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Productive Performance of Three Commercial Broiler Genotypes Reared in the Derived Savannah Zone of Nigeria

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ABSTRACT

Carcass characteristics of three broiler strains reared on deep litter and under similar management practices and feeding regime to 8 weeks of age were compared. The broiler strains are Marshall, Arbor Acre and Hubbard. The obtained result showed that breed has significant ($p<0.05$) effect on live weight at 8 weeks. Marshall Genotype has higher ($p<0.05$) mean values and was superior to Arbor Acre and Hubbard in live body weight. In terms of other carcass traits, the former also recorded higher ($p<0.05$) mean values than the latter in carcass weight, dressing weight, eviscerated weight, carcass percentage, breast muscle weight, back muscle weight, thigh muscle weight, drumstick and heart weight. However, the three breeds recorded similar mean values in dressing percentage, abdominal fat weight, liver and gizzard weight. As regards sex effect, males were superior ($p<0.05$) to females in live body weight at 8 weeks, eviscerated weight, back muscle weight, thigh muscle weight and drumstick weight. However, the two sexes had similar mean values in dressing weight, dressing percentage, carcass weight, carcass percentage, breast weight, abdominal fat weight and edible giblets. There was significant ($p<0.05$) strain x sex interaction effects on all the traits considered. Regardless of the sex therefore, Marshall was more productive, feed efficient and gave more carcass yield than Arbor Acre and Hubbard when slaughtered at the same age under uniform management practices and environmental conditions. Males also yielded more meat than the females. For increased broiler meat production and maximum profit in the industry, Marshall breed is recommended to poultry farmers.

Key words: Strain, carcass %, dressing %, muscle, trait

INTRODUCTION

Broiler chickens are raised for their delectable meat which has a higher biological value than plant proteins. Broiler production aside from providing high quality animal proteins also generates quick returns on investment and employment opportunities due to its short generation interval and general acceptability as there is no taboo against its production and consumption. According to Givens (2005), foods derived from animal products are important sources of nutrients in the human diet and play an increasing role in the human nutrition in future. Consumer preference for tender and white meat containing low contents of fat and cholesterol seems to act as catalyst engendering increased broiler production not only at festive periods but all the year round. Broiler meat is sold whole or cut into parts for individuals and families who could not afford whole chicken.

Ewart (1993) posited that there had been a dramatic increase in the proportion of birds being grown for portioning and further processing. Aho (2001) reported that poultry production and processing technologies have become rapidly accessible and are being implemented on a worldwide basis which will allow continued expansion and competitiveness in the meat sector. The genetic constitution of the broiler chicken as well as non-genetic factors such as nutrition and sex were reported in the literature to have significantly influenced carcass value of broiler birds. Merkley *et al.* (1980), Orr *et al.* (1984) and Ojedapo *et al.* (2008) reported significant effect of breed on live weight of broilers. Also, Merkley *et al.* (1980), Marks (1990), Smith and Pesti (1998) and Musa *et al.* (2006) observed significant effect of sex on live weight and carcass characteristics. On nutrition effect, Shahin and Abd Elazim (2005) reported that carcasses of chicks fed high protein diet had more muscle than the chicks fed low protein diet. It is an undisputable fact that intensive selection of meat type chicken for growth has impacted positively on meat production; it however, has its own demerits. According to Griffin (1996), intensive selection for rapid growth has a number of negative consequences including an increase in fat deposition. Fat deposition in chickens tends to lower carcass value and the breed that shows lesser tendencies towards this unproductive character and produces more lean meat is required in the broiler industry. A superior carcass according to Shahin and Abd Elazim (2005) is characterized by a desirable composition: maximum proportion of muscle, minimum proportion of bone and optimum proportion of fat dictated by trade preference. The authors also submitted that superior carcass must contain high proportion of most valuable muscles that is, breast and thigh muscles. Abdominal and subcutaneous fat deposition in chickens selected for rapid growth according to Musa *et al.* (2006) is associated with changing concentrations of hormones and neural control mechanisms (hunger-satiety control mechanisms) that regulate feed intake. Furthermore, Smith and Pesti (1998) reported that most modern meat type chickens eat more than they require for growth and maintenance and the result of this excessive energy intake is increasing fat deposition in the body. In order to sustain this industry and to have sufficient supplies to meet the increasing demand for tender and white meat, continued selection against breed of broiler chicken with greater tendency to deposit fat should be practiced. The objective of this study was to determine the effect of breed and sex of broilers on carcass characteristics of broiler chickens raised under the same intensive condition. It also includes determining the broiler breed and sex with greatest meat production required to meet the animal protein demands of the citizenry.

MATERIALS AND METHODS

Study location: The study was carried out at the Animal Breeding Unit, Teaching and Research Farm, University of Ado-Ekiti between September, 2010 and December, 2010. Ado-Ekiti is situated along latitude 7°31' and 7°49' North of the Equator and longitude 5°71' and 5°27' East of the Greenwich meridian. The city falls under Derived Savannah zone. The city enjoys two separate seasonal periods namely, Rainy (May-October) and Dry (November-April) seasons.

Management and experimental birds: A total of 150 broiler day-old chicks that, is 50 chicks each of Arbor Acres, Mashall and Hubbard were purchased from local hatcheries and raised on deep litter in separate pens for 56 days (8 weeks). The chicks were brooded using coal pot to supply heat for the first three weeks of life. Antibiotics and vitamins were administered as and when due. Also, vaccines against Infectious Bursae and Newcastle diseases were given at specified age intervals. Their beddings are made up of dry shavings to prevent coccidiosis outbreak and high

level of hygiene was maintained throughout the experimental period to ensure unhindered conducive conditions for growth and to lower death rate. The birds were fed *ad libitum* with starter mash (1-4 weeks) containing 3000 kcal/kg/ME, 22% CP and finisher feed (5-8 weeks) containing 3100 kcal/kg/ME, 21% CP.

Data collection: At the chronological age of 56 days, 10 birds (5 males, 5 females) from each breed were randomly selected after starving them overnight. The birds were numbered and weighed individually to obtain live body weight and thereafter, slaughtered, bled, scalded and plucked. After the removal of feathers, the carcasses were eviscerated and dissected manually into various parts such as breast muscle, back muscle, drumstick, thigh muscle, wings, legs and giblets (heart, liver and gizzard). The different parts were weighed using sensitive scale and were expressed in grams.

The appropriate statistical model used is:

$$Y_{ijk} = \mu + G_j + S_i + (GS)_{ij} + \epsilon_{ijk}$$

Where:

Y_{ijk} = Observation of the k^{th} population, of the jth genotype and ith sex
μ = Common mean
G_j = Fixed effect of jth genotype (j = 3)
S_i = Fixed effect of ith sex (I = 2)
$(GS)_{ij}$ = Fixed genotype x sex interaction effects
ϵ_{ijk} = Random error

Statistical analysis: Data collected were subjected to analysis of variance and the differences between means for breed and sex separated by Duncan New Multiple Range test as per SAS (2001).

RESULTS AND DISCUSSION

The least square means (Table 1) showed that breed has significant ($p<0.05$) effect on carcass traits. In this study (Table 2), there was also significant ($p<0.05$) effect of sex on live body weight and some carcass traits. Table 3 showed the significant ($p<0.05$) breed effect on heart but the reverse was the case for liver and gizzard which are the only portions that were considered good for consumption. In addition, there was no significant ($p>0.05$) effect of sex on heart weight, liver weight and gizzard weight (Table 3).

Effect of breed on carcass traits: In this study, there was significant ($p<0.05$) differences in live body weight among the breeds (Table 1). Marshall Genotype recorded superior and higher mean values than Arbour Acres and Hubbard. Arbor Acres and Hubbard had similar mean values. This result corroborates the findings of Orr *et al.* (1984), Shahin and Abd Elazim (2005), Ojedapo *et al.* (2008) and Razuki *et al.* (2011) who observed significant breed differences in live body weight of broiler chickens slaughtered for carcass evaluation at 8-12 weeks. In contrast however, Becker *et al.* (1981) found no significant effect of breed on live body weight. As regards carcass traits, Marshall breed had superior ($p<0.05$) and higher mean values in dressing out weight, eviscerated weight, carcass weight, carcass percentage, breast muscle weight, back muscle weight, thigh muscle weight, drumstick weight, head weight, neck weight, wing weight and leg weight when compared to Arbor Acres and Hubbard. However, the three genotypes recorded similar values

Table 1: The least square means showing the effect of breed on carcass characteristics of broiler chickens

	Breeds		
Traits	Marshall	Arbor acres	Hubbard
Live body weight (g)	2315±86.41[a]	2010±86.41[b]	2020±86.41[b]
Dressed weight (g)	2170±82.73[a]	1840±82.73[b]	1885±82.73[b]
Dressing percentage (%)	93.61±0.84	91.7±0.84	93.36±0.84
Eviscerated weight (g)	1915±72.06[a]	1595±72.06[b]	1650±72.06[b]
Carcass weight (g)	1795±71.63[a]	1475±71.63[b]	1540±71.63[b]
Carcass percentage (%)	77.45±0.79[a]	73.35±0.79[b]	76.18±0.79[a]
Breast muscle (g)	520.8±25.2[a]	398±25.2[b]	412±25.2[b]
Back muscle (g)	329.9±14.73[a]	275.6±14.73[b]	288.9±14.73[ab]
Thigh muscle (g)	254.1±10.48[a]	207.2±10.48[b]	208±10.48[b]
Drumstick weight (g)	236.8±8.74[a]	187.8±8.74[b]	186.1±8.74[b]
Wing weight (g)	185.1±6.87[a]	159±6.87[b]	159.4±6.87[b]
Leg weight (g)	90.9±3.03[a]	76.4±3.03[b]	76.3±3.03[b]
Abdominal fat (g)	27±2.81	19.7±2.81	21.4±2.81
Head weight (g)	52.2±1.69[a]	47.8±1.69[ab]	45.1±1.69[b]
Neck weight (g)	122.9±5.51[a]	98±5.51[b]	105.6±5.51[b]

Means along rows with different superscripts are significantly different at p = 0.05

Table 2: The least square means showing the effect of sex on carcass characteristics of broiler chickens

	Sex	
Traits	M	F
Live body weight (g)	2226.67±70.55[a]	2003.33±70.55[b]
Dressed weight (g)	2060±67.55	1870±67.55
Dressing percentage (%)	92.41±0.68	93.37±0.68
Eviscerated weight (g)	1810±58.84[a]	1623.33±58.84[b]
Carcass weight (g)	1686.67±58.49	1520±58.49
Carcass percentage (%)	75.51±0.64	75.81±0.64
Breast muscle (g)	448.53±20.58	439±20.58
Back muscle (g)	315.75±12.03[a]	280.53±12.03[b]
Thigh muscle (g)	236.6±8.56[a]	209.6±8.56[b]
Drumstick weight (g)	222.07±7.13[a]	185.07±7.13[b]
Wing weight (g)	177.33±5.61[a]	158.33±5.61[b]
Leg weight (g)	92.93±2.48[a]	69.47±2.48[b]
Abdominal fat (g)	25.07±2.3	20.33±2.3
Head weight (g)	51.93±1.38[a]	44.8±1.38[b]
Neck weight (g)	116.33±4.5[a]	101.33±4.5[b]

Means along rows with different superscripts are significantly different at p = 0.05

in dressing out percentage and abdominal fat. In agreement with this study, Musa *et al.* (2006) and Ojedapo *et al.* (2008) reported significant effect of breed in all the carcass traits evaluated including fat weight. It was indicated in this study that Marshall genotype was better and superior in all the carcass traits considered and might be due to its genetic superiority over and above Arbour Acres and Hubbard. The latter genotypes probably shared common genetic composition because there were no significant differences between them in live body weight and carcass traits evaluated.

Table 3: The least square means showing the effect of breed and sex on edible giblets of broiler chickens

	Edible giblets		
Factors	Heart	Liver	Gizzard
Breeds			
Marshal	11.00±0.43[a]	44.8±1.77	45±2.32
Hubbard	10.00±0.43[ab]	42.9±1.77	42.7±2.32
Arbor acre	9.5±0.43[b]	39.6±1.77	43.8±2.32
Sex			
Male	10.47±0.35	43±1.44	45.13±1.9
Female	9.87±0.35	41.87±1.44	42.53±1.9

Means along columns with different superscripts are significantly different at p = 0.05

Edible giblets: There was significant ($p<0.05$) effect of breed on heart weight and this agreed with the findings of Taha *et al.* (2010) who reported significant breed differences in this trait amongst five strains of chickens. However, there was no significant ($p>0.05$) effect of breed on liver and gizzard and this contradicted the result of Taha *et al.* (2010) who reported significant effect of breed on these traits. Marshall breed had the highest ($p<0.05$) mean values in heart weight than Arbor Acres and Hubbard but the three genotypes recorded similar mean values in liver and gizzard weight.

Interaction effects: There was significant ($p<0.05$) breed x sex interaction effects on live weight, dressing weight, eviscerated weight, carcass weight, breast weight and other carcass characteristics. This shows the ranking of breeds in terms of performance when the two sexes are considered for evaluation. The result agrees with Tarrago and Puchal (1977) who reported significant ($p<0.05$) strain x sex interaction effect on body weight at 8 weeks in caged broilers but indicated an insignificant ($p>0.05$) effect on commercial limbs. In contrast however, Ojedapo *et al.* (2008) found no breed x sex interaction effect on carcass characteristics.

Effect of sex on carcass characteristics: In this study, there was significant ($p<0.05$) effect of sex on live body weight and some carcass traits (Table 2). Male broilers had higher mean values in live body weight, eviscerated weight, back muscle weight, thigh muscle weight and drumstick weight than females. As regards dressing out weight, dressing percentage, carcass weight, carcass percentage, breast muscle weight and abdominal fat, the two sexes are similar that is, no significant ($p>0.05$) differences between them. The result on live body weight was in conformity with the findings of De-Marchi *et al.* (2005), Shahin and Abd Elazim (2005), Musa *et al.* (2006) and Razuki *et al.* (2011) who reported significant differences in body weight of broiler breeds. Furthermore, the results obtained on carcass weight, breast muscle weight and abdominal fat were at variance with the findings of Musa *et al.* (2006) who reported significant effect of sex on these traits. In addition, higher mean values obtained for males in drumstick and thigh muscle weights are in agreement with the findings of Becker *et al.* (1981). The differences between the findings in this study and the previous ones might be due to differences in genetic make-up of the birds, production environment, management and health status of the birds. The males' superiority in carcass traits was probably due to the fact that males are more aggressive and vociferous when being fed in the same pen with females. According to Musa *et al.* (2006), growth and carcass

differences between males and females were due to differences in feed metabolism and in the onset of fattening. In addition, Merkley *et al.* (1980) reported significant differences between sexes in the yield of all carcass traits considered.

Edible giblets: In this study (Table 3), there was no significant ($p>0.05$) effect of sex on heart weight, liver weight and gizzard weight. The result contradicted the findings of Shahin and Abd Elazim (2005) and Musa *et al.* (2006) who reported significant sex effect on these traits. There was significant ($p<0.05$) breed x sex interaction effect on heart weight but the reverse was the case for liver and gizzard weight.

CONCLUSION

It was revealed in this study that Marshall breed recorded highest mean values and showed superiority over Arbor Acres and Hubbard in almost all the carcass traits considered. The former could be recommended to farmers as the choice breed with faster growth rate in terms of body weight at market age (8 weeks) and superior carcass characteristics. In addition, carcass evaluation showed a marked significant ($p<0.01$) difference between males and females. The males are better and superior to females in live body weight and some carcass traits. It implies that the higher the percentage of male chicks hatched and reared on the farm, the more broiler meat will be produced for market and invariably, the greater profit for stockholders.

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