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Performance and Egg Quality Characteristics of Layers Fed Different Combinations of Cassava Root Meal and Bambara Groundnut Offals

G.A. Anyanwu, E.B. Etuk, I.C. Okoli and A.B.I. Udedibie
Department of Animal Science and Technology,
Federal University of Technology, Owerri, Nigeria

Abstract: A feeding trial of 84 day was conducted to evaluate the performance and egg quality characteristics of layers fed different combinations of Cassava Root Meal (CRM) and Bambara Groundnut Offal (BGO). Four layer diets were formulated such that diet T_1 (control) contained 50% maize, while diets T_2, T_3 and T_4 contained CRM and BGO in the ratios of 2:1, 1:1 and 1:2, respectively, completely replacing maize. Ninety six Shaver Brown point-of-lay pullets were allotted into four experimental groups of 24 pullets each and each group was replicated twice with eight pullets per replicate. These birds were randomly assigned to the experimental dies in a Completely Randomized Design (CRD) experiment. Results indicated that daily feed intake was significantly ($p<0.05$) higher for layers on diet T_3 and T_4 than those on diet T_1. Daily feed intake was significantly higher (129.48 and 128.60 g) for layers on the diet (T_1) than other treatment groups, while layers on diets T_2, T_3 and T_4 recorded higher egg weights than those on the control diet. Hen-day production was significantly ($p<0.05$) higher among layers fed diet T_1 (control) than those on the other treatment groups which contained different combination ratios of CRM and BGO. FCR was highest (2.11) and lowest (1.99) for layers fed diets T_3 and T_2, respectively. Yolk index, albumen index and yolk colour showed no statistical difference ($p>0.05$) in all the treatment groups. However, layers on diet T_4 and T_3, respectively recorded the highest (0.35 mm) and lowest (0.33 mm) shell thickness while those on diet T_1 and T_4, respectively recorded the highest (69.64) and lowest (60.62) Haugh units. It would appear that the different combinations of CRM and BGO significantly depressed the performance of laying birds.

Key words: Poultry, cassava root meal, bambara groundnut offal, layer diets

INTRODUCTION

Maize has remained the major source of energy in poultry feeds and constitutes about 50% of an ideal layers diet. Maize has however become a multi-purpose farm product in Nigeria serving both as staple food for large proportion of the Nigerian population and other confectionery industries. The level of maize production is grossly inadequate for what it is needed thus making the price to be very high.

Alternative sources of energy exist although they have their limitations. Cassava (*Manihot esculenta*) is a very popular and abundantly produced tuber crop. It contains 2.66% crude protein, 77.13% Nitrogen Free Extract (NFE) and 2680 kcal kg^{-1} metabolizable energy (Aduku, 1993). Although it is low in protein, its energy content is high and its price relative to maize is competitive. Cassava alone cannot replace maize in layer diets without adversely affecting the performance of layers (Willie and Kinabo, 1980; Longe and Oluyemi, 1977; Eruvbetine *et al.*, 1994).

Corresponding Author: G.A. Anyanwu, Department of Animal Science and Technology,
Federal University of Technology, Owerri, Nigeria

Bambara groundnut offal is a by-product of the processing of Bambara groundnut into a local pudding called okpa. It is abundantly produced in the middle belt and south eastern parts of Nigeria especially in Benue, Enugu and Eboyi states. Aduku (1993) reported that on analysis BGO yields 13.10% crude protein, 65.91% NFE and 2787.21 kcal kg^{-1} metabolizable energy.

Earlier reports by Anyanwu *et al.* (2003) indicate its potential as energy source in broiler diet. Onyimonyi and Onukwufor (2003) reported that 20% level of BGO in pullets' diets did not affect the performance of the birds. Appropriate combinations of CRM and BGO seem to have the potential to replace maize in poultry diet (Anyanwu *et al.*, 2006). This is because the could supply the needed energy and protein for the performance of birds.

The study herein reported was designed to determine the performance and egg quality characteristics of layers fed different combinations of CRM and BGO.

MATERIALS AND METHODS

the Cassava Root Meal (CRM) used for present study was food grade cassava chips purchased from Ose market in Onitsha. The chips were milled into flour to obtain the cassava root meal. The Bambara Groundnut Offal (BGO) was purchased from milling center in Ogbete market, in Enugu state of Nigeria. The offal represents residue of milled whole Bambara groundnut. The fine flour is used for okpa while the coarse residue which could not pass through a 2 mm sieve is referred to as the offal. The BGO was toasted before incorporation into the experimental diets. Toasting involved putting about 3 kg of the offal on a pan set on an open fire and stirring it until the creamy white colour of the offal turned light brown, this takes about 15 min. Maize and other feed materials were sourced from reputable feed raw materials shops in Owerri. Samples of Cassava root meal, Bambara groundnut offal and maize were analyzed for proximate composition. The cassava root meal was also analyzed for residual cyanide content. Four experimental layer diets were subsequently formulated such that diet 1 contained 50% maize as the main source of energy while in diets 2-4 the maize was totally replaced by CRM and BGO combined in the ratios 2:1, 1:1 and 1:2, respectively

Ninety six Point-Of-Lay (POL) pullets procured from the Agricultural Development Corporation farm at Nekede, Owerri were allotted into five experimental groups and maintained on a commercial layer diet (Pfizer^R feed) until egg laying pattern stabilized. Each group was then randomly assigned to the treatment diets in a Completely Randomized Design (CRD) experiment. Each experimental group was further subdivided into three replicates of 8 pullets each and housed in a pen measuring 3×4 m on deep litter. Water and feed were offered *ad-libitum* and appropriate vaccination, medication and other management practices were adequately administered. The birds were allowed a stabilization period of 14 days before data collection. Data collected included daily feed intake, hen-day production, body weight changes, egg weight and subsequently feed conversion ratio. The study lasted 12 weeks.

Three eggs were selected per replicate, giving 9 eggs per treatment on the 3rd, 6th, 9th and 12th week, respectively for egg quality evaluation. Yolk colour was determined using the Roche colour fan; shell thickness was measured using the micrometer screw gauge. Diameter and height of the of the yolk were measured using the vernier calipers while the albumen height and short and long diameters were taken with the aid of a spherometer and vernier calipers, respectively. These values were used to determine the yolk index and albumen index. Haugh units were calculated using the formula of Haugh as described by Oluyemi and Roberts (1979).

Data obtained were subjected to one way analysis of variance to detect significant treatment differences. The means were separated using the Duncan's New Multiple Range Test (DNMRT) (Steel and Torrie, 1980).

RESULTS

Table 2 shows the cyanide content of cassava root meal and proximate composition of Cassava Root Meal (CRM) and Bambara Groundnut Offal (BGO) while Table 3 and 4, respectively show the performance and egg quality characteristics of layers fed different combinations of CRM and BGO of layers. Calculated composition of the experimental diets indicated a gradual increase in crude protein with increasing level of BGO with diet T_4 recording the highest Crude protein level while the control diet recorded the lowest crude protein content. The metabolisable energy level was highest in the control diet and lowest in diet T_3 containing 1:1 ratio of CRM and BGO (Table 1).

Table 1: Composition of experimental layer diets (%)

	Combination ratios of CRM and BGO			
Ingredients	T_1 (0:0)	T_2 (2:1)	T_3 (1:1)	T_4 (1:2)
Maize	50.00	-	-	-
Cassava root meal	-	33.33	25.00	16.67
Bambara groundnut offal	-	16.67	25.00	33.33
Others*	50.00	50.00	50.00	50.00
Total	100.00	100.00	100.00	100.00
Calculated composition chemical composition (%)				
Crude protein	17.77	18.26	19.20	20.14
Crude fibre	4.57	6.51	6.10	6.14
Ether extract	3.79	3.37	3.67	3.28
Calcium	3.83	4.07	4.75	4.72
Phosphorus	1.02	0.98	0.97	0.93
ME (Kcal kg^{-1})	2585.90	2436.80	2423.90	2462.95

*All diets contained; Soybean meal 12.00%; Palm kernel cake, 5.00%; Wheat offal, 10.00%; Brewers' dried grain,7.00%; Fish meal, 2.00%; Blood meal, 3.00%; Bone meal, 6.50%; Oyster shell, 3.50%; Methionine 0.25%; Lyisine, 0.25; Salt, 0.25%; Vitamin /Min. Premix**, 0.25%, ** To provide the following per kg of feed: Vit. A 6,000000iu, Vit D3 800000, Vit E 2,000mg, Vit K 800 mg, Vit B1 600 mg, Vit B2 2,000 mg, Vit B3, 3,600 mg, Vit B6 1,200 mg, Vit B12 4 mg, Folic acid 400 mg, Bioti 80 mg, Choline chloride 80,000 mg, Iron 10,000 mg, Cu 2000mg, Mn 24000 mg, Cobalt 400 mg, Zinc 28000 mg, Iodine 400 mg, Selenium 160 mg, Ca 176%, Antioxidant BHT 500 mg, Lysine 80 mg, Methionine 8000 mg

Table 2: Proximate composition of Cassava Root Meal (CRM) and Bambara Groundnut Offal (BGO)

Parameters (%)	CRM	BGO
Moisture	12.1500	11.23
Crude protein	2.6600	10.94
Crude fibre	2.4000	3.10
Ether extract	4.3500	8.43
Ash	1.3000	0.40
NFE	77.1300	65.91
Cyanide (mg g^{-1})	0.1420	-
ME (Kcal kg^{-1})*	2680.2900	2787.21

*Adapted from Aduku (1993)

Table 3: Performance of layers fed different combinations of CRM and BGO

	Combination ratios of CRM and BGO				
Parameters	T_1 (0:0)	T_2 (2:1)	T_3 (1:1)	T_4 (1:2)	SEM
Initial Weight (kg)	1.41	1.38	1.39	1.48	0.018
Final Weight (kg)	1.59^{ab}	1.63^{a}	1.59^{ab}	1.55^{b}	0.016
Weight changes (kg)	0.18^{b}	0.25^{a}	0.20^{ab}	0.15^{b}	0.021
Daily feed intake (g)	123.50^{a}	126.72^{a}	129.48^{b}	128.60^{b}	1.330
Hen-day production (%)	64.79^{a}	52.33^{b}	52.18^{b}	52.61^{b}	3.430
Egg weight (g)	59.78^{a}	63.79^{b}	61.35^{ab}	61.50^{ab}	0.830
FCR (g feed g^{-1} egg)	2.06^{ab}	1.99^{b}	2.11^{a}	2.09^{a}	0.026
Feed cost (N kg^{-1} feed)	52.09	44.77	44.62	44.46	
Feed cost kg^{-1} egg (N)	153.33	166.17	173.10	169.85	

^{a,b}: Means within the same row with different superscript are significantly different ($p<0.05$)

Table 4: Egg quality characteristics of layers fed different combinations of CRM and BGO

	Combination ratios of CRM and BGO				
Parameters	T_1 (0:0)	T_2 (2:1)	T_3 (1:1)	T_4 (1:2)	SEM
Shell thickness (mm)	0.34^{ab}	0.34^{ab}	0.330^{a}	0.350^{b}	0.004
Yolk colour	1.00	1.00	1.000	1.000	0.000
Yolk index	0.41	0.41	0.390	0.400	0.010
Albumen index	0.64^{a}	0.06^{a}	0.061^{a}	0.055^{b}	0.001
Haugh unit	69.64^{a}	65.66^{ab}	66.850^{a}	60.620^{b}	1.880

a,b: Means within the same row bearing different superscript are significantly different ($p<0.05$)

The proximate analysis indicated a higher percentage of crude protein; crude fibre and ether extract for BGO than CRM however CRM recorded a higher NFE content.

Average daily feed intake was significantly ($p<0.05$) higher for layers on diet T_3 and T_4 than those on T_1 (control) and T_2. Layers on diet T_3 however recorded the highest feed intake. Body weight changes (body gain) was significantly ($p<0.05$) higher among layers fed diet T_2 than those on diets T_1 and T_4. Hen-day production was significantly ($p<0.05$) higher among layers fed diet T_1 (control) than those on the other treatment groups which contained different combination ratios of CRM and BGO. Egg weights of layers on diets T_2, T_3 and T_4 were higher than those of layers on the control diets however only those of layers on diet T_2 indicated a significant ($p<0.05$) difference with the control.

Feed conversion ratio was highest (2.11) for layers fed diet T_3 and lowest (1.99) for layers fed diet T_2. Conversely, egg weight was also highest (63.79 g) for layers fed diet T_2 while layers on the control (T_1) recorded the lowest (59.78) egg weight.

The replacement of maize with CRM and BGO progressively reduced feed cost with increasing level of BGO however layers on the control diet recorded the least cost per kg egg produced.

Eggs with the thickest shell were recorded among layers fed diets T_4, this was significantly ($p<0.05$) different from those with the thinnest shell recorded among layers fed diet T_3. The egg shell thickness values for T_3 and T_4 however did not significantly differ ($p>0.05$) from values obtained for layers on diets T_1 and T_2. Yolk colour and yolk index showed no significant difference ($p>0.05$) in all the treatment groups. However Albumen index and Haugh unit was significantly ($p<0.05$) higher for eggs obtained from layers on diet T_4.

DISCUSSION

Body weight changes (gain) increased progressively with increasing level of BGO until diet T_4 where there was a depression in weight gain. This may have resulted from residual trypsin inhibitors which have been reported to be present in BGO (Okah, 1992). Daily feed intake increased progressively with increasing levels of BGO and showed a slight depression in diet T_4. This trend reflects the metabolisable energy value of the different feeds, with diet T_1 recording the highest ME value and having the least feed intake. Diet T_3 on the other hand with the lowest ME recorded the highest feed intake. It has been established that poultry will feed to satisfy their energy requirement (Ademosun, 1973; Olomu, 1995; Uchegbu and Udedibie, 1998; Ugwuene *et al*., 2005). This perhaps explains the pattern of feed intake recorded. Similarly, diets with high level of CRM have been reported to record a reduction in feed intake mainly due to high fibre and residual cyanide content (Eruvbetine and Oguntona, 1997; Aderemi *et al*., 2006)). This perhaps further explains the low feed intake of layers on diet T_2 which contain 33.33% CRM.

Hen-day production clearly indicated significant depression for diets containing different combination ratios of CRM and BGO. This may have resulted from the lower energy levels and perhaps imbalance in amino acid content and protein: energy ratio of these diets. This agrees with Aderemi *et al*. (2006), who reported low hen-day production with high levels of CRM inclusion.

Onyinmonyi and Onukwufor (2003), however reported that 20% inclusion level of BGO did not affect the performance of pullets. The significantly low FCR recorded for layers fed diet T_2 may have resulted form the high egg weight and low feed intake recorded in this group. Similarly, the comparatively higher egg weights obtained for layers on different combinations of CRM and BGO may have resulted form the higher crude protein content of these diets. Feed cost kg^{-1} decreased with increasing level of BGO in the diet, this agrees with earlier report that CRM and BGO based diets recorded decreased feed cost kg^{-1} (Onyinmonyi and Onukwufor, 2003; Aderemi *et al*., 2006). Feed cost per kg egg was higher for diets T_2, T_3 and T_4 corresponding perhaps to the poor hen-day production.

Yolk index and colour were not affected by the treatment diets and were within acceptable values (Olomu, 1975; Essien, 1990; Essien *et al*., 1996), however Haugh units and Albumen index showed significant decrease in eggs laid by birds on diet T_4. The high Haugh unit recorded in eggs produced by birds on diet T_1 may indicate a better dietary utilization than those on CRM and BGO. Similarly, the slightly low shell thickness of egg from layers on diet T_3 may also indicate poor utilization of calcium (Aderemi *et al*., 2006). This however contrasts the findings of Lawal (1992), that cassava based diet did not interfere with calcium utilization.

It will appear that all combinations ratios of CRM and BGO depressed the performance of laying bird but had little effect on the quality of the eggs and body weight changes. The results of this study will allow further experiments to evaluate the effects of the feed ingredients on the performance of layers.

REFERENCES

Ademosun, A.A., 1973. Evaluation of brewers' dried grains in diets of growing chickens. Brit. Poult. Sci., 14: 463-468.

Aderemi, F.A., O.M. Alabi and T.E. Lawal, 2006. Utilization of whole cassava meal by egg laying type chicken. Proc. 11th Ann. Conf. Anim. Sci. Assoc. Nig. (ASAN). Sept. 18-21, 2006, IAR and T, Ibadan, Nigeria, pp: 73-75.

Aduku, A.O., 1993. Tropical feedstuff analysis table. Department of Animal Science, Ahmadu Bello University, Samaru, Zaria, Nigeria.

Anyanwu, G.A., B.O. Esonu, F. Iwuala, K. Okorie and E.B. Etuk, 2003. Bambara groundnut (*Voandzea subterranean* (L.) thours) offal as partial substitute for maize in broiler diets. Trop. Anim. Prod. Invest., 6: 55-61.

Anyanwu, G.A., C.M. Eze, A. Yacouba and E.B. Etuk, 2006. Performance of broilers fed different combinations of bambara groundnut offal, cassava root meal and yam peels as energy source. Anim. Prod. Res. Adv., 2: 17-22.

Eruvbetine, D., W.O. Biobaku and C.F.I. Onwuka, 1994. Cassava flour as energy source for laying hens. J. Agric. Technol., 2: 76-77.

Eruvbetine, D. and E.B. Oguntona, 1997. Unpeeled cassava root meal in diets for laying hens. Trop. Agric. (Trinidad), 774: 299-302.

Essien, A.I., 1990. Egg quality traits and their interrelationships as affected by storage method and duration of storage in the humid wet climate. Beitr. Trop. Landwirt Sch Vet. Med. 28 H, 3: 345-353.

Essien, A.I., L. Eboh and S.E. Emurashe, 1996. Models for the prediction of quality parameters of table eggs stored under different conditions. Nig. J. Anim. Prod., 23: 179-184.

Lawal, O.O., 1992. Cassava utilization in laying hens. B. Agric Thesis, University of Agriculture, Abeaokuta, Nigeria.

Longe, O.G. and J.A. Oluyemi, 1977. Comparative use of cassava, maize and guinea corn as the major dietary source of carbohydrate for chicks. J. Assoc. Adv. Agric. Sci. Afr., 4: 47-52.

Okah, U., 1992. Determination of metabolizable energy values of bambara groundnut meal. B. Agric Tech Thesis, Federal University of Technology, Owerri, Nigeria.

Olomu, J.M., 1975. Effect of storage on internal quality, physical composition and weights of eggs. Nig. J. Anim. Prod., 2: 188-193.

Olomu, J.M., 1995. Monogastric Animal Nutrition-Principles and Practice. Jachem Publications, Benin City, Nigeria.

Oluyemi, J.A. and R.A. Roberts, 1979. Poultry Production in warm wet climate. Mcmillian International College Edn., London.

Onyinmonyi, A.E. and J.O. Onukwufor, 2003. Effect of toasted bambara groundnut (*Voandzea subterranean* thours) waste (TBW) on performance of growing pullets. Proc. 28th Ann. Conf. Nig. Soc. Anim. Prod. 16th-20th March, Ibadan, Nigeria, 28: 237-240.

Steel, R.G.D. and J.B. Torrie, 1980. Principles and Procedures of Statistics. McGraw Hill Books Co., New York, USA.

Uchegbu, M.C. and A.B.I. Udedibie, 1998. Maize/sorghum based brewers' dried grains in broiler finisher diets. Nig. J. Anim. Prod., 25: 13-16.

Ugwuene, M.C., O.C. Onwudike, S.F. Abasiekong and C.M. Nnadiekwe, 2005. Effect of replacing maize with full-fat palm kernel meal in broiler diets. Proc. 30th Ann. Conf. Nig. Soc. Anim. Prod. 20th-24th March, 2003. Nsukka, Nigeria, 30: 179-182.

Willie, D. and A. Kinabo, 1980. Cassava or maize meal for broilers and the effect of supplementation with methionine and sulphate in cassava based diets. Trop. Anim. Prod., 5: 182-190.