

Comparative evaluation of carcass composition of FUNAAB Alpha broiler with two exotic broiler breeds

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Target Audience: Poultry breeders and Farmers

Abstract

The contribution of local chickens to meat supply in Nigeria is considered appreciable even though they have been poorly exploited. Thus, this study was conducted to compare the carcass performance of FUNAAB Alpha broilers to Arbor Acre and Cobb 500 breeds. A total of 50 FUNAAB Alpha, 50 Arbor Acre and 50 Cobb broilers were reared for a period of 8 weeks. Data collected were in percentage to the total dressed weight and Arcsine transformed to be used as absolute data Analysis of variance (ANOVA). The Cobb 500 breed had the highest value for bled, de-feathered and eviscerated weight (1621.64 ± 93.14 g, 1533.14 ± 93.37 g and 1254.71 ± 80.19 g respectively) followed by the Arbor Acre and FUNAAB Alpha breed. However, the FUNAAB Alpha broiler strain had the highest percentage of heart weight (3.12 ± 0.30), empty gizzard weight (2.34 ± 0.10), liver weight (2.45 ± 0.10), thigh weight (11.21 ± 0.21) and the neck weight (5.45 ± 0.09) while Cobb 500 and Arbor Acre broilers showed higher percentage for wing weight (9.73 ± 0.12), leg weight (4.64 ± 0.12) and drum stick weight (10.78 ± 0.13). The study concludes that the FUNAAB Alpha broilers have good potentials for meat production and could serve as an additional source of animal protein for the rural poor in Nigeria.

Keywords: FUNAAB Alpha; Arbor Acre; Cobb 500; Broiler; Carcass composition

Description of problem

Poultry breeding is one of the strategies adopted to increase animal protein production in the developing countries. Report such as (1) indicated that food security is one of the major challenges of Food and Agricultural Organisation, with respect to satisfying the demand of growing world population. However, the demand for chicken meat in both foreign and domestic markets has risen due to the accelerated increase in global population and improved consumer perception in terms of health benefits that associate with chicken meat (2).

Despite the numerical increase in

chicken production, poultry meat still remain below the needs expressed by consumers and this gap is being filled through the importation of exotic chickens which has been on the increase from year to year (3). About 10 years ago, reports of (4) showed that rate of importation of poultry meat increased from 19,361 metric tons in 2000 to about 49,634 metric tons in 2010 and it was recorded that only a few fast-growing broiler strains produced by commercial breeding companies are used to produce this quantity of meat (5) thereby providing an avenue for an improved economic benefit to both commercial and rural poultry farmers. In

some parts of the world, the indigenous chicken meat is preferred by consumers in comparison with the imported frozen and exotic chicken meat (1). Similarly, the indigenous chicken is typically appreciated for its high adaptive characteristic (6), taste and flavor in product and more acceptable to farmers (7 and 5) compare to their exotic counterpart.

In order to bridge the gap, an improved indigenous breed called the FUNAAB Alpha breed was registered in 2018. The breed was developed using the improved chicken genotypes; that is, Naked neck and Frizzled feather chickens developed at the Federal University of Agriculture, Abeokuta, Nigeria with over 6 generations of selection and inbreeding followed by 4 generations of crossbreeding with some exotic lines to improve its growth rate and carcass quality (8). The use of selection and cross breeding offered a means through which this genetic improvement in Nigeria indigenous chicken has been systematically leveraged and sustained for improved productivity. The intensification on breeding and genomic improvement has improved the growth performance of the improved indigenous breed and this has made it highly competitive with its exotic counterparts, with guaranteed reduction in production costs (9) more so that poultry business is one of the most famous enterprise adopted in all the rural and urban setting of Nigeria (10) and this has led to the improvement programs in traits of both broiler and local chickens in order to provide high quality meat at lower cost (11). In summary, FUNAAB Alpha has demonstrated the potential to grow fast with respect to age at slaughter and high adaptive ability. The goal of the study is to evaluate and compare the carcass characteristics of the FUNAAB Alpha with Cobb 500 and Arbor Acre broiler breeds.

Materials and Methods

Study location

The experiment was carried out at the Programme for Emerging and Agricultural Research Leaders-Federal University of Agriculture Abeokuta, Nigeria (PEARL-FUNAAB). The University is located within latitude 7° 10'N and longitude 3° 2'E and lies in the South Western part of Nigeria. It has an average temperature of 26 to 33.7°C and relative humidity of 80% with rainfall of about 1037mm. the vegetation in the University represents an interphase between the tropical rainforest and the derived savannah (12).

Experimental birds and management

A total of 150 birds were used for the study, which comprises 50 each of the FUNAAB Alpha broiler, Arbor Acre and Cobb 500. Arbor Acre and Cobb 500 broiler breeds were sourced from a commercial hatchery while the FUNAAB Alpha broiler chicks were purchased from the PEARL Unit. The birds were raised on a deep litter system and fed at *ad-libitum* using a commercial feed (Top feed from Premier Feed Manufacturing Industry Limited) for a period of 8 weeks at different phase of growth; starter phase (0-4 weeks) and finisher phase (5-8 weeks). The birds were also allowed free access to fresh and clean water throughout the period of experiment.

Carcass composition

A total of 20 birds were randomly selected for each breed of chicken at 8 weeks of age. This resulted into a total of sixty (60) birds, taking into consideration the sexes (Males and Females). Feed was withdrawn for 12hr before each randomly selected bird was euthanized. After bleeding, the birds were scalded in boiling water (60°C for 45sec.) before de-feathering and eviscerating. The carcass and giblets (head,

neck, legs, liver, heart and gizzard) weights were determined. The various cuts taken were the following: the breast, back, thigh, drumstick, wings and the carcass yield was measured using a sensitive scale (0.01g) and then expressed in percentage of live weight.

Statistical analysis

All percentages were arcsine transformed to use as absolute values using the formula;

$$\text{Absolute} = \sin^{-1} \sqrt{\%}$$

Analysis of carcass data was done using the General Linear Model (G.L.M) (13).

$$Y_{ijk} = \mu + G_i + S_j + (GS)_{ij} + \epsilon_{ijk}$$

Where:

Y_{ijk} = Observation of the k^{th} bird of the i^{th} Breed and j^{th} Sex

μ = Overall mean

G_i = Fixed effect of the i^{th} Breed (1, 2 and 3)

S_k = Fixed effect of the j^{th} Sex. (1 and 2)

GS_{jk} = Fixed effect of the interaction of the Breed and Sex

ϵ_{ijk} = Residual error.

Results

Effect of chicken breed on carcass traits

There were significant ($p < 0.05$) differences in the evaluated carcass characteristics as affected by chicken breed, except for the percent whole gizzard weight, leg weight, drumstick weight, neck weight, breast weight, head weight and de-feathered weight (Table 1). Cobb broilers had significantly ($p < 0.05$) higher body weight, than the Arbor Acre birds, but did not differ significantly ($p > 0.05$) from the FUNAAB Alpha chickens. Eviscerated weight, recorded for the Arbor Acre and Cobb birds were statistically similar ($p > 0.05$), but higher than values recorded for the FUNAAB Alpha breed. The percentage of empty gizzard weight values recorded for the FUNAAB Alpha birds was significantly

($p < 0.05$) higher than values recorded for the Arbor Acre birds but did not differ significantly ($p > 0.05$) from values shown by the Cobb 500 birds. The FUNAAB Alpha birds had the highest percent ($p < 0.05$) for the liver weight, while wing weight values recorded for the Arbor Acre breed was significantly ($p < 0.05$) higher than values of the Cobb broilers, but did not differ significantly ($p > 0.05$) from values recorded for the Arbor Acre birds. The percentage of the thigh weight displayed by the FUNAAB Alpha birds was significantly ($p < 0.05$) higher than values of the Arbor Acre chickens, but did not differ significantly ($p < 0.05$) from the values observed in the Cobb 500 breed. For the back weight, 12.03% was recorded for the Arbor Acre birds while 14.04 % was observed for the Cobb breed.

Effect of chicken sex on carcass traits

There was significant difference in the evaluated carcass characteristics as affected by sex (Table 2). The male chicken consistently had a significantly higher ($p < 0.05$) value and percent carcass value than the female, except for the whole gizzard weight; the female had a significantly higher percent carcass value ($3.49 \pm 0.12\%$) than the male ($3.10 \pm 0.16\%$). However, the male chicken had a higher percentage of carcass values for liver weight, wing weight, thigh weight, drumstick weight, neck weight, back weight and head weight but not significantly different ($p < 0.05$) from the values observed in the female chickens. However, it was noted that sexual dimorphism has significant effect on the different carcass traits of broiler chickens that were evaluated.

Table 1: Effect of genotype on the carcass characteristics of broiler birds (S.E.M)

Carcass Characteristics	Breed		
	Arbor Acre	Cobb 500	FUNAAB Alpha
Bled weight (g)	1438.50 ± 45.01 ^b	1621.64 ± 93.14 ^a	1468.00 ± 51.86 ^{ab}
De-feathered weight (g)	1346.07 ± 45.46 ^b	1533.14 ± 93.37 ^a	1388.40 ± 51.85 ^b
Eviscerated weight (g)	1089.37 ± 35.78 ^a	1254.71 ± 80.19 ^a	1018.29 ± 43.55 ^b
Cut out Parts*			
Wing weight (%)	9.73 ± 0.12 ^a	9.10 ± 0.13 ^b	9.36 ± 0.16 ^{ab}
Leg weight (%)	4.64 ± 0.12	4.33 ± 0.12	4.49 ± 0.22
Thigh weight (%)	10.44 ± 0.14 ^b	10.74 ± 0.22 ^{ab}	11.21 ± 0.21 ^a
Drumstick weight (%)	10.78 ± 0.13	10.00 ± 0.43	10.34 ± 0.18
Neck (%)	5.09 ± 0.61	4.77 ± 0.42	5.45 ± 0.09
Breast (%)	20.56 ± 0.32	20.95 ± 0.96	18.86 ± 0.58
Back (%)	12.03 ± 0.24 ^b	14.04 ± 0.65 ^a	13.53 ± 0.36 ^a
Head (%)	2.98 ± 0.08	2.78 ± 0.09	2.80 ± 0.10
Organs*			
Heart weight (%)	0.40 ± 0.03 ^b	0.40 ± 0.02 ^b	3.12 ± 0.30 ^a
Whole gizzard weight (%)	3.03 ± 0.19	3.45 ± 0.13	3.47 ± 0.20
Empty gizzard weight (%)	2.01 ± 0.08 ^b	2.26 ± 0.10 ^{ab}	2.34 ± 0.10 ^a
Liver weight (%)	2.11 ± 0.10 ^b	1.93 ± 0.09 ^b	2.45 ± 0.10 ^a

^{ab}: means on the same row with different superscript differ significantly (p<0.05).

SEM: Standard error of mean

Table 2: Effect of sex on the carcass characteristics of broiler chickens (S.E.M)

Carcass characteristics	Sex	
	Female	Male
Bled weight (g)	1397.48 ± 45.86 ^b	1637.42 ± 57.02 ^a
De-feathered weight (g)	1310.51 ± 45.20 ^b	1564.68 ± 57.88 ^a
Eviscerated weight (g)	1036.16 ± 39.48 ^b	1225.13 ± 54.95 ^a
Cut out Parts*		
Wing weight (%)	9.24 ± 0.12	9.54 ± 0.12
Leg weight (%)	4.28 ± 0.12 ^b	4.71 ± 0.11 ^a
Thigh weight (%)	10.77 ± 0.19	10.78 ± 0.14
Drumstick weight (%)	10.25 ± 0.12	10.51 ± 0.33
Neck (%)	4.90 ± 0.17	5.25 ± 0.47
Breast (%)	19.74 ± 0.60 ^b	20.59 ± 0.56 ^a
Back (%)	13.09 ± 0.28	13.27 ± 0.50
Head (%)	2.78 ± 0.06	2.93 ± 0.08
Organs*		
Heart weight (%)	1.25 ± 0.30	1.18 ± 0.33
Whole gizzard weight (%)	3.49 ± 0.12 ^a	3.10 ± 0.16 ^b
Empty gizzard weight (%)	2.29 ± 0.08	2.10 ± 0.08
Liver weight (%)	2.08 ± 0.08	2.23 ± 0.10

^{ab}: means on the same row with different superscript differ significantly (p<0.05).

SEM: Standard error of mean

Effect of chicken breed by sex interaction on carcass traits

The observed interaction between breed and sex had a significant ($p < 0.05$) effect on the carcass traits (Table 3). The male Cobb broilers had the highest bled weight (1813.00 ± 108.13 g) de-feathered weight (1746.71 ± 109.71 g), and eviscerated weight (1414.29 ± 95.44 g) while for the cut parts, FUNAAB Alpha birds had significantly higher heart weight (3.38 ± 0.43 %) than the other exotic breeds. Without considering the sexual dimorphism in chicken, the percentage of the whole gizzard weight ranged from (2.71 ± 0.22 %) recorded for the male Arbor Acre birds, to (3.53 ± 0.21 %) observed in their female counterpart. However, the empty gizzard weight was lower in the male Arbor Acre birds (1.87 ± 0.05 %), than the other sex and breed groups. The male Arbor Acre birds, had significantly (2.71 ± 0.10 %) higher liver weight, than the female counterpart (2.25 ± 0.11 %), though differences between

the male and female birds of the other breeds were not significantly different ($p < 0.05$). There were no significant differences in the wing weight of the male and female birds of the three chicken breeds. The males of the FUNAAB Alpha breed had a significantly ($p < 0.05$) higher leg weight (4.90 ± 0.32 %) than the female birds (4.019 ± 0.25). While the percentage of thigh weight ranged from 10.37 ± 0.20 % recorded for male Arbor Acre birds, to 11.37 ± 0.32 % recorded of the male FUNAAB Alpha birds. The percent carcass values for drumstick and neck weight was not significantly different for the three chicken breed and sex. However, FUNAAB Alpha female birds had the least breast weight, (17.82 ± 0.76 %), while the male and female Arbor Acre birds had significantly lower back weight (12.32 ± 0.43 % and 11.75 ± 0.19 %). The percentage of head weight ranged from 2.62 ± 0.03 % recorded for female FUNAAB Alpha birds, to 3.10 ± 0.13 % observed for male Arbor Acre birds.

Table 3: Effect of breed by sex interaction on broiler chickens (S.E.M)

Carcass Characteristics	Breed by Sex					
	Arbor Acre		Cobb 500		FUNAAB Alpha	
	Male	Female	Male	Female	Male	Female
Bled weight (g)	1549.86 ±	1327.14 ±	1813.00 ±	1430.29 ±	1514.20 ±	1435.00 ±
De-feathered weight (g)	55.90 ^b	38.97 ^b	108.13 ^a	117.01 ^b	84.93 ^b	67.68 ^b
Eviscerated weight (g)	1471.57 ±	1220.57 ±	1746.71 ±	1359.57 ±	1440.20 ±	1351.40 ±
	52.02 ^b	31.57 ^b	109.71 ^a	115.00 ^b	88.42 ^b	64.65 ^b
	1168.51 ±	1010.23 ±	1414.29 ±	1095.14 ±	1039.56 ±	1003.10 ±
	47.73 ^b	34.38 ^b	95.44 ^a	101.33 ^b	73.97 ^b	57.11 ^b
Cut out Parts *						
Wing weight (%)	9.88 ± 0.17 ^{ab}	9.58 ± 0.16 ^a	9.23 ± 0.13 ^{bc}	8.96 ± 0.23 ^c	9.51 ± 0.10 ^{bc}	9.15 ± 0.26 ^{abc}
Leg weight (%)	4.79 ± 0.14 ^{ab}	4.49 ± 0.18 ^{ab}	4.50 ± 0.11 ^{ab}	4.16 ± 0.21 ^b	4.90 ± 0.32 ^a	4.19 ± 0.25 ^b
Thigh weight (%)	10.50 ± 0.20 ^b	10.37 ± 0.19 ^b	11.04 ± 0.23 ^{ab}	10.44 ± 0.36 ^b	11.37 ± 0.32 ^a	10.99 ± 0.21 ^{ab}
Drumstick (%)	10.92 ± 0.20	10.64 ± 0.15	10.03 ± 0.14	9.98 ± 0.88	10.69 ± 0.12	10.09 ± 0.26
Neck (%)	5.83 ± 0.16	4.34 ± 1.18	5.06 ± 0.30	4.49 ± 0.80	5.47 ± 0.18	5.45 ± 0.11
Breast (%)	21.22 ± 0.28 ^a	19.89 ± 0.47 ^{ab}	20.95 ± 1.32 ^a	20.94 ± 1.49 ^a	19.60 ± 0.75 ^{ab}	17.82 ± 0.76 ^b
Back (%)	12.32 ± 0.43 ^b	11.75 ± 0.19 ^b	14.66 ± 1.24 ^a	13.43 ± 0.36 ^{ab}	13.70 ± 0.62 ^{ab}	13.40 ± 0.48 ^{ab}
Head (%)	3.10 ± 0.13 ^a	2.86 ± 0.08 ^{abc}	2.87 ± 0.16 ^{abc}	2.69 ± 0.10 ^{bc}	3.05 ± 0.19 ^{ab}	2.62 ± 0.03 ^c
Organs*						
Heart weight (%)	0.36 ± 0.03 ^b	0.44 ± 0.04 ^b	0.42 ± 0.04 ^b	0.38 ± 0.01 ^b	0.34 ± 0.23 ^a	0.39 ± 0.32 ^a
Whole gizzard (%)	2.71 ± 0.22 ^b	3.36 ± 0.28 ^{ab}	3.30 ± 0.19 ^{ab}	3.60 ± 0.17 ^a	3.38 ± 0.43 ^{ab}	3.53 ± 0.21 ^a
Empty gizzard (%)	1.87 ± 0.05 ^b	2.16 ± 0.14 ^{ab}	2.20 ± 0.12 ^{ab}	2.32 ± 0.17 ^a	2.27 ± 0.20 ^{ab}	2.39 ± 0.09 ^{ab}
Liver weight (%)	2.26 ± 0.13 ^b	1.97 ± 0.13 ^{bc}	2.02 ± 0.15 ^{bc}	1.85 ± 0.09 ^c	2.71 ± 0.10 ^a	2.25 ± 0.11 ^b

^{a, b, c}: means on the same row with different superscript differ significantly ($p < 0.05$).

SEM: Standard error of mean

Discussion

The carcass evaluation of the three different breed shows that the FUNAAB Alpha broiler is highly comparable to its exotic counterparts in absolute values for most carcass traits. This suggests that the FUNAAB Alpha breed can be improved out rightly for meat production. Using the percentages, the FUNAAB Alpha had the highest total percent of heart weight, empty gizzard weight, liver and the thigh weight, while the Cobb had the highest percentage in relation to the bled weight and this agrees with the findings of (14) and (15) who reported significant differences in body weight of broiler breeds. However, the results obtained on carcass weight, and breast muscle weight contradicts the findings of (14) who reported significant effect of sex on these traits.

In the same view, FUNAAB Alpha broilers yielded reasonable quantity of meat which is in association with good back length, vigour, femur conformity and long keel length. (16) and (17) stated that the body of the improved local chicken is compact with straight and broad back being broad towards the neck/shoulder region. However, the Cobb broiler chicken had the highest bled weight, eviscerated weight and breast weight followed by the Arbor acre breed. This marked superiority can be attributed to the long years of selection of the breeds for meat production.

The higher mean values obtained for males in de-feathered weight, and leg weight corroborates the findings of (18) who reported that the males consistently had the better grades than the females. Moreover, the differences in values of carcass traits to the outcome of this study maybe due to the differences in genetic make-up of the birds, production environment, management and health status. The males' superiority in carcass traits was probably due to the

presence of testosterone in males which makes them more aggressive when being fed in the same pen with females. According to (14), growth and carcass differences between males and females were due to differences in feed metabolism and in the onset of fattening. Therefore, the results of this study contradicts the reports of (19), (20) and (17) who reported lower values for the carcass traits in Nigerian local chickens at different ages ranging from 10 and 12 weeks. However, difference in the results can be attributed to the increase in selection and breed intensity of the FUNAAB Alpha breed.

Conclusion and Application

This study revealed that

1. The of carcass composition of the FUNAAB Alpha broiler breed (Nigerian indigenous broiler breed) is highly comparable to both the Arbor acre and Cobb 500 breed of chickens, which were the exotic broiler breed.
2. The FUNAAB Alpha breed has the ability to survive in the tropical region, as survival and adaptation is vital to production, reproduction and genetic improvement of any breed.
3. An improved performance in the carcass characteristics of the FUNAAB Alpha broiler breed over its indigenous progenitors has made it easier to be fully adopted by the rural poultry farmers. Moreover, Standard husbandry and management system, feeding and processing requirement are keys to achieving a desirable result at the end of a production season.

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In Loving Memory of **SHONOLA, Iyabode Misturat** who passed onto Glory on the 14th December, 2020

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