Meat yield and sensory evaluation of two commercial hybrid strains of broiler chicken reared in Abaliki, Ebonyi State, Nigeria

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Abstract

Sex, strain and the interaction of sex and strain have been found out by different researchers to significantly affect the growth and carcass analysis of broiler chickens in Nigeria. The Funaab Alpha has not been tested in the study area. The aim of this research was to determine the effect of sex and strain on the meat yield of this strain and how comparable to a popular exotic strain in the area. The research was conducted at the poultry unit of the teaching and research farm of Ebonyi State University. One hundred and ninety-two (192) sexed broiler chickens comprising of 96 each of Ross 308 and Funaab Alpha strains of broiler chickens were randomly allotted to four treatment groups in a 2 x 2 factorial arrangement. Each treatment was replicated 3 times with 16 birds per replicate. The birds were reared for 56 days. At the end of the rearing period, 12 birds (one per replicate) of average body weight per replicate were selected and slaughtered. Different meat yield parameters were recorded and sensory analysis carried out. Data collected were analyzed using the general linear model of Minitab 18 software. There were no significant differences in the effect of sex on the meat yield while there were significant differences in the effects of strain on the defeathered weight (1958g, 1576.67g), Breast meat % (28.22, 9.44), Thigh meat % (10.39, 5.90), Drumstick meat % (9.17, 5.18), Breast bone % (4.4, 2.88), Thigh bone % (2.59, 1.75) with the Ross 308 having the higher values. In the interaction effect of sex and strain on the meat yield, there were significant differences in the live weight (2400g, 1866.67g), defeathered weight (2166.67g, 1533g), Breast meat % (26.15, 8.38), Thigh meat % (10.87, 5.31), Drumstick meat % (9.35, 5.15), Breast meat to bone ratio (6.39, 2.86) with the Ross 308 male recording the highest values while the Funaab Alpha male recorded the lowest values. In the sensory evaluation, the Funaab Alpha had the better acceptability (7.83, 5.1) compared to Ross 308. Funaab Alpha was observed to have a higher coefficient of variation in most of the parameters measured. Ross 308 had a higher meat yield while the Funaab Alpha was more acceptable and a higher variability in meat yield which suggests the need for more selection for meat yield in the Funaab Alpha.

Keywords: Meat yield, Funaab Alpha, Ross 308, Hybrid strain, Selection

Rendement en viande et évaluation sensorielle de deux souches hybrides commerciales de poulet à griller élevées à Abaliki, État d'Ebonyi, Nigéria

Résumé

Le sexe, la souche et l'interaction du sexe et de la souche ont été découverts par différents chercheurs comme affectant de manière significative la croissance et l'analyse de la carcasse des poulets à griller au Nigeria. Le Funaab Alpha n'a pas été testé dans la zone d'étude. Le but de cette recherche était de déterminer l'effet du sexe et de la souche sur le rendement en viande de

cette souche et dans quelle mesure elle est comparable à une souche exotique populaire dans la région. La recherche a été menée dans l'unité avicole de la ferme d'enseignement et de recherche de l'Université d'État d'Ebonyi. Cent quatre-vingt-douze (192) poulets à griller sexués comprenant 96 chacune des souches Ross 308 et Funaab Alpha de poulets à griller ont été répartis au hasard en quatre groupes de traitement selon un arrangement factoriel 2 x 2. Chaque traitement a été répété 3 fois avec 16 oiseaux par répétition. Les oiseaux ont été élevés pendant 56 jours. A la fin de la période d'élevage, 12 oiseaux (un par répétition) de poids corporel moyen par répétition ont été sélectionnés et abattus. Différents paramètres de rendement en viande ont été enregistrés et des analyses sensorielles effectuées. Les données recueillies ont été analysées à l'aide du modèle linéaire général du logiciel Minitab 18. Il n'y avait pas de différences significatives dans l'effet du sexe sur le rendement en viande alors qu'il y avait des différences significatives dans les effets de la souche sur le poids plumé (1958 g, 1576,67 g), % de viande de poitrine (28,22, 9,44), % de viande de cuisse (10,39, 5,90), % de viande de pilon (9,17, 5,18), % d'os de poitrine (4,4, 2,88), % d'os de cuisse (2,59, 1,75), le Ross 308 ayant les valeurs les plus élevées. Dans l'effet d'interaction du sexe et de la souche sur le rendement en viande, il y avait des différences significatives dans le poids vif (2400 g, 1866,67 g), le poids plumé (2166,67 g, 1533 g), le % de viande de poitrine (26,15, 8,38), le % de viande de cuisse (10,87, 5,31), Viande de pilon % (9,35, 5,15), Rapport viande de poitrine sur os (6,39, 2,86) avec le mâle Ross 308 enregistrant les valeurs les plus élevées tandis que le mâle Funaab Alpha a enregistré les valeurs les plus faibles. Dans l'évaluation sensorielle, le Funaab Alpha avait la meilleure acceptabilité (7,83, 5,1) par rapport au Ross 308. Il a été observé que le Funaab Alpha avait un coefficient de variation plus élevé dans la plupart des paramètres mesurés. Ross 308 avait un rendement en viande plus élevé tandis que le Funaab Alpha était plus acceptable et une plus grande variabilité du rendement en viande, ce qui suggère la nécessité d'une plus grande sélection pour le rendement en viande dans le Funaab Alpha.

Mots-clés : Rendement en viande, Funaab Alpha, Ross 308, Souche hybride, Sélection

Introduction

The poultry subsector is the most commercialized of all the subsectors of Nigeria's agricultural sector (Adene and Oguntade, 2006). It has generated employment for millions of Nigerians (Aranmolaran *et al.,* 2013). This is due to its short gestation and generation interval, prolificacy and lack of taboos to its production coupled with an increasing demand for its product by a large segment of the populace especially during religious, local and national festivals (Olawunmi, *et al.*, 2012). The development of the poultry industry has been described as the fastest means of bridging the protein deficiency gap prevailing in most developing countries (Aranmolaran *et al*., 2013). Broiler production is the quickest way to increase the availability of high quality protein for human consumption because of its fast growth rate (Amao *et al*., 2015). The broiler industry is mostly dominated by different exotic broiler strains imported into Nigeria (Udeh *et al*., 2015). Currently, broiler production in the tropics is plagued with different challenges to farmers which include a very high cost of feeding, high mortality as a result of diseases and a reduced performance as compared to their performance in the temperate region (Adebambo, 2015) which ultimately reduced profit for farmers. This demonstrates the effect of tropical environment on exotic broiler strains and has led to the call for

the development of local strains of broilers using local genes in order to combat the effect of adaptability of broiler strains to local environment (Adebambo, 2015).

The Funaab Alpha broiler strain is an improved indigenous broiler strain developed from the Federal University of Agriculture Abeokuta. It was developed from crossing local genes from local breeds of chicken in Nigeria with exotic broiler breeds of chicken. The broiler strain has been tested by local farmers and has been found to be comparable with some exotic strains of broiler (Adebambo *et al*., 2018).

Different researches have been carried out on the Ross 308 strain (Amao *et al*., 2011, Udeh *et al*.,2011; Ogunnupebi *et al*., 2018) and have been found to be a favourite of most farmers in the study area because of its good body structure and larger size compared with the other strain in the study area (Ogunnupebi *et al.,* 2018). Genotype by environment interaction causes loss of fitness traits for those breeds of animals not suited to a particular environment. Therefore, broiler farmers should choose for rearing those strains that are best suited in a particular environment (Udeh*, et al.,* 2015)

Sex, strain and the interaction of sex and strain have been found out by different researchers to significantly affect the growth and carcass analysis of broiler strains in Nigeria (Ojedapo *et al*., 2008; Ajayi and Ejiofor, 2009; Amao *et al*., 2011; Udeh *et al*., 2011; Udeh *et al*., 2015). The Funaab Alpha has not been tested in the study area. The aim of this research was to determine the effect of sex and strain on the meat yield of this strain and how comparable to a popular exotic strain in the area.

Materials and Methods

The experiment was carried out at the Poultry Unit of the Teaching and Research Farms of the Department of Animal science, Faculty of Agricultural and Natural Resource Management, Ebonyi State University, Abakaliki, located within latitude 6º4'N, and longitude 8º6'E. It has a mean elevation of 400m above sea level. The annual rainfall of 1500mm to 1650mm and a temperature range of 16ºC (60ºF) to 38ºC (100ºF) (Aghamelu *et al.*, 2013)

A total of one hundred and ninety-two (192) broiler chicks comprising 96 each of Ross 308 and Funaab Alpha strains were used for this experiment. The Ross 308 and Funaab Alpha strains were purchased from Agrited Ltd hatchery in Ibadan, Oyo State and Federal University of Agriculture, Abeokuta, Ogun State, respectively. The birds were reared on deep liter, fed with commercial feed and served water ad libitum. The birds were sexed after one week of brooding using the feather sexing method by a trained veterinarian.

The birds were completely randomized into four treatment groups in a 2 by 2 factorial arrangement having Ross male (T1), Ross Female (T2), Funaab Alpha male (T3), Funaab Alpha female (T4). Each treatment had 48 birds with 3 replications and 16 birds per replicate. The experiment lasted for 56 days (8 weeks).

Carcass Analysis

At the end of the experiment (56th day), 12 birds (one per replicate) of average weight per replicate were selected for carcass evaluation. The birds were weighed, slaughtered and dressed. Cleaned carcass weight and the meatiest parts; breast, thigh, drumstick were purposely removed and deboned, the weights of the meat and bone were recorded. The weights of the cut-up parts were expressed as a percentage of the carcass weight. The meat to bone ratio of the breast, thigh and drumstick were also calculated.

$$\text{Dressing percentage} = \frac{\text{Carcass weight}}{\text{Live weight}} \times 100$$

$$\text{Percentage weights of cut-up parts} = \frac{\text{Weight of cut-up parts}}{\text{Carcass weight}} \times 100$$

Meat to bone ratio = Weight of meat / Weight of bone

Sensory Evaluation

After the carcass analysis, breast (deboned) meat from the Funaab Alpha, the Ross 308 strains and a commercial layer chicken (used as a control because of the preference for layer meat in the study area) were cooked at 100°C for 45 minutes, cooled and served to a group of trained panelist. The panel consists of six males and six females (made up of both staff and students between the ages 30 and 55 years). The panelists evaluated the appearance, colour, texture, juiciness, tenderness, taste, flavour and acceptance on a nine-point hedonic scale.

Experimental Design and Statistical Analysis

Data collected were analyzed using Minitab 18 software. Data collected for meat yield was analyzed using the general linear model of the Minitab 18 software to analyze. Significant means were separated using Duncan's Multiple Range Test (Obi, 2001)

A linear addition model for the design is as follows;

$$X_{ijk} = \mu + S_i + St_j + SSt_{ij} + e_{ijk}$$

Where; X_{ijk} is individual observation, μ is the population mean, S_i is the sex effect, St_j is the Strain effect, SSt_i is the interactive effect of Sex and Strain and e_{ijk} = experimental error of residual. The coefficient of variation of parameters between strains were computed using the formula

$$CV = \frac{\delta}{\mu} x100$$

Where δ is the standard deviation of the parameter while μ is the mean of the parameter

Data collected for sensory evaluation was subjected to one-way analysis of variance. The difference between the treatments means was separated using Duncan's New Multiple Range Test (Obi, 2001).

A linear addition model is as follows;

$$X_{ij} = \mu + t_i + e_{ij}$$

Where; X_{ij} is the Individual observation, μ is Population or overall mean, t_i is Treatment effect and e_{ij} is the Experimental error of residual.

Results

The main effect of sex on the meat yield of the two broiler strains is shown in Table 1. There were no significant differences ($P<0.05$) between the two sexes in all the parameters evaluated. Table 2 shows the effect of strain on the meat yield of the two broiler strains. There were significant differences ($P<0.05$) in the defeathered weight, breast meat, thigh meat, drumstick meat, breast bone, thigh bone, and meat to bone ratio of breast. Live weight, carcass weight, the dressing percentage, drumstick bone, meat to bone ratios of thigh and drumstick were not significantly affected ($P > 0.05$).

Table 1. Effect of sex on meat yield of the two commercial hybrid strains of broiler chicken.

Parameters	Male	Female	SEM
Live weight (g)	2080	1908	101.30
Defeathered weight (g)	1850	1685	96.05
Cleaned carcass weight (g)	1583.33	1500	86.57
Dressing percentage (%)	75.76	78.46	1.22
Breast meat %	17.27	17.40	2.48
Thigh meat %	8.08	8.20	0.85
Drumstick %	7.25	7.10	0.77
Breast bone %	3.52	3.77	0.35
Thigh bone %	2.05	2.28	0.20
Drumstick bone %	2.89	2.8	0.21
Meat to bone ratio (Breast)	4.63	4.66	0.49
Meat to bone ratio (Thigh)	3.86	3.71	0.24
Meat to bone ratio (Drumstick)	2.47	2.54	0.18

Table 2: **Effect of strain on meat yield of the two commercial hybrid strains of broiler chicken.**

Parameters	Ross 308	Funaab Alpha	SEM
Live weight (g)	2175	1813	115.68
Defeathered weight (g)	1958[a]	1576.67[b]	102.95
Cleaned carcass weight (g)	1700[a]	1383.33[b]	108.65
Dressing percentage (%)	78.16	76.30	1.82
Breast meat %	25.22[a]	9.44[b]	1.05
Thigh meat %	10.39[a]	5.90[b]	0.81
Drumstick %	9.17[a]	5.18[b]	0.78
Breast bone %	4.40[a]	2.88[b]	0.42
Thigh bone %	2.59[a]	1.75[b]	0.26
Drumstick bone %	3.26	2.43	0.28
Meat to bone ratio (Breast)	5.94[a]	3.34[b]	0.44
Meat to bone ratio (Thigh)	4.08	3.48	0.28
Meat to bone ratio (Drumstick)	2.84	2.17	0.24

[ab]Means with different superscripts on the same row are significantly different (P<0.05)

The effects of the interaction of sex and strain is shown in Table 3. There were significant (P<0.05) differences in all parameters except dressing percentage, breast bone, thigh bone, drumstick bone and drumstick meat to bone ratio. Ross 308 male had the highest values followed by Ross 308 female while Funaab Alpha male had the least values in all the parameters evaluated.

Table 4 shows the mean, standard deviation and the coefficient of variation of the meat yield parameters in the two strains. Ross 308 had the higher mean value than that of Funaab Alpha in most of the parameters evaluated. The Funaab Alpha had the higher standard deviation in the live weight, defeathered weight, carcass weight and the breast meat, but the Ross 308 had the higher values in the remaining parameters. The Funaab Alpha had the higher coefficient of variation in all parameters except the dressing percentage and the breast bone.

Table 3: Effect of sex and strain interaction on meat yield of two commercial hybrid strains of broiler chicken.

Parameters	Ross		Funaab Alpha		SEM
	Male	Female	Male	Female	
Live weight (g)	2400[a]	1950[ab]	1760[ab]	1866.67[ab]	163.59
Defeathered weight (g)	2166.67[a]	1750[ab]	1533[b]	1620	145.59
Cleaned carcass weight (g)	1833.33[a]	1566.67[ab]	1433.33[b]	1333.33[b]	153.66
Dressing percentage (%)	76.39	80	75.13	76.92	2.58
Breast meat %	26.15[a]	24.24[a]	8.38[b]	10.50[b]	1.48
Thigh meat %	10.87[a]	9.91[ab]	5.31[c]	6.48[bc]	1.15
Drumstick %	9.35[a]	8.99[a]	5.15[b]	5.20[b]	1.11
Breast bone %	4.10	4.71	2.94	2.83	0.59
Thigh bone %	2.39	2.78	1.71	1.78	0.36
Drumstick bone %	3.37	3.15	2.41	2.45	0.39
Meat to bone ratio (Breast)	6.39[a]	5.50[ab]	2.86[c]	3.81[bc]	0.62
Meat to bone ratio (Thigh)	4.61[a]	3.56[ab]	3.10[b]	3.86[ab]	0.4
Meat to bone ratio (Drumstick)	2.82	2.87	2.13	2.22	0.34

[abc]Means with different superscripts on the same row are significantly different (P<0.05)

Table 4: The Mean. Standard deviation (SD) and the Coefficient of Variation (COV) of the two commercial hybrid strains of broiler chicken.

	ROSS 308			FUNAAB ALPHA		
PARAMETERS	**MEAN**	**SD**	**COV**	**MEAN**	**SD**	**COV**
Live weight (g)	2175g	294.53	13.54	1813.33g	325.37	17.94
Defeathered weight (g)	1958.33g	272.79	13.93	1576.67	285.77	18.12
Cleaned carcass weight (g)	1700g	236.64	13.92	1383.33g	285.77	20.66
Dressing percentage %	78.20%	4.43	5.67	76.02%	4.13	5.43
Breast meat %	25.22	2.11	8.37	9.44	2.91	30.83
Thigh meat %	10.39	2.28	21.94	5.90	1.36	23.05
Drumstick %	9.17	2.11	23.01	5.18	1.20	23.17
Breast bone %	4.40	1.19	27.05	2.88	0.65	22.57
Thigh bone %	2.59	0.66	25.48	1.75	0.48	27.43
Drumstick bone %	3.26	0.70	21.47	2.43	0.53	21.82

SD – standard deviation, COV – coefficient of variation.

Table 5 shows the sensory evaluation of the Ross 308, Funaab Alpha and the commercial layer chicken. There were significant differences ($P<0.05$) in all the parameters except colour and texture. The commercial layer was the most preferred of all the three, followed by the Funaab Alpha while Ross 308 was the least. However, the Ross 308 was the most tender among the three.

Table 5: **Sensory evaluation of two commercial hybrid strains of broiler chicken with the Commercial layer used as control.**

Parameters	**Ross**	**Funaab Alpha**	**Commercial Layer (Control)**	**SEM**
Appearance	6.90^{c}	7.90^{b}	8.70^{a}	0.17
Colour	7.10	7.50	7.80	0.21
Texture	7.60	7.80	7.90	0.16
Juiciness	7.85^{b}	8.23^{a}	8.42^{a}	0.17
Tenderness	8.84^{a}	7.63^{ab}	7.03^{b}	0.15
Taste	6.67^{b}	7.83^{ab}	9.00^{a}	0.17
Flavour	6.96^{b}	8.08^{ab}	8.46^{a}	0.15
Acceptance	5.10^{c}	7.83^{b}	10.56^{a}	0.15

^{abc}Means with different superscripts on the same row are significantly different ($P<0.05$)

Discussion

The results of the effect of sex on the meat yields of the two broiler strains of chicken is not in agreement with the results of most researches where there is a significant sex effect on the carcass of broilers with males having a heavier carcass than the females (Shim *et al*., 2012; Udeh *et al.,* 2015).

The results of the effect of strain on the meat yield of the two broiler strains in agreement with Ojedapo *et al*. (2008), Ajayi and Ejiofor (2009) and Udeh *et al.* (2015) who all reported significant ($P<0.05$) strain differences in their researches but is not in agreement with Amao *et al*. (2011) who reported that the Ross 308 strain had significant ($P< 0.05$) higher live weight than the Marshall strain. The insignificant ($P<0.05$) strain difference suggests that the Funaab Alpha is comparable with the Ross 308 strain as reported by Adebambo, (2015) that the Funaab Alpha is comparable with some broiler strains.

The results of the interaction of sex and strain is in agreement with the results of Ajayi and Ejiofor (2009), Olawunmi *et al*. (2012) and Udeh *et al*. (2015) who reported a significant difference ($P<0.05$) in the interaction of sex and strain. The Ross 308 male had a higher value than the Ross 308 female supporting the superiority of the male in gaining heavier weight (Udeh *et al*., 2015). The Ross 308 female is comparable with the Funaab Alpha female. However, the Funaab Alpha male was observed to have a lower value than the female in most of the parameters evaluated. It was observed that there was a high disparity in the weights of the Funaab alpha birds. This suggests effects of the environment on this strain of broilers and the selection process used in developing it. According to Saxena and Kolluri (2018), development in the poultry breeding over the years has been as a result of the combination of pure line selection and crossbreeding programes and increase in production volume and productivity per bird may largely be attributed to the combined crossbred and purebred selection (CCPS). The Funaab Alpha was developed from crossbreeding of local breeds of chicken with exotic breeds of chicken (Adebambo, *et al.,* 2018). Pure line selection may not be optimal which might affect the nicking ability of genes in the improved indigenous strain.

The results of the standard deviation and coefficient of variation suggests a higher variability in the Funaab Alpha for these parameters which supports the high disparity in the weights of the Funaab Alpha. The greater difference in the coefficient of variation values of the breast meat suggest an intensive selection for the breast meat in the Ross 308 strain compared to the Funaab Alpha strain. Because of a shift in the consumer demand from whole chicken to carcass parts, there has been an emphasis on the improvement of breast meat yield and muscle mass development by the poultry breeder industry (Abdullah and Matarneh, 2010; Shim *et al*., 2012). Current commercial broiler strains are the result of successful selection programs for rapid growth, especially of the breast muscles. Because breast is the most valuable portion of the chicken carcass in the United States market, even small differences in breast yield among strain crosses could have a significant economic impact (Shim *et al*., 2012). These results confirm that selection for breast meat muscling was not intense in the Funaab Alpha.

Results of the sensory evaluation suggests that in the study area, the commercial layer is still the most acceptable. It was followed by the Funaab Alpha while the Ross 308 is the least acceptable. As reported by Pagani *et al*. (2008) spent layers together with local poultry and, to a less extent, spent parent stocks, supply the largest portion of poultry meat. During festive occasions (Christian and Islamic festivals), there is a peak in demand for poultry meat and this is mostly provided by broilers. There is a higher preference for the layer meat because of its price and toughness of the meat in the study area. This result suggests that Funaab Alpha displayed some of the traits of the layer and local chicken which were appreciated by the panelists.

Conclusion and Recommendation

There was no sex effect, while there were strain and sex and strain interaction effect on the meat yields of the Ross 308 and the Funaab Alpha strains. Ross 308 meat yield was better than that of the Funaab Alpha. The Funaab Alpha had a higher variability in meat yield. Funaab Alpha had a better sensory acceptance than the Ross 308 strain in the study area. There is a need for further intense selection for meat yield (especially the breast meat) in the Funaab Alpha.

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