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Evaluation of two commercial broiler strains differing in efficiency of feed utilization.

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Abstract - This study was conducted to evaluate the effects of strains on feed conversion efficiency of commercial broiler chickens reared on full-feeding, and under the same housing, feeding regime, agro-climatic zone and management practices. A total number of 150 broiler day old chicks comprising of 75 day-old Cobb chicks and 75 day-old Marshall chicks were used for the study, and raised on deep litter in separate pens for 56 days (8 weeks). Data collected include initial live weight and final live weight. This was done on daily basis and at the end of each week, the average is found to get the average daily gain and average daily feed intake as well as the feed conversion efficiency. Analyzed results showed that genotype had highly significant effects on all parameters evaluated on the two broiler chickens compared. The Cobb strain appeared superior to the Marshall strain in terms of initial body weight (48.00g vs 35.00g) and final body weight (1423.00g vs 114.69g) and thereby showing superiority in the average daily gain (66.05g/bird/day). As regards feed conversion, Marshall was statistically poorer both at the starter phase and the finisher phase with Cobb performing better. Cobb was adjudged good and profitable because the strain had the highest mean value (1423.00g) in body weight coupled with the feed conversion efficiency at maturity but adding more with feed consumed when compared with Marshall, and therefore could be recommended to poultry farmers in this zone for increased productivity, income generation and maximum profit.

Keywords: Broiler strains / feed intake / body weight gain / feed conversion efficiency

1. Introduction

Today's broiler industry has undergone a tremendous development and expensive during the last couple of decades around the world. The body weight gain of the broiler strains has been markedly increased, and the feed utilization has been strongly improved with the advancement of new technology applied in poultry nutrition as well as in genetics. This progress in breeding and nutrition has resulted in broiler strains having higher performances today than ever before (Anthony, 1998).

As a primary source of animal protein, the poultry sector offers a valuable repository to bridge the gap between demand and the availability of balanced nutrition. In the last two 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. Poultry production, particularly broiler production is the quickest way to increase the availability of high quality protein for human consumption. Since the feed cost alone contributes to about 60-70% of the total cost of production, economically poultry production is, therefore, possible only when the feed cost is reduced and efficiency of feed utilization is increased (Qureshi,1991).The production of low quality feed has created variety of problem for the broiler industry resulting in poor performance and lower returns. Some valuable nutrients in feed are wasted because the birds are not able to utilize them. This may be due to several reasons like lack of digestive enzymes,

insufficient time for digestive activity, sub clinical infection and inadequate processing of feed ingredient (Evens and David, 1991).

In Nigeria, the poultry industry is going through a gradual but definite change in product differentiation in response to consumer and industry demands. To implement these changes, genetic improvements have focused generally on selection for growth rate, feed efficiency and carcass characteristics. However, there are varying reports on genetic estimates of broilers for various characteristics. Amao *et al*., (2011); Ojedapo *et al* .,(2008); Oluyemi and Roberts, (2000) suggested the need to generate these baseline data for any future improvements efforts in this regard. As a result of these genetic changes made to broiler chickens to improve productions traits, there is need to evaluate various strains. Based on these strains, this study was focused on determining the effect of strains on feed efficiencies utilization of two commercial broiler chickens reared in deep litter system.

2. Materials and methods

2.1. Experimental site

The experiment was carried out at the Poultry unit of the Teaching and Research Farm, Ladoke Akintola University of Technology, Ogbomoso, Nigeria. It is located on Longitude $4^{0}15^{1}$ E and Latitude $8^{0}7^{1}$ N. It is about 145 km North-East of Ibadan, the capital of Oyo State. The altitude is 600 metres above sea level and the mean annual temperature of 27^{0}C with mean rainfall of 1247mm (Ojedapo, 2013).

2.2. Experimental birds and management

A total number of one hundred and fifty birds (150) were bought which were of two strains named Marshall and Cobb. The two broiler strains were purchased from reputable hatcheries at day old while Marshall strain was purchased from Obasanjo Farms, Cobb strain was got from Zartech both in Ibadan. Other materials used were sourced for based on their uses. These include feeders, drinkers, vaccines, drugs, anti-stress vitamins and lighting materials.

Prior to the arrival of the birds, the house was made ready for the birds to be comfortable taking into consideration the fragility of the birds. This was done by cleaning, washing sanitizing at least a week before the arrival of the birds. Lighting facility was already on ground as well as charcoal in case of power outage. Lighting is essential to keep the internal and ambient temperature constant at least for the first two weeks. The birds were separated into different pens based on strain. Brooding was done for the first four weeks. This procedure involves constant supply of lighting, feeding, vaccination, drug application as well as constant monitoring which is the most important management practice. The birds were vaccinated according to standard practices and medicated as the need arises based on diagnoses and symptoms shown by the birds. Right from the first day, birds were supplied feed and water *ad libitum*.

2.3. Feed and feeding

The birds were fed *ad libitum* on a standard broiler starter ration containing 24% crude protein and 2900kcal/kgME for four weeks of age followed by a finisher diet containing 21% crude protein and 2800kcal/kgME from five weeks till the end of the experiment at 8 weeks. Water and feed were also available *ad libitum* to the birds.

2.4. Collection of data

All birds were subjected to the same method of data collection. The measurements that were taken are: body weight gain (This was determined as a difference between the final live weight and the initial live weight measured in kilogram with scale every week), body weight gain, feed intake (This was measured by determining the difference between the feed supplied and the left-over on a weekly basis.

-Feed intake =(Feed supplied – Left-over),

-Feed/gain ratio (This was determined by relating the kilogram of feed intake to the kilogram of weight gain.

-Feed to gain ratio = Feed Intake ÷ Weight gain) and feed conversion efficiency (This measure was obtained by dividing the weight gain by feed intake.

-FCE = Daily weight gain÷ Daily feed intake).

2.5. Statistical analysis

Data obtained was subjected to Analysis of Variance (ANOVA) using the General Linear Method (GLM) of SAS (2003) with the student T-test of the same procedure used to separate the means (SAS, 2003). The model below was adopted:

$Y_{ij} = \mu + T_i + E_{ij}$

Where Y_{ij} = Observation on each strain, μ = Population mean, T_i = Treatments carried out (Strain effect)^{jth}, E_{ij} = Error in the distribution.

3. Results

The mean values of the live weight gain, feed conversion efficiency and feed intake at starter phase is presented in table 1. There was significant ($P<0.05$) difference between the strains. At the starter phase, there was noticeable increase in the average daily feed intake and feed conversion efficiency from Week 1 to Week 4 for both strains. The average daily feed intake for Cobb and Marshall strain of broilers at Week 1 were 11.67g/b/day and 5.10g/b/day respectively while at Week 4, their average daily feed intake for both strains were 152.70g/b/day and 125.07g/b/day respectively. Also, the feed conversion efficiency at this phase for Cobb and Marshall strain of broilers were 0.76 and 0.44 while at Week 4, it had increased to 1.78 and 2.43 respectively. Comparing strains, Cobb strain showed superiority over Marshall strain for average Daily feed intake in Week 1, Week 3 and Week 4 with values 11.67g/b/day, 59.40g/b/day and 152.70g/b/day as against the Marshall strain having 5.10g/b/day, 56.33g/b/day and 125.07g/b/day for the weeks under consideration. However, Marshall birds had higher average daily feed intake in Week 2 with 40.80g/b/day while Cobb birds had 38.47g/b/day.

Also the Cobb strain showed better performance considering average daily gain. They gained more weight when considering the data for Week 1, Week 2 and Week 4 with values, 15.46g/b/day, 29.12b/g/day and 85.80g/b/day while Marshall birds had 11.70g/b/day, 21.93g/b/day and 51.36g/b/day as their values for the weeks considered. But Marshall birds showed superiority in Week 3 by gaining more weight with average daily gain of 36.48g/b/day than Cobb birds which had 36.23g/b/day as their value. However, the feed conversion efficiency for Cobb strain had superiority over their Marshall counterpart in Week 1 and Week 3 with values 0.76 and 1.64 respectively while Marshall strain had 0.44 and 1.86 as their values for the weeks under considered. For Weeks 2 and 4, Marshall birds showed better performance by having values 1.86 and 2.43 respectively as against their Cobb counterpart which had 1.32 and 1.78 for the second and fourth weeks considered. Cobb strain performed better than Marshall strain at this phase considering the parameters under examination. Their performance spanned for three weeks while Marshall birds were favoured for one week at the starter phase for average daily feed intake, average daily gain and feed conversion efficiency.

Table 1: Means and standard errors of live weight gain, feed conversion efficiency and feed intake as affected by strains at starter phase

VARIABLES	STRAINS	STARTERPHASE			
		WEEK 1	WEEK 2	WEEK 3	WEEK 4
Initial weight(g/b/d)	Cobb	48.00±2.88	156.20±6.75	360.05±10.38	613.69±36.10
	Marshall	35.00±3.47	116.91±9.10	270.41±32.47	525.80±30.48
Final Weight(g/b/d)	Cobb	156.20±32.35	360.05±40.35	613.69±45.30	960.68±83.49
	Marshall	116.91±28.40	270.41±38.47	525.80±50.47	885.35±87.32
ADFI(g/b/d)	Cobb	11.67±0.10^{a}	38.47±3.01^{b}	59.40±4.12^{a}	152.70±0.34^{a}
	Marshall	5.10±0.13^{b}	40.80±6.12^{a}	56.33±3.15^{b}	125.07±0.23^{b}
ADG(g/b/d)	Cobb	15.46±2.01^{a}	29.12±3.01^{a}	36.23±6.01^{b}	85.80±6.01^{a}
	Marshall	11.70±1.01^{b}	21.93±2.01^{b}	36.48±3.01^{a}	51.36±6.01^{b}
FCE	Cobb	0.76±0.01^{a}	1.32±0.01^{b}	1.64±0.01^{a}	1.78±0.01^{b}
	Marshall	0.44±0.01^{b}	1.86±0.01^{a}	1.55±0.01^{b}	2.43±0.01^{a}

^{ab}means of the same row at each week with different superscript are significantly ($P<0.05$) different
ADFI= average daily feed intake; ADG= average daily gain; FCE= feed conversion efficiency

The mean values of the live weight gain, feed conversion efficiency and feed intake at finisher phase was shown in table 2. It also reflected a significant (P<0.05) difference between the strains considered and the variables measured. Between the strains, Cobb broilers were superior to the Marshall broilers for average daily feed intake as it showed better performance at the finisher phase. For weeks considered, Cobb birds performed better in Week 5 and Week 7 with values 195.03g/b/day and 251.67g/b/day while Marshall birds values were 175.10g/b/day and 249.03g/b/day respectively for the weeks considered. However, Marshall birds performed better than its Cobb birds counterpart in Week 6 by having 109.70g/b/day as its value while Cobb birds had 104.13g/b/day as its value. Also, for the average daily gain, Cobb birds were superior in Weeks 5 and 7 while Marshall birds performed better in Week 6 and Week 8. Cobb birds had values 66.05g/b/day and 60.38g/b/day respectively for the weeks they were superior while Marshall birds had 69.99g/b/day and 71.98g/b/day for the weeks they were superior. For Weeks 5 and 7, Marshall birds values were 36.48g/b/day and 52.96g/b/day respectively while for Weeks 6and 8, Cobb birds values were 64.45g/b/day and 71.22g/b/day respectively.

For feed conversion efficiency, there was also significant difference between the strains with Cobb broilers showing superiority in Weeks 6 and 7 while Marshall birds showed better feed conversion efficiency in Week 5. Cobb birds had values 1.61 and4.70 while Marshall birds had 1.57 and4.17 in Weeks 6 and 7 respectively while in the 5th week, Cobb birds had 2.95 as their value while Marshall birds had 4.80 as their value and by that showed superiority. Within the weeks, Cobb birds showed superiority in the average daily feed intake and average daily gain while Marshall birds were better in the feed conversion efficiency in Week 5. In Week 6, Marshall birds were better when the parameters evaluated were considered with Marshall birds showing better results for average daily feed intake and average daily gain while Cobb birds showed superiority for feed conversion efficiency. Week 7 result showed that Cobb birds were superior in all the parameters considered. These parameters were average daily feed intake, average daily gain and feed conversion efficiency.

Table 2: Means and standard errors of live weight gain, feed conversion efficiency and feed intake as affected by strains at finisher phase

VARIABLES	STRAINS	FINISHER PHASE			
		WEEK 5	WEEK 6	WEEK 7	WEEK 8
Initial weight(g/b/d)	Cobb	960.68±10.32	1423.03±9.47	1874.20±10.35	2296.84±50.88
	Marshall	885.35±9.30	1140.69±8.88	1630.60±9.88	2001.29±40.99
Final Weight(g/b/d)	Cobb	1423.00±10.48	1874.20±90.24	2296.84±9.72	2795.38±32.32
	Marshall	1140.69±8.24	1630.60±88.82	2001.29±6.60	2505.12±40.49
ADFI(g/b/d)	Cobb	195.03±0.42^{a}	104.13±9.38^{b}	251.67±9.41^{a}	105.17±3.26^{a}
	Marshall	175.10±0.44^{b}	109.70±9.49^{a}	249.03±6.69^{b}	108.73±0.43^{b}
ADG(g/b/d)	Cobb	66.05±3.01^{a}	64.45±2.01^{a}	60.38±3.01^{b}	71.22±7.01^{a}
	Marshall	36.48±2.01^{b}	69.99±3.01^{b}	52.96±4.01^{a}	71.98±6.01^{b}
FCE	Cobb	2.95±0.01^{a}	1.61±0.01^{b}	4.70±0.01^{a}	1.52±0.01^{b}
	Marshall	4.80±0.01^{b}	1.57±0.01^{a}	4.17±0.01^{b}	1.51±0.01^{a}

^{ab}means of the same row at each week with different superscript are significantly (P<0.05) different
ADFI= average daily feed intake; ADG= average daily gain; FCE= feed conversion efficiency

4. Discussion

The current results on the two commercial broiler strains were an indication that these strains have different genetic potentials for growth and that the strains studied have different ancestors. This was in agreement with Gonzales *et al.*,(1998) who found strain effects among several strains of birds in live weight. Korver *et al.*,(2004) also reported that genotype may affect the body weight of poultry birds.

From the results from both starter phase and finisher phase, it showed that there were differences in the average daily gain. This result agreed with those obtained in the previous studies (Leeson *et al*., 1997; Faran *et al.*, 2000a; Faran *et al*., 2000b) who reported marked strain differences for body weight in

chickens. The marked difference in body weight between the strains considered starting from the early and final week was noticeable as Cobb birds gained more weight as they consumed more than Marshall birds. This was in concordance with the findings of Abdullah *et al.*,(2010) who noted that this could be linked to the genetic make-up and environment. Feed conversion efficiency (FCE) of Cobb birds was found to be superior to Marshall birds in this study. This performance might be partly due to the capacity of this strain (Cobb) to consume greater quantities of feed as well as genetic make-up, resulting in higher intakes and hence greater live weight, weight gain and improved FCE than in Marshall strain. The improved FCE of Cobb birds indicates that this strain is more efficient in converting feed to meat more rapidly than in other strains. This is in an agreement with Gonzales *et al.*,(1998) who reported that FCE value may differ due to the interaction of genotype amongst the strains.

With regards to feed intake and age, there was increase in feed consumption as the birds advanced in age, and this increment occurred between the strains. This result showed that the average daily feed intake increased at this phase for both strains at the starter phase thus was in agreement with Rondelli *et al.*, (2003); Zhao *et al.*, (2009) and Taha *et al.*,(2010) that strains differed in growth rate and weight as they consume feeds at different ages. Their findings also corroborated those of Pingel *et al.*, (1990) who reported that age was the major determinant of growth and physiological development in chicks which is linked with feed intake. However, at the finisher phase, there was intermittent increase and decrease in the feed intake as birds age between the strains. This fluctuation could be linked with management practice as well as other environmental factors. Thus, this fluctuation result agreed with those of Leeson *et al.*, (1997); Rondelli *et al.*, (2003); Taha *et al.*, (2010) and Amao et al., (2011) who found significant differences in feed intake among strain of chickens.

At the starter phase, Cobb birds consumed more than Marshall birds in Weeks 1, 3 and 4 as this reflected in the average daily feed intake. This was further corroborated in the result at the finisher phase as Cobb birds consumed more than their Marshall birds counterpart in Weeks 5 and 7 while Marshall birds consumed more in Week 2 at the starter phase and Week 6 at the finisher phase. Cobb birds consumed feed to gain more meat. This indicates that Cobb broilers achieved heavier body weight and higher weight gain than the other strain. The improved body weight gain of this strain, possibly due to higher feed intake and several other factors might be involved herewith which was in agreement with the reports of several other previous researchers (Gonzales *et al.*, 1998; Sarker *et al.*, 2001 and 2002; Abdullah *et al.*, 2010), who found similar variations in rearing different strains in experimental condition.

Normally, one of the major criteria of identifying high performing strain is through the feed conversion efficiency. This was in agreement with Cahaner *et al.*, (1987); Cabel and Waldroup, (1991); Smith and Pesti, (1998); Rezaei *et al.*, (2004) who stated in their various researches that feed conversion efficiency and growth rate are traditionally the normal way of appraising the performance of broiler strains. Hence, the importance of feed conversion efficiency. The results obtained from the data were consistent with previous studies in literature (Rondelli *et al*., 2003; Taha *et al.*, 2010). The researchers found significant strain differences in feed conversion among chicken breeds. This was found between the strains considered both at the starter phase and at the finisher phase for this study. The result was not in line with Rondelli *et al*.,(2003) and Taha *et al*.,(2010) who said that feed conversion ratios decreased with advancing age of the birds. This was not so from the result as it was seen especially at the finisher phase that the feed conversion efficiency was intermittently increasing and decreasing. This could be due to management practice. The result of this study for feed conversion efficiency corroborates the findings of Adebambo *et al.*, (2008) and Olawumi and Dudusola (2011) who reported significant breed differences in feed efficiency among different strains of chickens. In general terms, there was consistent increase in body weight with advancing age of the birds regardless of bird's genotype. In addition, feed conversion efficiency showed significant difference between the strains in the weeks the experiment lasted with Cobb birds showing superiority.

5. Conclusion

It could be seen from the result that genotype of birds had significant effect on performance traits of broiler chicken strains especially feed conversion efficiency, average daily gain and average daily feed intake. From the results, it was obtained that Cobb birds performed better and were superior to Marshall

for feed conversion efficiency both at the starter phase and the finisher phase. Also, for other parameters examined, Cobb birds performed better in most weeks. It was better for at the average daily gain and average daily feed intake. The result also showed that the two strains considered significantly differed in terms of their final live weight. For feed intake, Cobb birds consumed more than Marshall birds and for profitability, Cobb birds were better because it consumed more to add more meat thereby increasing its final live weight.

6. Reference

Abdullah, Y., Abdullah, Nafez A., Al-Beitawi, M.S., Rjoup., Qudsieh, I. and Majdi, Ishmais, A.A.(2010). Growth performance, carcass and meat quality characteristics of different commercial crosses of broiler strains of chicken. *Journal of Poultry Science*, 47: 13-21.

Adebambo, A. O., Ikeobi, C. O. N., Ozoje, M. O. and Oduguwa, O. O. (2008). Genetic variation in feed efficiency among pure and crossbred meat type. *Nigerian Poultry Science Journal*, 5(2): 61 – 69.

Amao, S.R., Ojedapo, L.O. and Sosina, O.A. (2011). Evaluation of growth performance traits in three strains of broiler chickens reared in derived savannah environment of Nigeria. *World Journal of Young Researchers*, 1(2): 28-31.

Anthony, N.B. (1998). A review of genetic parameters in poultry. Efforts to improve meat quality. *Journal of Muscle Foods*, 9:25-33.

Cabel, M.C. and Waldroup, P.W. (1991). Effect of dietary protein level and length of feeding on performance and abdominal fat content of broiler chickens. *Poultry Science*, 70:1550-1558.

Cahaner, A., Dunnington, E.A., Jones, D.E., Cherry, J.A. and Siegel, P.B. (1987). Evaluation of two commercial broiler male lines differing in efficiency of feed utilization. *Poultry Science*, 66:1101-1110.

Evens, T. and David, M.(1991). Crusade against malnutrition. *Poultry International*. Oct. 6.

Faran, M. T., Khalil, R. F., Uwayjan, M. G. and Ashkarian, V. M. (2000a). Performance and carcass quality of commercial broiler strains. *Journal of Applied Poultry Research*, 9: 252 – 257.

Faran, M. T., Khalil, R. F., Uwayjan, M. G. and Ashkarian, V. M. (2000b). A comparative study of productive and physiological performance between two local strains of chicks. *Egyptian Poultry Science*, 30(1): 297 – 316.

Gonzales, E.,Buyse, J.,Loddi, M.M.,Takita, M.S., Buys, N. and Decuypere, E. (1998). Effect of feed restriction on broiler performance. *British Poultry Science*, 39:671–678.

Korver, D.R., Zuidhof, M.J. and Lawes, K.R. (2004). Performance characteristics and economic comparison of broiler chickens fed wheat-and triticale-based diets. *Poultry Science*, 83: 716-725.

Leeson, S., Caston, L. and Summers, J. D. (1997). Layer performance of four strains of Leghorn Pullets subjected to various rearing programs. *Poultry Science*, 76: 1 – 5.

Ojedapo, L.O., Akinokun O., Adedeji T.A., Olayeni T.B., Ameen S.A. and Amao S.R. (2008). Effect of strain and sex on carcass characteristics of three commercial broilers reared in deep litter system in derived savannah area of Nigeria. *World Journal of Agricultural Sciences*, 4:487-491.

Ojedapo, L.O. (2013). Effect of age and sex on serological indices of Japanese quail (*Cortunix japonica*) reared in derived savanna area of Nigeria. *Journal of Environmental Issues and Agriculture in Developing Countries*, 5(2): 1-9.

Olawumi, S.O. and Dudusola, I. (2011). Assessment of long-term production traits of three breeds of exotic commercial layers in the derived savannah zone of Nigeria. *Journal of Applied and Natural Science*, 3(1):20-24.

Oluyemi, J.A. and Roberts, F.A. (2000). Poultry Production in Warm Wet Climate. MacMillan Press Ltd London.

Pingel, H., Schneider, K. H. and Birla, M. (1990).Factors affecting meat quality in broilers. *Tierzucht*, 44(7): 300 – 301.

Qureshi, A.A. (1991). Selecting the best feeding and watering equipment. *Misset World Poultry*,7:17-19.

Rezaei, M., Nassiri, H., Moghaddam, Pour Reza, J. and Kermanshasi, H. (2004). The effect of dietary protein and lysine levels on broiler performance, carcass characteristics and excretion. *International Journal of Poultry Science*, 3(2):148-152.

Rondelli, S., Martinez, O. and Garcia, P. T. (2003). Sex effect on productive parameters, carcass and body fat composition of two commercial broiler lines. *Revista Brasileira de Ciencia Avicola*, 5(3): 169 – 173.

Sarker, M.S.K., Islam, M.A., Ahmed, S.U. and Alam, J. (2002). Profitability and meat yield traits of different fast growing broiler strains in Winter. *Online Journal of Biological Science*, 2(6): 361-363.

SAS (2003). Statistical Analysis System (SAS) Users guide, version 9.2 SAS Institute, Cary NC, USA.

Smith, E.R. and Pesti, G.M. (1998): Influence of broiler strain cross and dietary protein on the performance of broilers. *Poultry Science*, 77:276-281.

Taha, A. E., Abd 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.

Zhao, J. P., Chen, J. L., Zhao, G. P., Zheng, M. Q., Jiang, R. R. and Wen, J. (2009). Live performance, carcass composition and blood metabolite responses to dietary nutrient density in two distinct broiler breeds of male chickens. *Poultry Science*, 88: 2575 – 2584.