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Growth and Carcass Performance of Six Tropically Adapted Dual Purpose Chicken Breeds under Intensive Management System

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Abstract
The performance of Fulani, FUNAAB Alpha, Kuroiler, Noiler, Sasso and ShikaBrown was evaluated. Three hundred birds of each breed were raised from day-old on deep litter at two separate stationsin Ibadan and Abeokuta up to 140 days of age. Data on live performance, morphology, physiology and carcass characteristics were collected and proximate analysis of muscle was carried out. The feed intake, total weight gain and feed conversion ratios indicated the hierarchy of the breeds as follows: Kuroiler, FUNAAB Alpha, Sasso, Noiler, ShikaBrown and Fulani. FUNAAB Alpha had the highest haemoglobin content while Sasso had the lowest. Haemoglobin and rectal temperature were significantly higher for birds raised at the Abeokuta station than those raised in the Ibadan station indicative of the higher temperature-humidity index at Abeokuta.Thedressing percentageranged from 69.2 to 60.9 for Noiler and Fulani, respectively. Sasso had the highest muscle to bone ratio (2.8) and Fulani had the lowest (1.8). Fulani hadthe highest lung weight as a percentage of the live weight (0.9%).Muscles of Noiler had the highest moisture content (75.3%) and the lowest fat content (1.5%). Muscles from FUNAAB Alpha and Fulani had the highest CP contents (25.4 and 25.0%, respectively) while Noiler had the lowest CP (21.3%). Results from this study indicate that all the 6 breeds are adapted to the tropical environment, with performance characteristics higher for the improved breeds and adaptability characteristics higher in the unimproved or locally developed breeds.

Keywords: Chicken, breeds, morphology, physiology, performance, carcass

Introduction

The dominant purpose of rural smallholder chicken (SHC) farmers surveyed in 5 states of Nigeria in 2015-2016is family meat consumption,followed by sale of live adult chicken (ACGG-NG Baseline Survey, unpublished data). These two production objectives depend on the live performance and carcass characteristics of chickens. In addition, haematological characteristics, which show the response of birds to environmental factors, indicate how adapted the birds are to the local environment.The general objective of the study was to investigate the performance of sixdual purposebreeds when raised under optimum intensive production conditions.

The specific objectives were: i) to compare the live performance of cocks from the breeds; ii.) to compare their morphometric measurements;iii) tomeasure their physiology and haematology; iv) to compare their carcass yields; and v) to determine theproximate contents of theirmuscles.

Materials and Methods

Study locations: The birds were reared intensively on deep litter at 2 stations (Fol-Hope Farm, Ibadan, Oyo State, and Federal University of Agriculture, Abeokuta (FUNAAB), Ogun State). The average temperature, relative humidity and temperature-humidity index (THI) of the stations during the study was 23 and 30^0C, 78 and 82% and 69 and 75 for Fol-Hope and FUNAAB stations, respectively.Measurements of physiological and carcass characteristics were carried out at Obafemi Awolowo University, Ile-Ife.

Experimental birds and management: Three hundred day old chicks of each of three locally-developed breeds (FUNAAB Alpha, Noiler and ShikaBrown), two imported breeds (Kuroiler and Sasso), and one locally adapted breed (Fulani) were brooded for 42 days before observation up to 140 days Commercial feeds (Chick mash: 2,993 kcal ME/kg, 22.3 % CP; Grower mash: 3,013 kcal ME/kg, 17 % CP) and water were available*ad libitum*. The study was conducted as a randomised complete block design.

Data collection and analysis: Feed intake and mortality were measured daily. Body weights were taken every fourteen days.Rectal temperatureswere taken at 138-140 days only on birds to be slaughtered. Birds were rested for a day and fasted overnight before slaughtering. Blood samples were collected during slaughtering into 5 ml EDTA and 5 ml plain bottles for determination of packed cell volume (PCV), red blood cells (RBC), white blood cell (WBC) and haemoglobin (Hb) content as described by Durosinmi (2005).Un-eviscerated carcasses were

stored at -4^{0}C for 12 hours in a chest freezer (LG, GCS325GV, China) to facilitate measurement of the abdominal fat according to the methods of Sonaiya and Benyi (1983).Carcasses were cut up and weightstaken of carcass, heart, liver, abdominal fat, leg muscle (thigh and drumstick), wing and breast muscle. Percent carcass composition of muscle, skin and bone were calculated. Proximate analysis was carried out on feed samples and muscle samples according to AOAC (2000).Data were analysed using analysis of variance of the R Statistical Package. The differences between breed means and stations means were separated using Duncan Multiple Range test.

Results

At 42 days, Fulani had the lowest, Kuroiler and Sasso had the highest feed intake (FI). Fulani had the lowest total weight gain (TWG, 231 g),Noilerhad the highest(707 g). The feed conversion ratio (FCR) ranged from 2.25 (Noiler) to 4.71 (Sasso). At 140 days, Fulani had the least and Kuroiler the highest FI. The TWG ranged from 1,328 g(Fulani) to 2,886 g (Sasso), and the FCR ranged from 5.02 (Sasso) to 8.47 (Fulani).

Table 1. Live performance of cocks up to 42 and 140 days old

	Fulani	FUNAAB Alpha	Kuroiler	Noiler	Sasso	Shika Brown	Fol-Hope	FUNAAB
Brooding Phase								
Hatch weight, g	26	33	43	37	43	30	37	33
Mortality, %	3.0	5.0	26.0	1.82	8.6	11.5	7.5	11.3
Total FI/bird, g	997	1,264	2,440	1,575	2,355	1,224	1,561	1,724
Final body weight, g	257	501	637	744	552	345	548	482
Total weight gain, g	231	469	595	707	510	315	511	449
FCR , g:g	4.20	2.69	4.13	2.25	4.71	3.97	3.33	3.93
Growing Phase								
Mortality, %	12.5	2.7	6.9	26.0	7.9	2.1	6.8	9.6
Total FI/bird, g	11,245	13,214	14,828	12,497	14,492	13,174	12,342	14,131
Total weight gain, g	1,328	2,565	2,875	2,249	2,886	1,876	2,438	2,193
FCR , g:g	8.47	5.15	5.16	5.56	5.02	7.02	5.52	6.82

Haematology and physiological characteristics: The PCV for Noiler (28.5 %) differed (P<0.01) from FUNAAB Alpha (33.7%) which did not differ from the four other breeds.RBC was not different across the breeds. Noiler had the lowest WBC. Fulani and FUNAAB Alpha had the highest (p< 0.01) Hb. Rectal temperature of Kuroiler, Noiler and Sasso were higher than those of Fulani, FUNAAB Alpha and ShikaBrown.

Table 2. Haematology and physiological characteristics of the breeds

Characteristics	Breed					Station			P value
	Fulani	FUNAAB Alpha	Kuroiler	Noiler	Sasso	Shika Brown	Fol-Hope	FUNAAB	
PCV, %	32.2^{ab}	33.7^{a}	31.8^{ab}	28.5^{c}	30.3^{bc}	31.8^{ab}	32.0^{a}	31.9^{a}	0.006
RBC, x 10^{11}cells/L	25	27	30	27	28	26	27	28	0.703
WBC, x 10^{10} cells/L	10^{a}	8^{a}	8.4^{a}	1.4^{b}	7^{a}	9^{a}	8^{a}	9^{a}	0.005
Haemoglobin, g/dL	8.8^{a}	9.3^{a}	6.7^{cd}	7.2^{bc}	6.4^{d}	7.6^{b}	7.3^{b}	8.0^{a}	1.521
Rectal Temp. ^{O}C	38.5^{c}	38.4^{c}	42.1^{ab}	41.6^{b}	42.4^{a}	38.2^{c}	38.9^{b}	41.4^{a}	< 2.2 e^{-16}

$^{a-d}$Means with different superscripts on the same row were significantly different at P ≤ 0.05

Carcass characteristics: Table 3 shows that Noiler had the highest (p<0.01) DP (69.3%), Fulani had the lowest dressing percent - DP (60.9%).The DP of FUNAAB Alpha, Kuroiler, Sasso and ShikaBrown were not significantly different. The heart weight, liver weight and lung weight as proportions of the live weight were highest for the unimproved Fulani. Muscles made up 56.3 to 79.7% of the carcass weight for the breeds under study. The calculated muscle to bone ratio of all the breeds except Fulani exceeded 2.0. Kuroiler and Sasso had the highest

total muscle weight (TMW). FUNAAB Alpha and Noiler had lower TMW than Kuroiler and Sasso. Noiler had the lowest ($p< 0.01$) abdominal fat weight (AFW) which was not significantly different from that of ShikaBrown.

Proximate analysis: Noiler muscle had the highest moisture content and the lowest fat content ($p< 0.01$). The CP of the muscles of local breeds (except Noiler) were not significantly different from one another, but significantly higher (except ShikaBrown) than the CP of the muscles of foreign breeds ($p< 0.01$).

Table 3: Carcass characteristics of the breeds

Characteristics	Breed						Station		P value
	Fulani	FUNAAB Alpha	Kuroiler	Noiler	Sasso	Shika Brown	Fol-Hope	FUNAAB	
Live weight (LW), g	1,328^{e}	2,565^{b}	2,875^{a}	2,249^{c}	2,886^{a}	1,876^{d}	2,228^{b}	2,380^{a}	< 2.2 e $^{-16}$
Carcass weight, g	808^{d}	1,690^{ab}	1,821^{a}	1,572^{b}	1,851^{a}	1,154^{c}	1,442^{b}	1,534^{a}	< 2.2 e $^{-16}$
Dressing percentage, %	60.9^{c}	65.8^{ab}	63.2^{bc}	69.3^{a}	64.0^{bc}	61.6^{bc}	64.6^{a}	63.7^{a}	0.0002
Heart weight, % of LW	0.7^{a}	0.6^{ab}	0.4^{d}	0.5^{cd}	0.4^{d}	0.6^{bc}	0.5^{a}	0.5^{a}	1.073 e $^{-8}$
Liver weight, % of LW	1.9^{a}	1.5^{b}	1.6^{b}	1.9^{a}	1.7^{ab}	1.6^{ab}	1.7^{a}	1.7^{a}	0.029
Lung weight, % of LW	0.9^{a}	0.7^{b}	0.7^{b}	0.8^{b}	0.7^{b}	0.7^{b}	0.7^{a}	0.7^{a}	0.013
Total bone weight, g	253^{e}	464^{b}	542^{a}	422^{c}	523^{a}	345^{d}	421^{a}	431^{a}	< 2.2 e $^{-16}$
Total muscle weight, g	455^{d}	1,024^{b}	1,375^{a}	1,108^{b}	1,475^{a}	655^{c}	979^{b}	1,061^{a}	< 2.2 e $^{-16}$
Total skin weight, g	9.7^{c}	202.7^{a}	213.3^{a}	197.8^{a}	206.7^{a}	153.4^{b}	174.9^{b}	184.2^{a}	< 2.2 e $^{-16}$
Abdominal fat, g	9.4^{ab}	14.5^{a}	10.9^{ab}	1.3^{c}	8.5^{ab}	7.3^{bc}	10.08^{a}	7.20^{a}	0.0003

$^{a-e}$Means with different superscripts on the same row were significantly different at $P \leq 0.05$

Noiler muscle had the lowest CP.Sassomuscle had the highest fat content which was not significantly different from the fat contents of Fulani, FUNAAB Alpha and Kuroiler. The fat content of ShikaBrown muscle was significantly lower than that of Sasso but not significantly different from those of Fulani, FUNAAB Alpha and Kuroiler ($p< 0.01$).Noiler muscle had the lowest fat content (1.5%). The carcass of FUNAAB Alpha had the highest energy level which was significantly different from those of the other breeds except Sasso.

Discussion

The high mortality observed for Kuroiler in this study agrees with the reports of Sharma *et al.* (2015), and Galukande et al. (2016), which showed mortality rates of 15 and 16%, respectively. The lower temperature and lower THI of the Fol-Hope station could be responsible for the lowerperformance of birds from the station. These observations agree with the report of Sonaiya *et al.*(1989) that higher ambient temperature promotes feed efficiency and live performance in birds raised under cycling high temperature (21-32^{0}C).The PCV, RBCandHbfall within the normal range for chickens (Ladokun *et al.,* 2008; CCAC, 2017). Three of the local breeds (Fulani, FUNAAB Alpha and ShikaBrown) had lower RT but one local breed (Noiler) and the two imported breeds (Kuroiler and Sasso) had higher RT (CCAC, 2017). Except for Kuroiler and Sasso, the DP of the breeds were similar to those reported by Ndzi *et al.* (2016). The proportion of muscle observed in this study (56.3 to 79.7%) is higher than the 51% calculated from the data of Hui *et al.* (2001). The muscle to bone ratio is lower than the value of 3.6 reported by Shahin and Elazeem (2005) for broiler chickens.

Conclusion and Recommendation

It can be concluded that the 6 breeds are adapted to the hot humid environment in which they were raised. The hierarchyin physiological characteristics, growth performance and carcass characteristics is as follows: Kuroiler, FUNAAB Alpha, Noiler, Sasso, ShikaBrown and Fulani. There is need for careful attention to Kuroiler, especially during the brooding phase.

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