (NUMIDA MELEAGRIS) REARED IN THE SAHEL REGION OF NIGERIA

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Abstract

A comparative study of body measurement, carcass and organ characteristics was conducted on guinea fowl in Nigeria using two genotypes. A total of 75 (40 pied and 35 pearl) guinea fowls of both sexes were used in this study. Statistical comparisons were made for differences in values between the genotypes, sexes, and different age groups. The result showed that the body measurement was highly significant ($p<0.001$) between the genotypes and sex. Pearl guinea fowl had significantly heavier ($p<0.001$) carcass components than the pied. It was also observed that the weights of the head, gizzard, intestine, heart, and abdominal fat were highly significant ($p<0.001$) between the genotypes with the Pear been superior to the Pied genotype. Shank weight was significant ($p<0.05$) while crop length and weight were not significantly ($p>0.05$) affected by genotype, but that was not completely the case in the sex, as neck weight, wing weight and breast weight were not significant ($p>0.05$). However, the effect of sex and sex x genotype interactions on organs weight were fairly constant ($p>0.05$). The results revealed that pearl genotype was superior to the pied. The information generated could serve as a baseline data on guinea fowl production and improvement in Nigeria.

Keywords: Guinea fowl, body measurement, carcass, genotype, sex.

Introduction

Guinea fowl (*Numida meleagris*) hails from the Sub-Saharan region of West Africa and are now found in every region of the world. Their widespread and excellent reputation allows them to rise above its former meat production. It is today considered a delicacy in virtually every region of the world. Their increasing role in the farm has taken on many purposes in today's diversified livestock community. The increasing demand for guinea fowl is to bridge the inadequate supply of animal protein in developing countries although its production is found predominantly in Small-holder farmers often described as a "poor man's pheasant" (Bonds, 1997).

The advantages of raising guinea fowl when compared to local chickens include; low cost of production, better ability to protect itself against predator and better resistance to common poultry parasites and diseases like Newcastle disease and fowl pox. Other attributes include premium quality meat as well as greater capacity to scavenge for insects and grains (Dieng *et al.,* 1998). This indicates that there is potential to improve guinea fowl production in order to increase household animal protein supply to combat rural protein-energy malnutrition in addition to increase income to small holder farmers.

Genotype has great impact on the performance of guinea fowl which is limited by poor live weight traits of native types (Ayorinde, 1987). However, commercial genetic selection for economically important traits has brought about body conformation and composition of guinea fowl (Fajemilehin, 2007). Genetic improvement of guinea fowl had attracted very little attention in Nigeria. Hence, there is inadequate information on guinea fowl genetic and breeding programme (Ayorinde, 1987; Fajemilehin *et al.*, 2010).

Body measurement of birds enables a description and estimation of body weight on one or more characteristics which can be measured readily (Oke *et al.*, 2004). The relationship existing among linear body trait provides useful information on performance, productivity, carcass characteristics of animal and also provides the shape necessary for estimating genetic parameters in animal breeding programmes (Chineke *et al.*, 2002). Carcass cut is an important aspect in poultry production which provides useful information on the quality and carcass characteristics (Ikani and Dafwang, 2004). Therefore, this study was carried out to evaluate the influence of genotype and sex on the body measurements and carcass characteristics of indigenous guinea fowls reared under intensive system.

Materials and method

Location: The study was conducted at the poultry unit of the teaching and research farm, Faculty of Agriculture, University of Maiduguri. Maiduguri is situated in the North-eastern part of Nigeria. It is located on latitude $10^0$50 North and longitude $13^0$09 east and at an altitude of 354 meters above sea level. Maiduguri falls in the Sahel region of West Africa which is well noted for its great climatic and seasonal variation. The area is usually characterized by very short period (3-4 months) of rainfall usually from June to October and a prolonged period of dry season (8-9 months). Annual rainfall ranges from 300-700mm while ambient temperature reaches 40^0c and above during the months of March to May. The mean relative humidity ranges from 30 to 50% with minimum in February to March when it drops to as low as 10% and maximum of about 90% in August (Encarta, 2007).

Experimental Stock and management: a total of 250 eggs of two genetic groups were hatched at the university of Maiduguri Livestock Teaching and Research Farm of the Department of Animal Science. At hatching the keets were separated into two genotypes, pearl grey and pied based on the sources of the eggs. They were fed commercially prepared chick mash (20% CP) and growers mash containing 15% CP at chicks and grower levels respectively. Water was provided *ad libitum.* They were treated against diseases (Newcastle disease, fowl pox, worms) and were vaccinated (IBDV, Lasota) all through the various stages.

Data Collection: Data were collected using a 5kg digital sensitive weighing scale and a measuring tape (calibrated in centimetres).

Linear body measurement: All measurements were taken on a weekly basis by use of a measuring tape as described by Ewalds (1987), Shank length: Length between the genu and the regiotursalis. Shank circumference: Circumference of the middle of the shank. Drumstick length: Length between the middle of the coax and genu (kneet). Drumstick circumference: Circumference of the drumstick at the coax region. Body length: Length between the base of the neck and the tip of the caudal (Tail without feathers). Body circumference: Circumference of the body at the tip of the pectus (hind breast). Wing length: Length between the tip of phalanges and the carocoid-humerous joint.

***Carcass and Organ Measurement*:** At the end of the experiment, 75 guinea fowls were weighed and starved over night before slaughtered for carcass analysis. A clear cut was made at the jugular vein just below the ear lobe, to drain the blood. After scalding and plucking, the visceral organs were removed, the carcass was weighed to determine the dressing percentage and then cut according to the parts as follows: drumstick, thighs, breast, neck, back, wings and thorax. The parts were then weighed. The visceral organs were collected from individual carcass and weighed. The organs which include gizzard, liver, crop, heart, abdominal fat, full intestine, head and shanks were also weighed.

***Statistical Analysis*:** All data collected were subjected to analysis of variance using the 2 x 2 x 2 factorial Design and significant means were separated using least significant difference (LSD). The statistical model used were: $Y_{ij} = \mu + G_i + S_j + A_k + T_{kl} + e_{ijk}$;

where Y_{ij}= any observation per bird; μ= overall mean; G_i= effect of genotype; S_j= effect due to sex;

A_k= effect due to age; T_{kj}= interaction effect between age and sex, and e_{ijk}= random error term.

Results

The mean values of the effect of genotype, sex and age on body measurements of guinea fowl examined are presented in Table 1. Table 2 represents the effect of genotype, sex and their interaction on carcass components while Table 3 shows the values of organs weight in relation to genotype and sex of guinea fowl.

Table 1: Effect of genotype, sex and age on body measurement (cm) of two guinea fowl genotypes

	N	BL	BC	SHL	SHC	DSL	DSC	WL
OVERALL	**75**	**20.49±0.12**	**33.892±0.14**	**6.47±0.03**	**3.56±0.01**	**10.78±0.06**	**9.16±0.05**	**17.90±0.06**
GENOTYPE		***	***	***	***	***	***	***
Pearl	35	22.92±0.18^{a}	36.64±0.22^{a}	7.05±0.05^{a}	3.87±0.08^{a}	11.77±0.09^{a}	9.87±0.08^{a}	19.44±0.09^{a}
Pied	40	18.06±0.14^{b}	31.14±0.17^{b}	5.89±0.04^{b}	3.25±0.02^{b}	9.79±0.07^{b}	8.45±0.06^{b}	16.36±0.07^{b}
SEX		***	***	***	***	***	***	***
Male	33	21.05±0.16^{a}	34.58±0.19^{a}	6.70±0.05^{a}	3.64±0.02^{a}	11.28±0.08^{a}	9.41±0.07^{a}	18.43±0.08^{a}
Female	42	19.93±0.17^{b}	33.21±0.02^{b}	6.24±0.05^{b}	3.49±0.02^{b}	10.29±0.08^{b}	8.91±0.07^{b}	17.37±0.08^{b}
AGE		***	***	***	***	***	***	***
Week 10	75	17.34±0.38^{f}	27.46±0.46^{f}	5.15±0.11^{f}	3.54±0.05^{f}	9.46±0.19^{f}	6.62±0.16^{f}	14.56±0.18^{f}
Week 12	75	19.47±0.38^{e}	31.48±0.46^{e}	5.79±0.11^{e}	3.43±0.05^{e}	9.88±0.19^{e}	8.32±0.16^{e}	17.24±0.18^{e}
Week 14	75	20.25±0.38^{d}	34.59±0.46^{d}	6.40±0.11^{d}	3.36±0.05^{d}	10.10±0.19^{d}	8.98±0.16^{d}	17.88±0.18^{d}
Week 16	75	21.74±0.38^{c}	34.61±0.46^{c}	6.82±0.11^{c}	3.53±0.05^{c}	10.98±0.19^{c}	9.67±0.16^{c}	19.17±0.18^{c}
Week 18	75	21.89±0.38^{b}	36.84±0.46^{b}	7.13±0.11^{b}	3.70±0.05^{b}	11.36±0.19^{b}	9.83±0.16^{b}	19.59±0.18^{b}
Week 20	75	23.04±0.38^{a}	38.10±0.46^{a}	7.51±0.11^{a}	3.87±0.05^{a}	12.47±0.19^{a}	10.73±0.16^{a}	19.75±0.18^{a}

a, b, c, d, e, f= means within subset bearing different superscript a, b. are statistically significant ($p<0.001$). ******* = $p<0.001$ N = Number of observation. BL = Body length, BC = Body circumference, SHL = Shank length, SHC = Shank circumference, DSL = Drumstick length, DSC = Drumstick circumference, WL = Wing length.

Genotype effect

Pearl genotype had significantly higher ($p<0.05$, $p<0.001$) body measurements, carcass components and organs weights than the pied genotype.

Sex effect

Male guinea fowls had significantly ($p<0.001$) higher body dimensions than females. Similarly, male guinea fowl had significantly ($p<0.05$, $p<0.01$,) higher live weight, slaughter weight, dressed weight, dressing percentage, drumstick, thigh, shank and back weight than females. The neck, chest, breast, and wing were not affected by the sex ($p>0.05$). There were no significant differences ($p>0.05$) in the weight of body organs between males and females.

Table 2: Effect of genotype, sex and their interaction on carcass weight of guinea fowl

	LW (g)	SW (g)	DW (g)	DP (%)	NW (g)	TW (g)	DSW (g)	BW (g)	WW (g)	SW (g)	BSW (g)
GENOTYPE	***	***	***	***	***	***	***	***	***	***	***
Perl	1558.5±48.2^{a}	1503.0±48.2^{a}	1144.8±37.2^{a}	73.5±7.7^{a}	5.3±0.8^{a}	12.4±1.5^{a}	9.5±1.1^{a}	9.1±1.3^{a}	9.2±9.4^{a}	2.8±0.1^{a}	20.2±2.1^{a}
Pied	968.8±35.7^{b}	925.6±35.7^{b}	698.3±27.6^{b}	72.1±7.7^{b}	4.9±0.8^{b}	12.1±15^{b}	8.9±1.1^{b}	8.7±1.3^{b}	9.9±0.9^{b}	2.6±0.3^{b}	19.2±2.1^{b}
SEX	**	**	**	**	Ns	**	**	**	Ns	*	Ns
Male	1351.2±41.7^{a}	1300.4±41.8^{a}	991.3±32.2^{a}	73.4±7.7^{a}	5.3±0.8	12.6±1.5^{a}	9.7±1.1^{a}	8.7±1.3^{b}	9.4±0.9	2.8±0.3^{a}	19.7±2.1
Female	1176.2±43.1^{b}	1128.1±43.1^{b}	851.8±33.3^{b}	72.4±78^{b}	5.1±0.8	11.9±1.5^{b}	8.9±1.1^{b}	9.2±1.3^{a}	9.5±0.9	2.6±0.3^{b}	19.9±2.1^{ns}
GENOTYPE X SEX INTERACTION											
PEARL	*	Ns	*	Ns	Ns	Ns	Ns	*	*	Ns	**
Male	1467.7±68.1^{a}	1588.3±68.2	1211.0±52.6^{a}	73.5±7.7	5.4±0.8	12.7±1.5	9.8±1.1	8.7±1.3^{b}	8.9±1.0^{b}	2.9±0.3	20.0±0.2^{b}
	*										
Female	1469.3±68.1^{b}	1417.7±68.2^{b}	1078.7±52.5^{b}	73.4±7.7	5.3±0.8	12.1±1.5	9.1±1.1	9.4±1.3^{a}	9.6±0.9^{a}	2.7±0.3	22.4±2.1^{a}
PIED	**	**	*	*	Ns	*	*	Ns	*	Ns	Ns
Male	1054.7±48.1^{a}	1012.5±48.2^{a}	771.5±37.2^{a}	73.1±7.7^{a}	5.0±0.8	12.4±1.5^{a}	9.3±1.1^{a}	8.6±1.2	10.3±0.9^{a}	2.6±0.3	19.3±2.1
Female	883.0±52.8^{b}	838.6±52.8^{b}	625.0±40.8^{b}	70.8±7.7^{b}	4.9±0.8	11.7±1.5^{b}	8.6±1.1^{b}	8.7±1.3	9.4±1.0^{b}	2.4±0.2	19.1±2.1

$^{a,\ b}$ = means within subset bearing different superscript are statistically different from each other. *=p<0.05, **=p<0.01, ***=p<0.001 Ns = Not significant. LW =Live weight, SW =Slaughter weight, DW =Dressing weight, DP =Dressing percentage, NW =Neck weight, TW =Thigh weight, DSW =Drumstick weight, BW =Back weight, WW =Wing weight, SW =Shank weight, BSW =Breast weight

Age effect

Body measurements was significantly different ($p<0.001$) across all the ages observed. The measurements increased with increasing age, being highest at 20 weeks and lowest at 10 weeks.

Interaction effects

The interaction between genotype and sex had significant effects ($P<0.05$) on live, dressed, back, wing and chest weights respectively, but no significant effects ($P>0.05$) on weight at slaughter, neck, thigh, drumstick, shank and dressing percentage measurements respectively.

Table 3: Effect of genotype, sex and their interactions on organs weight of guinea fowls

	HW (g)	GW (g)	IW (g)	IL (g)	HTW (g)	SW (g)	CL (g)	CW (g)	ADFW (g)
GENOTYPE	***	***	***	***	***	*	Ns	Ns	***
Pearl	2.49±0.16^{a}	2.00±0.36^{a}	2.01±0.45^{a}	6.19±0.78^{a}	5.24±0.10^{a}	1.35±0.28^{a}	0.26±0.06	0.42±0.21	0.60±0.43^{a}
Pied	2.95±0.17^{b}	1.97±0.36^{b}	1.92±0.45^{b}	7.52±0.79^{b}	0.46±0.10^{b}	1.23±0.28^{b}	0.40±0.06	0.55±0.21	0.07±0.43^{b}
SEX	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns
Male	2.77±0.17	1.80±0.36	1.97±0.45	6.20±0.79	0.51±0.10	1.36±0.82	0.30±0.06	0.48±0.21	0.37±0.43
Female	2.55±0.17	2.21±0.36	1.89±0.45	7.28±0.78	0.49±0.10	1.23±0.28	0.32±0.06	0.45±0.21	0.43±0.43
GENOTYPE X SEX INTERACTION									
Pearl	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns
Male	2.65±0.17	1.82±0.36	2.06±0.45	5.81±0.79	0.51±0.10	1.46±0.28	0.27±0.06	0.45±0.21	0.61±0.43
Female	2.31±0.17	2.20±0.36	1.95±0.45	6.62±0.79	0.54±0.10	1.23±0.28	0.25±0.06	0.39±0.21	0.59±0.43
Pied	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns
Male	2.96±0.17	1.77±0.36	1.83±0.45	6.81±0.79	0.51±0.10	1.22±0.28	0.37±0.06	0.54±0.21	0.21±0.43
Female	2.94±0.17	2.22±0.36	2.02±0.45	7.36±0.79	0.41±0.10	1.25±0.28	0.44±0.06	0.57±0.21	0.16±0.43

$^{a,\,b}$ = means within subset bearing different superscript are statistically different from each other. *=p<0.05, **=p<0.01, ***=p<0.001 HW= Head weight, GW= Gizzard weight, IW= Intestinal weight, HTW= Heart weight, LW= Lungs weight, CL= Crop length, CW= Crop weight, ADFW= Abdominal fat weight.

Discussion

The present study revealed that genotype, sex and age had a highly significant (p<0.001) effect on all the body measurements. The pearl genotype had the highest values for all the body measurements in comparison to the pied. This result agrees with the work of Fajemilehin (2010) who reported a significant (p<0.05) effect of genotype on body measurements (shank length, drumstick length, wing length and chest girth). The variation among these genotypes may be as a result of individual differences in performance which is common within the same breed. The male guinea fowls showed higher values of all body measurements compared to their female counterparts. The result of this study is similar to those of Dafwang (1990) in guinea fowl and Adebambo *et al.* (1999) in local chickens. The reasons for these differences may be due to the fact that males generally grow heavier than the females and also due to physiological and hormonal factors i.e. testosterone promotes anabolism resulting in increased body size in males. The body measurement of guinea fowl was significantly (p<0.001) effected by age. Similar results were reported by Adeogun and Adeoye (2004), and Bamgatner (1993) who independently reported that body measurements increase with the advancement in age. It is inferred that as the bird grow and advance in age, the body dimensions also increases.

In the present study, the mean values of all the carcass components were highly (p<0.001) influenced by genotype. All carcass components were higher in the pearl genotype than the pied. The present result is in consonance with that of Ayorinde *et al.* (1989) and Fajemilehin (2010) where genotype of birds significantly (p<0.05) influence carcass yield of guinea fowl. This may be attributed to the differences in genetic makeup and the assertion by Moran (1995) that heavier birds produced greater portion of carcass components. These results clearly showed that there were considerable differences in genotypes which may be due to their genetic pool as previously reported by Elewa (2004) and El Full *et al.* (2005). Sex was found to affect carcass yield (p<0.05). The mean values for thigh, drumstick and shank weight were highly significant (p<0.01). The values of dressing percentage, live, slaughter and dressed weights were significant (p<0.05) except for the back, neck, chest, and breast weights (p>0.05). In this study, it can be seen that there was a sexual dimorphism in favour of males compared to females; the males have higher values of carcass traits compared to their female counterparts. This result corroborates the work of Dafwang (1990) who reported a significant superiority ($p<0.01$) of male over female birds. The superiority also agrees with the results of Zerehdaran *et al.* (2004) and Khosravania *et al.* (2005). Similarly, Marks (1995) and Moran (1995) asserted that heavier birds produced a greater portion of thigh, drumstick and other carcass components.

The mean values of gizzard, intestine, heart, and liver weight as well as intestine length were highly significant ($p<0.001$) while the values for crop length and crop weight were not significant ($p>0.05$) on genotype. This result corroborate the report of Fajemilehin (2010) who reported a significant ($p<0.05$) effect of genotype on organs weight. Similarly, Fujihara (1990) reported that significant differences among carcass and organs weight of different breeds are known to exist. The effect of sex on all the body organs weight were not observed ($p>0.05$). This result showed that, there was no sexual dimorphism in favour of either the males or females, and there is no clear explanation for such gender similarities in organs weight. However, this is an indication of similarity in the ranking of the two sexes under consideration.

In conclusion, the pearl genotype recorded the highest values in both body measurements and carcass components, males had the highest values of both body measurements and carcass component. The results of this study may be useful as a baseline data and that farmers should involve in the production of the pearl genotype since they can perform well in the semi-arid environment.

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