Effect of strain and feed form growth performance of finisher broiler chickens

*[1]Nwali C. C.,[2] Amaefule K. U, [2]Obua B. E. [1]Ekwe O. O, [1]Iyaka S. A and [1]Ogunnupebi J. T.
[1] *Department of Animal Science, Faculty Agriculture and Natural Resources Management. Ebonyi State University, Abakaliki.*
[2] *Department of Animal Production and Livestock Management. Michael Okpara University, Umudike, Abia State.*
***Corresponding author:** celestinachinyeren@gmail.com, 08062349406

Abstract

Physical forms of diets and feed processing provides an opportunity to improve broiler performance which have a great effect on poultry yield (Amerah and Ravindran, 2008). The continuing effort made by breeders to produce broiler chickens with improved production traits necessitates continuing evaluation of various broiler strains. This study was conducted to determine the growth performance of three strains of broiler chickens fed two forms of feed (mash or pellet). A total of 60, four weeks old chicks of each Arbor Acres, Ross 308 and Cobb500 strains were randomly allocated to six treatments combination of three replicates of 10 birds each in a 3 X 2 factorial arrangement of a completely randomized design. The birds were fed ad libitum on a finisher diet pellet or mash containing 21% crude protein and 2850kcal/kg ME from five weeks to eight weeks of age. Growth performance parameters measured were final live weight (FLW), weight gain (WG), feed intake (FI), feed conversion ratio (FCR), daily Protein intake (DPI) and protein efficiency ratio (PER). Data were analyzed using the General Linear Model procedure of SPSS. There were significant (P < 0.05) effect among the strains and form of feed on the growth performance of the broiler chickens. Result obtained significantly (p<0.05) differ in final body weight gain due to differences in initial weight of the broiler chickens. Ross 308 strain was significantly different from arbor acre but not statistical different from cob 500.. The interaction between the strains and feed form on performance showed significantly interaction effect. It can therefore be concluded that feed form and strains of broiler chickens has various impact on growth performance due to variations in the physical quality of feed ,because broiler chickens fed pellet feed form exhibit advantages in rate and efficiency of growth . it is therefore suggested that farmers could use pellet to raise broiler chickens to make a better profit from them

Keywords: strains, form, pellet, mash, growth and performance

Effet de la souche et de la forme d'alimentation sur les performances de croissance des terminaux des poulets à griller

Résumé

Les formes physiques des régimes et le traitement des aliments offrent une opportunité d'améliorer les performances des poulets à griller, ce qui a un grand impact sur le rendement avicole (Amerah et Ravindran, 2008). L'effort continu des éleveurs pour produire des poulets à griller avec des caractéristiques de production améliorées nécessite une évaluation continue de diverses souches des poulets à griller. Cette étude a été menée pour déterminer la performance de croissance de trois souches des poulets à griller nourries avec deux formes d'aliment (mélange ou granulé). Un total de 60 poussins de quatre semaines de chaque souche Arbor Acres, Ross 308 et Cobb500 a été réparti au hasard en six traitements avec trois répétitions de 10 oiseaux chacun dans un arrangement factoriel 3 X 2 d'un design complètement randomisé. Les oiseaux ont été nourris ad libitum avec un régime de finition sous forme de granulés ou de mélange contenant 21 % de protéines brutes et 2850 kcal/kg ME de cinq à huit semaines

d'âge. Les paramètres de performance de croissance mesurés étaient le poids vif final (PVF), le gain de poids (GP), la consommation alimentaire (CA), le rapport de conversion alimentaire (RCA), la consommation quotidienne de protéines (CQP) et le rapport d'efficacité protéique (REP). Les données ont été analysées à l'aide de la procédure du Modèle Linéaire Général de SPSS. Des effets significatifs (P < 0,05) ont été observés entre les souches et les formes d'alimentation sur la performance de croissance des poulets de chair. Les résultats obtenus ont montré une différence significative (p<0,05) dans le gain de poids final en raison des différences de poids initial des poulets à griller. La souche Ross 308 était significativement différente de Arbor Acres mais pas statistiquement différente de Cobb 500. L'interaction entre les souches et la forme d'alimentation sur la performance a montré un effet d'interaction significatif. On peut donc conclure que la forme d'alimentation et les souches des poulets à griller ont divers impacts sur la performance de croissance en raison des variations dans la qualité physique de l'aliment, car les poulets à griller nourries avec des granulés présentent des avantages en termes de taux et d'efficacité de croissance. Il est donc suggéré que les agriculteurs pourraient utiliser des granulés pour élever des poulets à griller afin de réaliser de meilleurs profits.

Mots-clés : souches, forme, granulé, mélange, croissance et performance

Description of problem

In Nigeria, development of new broiler strains varies in performances and feed intake. Abdollahi *et al*. (2014) reported that, because of the high appetite for food by modern meat-type birds, their feed intake (FI) must be tightly monitored in order to achieve high genetic potential.

Broiler chicken production in Nigeria is a fast growing agricultural business (Agbede and Aletor, 2007). About 10% of the populace engage in broiler production (Agbede and Aletor, 2007; Ufele *et al*., 2015). According to Olawumi and Fagbuaro (2011), broiler production apart from providing high quality proteins, also serves as a source of income due to its quick returns on investment. Broiler meat is known for its tenderness, low fat content and low cholesterol level which have increased their consumption preference not only during the festive seasons but all year round (Olawumi and Fagbuaro, 2011). Broiler meat is also an important source of high quality protein, vitamins and minerals to human diets (Ufele *et al*., 2015).

The genetic, environmental (nutrition and climatic) factors and sex have been reported as the major factors that have significant influence on the growth performance and carcass characteristics of broiler chickens (1keobi and Peter, 1996; Ibeh and Nwosu, 1999; Peter, 2000; Adedeji *et al*., 2004; Malik *et al*., 2005; Olawumi and Fagbuaro, 2011; Olufunmilayo *et al*., 2015). Olufunmilayo *et al.* (2015) studied the effect of genotype on the growth performance characteristics of purebred and crossbred progenies of broiler chickens and reported significant differences in all the growth performance traits, with feed intake and the feed conversion efficiency increasing significantly as the birds advanced in age. Ikeobi and Peter (1996), Ibeh and Nwosu (1999), Peter (2000), Malik (2005) and Adedeji *et al*. (2006) also reported significant differences in the body weights of different broiler strains and pointed out that the trait is highly influenced by genetic factors. Orr *et al.* (1984) and Ojedapo *et al*. (2008) reported that breed had significant effect on the live weight of broiler chickens. According to Stringuini *et al*. (2003) and Abdullah *et al*. (2010), different broiler strains differed significantly in their feed intake, body weight gain and live weight. Abdullah *et al*. (2010) in a study using four strains of broilers at 12-14 days old, observed significant differences in the feed intake with Ross strain having 12.3% higher intake than other strains. Ferran *et al*. (2000) evaluated the performance characteristics of three

broiler strains (Arbo Acres, Lohman and Ross) at 1-21 days of age and found no significant effect of strain on the live weight of the birds. Mehaffey *et al*. (2006) in a comparative study with five broiler strains at 42 days of age observed similarities in the live weights of the five genetic groups, with the highest value being recorded for the Ross, which was 5.8% higher than the average weight of the other strains. The substantial effects of genotype on the performance characteristics of broiler chickens such as live weight, feed conversion ratio, carcass composition and internal organ characteristics have been reported by many researchers (Barbato, 1992; Fontana *et al*., 1993; Havenstein *et al*., 2003; Rondelli *et al*., 2003; Santos *et al*., 2004 and Ojedapo *et al*., 2008). According to Sheuerman *et al.* (2003), live weight as well as the feed intake and utilization in broiler chickens were influenced by the genetic make-up of the birds. A similar report was also given by Musa *et al*. (2006). Carborg *et al*. (2003) obtained significant strain differences on broiler bird's weight, feed intake and feed efficiency. Smith *et al*. (1998) also reported that the abdominal fat content as well as the carcass composition of broiler chickens varies with the gender of the birds. The present study was conducted to determine the response of three broiler strains (Ross 308, Cobb 500 and Abore acre) to mash or pellet diets. Broiler chicken strains in Nigeria are expensive, early marketing (5-6 weeks) and consume relatively higher quality feed. Also various feed millers produce different forms of feed. There is need therefore to determine the response of these different strains of broiler chickens fed different form of feed and feed of diferent/varying pellet sizes.

Materials and methods

The study was carried out at the Poultry Unit of the Teaching and Research Farm, Department of Animal Science, Faculty of Agriculture and Natural Resources Management, Ebonyi State University,Abakaliki, Ebonyi State. Abakaliki lies between Latitude 06^{o}14' and 06^{o}30' North with longitude08^{o}1' and 08^{o}15' East of the equator (Njoku *et al.,* 2020), at the elevation of 71.44m above sea level. Ebonyi State has a bimodal rainfall pattern (April to July and September to November) with a quick dry spell in August normally referred to as "August Break'. The area has minimum temperature of 27^{o}C and maximum mean daily temperature of 31^{o}C. Humidity is high (80%) during rainy season and low (60%) during dry season (Njoku *et al.,* 2020). The state is bordered with Cross River state in East, Abia State in South, Enugu State in the West and Benue State in the North. Rice, yam and cassava are the predominant crops cultivated by the people of the area (Onyeneke, 2010).

Experimental diets

The birds based on their strain were fed *ad-libitum* mash or pellet (2 mm) diets after one week of acclimatization on a starter broiler diet containing 19.15% crude protein and 3293kcal/kgME for four weeks, followed by a finisher diet containing 17.77% crude protein and 3258kcal/kgME from five weeks to eight weeks.

Table 1: Composition (%) of diets fed in the experiment three strains of broiler chickens at the finisher phase

Ingredient	Starter	Finisher
Maize	46.30	50.00
Soyabean	22.00	16.00
Palm kernel cake	14.00	16.00
Brewery Dry Grain	10.00	12.00
Bone meal	3.00	3.00
Premix*	0.25	0.25

Common salt	0.25	0.25
Methionine	0.10	0.10
Lysine	0.10	0.10
Total(%)	100	100
Calculated chemical compositions		
Crude protein (%)		
Crude fibre (%)	19.15	17.77
M.E. (Kcal)	5.98	6.22
Methionine (%)	3293	3258
Lysine (%)	1.32	1.41
Calcium (%)	1.51	1.92
Phosphorous (%)	1.57	1.37
Ca: P ratio	1.02	1.09
	0.35	0.32

*A vitamin, trace mineral mix manufactured by Piper feed which contains the following /kg: Vit A 10000iu; Vit. D 20,000iu; Vit. E2.5mg; Vit. K 20mg; riboflavin 4.2mg;20mg; Pantothenic acid 5mg; nicotinic acid; Chlorine-mg; Folic acid 5mg; methoionine 0.225mg; Mn 56mg; Iodine 1.0mg; Fe 20.0mg; Cu 10.0mg; Zn 50.0mg;Cobalt 1.25mg.

Birds and management

Sixty broiler chickens each of Arbor Acres, Ross 308 and Cobb 500 were purchased from CHI, Agrited and Zartech Farms Limited, respectively, in Ibadan, Oyo State, Nigeria. There were a total of 180 birds in all. The pens were cleaned, washed and sanitized a week before the arrival of the birds. The experimental design was laid out on a 3x2 factorial arrangement in a Complete Randomized Design (CRD). The factors are strains of broiler chickens at three levels (Arbor Acres, Ross 308 and Cobb 500) and forms of feed at two levels (mash and pellet). Each treatment was replicated three times, with 10 birds per replicate.

Statistical model

$\mathbf{Y_{ij} = \mu + S_i + F_j + (SF)_{ij} + \mathcal{E}_{ij}}$

$\mathbf{Y_{ij}}$ is the value of any observation**,** $\boldsymbol{\mu}$ is the mean value of the population; $\mathbf{S_i}$ is the effect of strain of the birds**;** $\mathbf{F_j}$ is the effect of form of feed**;** $\mathbf{(SF)_{ij}}$ is the interaction effect of strain and form of feed**;** $\boldsymbol{\mathcal{E}_{ij}}$ is the effect of experimental error.

Data analyses

All the data were analyzed using the GLM procedures of SPSS version 22, 2007. Differences among treatment means were separated using Duncan's New Multiple Range Test (DWMRT) according to Duncan (1955).

Results and discussion

Result on the effect of strain on performance of three strains of finisher broiler chickens fed mash or pellet diets are presented in Table 2.

The initial live weight of Cobb500 and final live weight of the Ross 308 strains fed mash or pellet were significantly ($p < 0.05$) different. The final live weight of the broiler strains were significantly ($p < 0.05$) similar among Ross 308 strain and Cobb500 but significantly differ from Arborcres strains of broiler chickens studied. Comparison of final weight of the broiler strains at the finisher phase showed that Ross 308 gained significantly ($p < 0.05$) more final weight gain than Cobb 500 and ArborAcres at finisher phase(8 weeks). This result was not in line with the findings of Amao *et al*. (2011) and Carborg *et al*. (2003) except in body weight who studied the

growth performance traits in various strains of broiler chicken and reported variation in the body weight, average daily weight gain, feed intake and feed conversion ratio among the broiler strains. .

Table 2: Effect of strain on performance of finisher broiler chickens

Parameters	Arbor-Acre	Ross 308	Cobb 500	P-value	SEM
Initial live weight (g/b)	379.75[c]	545.83[b]	683.33[a]	0.55	53.43
Final weight (g/b)	1950.00[b]	2318.33[a]	2158.33[ab]	0.03	10.53
Daily weight gain (g/b)	69.64	82.79	77.08	0.06	2.15
Daily feed intake (g/b)	151.19	149.58	150.63	0.76	1.55
Feed conversion ratio	2.17	1.81	1.95	0.07	0.29
Daily protein intake	33.26	32.90	33.13	0.08	0.46
Protein efficiency ratio	1.23	1.74	1.96	0.01	0.15

[a,b,c:] Means with difference superscript are significantly different (P < 0.05). SEM = Standard error of mean.

Effect of form of feed on performance of finisher broilers fed mash or pellet diets phase are presented in Table 3.There were no significant differences between the three strains of broiler chickens fed mash or pellet diets due to the similarities in nutrient composition of the two diets. .The result support the findings of Galobart and Morant (2005) and Salari *et al.* (2006) who reported that the form of diet had no significant effect on weight gain and dry matter intake. However, numerically, form of feed had a greater impact on the growth performance as mash diet resulted in lower ADG and ADFI than pellet diets during the finisher phase.

Table 3: Effect of feed form on performance of finisher broiler chickens

Parameters	Mash	Pellet	p-value	SEM
Initial weight (g)	261.11	261.11	1.00	7.86
Final live weight (g)	1970.00	2314.44	0.02	12.13
Daily feed intake (g)	105.70	107.26	0.22	1.20
Daily weight gain (g)	70.36	82.66	0.02	2.48
Feed conversion ratio	2.17	2.69	0.23	0.25
Daily protein intake (g)	16.78	15.78	0.06	0.47
Protein efficiency ratio	2.11	2.72	0.01	0.18

SEM = Standard error of mean.

Interaction effect of strains and feed form on performance of broiler chicken at the finisher phase is presented in Table 4.

The interaction effect of strain and form of feed on the performance of finisher broiler chicken was significant ($p < 0.05$) for strains of broiler chickens and form of feed. Cobb 500 broiler chickens fed pellet diet had significantly ($p < 0.05$) higher final live weight gain than Ross 308 chickens fed pellet and Arbor acres fed either mash or pellet diets. There were no significant ($P > 0.05$) differences between Ross 308 fed either mash or pellet, Cobb 500 fed mash and Arbor Acres fed pellet diet in final live weight. However, Ross 308 chickens fed mash had significantly ($p < 0.05$) higher daily weight gain compared to Ross 308 fed pellet, Cobb 500 fed either pellet or mash and Arbor acre fed mash diet. Ross 308 chickens had significantly ($p < 0.05$) lower daily feed intake than Arbor Acres broiler chickens fed either mash nor pellet diet and Cobb 500 broilers fed mash diet only. In terms of feed conversion ratio (FCR), Arbor Acres broilers fed mash diet had significantly ($p < 0.05$) higher FCR than Arbor Acres fed pellet, Ross 308 fed either pellet or mash and Cobb 500 fed either pellet or mash diets. Daily protein intake of the strains of broiler chickens fed either pellet or mash diets followed the same trend as daily feed intake.

Table 4: Interaction of strains and feed form on performance of finisher broiler chicken

Parameters	Feed form	ArborAcres	Ross 308	Cobb 500	P-value	SEM
Initial live weight (g/b)	Mash	212.83^{c}	418.33^{bc}	673.33^{a}	0.34	75.56
	Pellet	546.67^{b}	673.33^{a}	670.00^{ab}		
Final weight (g/b)	Mash	1653.33^{c}	2513.33^{ab}	1743.33^{bc}	0.30	14.89
	Pellet	2246.67^{b}	2123.33^{b}	2573.33^{a}		
Daily weight gain (g/b)	Mash	32.50^{cd}	68.93^{a}	37.38^{c}	0.25	5.05
	Pellet	60.71^{ab}	51.78^{bc}	56.97^{b}		
Daily feed intake (g/b)	Mash	150.26^{a}	150.72^{ab}	148.23^{ab}	0.50	2.18
	Pellet	152.12^{a}	148.42^{b}	153.02^{a}		
Feed conversion ratio	Mash	4.62^{a}	2.18^{c}	3.23^{b}	0.27	0.42
	Pellet	2.50^{c}	2.86^{bc}	2.68^{bc}		
Daily protein intake (g/b)	Mash	33.05^{ab}	33.15^{ab}	32.61^{b}	0.12	16.78
	Pellet	33.46^{a}	32.65^{b}	32.26^{b}		
Protein efficiency ratio	Mash	0.98^{d}	2.07^{a}	1.14^{c}	0.13	2.11
	Pellet	1.81^{ab}	1.58^{bc}	1.71^{b}		

$^{a, b, c,d:}$ Means on the same row with different superscripts are significantly ($p < 0.05$) different.

SEM= Standard Error of Mean. F = feed form,S= strain, SxF = interaction

The observed significant effect on interaction of broiler strains and feed form on broiler performance among three strains fed mash or pellet diets at finisher phase indicated the degree of absorption and utilization of the experimental diets. This suggests that response of strains of broiler chickens to diet could be different and could be attributed to differences in genetic make up of the strains. The result agrees with the observation of Meurer *et al.* (2008) that broiler chickens fed mash or pellet diets had similar weight gain.both mash and The feed conversion ratio indicated the degree of utilization of the experimental diets. There was a high degree of conversion of the experimental diets which is confirmed by the final weight of the broilers.

Conclusion

The observed significant effect on performance and interaction effect of broiler strains and feed form on broiler suggests that response of strains of broiler chickens to diet could be different and could be attributed to differences in genetic make-up of the strains.

References

Abdullah, Y. A., Nafez, A. A., Murad, M. S. R., Rasha, I. Q and Majdi, A. A. I. 2010. Growth performance, carcass and meat quality characteristics of different commercial crosses of broiler strain of chicken. *Japan Poultry Science*, 47: 13 – 21.

Adedeji, O. S., Farinu, G. O., Ameen, S. A. and Olayeni, T. B. 2006. Effect of bitter kola (*Garcinia kola*) as growth promoter in broiler chicken from day old to four weeks old.*Journal of Animal and Vertinery Advances,* 5(3): 191-193.

Adedeji, T. A., Adebambo, O. A. and Ozoje, M. O. 2004. Early growth performance of crossbred from different sire strains. Proceedings of the 29th Annual conference of the Genetic Society of Nigeria, Oct.11-14th, University of Agriculture, Abeokuta, Nigeria. pp: 126-129.

Agbede, J. O., and Aletor, V. A. 2007. The Performance, Nutrient Utilization and Cost Implications of Feeding Broiler Finisher Conventional or Underutilized Resources. *Applied Tropical Agriculture.* 2(2): 57-62.

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 savanna environment of Nigeria.*World Journal of Young Reaseachers*,1(2); 28-31.

Amerah, A. M. and Ravindran, V. 2008. Influence of Method of Whole-Wheat Feeding on the Performance, Digestive Tract Development and Carcass Traits of Broiler Chickens. *Animal Feed Science and Technology,* 147: 326-339.

Carborg, O., Kerje, S., Schutz, K., Jacobsson, K., Jensen, P. and Anderson, K. 2003. A global search reveals epistatic interaction between QTL for early growth in the chicken. *Genome Research*, 13(3): 413-421.

Duncan, D. B. 1955. Multiple Range and Multiple F-test. *Biometrics*, 11:1-42.

Farran, M. T. Khalil, R. F. Uwayjan, M. G. and Lesson, S. 2000. New concepts in feeding broiler Ashkarina, 2000. Performance and carcass quality of chickens.XIV Congreso Latinoamericano de commercial broiler strains.*Journal of Applied Poultry Agricultural* Science, 9: 252-257.

Fontana , E. A.,Weaver ,W. D., Denbow, D. M. and Watkins, B. A. 1993.

Early feed restriction of broilers: Effect on abdominal fat pad, liver and gizzard weight, fat deposition and carcass composition. Poultry Science , vol.72, p.243-250.

Galobart, J. and Morant, E. T. 2005. Influence of stocking density and feed pellet quality on heat stressed broilers from 6 to 8 weeks of age. *International Journal of Poultry Science,*4:55-59.

Ibe, S. N. and Nwosu, U. F. 1999. Influence of naked neck and frizzle genes on early growth of chickens. Book of Proceedings. 26th Annual Nigerian Society for Animal Production Conference 21 – 25 March, Ilorin Nigeria, Pp 292-295.

Ikeobi, C. O. N. and Peters, S. O. 1996. Strain differences in genetic parameter estimates for growth traits in meat-type chicken. *Nigerian Journal of Animal Production,*23(2): 103 – 106.

Malik, B. S. Didar, S. and Singh, R. P. 2005. Evaluation of production performance of two strains of White Leghorn and their crosses.*Poultry Science*, 39: 71-78.

Mehaffey, J. M., Pradhan, S. P., Meullenet, J. F., Emmert, J. L., Mekee, S. R. and Owens, C. M. 2006. Meat quality evaluation of minimally aged broiler breast fillets from five commercial genetic strains. Poultry Science , savoy, v, 85, n.5, p.902-908.

Meurer, R. P., Fávero, A. Dahlke, F. and Maiorka, A. 2008. *Avaliação de rações peletizadas para frangos de corte. Archives of Veterinary Science*, 13(3): 229 – 240

Njoku, C. C., Mbah, C. N., Nwite, J. N., Agwu, J. O., Elom, O. and Igwe, T. S. 2020. Effect of slum on water quality in Abakaliki Southeastern Nigeria. *Indian Journal of Ecology,*47(2):288-289.

Olawumi S. O. and Fagbuaro S. S. 2011. Productive performance of three commercial broiler genotypes reared in the derived savannah zone of Nigeria. *International Journal of Agricultural Research,* 6 (11): 798- 804.

Olufunmilayo, A. A., Tosin, A. A. and Samuel, A. A. 2015. Effect of chicken genotype on growth performance of pure and crossbred progenies in the development of Broiler line.*International Journal of Agriculture Innovations and Research*, 4(1): 2319 -2373.

Onyeneke, R. U. 2010. Climate change and Crop Farmers Association measures in the South East rain forest zone of Nigeria. M.Sc Thesis, Department of Agricultural Economics, Extension and Development, Imo State University, Nigeria.

Orr, H. L., Hunt, C. and Randall, C. J. 1984. Yield of carcass parts, meat, skin and bone of eight strains of broilers. *Poultry Science*, 63: 2197-2200.

Peters, S. O. 2000. Genetic variation in the reproductive performance of Indigenous chicken and the growth rates of its pure and half-bred progeny'. *M.Agric. Thesis*. Dept. of Animal Breeding and

Genetics.Federal University of Agriculture Abeokuta.

Salari, S. Kermanshahi, H. Nasiri, M. H. 2006. Effect of sodium bentonite and comparison of pellet vs. mash on performance of broiler chickens. *International Journal of Poultry Science*, 5: 31 – 34.

Stringuini, J. H., Laboissiere, M., Muramatsu, K., Leandro, N. S. M and Cafe, M. B. 2003. *Avaliação do desempenho e rendimento de carcaça de quatro linhagens de frangos de corte criadas em Goiás. Revista Brasileira de Zootecnia, Viçosa*, 32 : 183-190.

Ufele, A. N., Ogbu, A. U., Ebenebe, C. I. and Akunne, C. E. 2015. Effect of Locally Produced Blood Meal on Growth Performance and Packed Cell Volume of Broiler Chicks.*American Journal of Agriculture and Forestry*, 3: 105-108.

Date received: 16th July, 2024
Date accepted: 3rd September, 2024