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Evaluation of growth traits in three strains of broiler chicken

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Abstract

This study was carried out to evaluate the growth performance of Marshall, Cobb and Arbor acre strains of broiler chicken. A total number of three hundred (300) day-old broiler chicks of Arbor acre, Cobb and Marshall strains were raised under the same management condition. Data was obtained on the growth performance and analyzed. Cobb strain had the highest weight of 175.78 ± 2.51g at 2 weeks of age while Arbor acre and Marshall strain had similar (p>0.05) body weight at that age. Marshall had the highest body weight of 1804.37± 50.47g followed by Cobb with a weight of 1760.16 ±15.38g) while Arbor acre had the least body weight of 1683.43 ± 25.06g at 8weeks. Cobb strain had the highest body length (32.33 ± 0.10cm) at 8 weeks. All the strain studied had similar breast girth at 4 weeks. However, Marshall strain had the highest breast girth followed by Arbor acre while Cobb strain had the least breast girth at maturity. Marshall strain and Arbor acre had similar thigh lengths while the least thigh length was recorded for the Cobb strain. The effect of sex was significant (p<0.05) on all the growth parameters at 8weeks as male broilers had higher body measurements than their female counterparts. In conclusion, Marshall strain had better growth performance than Arbor acre and Cobb strain of broiler chicken.

Keywords: broiler strain, growth performance, marshall, cobb, arbor acre

Introduction

The contribution of poultry to animal protein supply cannot be over emphasized (Ahmed *et al*., 2018). Poultry products such as meat and egg are excellent sources of animal proteins necessary to meet human protein requirements (Olawumi *et al*., 2012). Over the years, the Nigerian poultry industry has witnessed the introduction of different broiler chicken strains (Ojedapo *et al*., 2016). Breeding and selection strategies can therefore be exploited to achieve the best in the poultry industry thus, selection for broiler strains that will reach market weight at reasonable age is important for profit maximization (Sam, 2019). Growth is a complex trait that is controlled by genetic and non- genetic factors (Udeh and Ogbu, 2011). According to Yakubu and Salako (2009), growth is a dynamic physiological process that exists from conception until maturity. Animal growth refers to an increase in body size, accumulation of adipose tissue during development from conception to maturity (Ajayi and Ejiofor, 2009). It also involves changes in functional capabilities of the various tissues and organs of animal (Adeleke *et al*., 2010). The growth performance is an important trait to be considered in meat type chicken. Growth is normally accompanied by an orderly sequence of maturational changes and involves accretion of protein and increase in length and size not just an increase in body weight. According to Ojedapo *et al*. (2016), there are several factors which affect the growth performance of broiler chickens and these include strain, sex, nutrition, housing and stocking density. Taha *et al*. (2010) reported the significant effect of chicken strain on growth rate and body weight at different ages. Body weight and linear body parameters of broilers are dependent on

their genotypes (Atansuyi *et al*., 2017). However, Saki *et al*. (2010) reported no significant difference in body weight and growth rate of Cobb and Arbor acre strain raised in Iran. There are contradictory reports on the superiority of the most common strains of broilers (Cobb, Arbor acre and Marshall) with regards to their growth performance in Nigeria. Ojedapo (*et al*.) 2016 reported that Cobb broiler had higher body weight and body length throughout the growing period than Marshall strain. However, the report of Atansuyi *et al*. (2017) showed that Marshall broiler had the highest body weight among four genotypes of broilers studied. Udeh and Ogbu (2011) reported that Arbor acre had higher body weight than Marshall and other broiler strains at 8 weeks. This study was therefore carried out to evaluate the growth performance of Marshall, Cobb and Arbor acre strains of broiler chicken.

Materials and methods

Experimental site

The experiment was carried out at the Poultry unit of the Department of Animal and Environmental Biology, Adekunle Ajasin University Akungba-Akoko, Ondo State. Akungba–Akoko is located in Akoko South West Local Government Area of Ondo state, Nigeria. The area lies in the south western region of Nigeria (7º 28' and 5º43') according to Geographical Positioning System (GPS) and has the following environmental condition: ambient temperature of 27^0C and relative humidity of 46mm Hg.

Experimental animals and management

A total number of three hundred (300), one day-old broiler chicks comprising of 100 each of Arbor acre, Cobb and Marshall strains were used for the study. The chicks were brooded for four weeks using charcoal stove as source of heat. They were fed with broiler starter mash diet containing 2700Kcal/kg metabolizable energy and 23% crude protein from day old to 4 weeks of age and later fed with broiler finisher diet containing 2950Kcal/kg metabolizable energy and 20% crude protein. The birds had free access to clean water throughout the period of the experiment. The vaccination schedule for gumboro and lasota vaccines were strictly adhered to and adequate medical attention was given to unhealthy birds.

Data collection

The body weight of bird was measured individually using a digital sensitive weighing scale. Breast girth was taken as the circumference of the breast round the deepest region of the breast using a measuring tape. Body length was measured as the distance between the base of the neck and the pygostyle with a measuring tape. The distance between the hock joint and the pelvic joint was measured as thigh length while wing length was taken as the distance between the point of attachment of wing to the body and tip of the wing using a measuring tape.

Statistical analysis

Data obtained from the measurements were subjected to analysis of variance (SAS 2010) and means were separated using Duncan procedure.

Results and discussion

The body weight performance of Arbor acre, Marshall and Cobb broiler chicken at different ages are presented on Table 1. Cobb strain had the highest weight of 175.78 ± 2.51g at 2 weeks of age. However, Arbor acre and Marshall strain had similar body weight at that age. This result corroborated the findings of Amao *et al*. (2015) that the Cobb strain of broiler appeared to be superior to Marshall strain in terms of initial body weight. Cobb strain also had the highest body weight (523.74 ±6.80g) followed by Marshall (501.75±1.75g) while Arbor acre had the

least body weight (477.11± 3.98g) at 4weeks. There was a change in the trend of body weight performance among the strains of broiler chicken at 6 weeks as Marshall had the highest body weight followed by Cobb and Arbor acre strain. Similarly, Marshall strain had the highest body weight of 1804.37± 50.47g followed by Cobb with a weight of 1760.16 ±15.38g while Arbor acre had the least body weight of 1683.43 ± 25.06g at 8 weeks. Atansuyi *et al.* (2017) reported that Marshall broiler had the highest body weight among four genotypes of broilers studied. Gwaza *et al*. (2017) also reported that Marshall broiler strain had better growth than Arbor acre and Hubbard strain of broilers in the derived guinea savannah region of Nigeria. Ahmed *et al*. (2018) reported highly significant difference between Marshall and other strains of broiler chicken studied at 4 and 8 weeks. The observed heavy weight in Marshall strain at 4 and 6 and 8 weeks may be because of its high genetic potential for growth. The result of this work however, was contrary to the report of Makka (2016) that Arbor acre strain had higher body weight at 4, 6 and 8 weeks than Marshall strain. Olawumi *et al*. (2012) also reported that Arbor acre broiler had higher body weight than Marshall broiler. The live body weight of any animal is an important variable that determines the market value of that animal (Ojedapo, 2013). There was increase in the body weights of Arbor acre, Marshall and Cobb broiler chicken as the birds advance in age as shown on Table 1.

Table 1: Body weight ± SEM (g) of broiler chickens as influenced by strain and sex

	Age (weeks)			
	2	4	6	8
Strains				
Arbor-Acre	165.70± 0.80 [b]	477.11±3.98 [c]	1179.69±27.09 [c]	1683.43± 25.06[c]
Marshall	167.40 ± 0.88 [b]	501.75±1.75 [b]	1250.30±13.62 [a]	1804.37± 50.47[a]
Cobb	175.78± 2.51 [a]	523.74±6.80 [a]	1215.97±8.61[b]	1760.16±59.86[b]
Sex				
Male	172.65±0.98	520.75± 2.87	1209.60±11.60[a]	1800.78 ±34.56[a]
Female	171.06±0.76	519.63± 3.61	1035.65±14.34[b]	1740.50 ±25.60[b]

[abc] Means within a column with different superscript are significantly different for strain and sex ($p<0.05$)

According to Olawumi and Dudusola (2011), there was consistent increase in body weight with advancing age of the birds regardless of bird's genotype. Ojedapo (2013) also reported an increase in the live body measurements as the birds mature, indicating a direct positive relationship between body weight and age. The three commercial broiler strains have different genetic potentials for growth and the strains studied have different ancestors. The effect of sex was not significant ($p>0.05$) on the body weight of broilers before 6 weeks of age. Sexual dimorphism was not observed in the body weight of male and female broilers at 2 and 4 weeks. However male broilers had higher body weights than their female counterparts at 6 and 8 weeks as shown on Table 1. The body lengths of Arbor acre, Marshall and Cobb broiler chicken at different ages presented on Table 2 showed that the effect of strain was not significant ($p>0.05$) on the body length of broiler chicks at 2 weeks. All the strain studied had similar body length at 2 weeks. This was in line with the findings of

Makka (2016) who reported that body length was similar in Arbor acre and Marshall at 2weeks. However, the effect of strain was significant ($p< 0.05$) on the body length of the broiler chicks at 4 weeks with the Marshall strain having the highest value of 14.17± 0.67cm. Arbor acre and Cobb broiler strain had similar body length at 4 weeks, though body length of Arbor acre was higher than Cobb at 6weeks. However, at 8 weeks Cobb was superior to the two other strains in body length (32.33 ± 0.10cm). Ojedapo *et al.* (2016) reported that Cobb broiler had higher body length throughout the growing period than Marshall strain. In this study, Arbor acre strain had longer body than Marshall strain at 6 and 8 weeks. This was in line with the report of Udeh and Ogbu (2011) that Arbor acre had higher body length than Marshall strain but contradicts the findings of Olawumi *et al*. (2012) that Marshall and Arbor acre had similar body length. In this study, the effect of sex was significant ($p<0.05$) on the body length of broilers from 6 weeks of age. Male broilers had higher body lengths than their female counterparts at 6 and 8 weeks of age. Breast girth is an important parameter associated with breast meat yield. The largest breast girth of 8.86 ±0.07 cm at 2 weeks was observed in Cobb broiler while Arbor acre and Marshall strains had similar breast girth as shown in Table 3. This corroborated the findings of Makka (2016) that Arbor acre and Marshall strain had similar breast girth at early weeks. Olawumi *et al*. (2012) also reported that Marshall and Arbor acre had similar breast girth. Cobb strain, Arbor acre strain and Marshall strain all had similar breast girth at 4 weeks. However, at 6 weeks, the highest value of breast girth (19.33±0.04cm) was recorded for Marshall strain followed by Arbor acre (18.12± 0.01cm) and Cobb (17.90 ± 0.03cm). Comparatively, Marshall strain had the highest breast girth followed by Arbor acre while Cobb strain had the least breast girth at 8 weeks. Makka (2016) reported that Arbor acre had lower breast girth at 6 and 8 weeks. Udeh and Ogbu (2011) also reported Marshall strain had higher breast girth than Arbor acre at 8 weeks.

Table 2: Body length ± SEM (cm) of broiler chickens as affected by strain and sex

	Age (weeks)			
	2	4	6	8
Strains				
Arbor-Acre	9.01± 0.11	12.86±0.14 [b]	25.78± 0.13[a]	31.73± 0.06 [b]
Marshall	9.05± 0.13	14.17± 0.67 [a]	24.74± 0.09 [b]	30.36±0.29 [c]
Cobb	9.04 ± 0.05	12.81±0.19 [b]	24.44±0.21 [b]	32.33± 0.10[a]
Sex				
Male	9.04±0.03	13.65±0.12	24.80 ±0.34	31.96 ±0.72
Female	9.01 ± 0.05	12.91± 0.23	21.30±0.12	28.65±0.96

[abc] Means within a column with different superscript are significantly different for strain and sex ($p<0.05$)

The effect of sex was also significant ($p<0.05$) on the breast girth of broilers from 6 weeks of age as male broiler chickens had higher breast girths than their female counterparts at 6 and 8 weeks as shown on Table 3. Ajayi and Ejiofor (2009) reported sexual dimorphism in the growth performance of broilers with the male superior to female in all growth traits.

Table 3: Breast girth ± SEM (cm) of broiler chickens as affected by strain and sex

	Age (weeks)			
	2	4	6	8
Strains				
Arbor-Acre	8.17±0.01 [c]	14.92± 0.02[a]	18.12±0.01[b]	23.70± 0.83[b]
Marshall	8.28±0.02 [b]	14.46± 0.04[a]	19.33± 0.04[a]	24.25± 0.66 [a]
Cobb	8.86± 0.07[a]	14.95± 0.08[a]	17.90± 0.03 [c]	22.86± 0.74[c]
Sex				
Male	8.24± 0.03	14.12± 1.20	19.10± 0.59[a]	23.62±0.55[a]
Female	8.16± 0.09	13.98 ±1.11	17.80± 0.34[b]	21.78± 0.42[b]

[abc] Means within a column with different superscript are significantly different for strain and sex (p <0.05)

The thigh lengths of Arbor acre, Marshall and Cobb broiler chicken at different ages are presented on Table 4. The effect of strain was not significant (p>0.05) on the thigh length of broilers at the starter phase. Cobb, Arbor acre and Marshall strains all had similar thigh length at 2 and 4 weeks. Nevertheless, the thighs of Arbor acre and Marshall strain, though similar were longer than the thighs of Cobb strain at 6 weeks. This trend was also observed at 8 weeks. Arbor acre and Marshall strain had similar thigh lengths while the least thigh length was recorded for the Cobb strain. The findings on thigh length of broiler chicken in this study contradicts the report of Makka (2016) that thigh length is higher in Arbor acre than Marshall at all ages. Sexual dimorphism was observed in the thigh length of the broilers from 4weeks of age. Male broilers had higher thigh lengths than female broilers at 4, 6 and 8 weeks. The observed sexual dimorphism in favour of the males with regards to growth had also been reported by Sola-Ojo *et al*. (2008) and Adedeji *et al*. (2008). The superiority of male over their female counterparts could be due to the testosterone hormone. Apart from testosterone stimulating and maintaining secondary sexual development, it also affects the growth process and development of body parts and features that are not directly related to reproduction (Adeleke *et al*., 2010). Table 5 shows the mean and standard error of means of wing length of Arbor acre, Marshall and Cobb broiler strains at different ages. All the strains had similar wing length till 4 weeks, however, Marshall had longer wing than Arbor acre and Cobb at 6 and 8 weeks. Udeh and Ogbu (2011), however reported that Arbor acre had longer wing length than Marshall strain. The least wing length was recorded for Cobb strain at 8 weeks. Unlike with other growth parameters where sexual dimorphism was observed from 6 weeks, the effect of sex on the wing length was only observed at 8 weeks with male having higher values than females. The aggressiveness of males over the females especially when reared together put the females at a disadvantage for feed and water.

Table 4: Thigh length ± SEM (cm) of broiler chickens as affected by strain and sex

	Age (weeks)			
	2	4	6	8
Strains				
Arbor-Acre	6.83±0.01	8.35± 0.07	9.82± 0.25[a]	10.86±0.19 [a]
Marshall	6.81±0.02	8.34±0.01	9.93±0.11[a]	10.95± 0.01 [a]
Cobb	6.85±0.03	8.31±0.11	9.03± 0.20[b]	9.82±0.08[b]
Sex				
Male	6.79± 0.02	8.20 ± 0.12	9.72± 0.21[a]	10.15±0.03[a]
Female	6.75±0.04	8.01±0.14	8.58± 0.43[b]	9.80 ± 0.05[b]

[abc] Means within a column with different superscript are significantly different for strain and sex ($p<0.05$)

Table 5: Wing length ± SEM (cm) of broiler chickens as affected by strain and sex

	Age (weeks)			
	2	4	6	8
Strains				
Arbor-Acre	9.76± 0.16[a]	12.87± 0.11[a]	16.00 ± 1.25[b]	23.85± 1.65 [b]
Marshall	9.65±0.36 [a]	12.82± 0.12[a]	16.45± 0.05[a]	24.10± 0.21 [a]
Cobb	9.75± 0.25[a]	12.92± 0.28[a]	15.25±0.18[c]	21.80±0.22 [c]
Sex				
Male	9.68 ± 0.21[a]	12.96±0.45[a]	15.82±0.12 [a]	23.95± 0.41 [a]
Female	9.35±0.38[a]	12.85±0.52[a]	15.79±0.24[a]	21.70±0.56[b]

[abc] Means within a column with different superscript are significantly different for strain and sex ($p<0.05$)

Conclusion

Marshall had the highest mean of body weight maturity. Cobb broiler had higher values for the growth parameters at early age. All the strains studied had similar breast girth at 4 weeks. Marshall strain had the highest breast girth followed by Arbor acre while Cobb strain had the least breast girth at 8 weeks. The effect of strain was not significant on the thigh length and wing length of broilers at the early stage. Males had higher values for body weight, body length, breast girth and thigh length than female broilers at 6 and 8 weeks while sexual dimorphism was only found for wing length at 8 weeks. The genetic variation that existed in the growth performance of Marshall, Cobb and Arbor acre strain of broilers is important in effective selection for meat yield. Marshall strain had better growth performance than Arbor acre and Cobb strain of broiler chicken.

References

Adeleke, M. A., Peters, S. O., Ozoje, M. O., Ikeobi, C. O. N., Bamgbose, A. M. and Adebabambo, O. A. 2010. Growth performance of Nigerian local chickens in crosses involving an exotic broiler strainer. *Tropical Animal Health and Production* 43: 643-650

Ahmed, I. A., Adeyinka, I. A., Kabir, M., Mohamed, A. B, Sani, I., Galadima, N. M. and

Muhammad J. Y. 2018. Evaluation of growth performance traits in three strains of broiler chickens reared in semi-Arid zone of Nigeria. *International Journal of Innovative Research and Advanced Studies* 5 (3): 276-280

Ajayi, F. O. and Ejiofor, O. 2009. Effects of genotype X Sex interaction on growth and some development characteristics of Ross and Anak broiler strains in the high forest zone of Nigeria. *Asian Journal of Poultry Science* 3 (2) 51-56

Akporhuarho, P. O. and Unukevwere J. U. 2015. Carcass and adipose tissue deposit characteristics of four strains of broiler chicken reared in a humid tropical environment. *Journal of Agriculture and Food Environment* 2: 115-121

Amao, S. R., Ojedapo, L. O. and Oso, O. E. 2015. Evaluation of two commercial broiler strain differing in efficiency of feed utilization. *Journal of New Sciences* 14: 1- 5

Atansuyi, A. J., Lasore, C. O. and Chineke, C. A. 2017. Growth performance characteristics and linear body measurements of four-chicken genotypes raised under intensive management system in South-Western Nigeria. *Applied Tropical Agriculture* 22(1): 122-127

Gwaza, D. S., Ochefu, J., and Victor, G. 2017. Strain by environmental interaction effects on broiler chicken performance in the derived southern guinea savannah region of Nigeria. *Journal of Research and Reports on Genetics* 1(1):18-22

Makka, N. 2016. Comparative study of three strains of broiler chickens using growths, biochemical profile and mathematical model. A M Sc.Dissertation submitted to school of Postgraduate Studies Ahmadu Bello University Zaria, Nigeria pp 32-37

Ojedapo, L. O. 2013. Evaluation of body weight and other linear parameters of Marshall broiler for repeatability estimates. *International Journal of Applied Agricultural and Apicultural Research* 9: 175-181

Ojedapo, L. O., Amao, S. R. and Aderibigbe, D. O. 2016. Evaluation of parameters needed to describe the growth traits of two commercial broiler strains. *Journal of Natural Science Research* 6 (4):96-101

Olawumi, S. O. and Dudusola, I. 2011. Assessment of long - term production traits of three strains of exotic commercial layers in the derived savannah zone of Nigeria. *Journal of Applied and Natural Science* 3(11): 20-24

Olawumi, S. O., Ogunlade, J. T. and Fajemilehin, S. O. 2012. Production traits of broiler chicken strains fed ad libitum and raised on deep litter system in the humid tropics. *Animal Research International* 9(1) 1529-1536

Sam, I. M. 2019. Influence of sex on relationship between morphometric trait measurement and carcass traits in broiler chicken raised in humid tropics. *Journal of Agriculture, Environmental Resource and Management* 4(1):395-403

SAS 2010. Statistical Analysis System. SAS Stat. Version 12. SAS Institute Inc. Gary NC 27513, U.S.A.

Taha, A. E., Abde, El -Ghany, F. A. and Sharaf, M. M. 2010. Strain and sex effect on productive and slaughter performance of developed local Egyptian and Canadian chicken strains. *Egyptian Poultry Science* 30(4): 1059- 1072

Udeh, I. and Ogbu, C. C. 2011. Principal component analysis of body measurements in three strains of broiler chicken. *Science World Journal* 6(2): 11-14

Yakubu, A. and Salako, A. E. 2009. Path coefficient analysis for body weight and morphological traits of Nigerian indigenous chicken. *Egyptian poultry science* 29(3) : 837-850.

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