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Genetic Composition and Sexual Dimorphism of Crossbred Chickens Derived from Broiler Chicken and Nigerian Indigenous birds on Slaughter performance and Meat Quality Characteristics

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Abstract

Over recent years, consumers have increasingly favoured poultry products that are of high quality and produced through less intensive farming systems. Crossbred chicken genotypes, created by combining exotic breeds with native Nigerian chickens, have been identified as valuable for improving meat production while preserving local genetic diversity. This study assessed and compared carcass yield and meat characteristics in crossbreds generated by mating Arbor Acre broiler breeder sires with four types of hens: normal feather, frizzled feather, naked neck, and Fulani ecotype (designated AANF, AAFF, AANN, and AAFE). A total of 104 birds from each cross were reared under identical conditions and slaughtered at 12 weeks of age. The results showed that AANN birds produced the highest live weight (2,747.43 g), slaughter weight (2,700.45 g), dressed weight (2,605.23 g), wing weight (246.34 g), thigh weight (458.66 g), drumstick weight (489.90 g), breast weight (800.23 g), and shank weight (190.45 g), outperforming other crossbred groups in most carcass components, including internal organs. Males consistently displayed superior slaughter performance compared to females. Analysis of meat quality attributes revealed no major effect of genotype or sex on breast and thigh muscle properties, except for shear force, which was higher in AAFE birds. Male birds also had greater water loss than females, while muscle pH values remained unaffected. Overall, the AANN crossbred showed superior carcass yield compared to other genetic combinations, with males generally outperforming females, while meat quality remained largely uniform across all groups.

Keywords: *Genetic Composition, Crossbred, Nigerian indigenous chicken, Arbor acre, Carcass performance, Meat quality.*

INTRODUCTION

Meat ranks among the most nutrient-dense foods and is widely regarded as a vital component of the human diet, supporting optimal growth and development. Within animal based foods, poultry meat stands out because of its many favorable qualities, notably its relatively low fat content and its richness in polyunsaturated fatty acids, which are essential for human nutrition [1]. Chicken meat is widely recognized as an affordable, high-quality protein source rich in essential amino acids, and it also provides important minerals and vitamins, including threonine, lysine, methionine, cysteine, and tryptophan [2]. The quality of poultry meat has been shown to be strongly affected by the genetic makeup of the birds [3]. Furthermore, carcass and meat characteristics can be influenced in some way by a number of husbandry aspects, including as feeding, breeding, and management (pre-slaughter, stunning, slaughter and post-slaughter procedures, chilling, and storage conditions) [4], [5]. According to [6], the global desires for chicken meat have doubled in the past 20 years (+110% from 2000 to 2022) because of its high nutritional value, affordability, environmental sustainability, and lack of religious or cultural constraints [7].

The poultry industry has concentrated on the rigorous selection of genotypes with rapid growth [8] and large breast yields [9] in order to meet this demand and the accompanying production. Meanwhile, the improved selection processes have led to improvements in the meat's texture, color, and flavor as well as the appearance of more meat in the chickens' breast and thighs, which has an impact on consumer acceptability and buy intentions [10] and [11].

The indigenous or local chickens produce superior meat and eggs with lower cholesterol and a more pleasant flavor [12]. Studies from [4], [13], [14], [15] and [16] affirmed that these indigenous chickens needs improvement or upgrading by crossing them with exotic meat-type and egg type chickens. Sexual dimorphism is significant because it makes it possible to evaluate the impact of sex on survival, dispersal, and population dynamics. The typical sex-specific hormonal impacts on growth may be the cause of these apparent sex-associated variations [17].Weight, pH, and water-holding capacity (WHC) characteristics are the most commonly utilized characteristics to determine carcass and meat quality [18]. But over the past 20 years, the focus has shifted to the advancement of carcass technology and research techniques, which has allowed us to learn more about other characteristics like texture, the amount of nucleotides linked to flavor, chemical composition, histological characteristics, and muscle color characterization. Because of this, current studies have concentrated on describing the previously described quality attributes and how they relate to the production of chicken meat [19], [20], [21], [22] and [23]. These investigations support the defining of such qualities in addition to offering insight into the characterisation of the quality of the meat and carcass from native breeds. A quality characteristic that is essential to consumers' acceptability is meat softness [10].

It mostly depends on the fibre size and collagen content in the muscles while others also showed that it depended on the genetic strain and rearing system [24] and [25].

Recent studies of [16] affirmed that genetic components of chickens affected the slaughter composition and meat quality of the breast and thighs of crossbred chickens. The chicken performance has been documented to be influenced by breed [26], [27], [28], sex ([29], [30] and [31], nutrition [32], [33] and mechanism for managing feeding [34], [35].

Sex is the primary determinant of slaughter performance and meat quality under the same genetic background and breeding practices [29], [36]. A traditional and well-liked tonic in Nigeria is chicken soup made from local male and female chickens, and customers in various geographic areas typically favor local goods [10]. Additionally, consumers' preferences for male and female chickens vary by geography; according to a survey conducted by [37], consumers in Northern Nigeria favored male chickens, while those in Southern China favored female chickens [38]. Thus, the goal of the study is to identify the distinct clustering patterns that characteristics linked to carcass and meat quality characterize by breed of chicken, sex, and genotype.

MATERIALS AND METHODS

Site of the study

The study was conducted in the Animal Breeding and Genetics Unit of Teaching and Research Farm and Home Economics Food Laboratory at Emmanuel Alayande University of Education in Oyo, Oyo State, Nigeria. Latitude 7°5' northeast of Oyo State's capital, Ibadan, and longitude 3°5' east of the Greenwich meridian are the coordinates of Oyo. At this elevation, it is between 300 and 600 meters above sea level. The average annual temperature is 27°C, and the average rainfall is 1,165 mm. It is Nigeria's Southern Guinea Savanna vegetation covers the area [16].

Experimental animals and management

Twenty-four Arbor acre broiler breeder sires and twenty each of normal feather, frizzled feather, naked neck, and Fulani ecotype chickens' dams were among the 104 adult birds utilized in the experiment. Twenty dams and six Arbor acre sires were given to each native bird and each genotype. While the Arbor acre broiler breeder chicken sires were acquired from a reputable breeder farm in Ibadan, Nigeria, the Nigerian native birds were acquired from the pre-existing chickens at the Breeding and Genetics Unit of the Poultry division of the Teaching and Research Farm of Emmanuel Alayande University of Education, Oyo. An intense management system was used to closely monitor the experimental birds. The cocks were 18 weeks old, and the dams were between 18 and 24 weeks old. In order to make identification easier, each bird's wing was uniquely tagged. Each chicken had its own label, and it was kept in an open-sided poultry house with a galvanized battery cage that was 1800 square inches and had two tiers. Each bird was housed in a 15 by 7.5-inch cage. Medication and immunizations were given as needed.

Feeding regimes of parent stock

The cocks were given commercial breeder's grower mash on an ad-libitum basis, which included 16% crude protein and 2600 kcal/kg metabolizable energy. The dams were also given commercial layers that were mashed with 16% crude protein and 2800 kcal/kg of metabolizable energy, in addition to unlimited supplies of clean, cool water.

Mating experiments

Artificial Insemination (AI) was used to mate the chickens. Prior to producing sperm, the cocks were trained for two weeks to gather semen by pressing forty times from the back towards the tail. The massage technique was then applied to the cocks. At 22 weeks of age, the cock started to produce semen after its vent feathers were cut every two weeks. In the shape of a doughnut, the semen was then rapidly inseminated into the hen's left vent. This was done in the evening twice a week. Each hen received 0.1 mL of fresh, pure semen each time an inseminator was used for insemination.

Mating procedure:
The mating design is as shown below:
AANF = Arbor acre (sire) × Normal feather (dam)
AANN = Arbor acre (sire)×Naked neck (dam)
AAFF = Arbor acre (sire)×Frizzled feather (dam)
AAFE = Arbor acre (sire)×Fulani ecotype (dam)

Egg collection and incubation
The eggs from artificially inseminated hens were gathered based on genetic lines and allowed to accumulate in a cold room at 25°C for five days prior to being transferred to the hatchery for incubation. For 18 days, eggs were housed in a cabinet-style incubator at a commercial hatchery in Ibadan, Oyo State, Nigeria, with a temperature range of 27–39°C and a relative humidity of 55–56%. Then, until hatching time, the temperature and humidity rose to 29–40°C and 70–75%, respectively. The eggs were mechanically rotated 90 degrees in the incubator. On the fifth and eighteenth days of incubation, candling was carried out using a candler fixed with a neon fluorescent tube in a dark atmosphere in order to distinguish between transparent and viable eggs.

Management of the chicks
At two weeks old, all of the chicks from each genotype's lines were properly identified by having an industrial aluminum galvanized tag attached to their wings. The same strict management routine was used to raise each chick. Medication and vaccine schedules were appropriately adhered to from the beginning. After being cleaned, the day-old chicks were transferred to another brooder pen. For six weeks, each batch was raised.

Feeding regimes of the chicks
The chicks were given a commercial chick mash containing 22% crude protein and 2900 kcal/kg of metabolizable energy on an ad libitum basis from the time they were born until they were 4 weeks old. After that, they were given finisher broiler feed for a duration of 12 weeks.

Collection of Data
Carcass Evaluation
A total of eighty birds were manually slaughtered, 10 of each sex and twenty of each genotype. After being killed, the birds' bodies were immersed in cold water for an hour after they had been physically de-feathered and disemboweled. The carcasses were removed from the refrigerator, hung to drip, and then divided into different parts for further analysis. Weighing each component in grams at the moment of slaughter allowed us to calculate the yield of the live weight, slaughter weight, dressing weight, breast, thigh, wing, drumstick, back, shank, head, neck, and back (external traits), as well as the liver, heart, gizzard, kidney, and intestine (internal traits).

Evaluation of Meat Quality
The Warner-Bratzer shear force, pH meter, and reflectance colorimeter used to check the quality of the meat were given by the Emmanuel Alayande University of Education's Home Economics Department.

Both male and female broiler chickens' thigh and breast muscles were used to measure the meat quality attributes. Following the protocol outlined by [38], each carcass was refrigerated before the breast and thigh muscles were removed. For the final assessment of pH and water-holding capacity, both muscles and, following excision, the muscles from the breast and thigh were utilized. The thigh and breast muscles were weighed, put in plastic bags, and fried for a minute [39]. To calculate cooking loss, the muscles were then dried, left to cool at room temperature, and weighed again. Then, using a Warner-Bratzler meat shear (G-R manufacturing Co. Collins LN, Manhattan, Kansas, USA) with a triangular slot cutting edge placed on a Salter model, the tenderness of cooked muscle cores was assessed. The iodoacetate method, as outlined by [40], was used to measure the pH values in triplicate samples. One to 1.5 grams of raw meat were placed in a plastic test tube with 150 milliliters of KCl and 10 milliliters of neutralized 5 mM iodoacetate reagent. The meat was then homogenized using a Digital Benchtop LC-H11L homogenizer. China's Infitek. A pH meter (Benchtop pH meter, PH-B400F) was used to measure the homogenate's final pH values after 24 hours.By measuring the amount of water that is released from muscle protein when force is applied, as well as the muscle protein's capacity to hold onto excess water under the influence of internal force, the water-binding qualities of the breast and thigh were estimated. Samples of roughly 5g of raw meat (starting weight) were used to measure the water-holding capacity following the procedure outlined by [16]. Every sample was sliced into tiny bits. Two filter papers (qualitative, 150mm/ circles, fine crystalline retention, Whatman International Ltd, England) and two thin plates of quartz material were then placed over the sample meat parts (breast and thigh) and pressed for five minutes using a weight of 2500 g. After the meat samples were taken off the filter paper, their final weight was noted. Water holding capacity was calculated as a percentage, which was calculated by dividing the weight lost during sample pressing by the initial sample weight.

Statistical analysis
The General Linear Model (GLM) procedure of SAS was used to determine the least significant difference, while the 2018 version of Duncan's multiple range test was used to analyze the variance of carcass evaluation and meat quality characteristics data. The significance level was set at $p<0.05$.
The following model was used:
$Y_{ijk} = \mu + G_i + S_j + (GS)_{ij} + e_{ijk}$
Where:
Y_{ijk} = Observed value of a dependent variable
μ = General mean
G_i = Fixed effect of the i^{th} genotype ($i = 1, 2, 3, 4$)
S_j = Fixed effect of the j^{th} sex ($j = 1, 2$)
$(GS)_{ij}$ = Interaction between i^{th}Genotype and j^{th} Sex
e_{ij} = Random error common to measurement in each chicken and assumed to be normally and independently distributed with a mean of zero and variance δ^2

RESULTS

Table 1 represented the carcass evaluation (cut-part) of the crossbred progenies chickens as affected by sex. A significant (P<0.05) effect existed between the genetic stocks of the birds produced and the carcass characteristics measured. The crossbred chickens of AANN displayed highest live weight (2747.43 g), slaughtered weight (2700.45 g), dressed weight (2605.23 g), wing weights (246.34 g), thigh weight (458.66 g), drumstick weight (489.90 g), breast weight (800.23 g) and shank weight (190.45 g) while the least values was recorded for crossbred chickens of AAFF of values 20.49.48 g, 2000.80 g, 1950.99 g, 204.56 g, 425.67 g, 200.34 g, 700.89 g and 170.52 g for live weight, slaughtered weight, dressed weight, wing weights, thigh weight, drumstick weight, breast weight and shank weight respectively. Male crossbred chickens significantly tended to have more live weight, slaughtered weight, dressed weight, wing weights, thigh weight, drumstick weight, breast weight and shank weight compared to their female counterpart. The carcass characteristics evaluated were significantly influenced by an interaction between genotype and sex.

The carcass evaluation (visceral organs) of the crossbred progenies chickens as affected by sex is presented in Table 2. There are significant (P<0.05) differences between the crossbred chickens' genotype and the visceral organs indices measured. The results indicated that heart weight, liver weight (52.56 g), kidney weight (18.65 g) and gizzard weight (65.35 g) were heaviest in AANN crossbred chickens, while their counterpart birds while least value of weight of 42.22 g was recorded for AANN with respect to abdominal fat weight. However, lung weight and spleen weight displayed non-significant (P>0.05) effects. The males of the crossbred chickens had the heaviest weight for heart weight, liver weight, kidney weight, gizzard weight, while abdominal fat was more in female crossbred chickens than their male counterpart. Meanwhile, there was no significant (P>0.05) effect on genotype and lung weights. The visceral organs indices measured were significantly influenced by an interaction between genotype and sex.

The meat quality evaluation of breast muscles of different genotypes for male and female chickens is represented in Table 3. The results indicated that meat quality parameters measured on breast muscle were not influenced by genotype and sex, except for shear force values which were affected by genotype and cooking loss percentage which was influenced by sex. An interaction effect between genotype and sex was also observed only for water holding capacity percentage. The shear force values obtained were the highest in crossbred chickens of AAFE, yet these obtained values are still within the tolerable range of tenderness for chickens. Male crossbred chickens recorded higher water loss when compared to their female crossbred chickens counterparts. Sex and genotype had no significant effects on the pH of breast muscles. The pH of chicken breast muscles has been reported to decline from 6.4 to 5.4 in the 24h period after slaughter.

Table 4 shows the meat quality evaluation of thigh muscles of different genotypes for male and female chickens. The results displayed that meat quality parameters measured on Shear force values, which were impacted by genotype, and cooking loss percentage, which was influenced by sex, were the only factors that affected thigh muscles while ultimate pH (The pH of chicken thigh muscles been reported to decline from 6.2 to 5.5 in the 24h period after slaughtered, yet these values are still within the acceptable range of tenderness) and water holding capacity were not affected by both genotype and sex. The shear force values obtained were the highest in crossbred chickens of AAFE. Male crossbred chicken's recorded higher water loss when compared to their female crossbred chicken counterparts. An interaction effect between genotype and sex was also observed only for water holding capacity percentage.

DISCUSSION

The pattern of current results obtained for different genetic composition of crossbred chickens and sex dimorphism in respect to evaluation of carcass performance and meat quality affirmed the earlier studies of [4], [15], and [27] for different genetic composition of chicken breeds and confirming the genetic potential of Naked Neck chickens and [41], [42] for sex differences in chicken crosses with the conclusion that sex is the primary determinant of slaughter performance and meat quality under the same genetic background and breeding practices. The results of crossbred chicken of AANN displayed the highest carcass performance among other genetic stocks measured as corroborated by the finding of [27] that the combination of NN genetic stock produced high performance compared with other Nigerian indigenous birds. The sexual dimorphism found in this investigation was consistent with the results documented in *Bianca di Saluzzo* and *Bionda Piemontese* chicken breeds by [43]. The males of all genetic composition of genotype produced were better than female in terms of carcass performance and thus, affirmed the findings of [44], [45], [46] confirmed that compared with male and female chickens in respect to carcass evaluation, male chickens grow quickly, produce high yield of legs, but have low yields of breast and p. major muscles. [47] earlier finding agreed with this current study that the "Branca" Portuguese Autochthonous chicken breed's male and female carcass and meat quality attributes were preferred by the males of both breeds.

Meanwhile, the present results on the breast and thigh yields in respect to genetic compositions and sexual variation that indicated difference in the Shear force as only quality parameter that affected the genetic make-up of the chickens' genotypes was in line with the works of [28] who reported that variation exist between the meat quality parameters of *Bianca di Saluzzo* and *Bionda Piemontese* chickens and sexwisely, male of all genetic composition of the chickens displayed higher cooking loss % corroborate the findings of [45], [47], [48] that affirmed that variation exist in the meat quality of male and female chickens. Recently, [47] confirmed significant differences in the meat quality, that male XueShan chickens had more quality loss than the female

XueShan chickens. [48] discovered a notable difference between the sexes in the quality of the flesh of the Da-Heng meat type chickens. [49] investigation of the effects of sex and genotype on the nutritional qualities and carcass composition of chicken meat conformed to the current findings for a significant variation on carcass characteristics of chickens based on genotype and sexes. [45] claimed that there are significant differences between the male and female chickens in respect to meat quality and most of variables measured favoured the female chickens. The findings of [49] agreed to the current study with similar reports on sex effect on carcass yield and quality of broiler meat.

Table 1: Carcass evaluation (cut-part) of the crossbred progenies chickens as affected by breed and sex

Variable				Primal Cut						
Genotype		**LW**	**SW**	**DW**	**WW**	**TW**	**DSW**	**BW**	**BRW**	**SHW**
AANF		2145.90^{c}	2105.77^{c}	2050.45^{c}	225.34^{b}	445.45^{b}	467.00^{b}	230.25^{b}	720.90^{c}	140.89^{c}
AANN		2747.43^{a}	2700.45^{a}	2605.23^{a}	246.34^{a}	458.66^{a}	489.90^{a}	250.33^{b}	800.23^{a}	190.45^{a}
AAFF		2049.48^{d}	2000.80^{d}	1950.99^{d}	204.56^{d}	400.34^{d}	425.67^{d}	200.34^{d}	700.89^{d}	120.23^{d}
AAFE		2403.05^{b}	2380.34^{b}	2355.12^{b}	210.45^{c}	430.56^{c}	455.33^{c}	220.56^{c}	750.45^{b}	170.52^{b}
Pooled SEM		65.78	25.77	60.55	4.65	25.65	30.43	10.47	31.45	23.66
Sex										
Male		2678.78^{a}	2450.80^{a}	2300.60^{a}	230.89^{a}	435.07^{a}	455.45^{a}	240.42^{a}	732.88^{a}	155.90^{a}
Female		2345.90^{b}	2189.45^{b}	2100.23^{b}	200.56^{b}	422.90^{b}	431.09^{b}	210.89^{b}	699.06^{b}	145.45^{b}
Pooled SEM		56.90	45.23	55.45	34.90	78.98	23.90	15.89	22.81	13.55
P-value^{1}										
Genotype		***0.0001	**0.001	***0.0001	**0.001	**0.001	***0.0001	**0.001	***0.0001	**0.001
Sex		**0.001	**0.001	**0.001	**0.001	*0.05	**0.001	*0.05	**0.001	*0.05
Interaction		S	S	S	S	S	S	S	S	S

^{abcd}*Means along the same column at each variable with different superscripts are significantly (p<0.05) different*
AANF = Arbor acre normal feather crossbred, AANN = Arbor acre neck naked crossbred, AAFF = Arbor acre frizzled feather crossbred, AAFE = Arbor acre Fulani ecotype crossbred, P-value^{1} = probability values, S = significant, SEM = Standard error of the mean, LW = Live weight (g), SW = Slaughtered weight (g), DW = Dressed weight (g), WW = Wing weight (g), TW = Thigh weight (g), DSW = Drumstick weight (g), BW = Back weight (g), BRW= Breast weight (g), SHW = Shank weight (g)

Table 2: Carcass evaluation (Visceral organs) of the crossbred progenies chickens as affected by breed and sex

Variable				Visceral Organs				
Genotype		**LW**	**HW**	**LRW**	**KW**	**GD**	**AB**	**SP**
AANF		15.60	17.00^{c}	48.25^{b}	17.56^{b}	55.67^{b}	55.65^{b}	6.25
AANN		15.43	18.65^{a}	52.65^{a}	18.65^{a}	65.35^{a}	42.22^{d}	6.33
AAFF		15.49	15.05^{d}	40.35^{c}	12.65^{d}	50.25^{c}	50.67^{c}	6.34
AAFE		15.33	16.47^{b}	50.25^{ab}	15.02^{c}	52.35^{bc}	60.52^{a}	6.26
Pooled SEM		1.12	2.45	1.56	3.22	1.45	3.56	1.22
Sex								
Male		15.89	16.99^{a}	48.89^{a}	15.82^{a}	55.37^{a}	48.15^{a}	5.99^{b}
Female		14.45	15.23^{b}	45.71^{b}	13.99^{b}	48.99^{b}	43.01^{b}	6.20^{a}
Pooled SEM		0..23	1.44	2.88	2.33	3.56	3.99	1.11
P-value^{1}								
Genotype		NS	0.001	0.0001	0.05	0.001	0.05	0.067
Sex		0.05	0.05	0.05	0.001	0.05	0.05	0.05
Interaction		NS	S	S	S	S	S	NS

^{abcd}*Means along the same column at each variable with different superscripts are significantly (p<0.05) different*
AANF = Arbor acre normal feather crossbred, AANN = Arbor acre neck naked crossbred, AAFF = Arbor acre frizzled feather crossbred, AAFE = Arbor acre Fulani ecotype crossbred, P-value^{1} = probability values, S = significant, NS = Non-significant, SEM = Standard error of the mean, LW = Lung weight (g), HW = Heart weight (g), LRW = Liver weight (g), KW = Kidney weight (g), GW = Gizzard weight (g), AB = Abdominal Fat weight (g), SW = Spleen weight (g)

Table 3: Meat quality evaluation of breast muscles of different genotypes for male and female chickens

Variable	Ultimate pH	Cooking loss%	WHC %	Warner-Bratzer shear Force (kg/cm^{2})
Genotype				
AANF	5.02	25.65	18.45	2.45^{b}
AANN	5.05	25.72	18.65	2.12^{c}
AAFF	5.03	25.80	18.60	2.10^{c}
AAFE	5.05	25.75	18.30	2.80^{a}
Pooled SEM	0.05	0.10	1.02	
Sex				
Male	5.03	25.35^{a}	18.35	2.23
Female	5.01	23.49^{b}	18.20	2.19
Pooled SEM	0.02	1.04	1.78	0.01
P-value^{1}				
Genotype	NS	NS	NS	0.001
Sex	NS	0.05	NS	NS
Interaction	NS	0.01	0.05	NS

^{abcd}*Means along the same column at each variable with different superscripts are significantly (p<0.05) different*
p-value^{1} = probability level, WHC = Water Holding Capacity %, NS = Not significant

Table 4: Meat quality evaluation of thigh muscles different genotypes for male and female chickens

Variable	Ultimate pH	Cooking loss%	WHC %	Warner-Bratzer Shear Force (kg/cm^{2})
Genotype				
AANF	5.82	25.65	22.97	2.50^{b}
AANN	5.85	25.72	23.00	2.35^{c}
AAFF	5.83	25.80	22.99	2.40^{ab}
AAFE	5.89	25.75	22.90	2.48^{a}
Pooled SEM	0.01	0.10	1.02	
Sex				
Male	5.03	27.35^{a}	20.35	2.33
Female	5.01	25.49^{b}	20.30	2.30
Pooled SEM	0.02	1.04	1.78	0.02
P-value^{1}				
Genotype	NS	NS	NS	0.05
Sex	NS	0.05	NS	NS
Interaction	NS	0.01	0.05	NS

^{abcd}*Means along the same column at each variable with different superscripts are significantly (p<0.05) different*
p-value^{1} = probability level, WHC = Water Holding Capacity %, NS = Not significant

CONCLUSION

The current findings shown crossing Arbor Acre broiler and Naked neck (AANN) chickens can result in marketable live weight and good meat production. The crossings in the formation where the dam was of the NN genotype, had a better meat production than other genetic composition crossings. There are differences in the meat quality variables measured; therefore, an outstanding genotype of AANN is established. The male of all genetic compositions were better in respect of carcass evaluation than their female counterparts. The meat quality of breast and thigh muscles parameters of such as ultimate pH, cooking loss and water holding capacity did not differ genetically but differed in term of sexes with males having higher cooking loss.

AUTHOR CONTRIBUTIONS

Conceptualization, methodology and investigation, Amao, S.R.; methodology, Adebimpe, A. T.; data curation, Akinde, S. T.; writing original draft preparation, Amao, S. R; writing review and editing, Sikiru, A. B.; project administration, Ayoola, O. V.; project administration, Hammed. K. O.; project administration, Babatunde, S.O. The published version of the manuscript has been read and approved by all authors.

CONFLICT OF INTEREST:

Absence of a conflict of interest.

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