CARCASS AND ADIPOSETISSUEDEPOSIT CHARATERISTICS OF FOUR STRAINS OF BROILER CHICKEN REARED IN A HUMID TROPICAL ENVIRONMENT

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Abstract

This research work, carried out in the poultry unit of the Teaching and Research Farm of the Delta State University, Asaba Campus, was designed to assess the carcass traits and adipose tissue fat deposit of four strains of broilers (Abro, Abor Acre, Ross and Marshall), using body weight measurements and ether extraction. Two hundred (200) birds at 50 birds per strain were housed in the deep litter system, and fed with commercial diets and water ad-libitum for 8 weeks. Data on body weight, dressed carcass weight, carcass characteristics and adipose tissue fat deposit were collected from 20 birds at five birds per strain, which were randomly selected. Data collected were subjected to analysis of variance (ANOVA) and mean separation treatment in line with standard statistical practices. Results indicate that Abor Acre recorded the highest body weight (2.25±0.18), followed by Marshall (2.16±0.0), Ross (2.03±0.10), and Abro (1.89±0.09) with attendant carcass equivalents in that order at 8 weeks of age. The Marshall strain (0.46%) ranked second (but statistaclly equal) to the Ross (0.44%) in giving the leanest fat tissue deposit. Based upon these findings, it was suggested that the Marshall strain should be adopted for rearing by farmers for improving broiler chicken production in live weight, carcass weight and low fat deposit traits to finishing age (8 weeeks), for good economic returns, while the Ross should be sought by breeders to generate specialized lines with lean meat for safer health benefits of consumers.

Key words: *Carcass characteristics, fat deposit, broiler chicken, strains*

Introduction

Poultry production, especially broiler chicken provides a rapid means of producing animal protein to meet the nutritional requirement of the teeming populace (Taiwo *et al.*, 2005). Broiler chickens reach table size in about 8-12weeks. Poultry farmers are faced with the problems of knowing which strain to rear, that will yield better carcass with less tissue, fat deposit and which have no nutritional adverse effect on health. One of the characteristics of a fully grown broiler is the possession of abdominal and tissue, fat deposit in the carcass (Laseinde and Oluyemi, 1994). The fat is usually undesirable for consumption and it is extracted while dressing the chicken. The realization of the full growth potential of the improved strains of chickens, is largely influenced by environmental factors such as nutrition, climatic variable and management pattern and the genetic growth potential of the birds (Sharma, 1997).

The composition of the carcass of a broiler chicken determines largely by the nutrition and housing of bird (Laseinde and Oluyemi, 1994). The energy component of broiler finished diet usually predisposed the bird to deposit fat (Sonaiya *et al.*, 1986)). Feed with lower energy levels like the grower mash has been used to prevent precocious growth as well as reduced excessive fat deposit in the growing broiler (Onu, *et al*, 2001).Though raising broilers

commercially in cages is not popular in many parts of the world, including Nigeria, cage confinement reduced ambulatory activities of the birds (Uchegbu *et al.,* 2004). Reduced exercise would enhanced increased abdominal and tissue, fat deposition in broilers (Laseinde and Oluyemi, 1994).The desire of an average broiler chicken processor and consumer is a free or minimal abdominal tissue, fat content in the carcass of a finished broiler. The implication of this is that the broiler producer should select stock with genetic potential for fast growth rate and which can attain market weight early enough under the existing climatic conditions, and which has less abdominal and tissue fat deposits (Adeyemi, *et al.,* 2000; Agbede and Aletor, 2003). For efficient production and maximum economic returns, producers need to establish relationships between dressing percentage, carcass characteristics and adipose tissue fat deposit in broilers.

The objective of this study is to compare the adipose tissue fat deposit and carcass characteristics of four strains of broiler chickens raised in a humid tropical environment.

Materials and Methods

Experimental location

The experiment was conducted at the poultry unit of the Teaching and Research farm, of the Department of Animal Science, Delta State University, Asaba Campus Nigeria. Asabais located at latitude $5^0$38`and $5^0$45` North of the equator and longitude $5^0$40` and 6^0E of the Greenwich meridian. Asaba has a mean annual rainfall and a rainy season lasting from April to October. It has a moderate climate with very high temperature during the dry season and a mean annual temperature and relative humidity of $32.7^{0c}$and 82% respectively (Asaba Met. Station (2014).

Experimental Animal

Two hundred day-old broiler chicks comprising 50 chicks per strain were obtained from a reputable hatchery in Agbor, Delta State. The strains were Abro, Arbor Acre, Ross and Marshall. The birds were brooded and reared separately in different pens according to strain on deep litter floor by conforming to standard management procedures as described by Oluyemi and Roberts (1979). The birds were fed *ad libtum* with a broiler starter mash from day old to 4 weeks of age and a broiler finisher from 4 to 8 weeks of age. Clean drinking water was supplied freely.

Feeds and feeding

The starter mash containing 20% crude protein and 2996 Kcal/kg metabolizable energy (ME) was fed to the chicks from day old – 4 weeks of age, while the finisher marsh with 16.80% crude protein and 2823 Kcal/kg ME was provided from 4-8weeks of age. The proximate nutrient composition of the experimental diets are as presented in Table 1.

Table 1: Composition of the Experimental Diets

Ingredient	Starter Diet	Finisher Diet
Maize	45.90	56.90
Groundnut Cake	25.05	20.05
Wheat Offal	18.00	15.00
Fish Meal	3.00	2.00
Bone Meal	2.00	2.00
Limestone	5.00	5.00
Premix	0.25	0.25
Salt	0.30	0.35
Lysine	0.25	0.20
Methionine	0.25	0.25
Total	100.00	100.00
Calculated CP (%)	20.17	16.80
ME (Kcal/kg)	299640	2823.14

Premix Contained: - vitamin A 1500i. You; VitD_3, 3000iu; VitE12,iu;VitaminK2.4mg;thiamine3.0mg;Riboflavin,6.0mg;pyriooxine4.8mg; 1000mg;nicotinic acid 43mg;calcium panthotenic acid 12mg; 0.6mg; Vitamin B12 0.024mg;vitamin B2 5mg; folic acid 12mg; chlorine chloride, 350mg manganese, 56mg, leading 1mg; zinc 50mg, copper, 400mg, loading, 20mg;cobalt, 1.25mg, selenium, 4.8mg

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Data Collection

Data were collected at the end of 8 weeks of the experiment. Five (5) birds each were selected randomly from the four strains. These birds were starved overnight (18 hours) to empty their gut content. Liver weights of the birds were collected before slaughter, using a weighing balance. The dressed carcass characteristics that were evaluatedinclude, the following parameters-shank, thighs, drumstick, wings, neck, back, breast and organs such as liver, gizzard, lungs, spleen, pancreas and the intestine. All weights were obtained using a weighing balance and a sensitive electronic scale in the laboratory.

Two gram (2g) of a meat sample was collected from the breast region of each chicken and subjected it to ether extraction for adipose tissue fat deposit determination, using the substrate apparatus on a heating mantle. According to Official Methods of Analysis Association of official Analytical Chemists (1980).

Experimental Design and Statistical Procedures

The chicks were allotted into four groups of fifty (50) birds each in a completely randomize design. Each treatment group was further divided in to 5 replicates of 10 birds per group. Data on each parameter were subjected to analysis of variance (ANOVA) by Steel and Torie (1982).The new Duncan's multiple range tests technique (SAS, 2002) was used to separate the statistically different means.

Results

Table 2: Carcass and Adipose Tissue Deposit Characteristics of Four Strains of Broiler Chicken

Traits	Abro	Arbor Acre	Ross	Marshall
Live weight (kg/bird)	1.89±0.09[a]	2.25±0.13[b]	2.03±0.10[ab]	2.16±0.09[ab]
Dressed carcass weight (kg/bird)	1.77±0.11[b]	2.09±0.12[c]	1.66±0.08[a]	2.01±0.08[c]
Dressing percentage	93.65%	92.89%	81.77%	93.06%
Back (g)	321.48±18.02[a]	343.75±25.77[a]	343.00±25.77[a]	381.25±15.73[a]
Drumstick (g)	162.83±15.65[a]	221.0.2±13.58[b]	187.00±6.91[ab]	200.07±7.9[b]
Breast (g)	292.40±26.28[a]	320.06±43.77[a]	393.75±21.35[a]	356.25±35.90[a]
Head (g)	49.92±1.92[a]	55.89±5.47[a]	51.60±3.66[a]	39.05±1488[a]
Neck (g)	85.75±1.92[a]	138.83±15.81[b]	125.11±4.68[b]	135.52±4.83[b]
Shank (g)	63.57±18.28[a]	84.52±23.26[a]	49.18±21.49[a]	58.83±24.33[a]
Thighs (g)	234.02±18.43[a]	272.10±19.04[a]	267.74±11.02[a]	237.75±7.70[a]
Wings (g)	190.58±22.45[a]	278.71±23.63[b]	203.62±19.22[a]	293.37±19.22[b]
Heart (g)	14.61±170[a]	15.43±1.10[a]	12.01±0.89[a]	13.55±0.95[a]
Liver (g)	49.99±2.21[a]	42.95±10.46[a]	42.01±3.39[a]	48.23±3.38[a]
Intestine (g)	124.64±12.07[a]	136.22±2.21[a]	110.66±11.30[a]	111.80±6.69[a]
Lungs (g)	11.41±1.43[a]	13.19±1.17[a]	11.891.46[a]	10.78±0.62[a]
Pancreas (g)	5.25±0.92[a]	4.70±1.08[a]	5.26±1.25[a]	5.41±0.45[a]
Spleen (g)	4.15±0.57[a]	3.88±0.97[a]	2.99±1.78[a]	3.13±0.39[a]
Gizzard (g)	44.38±2.32[a]	57.07±1.52[b]	46.99±3.42[a]	45.33±3.16[a]
Adipose fat deposit (g)	0.52±0.14[b]	0.52±0.12[b]	0.44±0.06[a]	0.46±0.08[ab]

a, b mean within a row with different superscripts are significantly different (P< 0.05).

Table 2 shows the results of the body weight, carcass characteristics and adipose tissue fat deposits of four strains of broilers. Significant (P < 0.05) differences in body weight and dressed carcass weight were obtained among the four strains of broilers. Arbor Acre had the highest bodyweight (2.25 kg) compared to Marshall, Abro and Ross, with Abro having the least bodyweight (1.89 kg). The mean dressed carcass weights of Arbor Acre (2.09±0.12 kg) and Marshall (2.01±0.08 kg) were statistically similar, either of which was heavier (P<0.05) compared to Ross (1.66±0.18 kg) or Abro (1.77±0.11kg). The dressing percentage results for Abro (93.65%), Marshall (93.06%) and Arbor Acre (92.89%) strains were not significantly different (P>0.05), each of these three strains having a superior dressing percentage compared to Ross (81.77%).

There were no significant (P>0.05) differences between Arbor Acre (221.02±13.58g) and Marshall (200.00±7.09g), and between Abro (162.83±15.63g) and Ross (187.00±6.91g) in the mean weight of the drumstick. However, Arbor Acre and Marshall had higher numerical values of drumstick than did Abro and Ross strains. Significant (P<0.05) differences existed between Abor Acre (138.83±15.81g) and Abro (85.75±26.I7g) in neck weight, while Ross (125.11±4.68g) and Marshall (135.52±4.83g) did not differ statistically (P>0.05). The wing weight results showed significant (P<0.05) differences between Abro (190.58±22.45g) and Ross (203.62±19.22g) as well as between Abor Acre (278.71 ±25.63g) and Marshall (293.87±19.22g).The gizzard weight for Abor Acre (57.07±1.52g) differed significantly

(P<0.05) as it was superior to the other three strains of broilers: Abro (44.38±2.32g), Ross (46.99±3.42g) and Marshall (45.33±3.16g). There were no significant (P>0.05) strain differences in the mean weights for the following parameters: back, breast, head, shank, thighs, heart, liver, intestine, lungs, pancreas, and spleen, among the experimental broilers. There were no significant (P>0.05) differences in the adipose tissue deposits between Abro and Arbor Acre, but Ross had the least (P<0.05) fat deposit (followed closely at P>0.05 by the Marshall) compared to either Abro or Arbor Acre.

Discussion

Dressing percentage is an important trait in carcass merit evaluation as it reflects an assessment of the meat to bone ratio (Louvandini *et al*. 2006). Such information is important in planning breeding programmes to improve meat production and quality characteristics of broiler chickens. In this study Abro had the highest dressing percentage when compared (but equal statistically to Marshall) to Arbor Acre and Ross. The higher dressing percentage of Abro could be as a result of genotype. This is in line with the findings of Ayorinede *et al.* (1989) and Fajemilehin (2010) where genotype of birds was found to have significantly ($P < 0.05$) influenced carcass yield and dressing percentage of guinea fowl. This may be attributed to the differences in genetic makeup. These results rightly showed that there were considerable differences in genotypes which may be due to their genomes as earlier reported by El-full *et al.* (2005). This means that Abro was genetically superior to others in terms of dressing percentage, followed by Marshall.

There were no significant differences among the four strains of broiler on the following parameters; back, breast, head, shank, thighs, heart, liver, intestine, lungs, pancreas and spleen. This means that the four strains of broilers share those body-part characteristics that commonly identify broilers from the egg-type chickens. This is in line with the report of Laseinde and Oluyemi (1997), who stated that most commercial stock of broiler chicken share a lot of body characteristics in common.

The results also show that Ross followed by Marshall gave low fat tissue deposit compared to the other two breeds (Abro and Arbor Acre). It is an indication, that the Ross and Marshall have a great future in being utilized for the genetic improvement of broilers in lean meat production especially since the present mix of animal protein consumption is changing towards cheaper, low fat meats for better human health and wellness. In spite of the above difference, generally the fat deposit figures among the four strains ranged from 0.44% to 0.52% and thus were close enough in range. Durunna *et al.,* (2004) had reported that the abdominal fat content from different strains of broilers were similar. This was further buttressed by the work of Laseinde and Oluyemi (1997) who also reported that different strains of broilers reared under the same management system had no significant difference in their abdominal fat contents.

Conclusion and Recommendation

The Abro and Marshall strains of broiler performed best in dressing percentage among the four strains. It is therefore recommended that farmers and producers of broilers with keen eyes for strains for high carcass percentage at 8 weeks of age should choose topmost, the stocking or

breeding of parent stocks of the Abro strain, followed by the Marshall. On the other hand, Ross followed by Marshall, should be preferred for safe meat production on account of having given the lowest adipose tissue deposits compared to other two (Abro and Arbor Acre) strains. Finally, for ranking second to Arbor Acre in body weight development on one consideration, and ranking equally with Ross in lean meat production on the other, the Marshall strain has emerged the "star" strain and should be so sought for by both breeders and producers. The aim should be to generate and supply broiler chicks with fast growth and lean meat production for good returns on business and for safe meat consumption by humans.

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