GENETIC POTENTIAL FOR FEED UTILIZATION IN THREE STRAINS OF BROILER CHICKEN

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Abstract: Optimization of feed utilization is one of the main challenges in improvement programmes in poultry genetics. Feed utilization of one hundred and fifty day-old broiler chicks comprising of Arbo acre, Cobb and Marshall strains were appraised at the poultry unit of Department of Animal and Environmental Biology, Adekunle Ajasin University, Akungba-Akoko, Nigeria. Data was obtained on feed intake, body weight and feed efficiency and analyzed. Analysis of variance showed that Cobb strain had the highest body weight of 523.74±6.80 g at the end of the starter phase. This was followed by Marshall strain (501.75±1.75 g) while Arbo acre had the least body weight. Although the effect of strain was not significant on the daily feed intake at the starter phase, there was significant difference ($p<0.05$) in the feed intake among the strains at the finisher phase. Marshall strain had the highest average daily weight gain (186.52±1.78 g) and final body weight (1804.37±0.47 g) while Arbo acre had the least records of body weight gains. The effect of strain was also significant ($p<0.05$) on the feed efficiency of broilers at the finisher phase. Marshall strain had the highest feed efficiency followed by Cobb while Arbo acre had the least feed efficiency during the finisher phase. The effect of sex was significant ($p<0.05$) on the parameters at the finisher phase with males having higher values than the female broilers. In conclusion, Marshall strain had better genetic potential for utilization of feed than Cobb and Arbo acre broiler strains.

Keywords: Broiler, feed efficiency, feed intake, strain, weight gain

Introduction

In the last few decades, poultry industry has played an important role in meeting the shortage of animal protein through the increased availability of eggs and meat in Nigeria (Amao *et al*., 2015). White meat such as chicken meat is superior to red meat because of its comparatively low fat content and low cholesterol level (Jaturasitha *et al.,* 2008). Broiler birds among other species of poultry have the potential of providing quality protein to the populace owing to its short generational interval (Saadu*et al.,* 2018). However, the cost of feeding is of primary concern as the major cost of broiler production is the cost of feeding. Optimization of feed efficiency is one of the main challenges in improvement programmes in poultry genetics (Sell-Kubiak *et al*., 2017).

Abdullah *et al.* (2010) reported that feed consumption and utilization could be linked to genetic makeup and environment. Olawumi and Dudusola (2011) reported significant strain differences in feed efficiency among different strains of chicken. Safiyu *et al*. (2016) also reported the significant effect of strain and season on feed intake, weight gain and feed conversion ratio of broilers. However, Zaman *et al.* (2015) found no significant difference in body weight and feed intake of Cobb, Hubbard and Arbo acre at 3rd and 4th weeks of age in Bangladesh. As stated by Ojedapo *et al*. (2016), the Nigeria poultry has over the years witnessed the introduction of different broiler strains. The common commercial strains of broiler are Cobb, Marshall and Arbo acre, among others. Breeding and selection strategies can therefore be exploited to achieve the best in the poultry industry.

This study was therefore carried out to evaluate the feed utilization of Marshall, Cobb and Arbo 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 46 mm Hg.

Experimental animals and management

One hundred and fifty (150) day-old broiler chicks comprising of Arbo acre, Cobb and Marshall strains were used for the study. The day old chicks were sourced from Zartech and Obasanjo farms and brooded for four weeks using charcoal stove as source of heat. They were fed with commercial broiler starter mash diet containing 2700 Kcal/kg metabolizable energy and 23% crude protein from day old to 4 weeks of age. They were later fed with commercial broiler finisher diet containing 2950 Kcal/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 the birds.

Data collection

Feed intake, weight gain and feed efficiency were determined for the broilers during the starter phase (0 – 4 weeks) and the finisher phase (5 – 8 weeks). Feed intake: A measured quantity of feed was given to different groups of birds in separated compartments. The quantity of feed left over was weighed and deducted from the quantity of initial feed to determine the feed intake within 24 h. The daily feed intake for each bird was estimated from the group feed consumption.

Weight gain: This was taken as the deduction of initial weight from the final weight.

$$Total\ \ feed\ efficiency = \frac{total\ weight\ gain}{total\ \ feed\ \text{int}\ ake}$$

Statistical analysis

Data obtained from the measurements were subjected to analysis of variance (SAS 2010). The linear model is as specified below:

$$Y_{ijk} = \mu + A_i + B_j + e_{ijk}$$

Where: Y_{ijk} = the parameter or interval; μ = overall mean for the parameter of interest; A_i = Fixed effect of ith strain (i=1-3); B_j = Fixed effect of jth sex (j=1-2); e_{ijk} = random error associated with each record (Normally = Independently and identically distributed with zero mean and variance ($\delta^2 e$)

Results and Discussion

The body weights, feed intake and feed efficiency of Arbo acre, Cobb and Marshall broiler chicken at the starter phase (0 – 4 weeks) are presented in Table 1. Cobb strain had the highest body weight of 523.74±6.80 g at the end of the starter phase of rearing the broilers. This was followed by Marshall strain (501.75±1.75 g) while Arbo acre had the least body weight at the end of the starter phase. The superiority of Cobb broiler in body weight at the starter phase observed in this study was in line with the findings of Amao *et al.* (2015) that the Cobb strain of broiler appeared to be superior to Marshall strain in terms of body weight at the starter phase. The effect of strain was not significant ($p< 0.05$) on the average feed intake at the starter phase. All the strains of broiler studied had similar average feed intake. This corroborated the report of Rahimi *et al*. (2006) that the variations in daily feed intake among strains of broiler were not significant during the starter phase. Saadu *et al.* (2018) also reported similar feed intake at starter phase for Arbo acre and Marshall strains. Saki *et al.* (2010) found no significant difference in feed intake and feed conversion ratio of Cobb and Arbo acre strains raised in Iran.

Contrary to the report of Amao *et al*. (2015) that the average daily gain of Cobb was better than the Marshall strain of broiler at the starter phase, Cobb and Marshall strains had similar average daily weight gain at the starter phase in this study. Nevertheless, the highest total weight gain was recorded for Cobb strain followed by Marshall strain while Arbo acre had the least weight gain of 437.12 ± 4.97 g at the end of the starter phase as shown in Table 1. Cobb had the highest feed efficiency followed by Marshall strain while the least feed efficiency was recorded for Arbo acre strain during the starter phase in this study. This corroborated the report of Amao *et al.* (2015) that Cobb had better feed efficiency than Marshall strain.

Table 1: Feed utilization as affected by strain at the starter phase (0 – 4 weeks)

Parameters	Arbo acre	Cobb	Marshall
FBDW, g	477.11 ± 3.98^{c}	523.74 ± 6.80^{a}	501.75 ± 1.75^{b}
ADFI, g	55.28 ± 0.29^{a}	55.35 ± 0.21^{a}	55.38 ± 0.18^{a}
ADWG, g	25.62 ± 0.51^{b}	27.28 ± 1.20^{a}	28.49 ±1.12^{a}
TWG, g	437.12 ± 4.97^{c}	483.75 ±10.20^{a}	461.76 ± 5.98^{b}
TFI, g	1547.84 ± 8.12^{a}	1549.00 ± 5.88^{a}	1550.64 ± 5.04^{a}
Feed Efficiency	0.28 ± 0.03^{c}	0.34 ± 0.02^{a}	0.30 ± 0.01^{b}

^{abc} Mean on the same row with different superscripts are significantly ($p< 0.05$) different; *FBDW = Final body weight , ADFI = Average daily feed intake, ADWG = Average daily weight gain , TWG = Total weight gain TFI = Total feed intake.*

Table 2: Feed utilization as affected by strain at the finisher phase (5 – 8 weeks)

Parameters	Arbo acre	Cobb	Marshall
FBDW, g	1683.43±25.06^{c}	1760.16±59.86^{b}	1804.37±50.47^{a}
ADFI, g	130.17±0.40^{a}	115.24±0.27^{b}	100.21 ± 0.24^{c}
ADWG, g	143.08±1.21^{c}	154.16±0.96^{b}	186.52 ± 1.78^{a}
TWG, g	1206.32±11.08^{c}	1236.42±10.06^{b}	1302.62±13.68^{a}
TFI, g	3644.76±11.20^{a}	3226.72±7.56^{b}	2805.88 ± 9.12^{c}
Feed Efficiency	0.33 ± 0.01^{c}	0.38 ± 0.02^{b}	0.46 ± 0.04^{a}

^{abc} Mean on the same row with different superscripts are significantly ($p< 0.05$) different; *FBDW = Final body weight, ADFI = Average daily feed intake, ADWG = Average daily weight gain , TWG = Total weight gain, TFI = Total feed intake.*

Table 2 showed the body weight, feed intake and feed efficiency of Arbo acre, Cobb broiler and Marshall broiler at the finisher phase (5 – 8 weeks). Marshall strain had the highest body weight of 1804.37± 50.47 g followed by Cobb with a weight of 1760.16 ±15.38 g while Arbo acre had the least body weight of 1683.43 ± 25.06 at 8 weeks. The report of Atansuyi *et al.* (2017) showed 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 Arbo acre and Hubbard strain of broilers in the derived guinea savannah region of Nigeria.

Although the effect of strain was not significant on the daily feed intake at the starter phase, there was significant difference ($p<0.05$) in the feed intake among the strain at the finisher phase. The highest average daily feed intake (130.17 ± 0.40 g) was recorded for Arbo acre compared to Cobb with the intake of 115.24 ± 0.27 g and Marshall strain with 100.21 ± 0.24 g at the finisher phase as shown in Table 2. This was in line with the report of Rahimi *et al*. (2006) that daily feed intake among strains was not significant during the starter but was significant during the finisher phase.

Despite that, Arbo acre consumed more feed than the two other strains during the finisher phase; Marshall strain had the highest average daily weight gain and total weight gain while Arbo acre had the least record of body weight gains. Gwaza *et al*., (2017) also found that Marshall had higher daily body weight gain than Hubbard and Arbo acre. Amao *et al.* (2015) however reported that the average daily weight gain of Cobb was better than the Marshall strain of broiler both at the starter and the finisher phase. Saadu *et al*. (2018) reported similar feed intake, feed conversion ratio and average body weight gain at finisher phase of Arbo acre and Marshall strains. Abd-Elwahab (2016) however found no significant difference in feed intake of Arbo acre and Cobb strains.

The effect of strain was also significant ($p<0.05$) on the feed efficiency of broilers at the finisher phase. Comparatively, Marshall strain had the highest feed efficiency followed by Cobb strain while Arbo acre had the least feed efficiency during the finisher phase as shown in Table 2. According to Olawumi *et al* (2012), genotype and age of birds had highly significant effect on all the performance traits of broiler chicken.

In this study average feed intake as well as the total feed intake was higher at the finisher phase (5 – 8 weeks) than the starter phase (0 – 4 weeks) in all the strains. This is in line with the report of Abdullah *et al.* (2010) that there was increase in the feed intake and body weight as birds advance in age.

The final body weights, feed intake, weight gains and feed efficiency of male and female broilers at the starter phase (0 – 4 weeks) are presented in Table 3. The effect of sex was not significant ($p>0.05$) on most of the parameters at this phase. Male and female broilers had similar final body weight, average daily weight gain total weight gain and feed efficiency. However, the total feed intake was slightly higher in male broilers than female broilers during the starter phase. Nogueira *et al*. (2019) also recorded similar feed intake and feed conversion for male and female Cobb broilers at starter phase.

Table 3: Feed utilization as affected by sex at the starter phase (0 – 4 weeks)

Parameters	Male	Female
FBDW, g	520.75 ± 2.87^{a}	519.63 ± 3.61^{a}
ADFI, g	56.39 ± 0.22^{a}	55.26 ± 0.11^{a}
ADWG, g	27.16 ± 0.96^{a}	26.97 ± 0.75^{a}
TWG, g	480.60 ± 3.78^{a}	475.28 ± 4.62^{a}
TFI, g	1578.92 ± 9.28^{a}	1547.28 ± 11.17^{b}
Feed Efficiency	0.30 ± 0.01^{a}	0.31 ±0.02^{a}

^{abc} Mean on the same row with different superscripts are significantly ($p< 0.05$) different; *FBDW = Final body weight, ADFI = Average daily feed intake, ADWG = Average daily weight gain, TWG = Total weight gain, TFI = Total feed intake.*

Table 4: Feed utilization as affected by sex at the finisher phase (5-8weeks)

Parameters	Male	Female
FBDW, g	1800.78 ± 34.56 [a]	1740.50 ± 25.60[b]
ADFI, g	135.26 ± 2.34[a]	100.28 ± 3.22[b]
ADWG, g	175.71 ± 3.72[a]	143.60 ± 5.96[b]
TWG, g	1280.03 ± 15.68[a]	1220.87 ± 21.62[b]
TFI, g	3787.28 ± 10.23[a]	2807.84 ± 21.10[b]
Feed Efficiency	0.34 ± 0.11[a]	0.43 ± 0.09[a]

[abc] Mean on the same row with different superscripts are significantly ($p< 0.05$) different; *FBDW = Final body weight, ADFI = Average daily feed intake, ADWG = Average daily weight gain, TWG = Total weight gain, TFI=Total feed intake.*

Sexual dimorphism was observed in the feed utilization of the broilers at the finisher phase. Male had higher values for final body weight, average daily feed intake, average daily weight gain, total weight gain and total feed intake as shown in Table 4.

The results is corroborated by the report of Abdullah *et al*. (2010) that males had higher body weight, average daily gain and feed intake when compared to female broilers. Rahimi *et al*. (2006) also reported that differences in daily feed intake were significant between male and female chicks during the growing period with male having higher values.

Conclusion

Genetic variation existed in the feed utilization by different strain of broilers in this study. Cobb strain had the highest body weight only at the end of the starter phase of rearing the broilers. Although the effect of strain was not significant on the daily feed intake at the starter phase, there was significant difference in the feed intake among the strain at the finisher phase. Arbo acre consumed more feed than the two other strains during the finisher phase, Marshall strain had the highest average daily weight gain and total weight gain while Arbo acre had the least record of body weight gains which indicated that the strain has low feed conversion to flesh. Marshall strain had the highest feed efficiency when compared with Cobb and Arbo acre at the finisher phase. The effect of sex was not significant on feed utilization at the starter phase however male had higher values for the parameters at the finisher phase.

Conflict of Interest

Authors have declared that there is no conflict of interest reported in this work.

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