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Performance of Laying Hens Fed Varying Dietary Levels of Bambara (*Voandzeia subterrenea* Thouars) Offals

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Abstract: A feeding trial was conducted to evaluate the performance of laying hens fed varying dietary levels of Toasted Bambara Offals (TBO). The TBO was included in the diet at five levels of 0, 5, 10, 15 and 20 percent. A total of ninety laying hens on their eight week of lay were used for the trial that lasted for 133 days. The ninety birds were randomly assigned to the five dietary levels (0, 5, 10, 15 and 20 percent) with 18 birds per levels. Each dietary level was further replicated four times in a completely randomized design. Results showed that egg weight (g), yolk weight (g) and albumen weight (g) were significantly ($P<0.05$) affected by treatments. Values of 61.38, 64.00, 64.67, 65.00 and 68.45 g was recorded as egg weights for birds on the 0, 5, 10, 15 and 20 percent diets respectively. Yolk weight was 16.53, 16.50, 16.43, 17.83 and 18.07 for 0, 5, 10, 15 and 20 percent diets respectively and albumen weight of 37.78, 39.51, 39.44, 39.82, 43.09 was also observed in that order. The cost of feed (₦) significantly ($P<0.05$) decreased as level of TBO in the diets increased. Cost of feed consumed/bird (₦) significantly decreased as level of TBO in the diets increased. Total eggs produced/bird followed the same trend. Profit recorded from sale of eggs was significantly ($P<0.05$) highest at the 10 percent level. A value of ₦ 1139.81 was recorded for the 10 percent diet, as compared to ₦ 1120.13; ₦ 1126.96, ₦ 1089.75 and ₦ 1083.87 recorded for the control, 5, 15 and 20 percent diets respectively. The results of the present study showed that TBO can be fed at 10 percent to laying hens to replace substantial levels of the more costly maize and soyabean meal. This level of feeding will ensure optimum performance and economic benefit to the farmer.

Key words: Bambara offal, performance, laying hens

Introduction

Animal Nutritionist in Nigeria have over the past few decades been engaged in various researches towards finding cheaper alternative feed stuffs for poultry (Oladunjoye *et al*., 2005; Uchegbu *et al*., 2004; Onuh, 2005; Otokunefor and Olomu, 2000; Amaefule and Obioha, 1998; Okonkwo and Oketola, 1996; Longe, 1986 and Onwudike, 1986). The search has been prompted by the ever escalating cost of the conventional feedstuffs which has resulted in the increasing cost of poultry production and consequent increase in the cost of poultry products (Iyayi, 2002). To counter this increase in the prices of conventional feedstuffs and produce poultry products at affordable prices, the use of agro-industrial by products in poultry feeding must be exploited in Nigeria. There is evidence in the literature that the use of agro-industrial products reduces the cost of feed as they attract little pricing (Onyimonyi, 2002; Onuh, 2005). One of such readily available agro-industrial by products in Nigeria is Bambara offal. Bambara offal is the ultimate discard from the milling of bambara nut. It has no direct feeding value for humans and in most places it is dumped indiscriminately thus causing environmental problems. Bambara nut is widely grown in Nigeria where annual production has progressively increased over the years due to increasing consumption.

The utilization of bambara offal in feeding poultry has not been fully investigated. Okeke (2002) reported that a 20 percent level of bambara offal in the diet of finishing broilers supported growth as the control diet. In another study, it was reported that the inclusion of 20 percent bambara offal in the diet of growing pullets improved performance (Onyimonyi and Onukwufor, 2003). Amaefule and Osuagwu (2005) showed that the performance of chicks fed diet containing 5 percent bambara offal did not differ significantly ($p>0.05$) from that of the control. Ekenyem and Onyeagoro (2006) reported that bambara offal could appreciably reduce cost of broiler chicken production and could be included up to 15 percent in the diets.

The present study was conducted to evaluate the performance of laying birds fed varying dietary levels of bambara offals.

Materials and Methods

Location and duration of study: The experiment was conducted at the Poultry Research Unit of the Department of Animal Science, University of Nigeria, Nsukka. The study lasted for nineteen weeks (ie. From the 8th week of lay to the 27th week of lay).

Processing of the material: Bambara offals were purchased from processing plants at Nsukka Town. They were toasted over fire in aluminium pan for about

15 min during which period the material were stirred steadily with wooden stick to ensure uniform heating. The toasted offal were spread on a clean floor to cool.

Experimental birds and management: A total of ninety hens at their eighth week of lay were randomly selected from a flock of one hundred and twenty birds. They were housed individually in a battery cage. Water was provided *ad libitum* and feed was provided at the rate of 120g/hen/day. Routine medication and vaccination typical of laying hens were strictly followed.

Experimental design: The design used was a Completely Randomized Design (CRD) with the following model

$$Xij = \mu + T_i + eijk$$

Where:

Xij = observation on a parameter eg. the jth egg weight of a hen receiving the ith diet.
T_i = Treatment effect ie. the effect of the ith diet
eijk = Random error of the kth observation in the ij sub-group.
μ = Population mean

The ninety birds were randomly allotted to five dietary treatments ie. 0 (control), 5, 10, 15 and 20 percent levels of toasted bambara offal (Table 1). Each treatment was replicated four times with four birds per replicate.

Measurement of relevant parameters: The daily feed intake of each replicate was determined by the difference between feed given in a day and the left over in the following morning. Record was kept of the number of eggs produced per bird on daily basis. The measurement of external and internal egg characteristics were done using the methods of Ayanwale *et al.*, 2006.

Statistical analysis: Data collected were processed and analyzed according to the procedure as outlined by Steel and Torrie (1980) using a Statsgraphic Computer Package. Significantly different means were separated by the methods of Duncan's New Multiple Range Test (Duncan, 1955) in the same package.

Analytical techniques: The test material (Toasted bambara offal) was analyzed for its proximate composition using the method of AOAC (1990) see Table 2.

Table 1: Percentage Composition of the Experimental Diets

Ingredient (%)	0	5	10	15	20
Maize	43	39	36	35	30.5
Soyabean meal	18	17	15	11	10.5
Bambara offal	-	05	10	15	20.0
Common ingredients[a]	39	39	39	39	39.0
Total	100	100	100	100	100.0
Calculated					
Crude protein	17.39	18.00	18.08	17.50	18.20
Crude fibre	5.02	5.97	5.94	6.25	6.60
Energy (Kcal ME/Kg)	2754.00	2662.00	2591.00	2562.00	2500.00

[a]Common ingredients (%): wheat offal, 17; Palm kernel cake 9; fish meal 3; Oyster shell, 6; Bone meal, 3; Lysine, 0.25; Methionine, 0.25; common salt, 0.25; Vitamin Mineral Premix, 0.25

Table 2: Proximate Composition of Toasted Bambara Offal

Parameter	%
Moisture	8.00
Crude protein	17.40
Crude fibre	21.50
Ether extract	4.50
Ash	3.50
NFE	53.60
Gross energy (Kcal ME/Kg)	3980.00

Results and Discussion

Table 3 shows the effect of treatments on the egg quality characteristics of the hens.

Results show that the effect of treatment on egg weight (g), yolk weight (g) and albumen weight were significantly different ($P<0.05$). Egg weight increased as the inclusion level of Toasted Bambara Offal (TBO) in the diets increased. Birds on the control (0% TBO) and 5% diets did not differ in their egg weight ($p>0.05$). However their values differed significantly from those observed for birds on the 10, 15 and 20% diets ($P<0.05$). Egg size is a function of so many factors, notably; quality and quantity of feed, strain of the birds, stage of lay and management system. In the instant case, it seems there is a factor that increases egg weight as level of TBO in the diets increased. This may be associated with the enhanced nutrient profile of the diets as the level of TBO in the diet increased. It appears that the level of lysine increased with increasing level of TBO in the diets. There is evidence in the literature that each 0.1 unit of extra lysine increased egg weight by 1.16 g. Further work may need to be carried out to verify this claim. The response of birds on the 10, 15 and 20 percent TBO in producing significantly bigger eggs could be attributed to the high protein content of the diets. This agrees with the report of Scott *et al.* (1976) that egg weight or size are controlled by the amount of protein in the feed. The implication of the egg size to consumers is enormous. Egg size has been reported as one of the most important factors that determine consumer choice of eggs. Consumers are not so much concerned with other measures of egg quality as they are with size of the egg and assurance of freshness. Egg size ranked highest among traders in determining the eggs to purchase (Iposu *et al.*, 2000). Results further revealed that the yolk and albumen weights were significantly ($P<0.05$) affected by treatments. The trend is that these parameters increased with increasing levels of TBO in the diets. Birds on the higher level of TBO inclusion (20% diet) had the highest significant value ($P<0.05$)

Table 3: The Effect of Varying Dietary Levels of TBO on Egg Quality Characteristics

	Dietary levels of TBO (%)					
Parameters	0	5	10	15	20	SEM
External characteristics						
Egg weight (g)	61.39[a]	64.00[a]	64.67[b]	65.00[b]	68.45[c]	1.014
Egg length (cm)	5.50	5.53	5.27	5.23	5.35	0.011
Egg width (cm)	3.00	2.80	3.23	2.97	3.40	2.024
Shape index	0.54	0.51	0.51	0.57	0.62	0.018
Shell weight (g)	6.54	6.40	6.27	6.30	6.29	0.015
Shell thickness (mm)	0.60	0.59	0.64	0.65	0.67	0.027
Internal characteristics						
Yolk weight	16.53[a]	16.50[a]	16.43[a]	17.83[b]	18.07[b]	1.134
Albumen weight	37.78[a]	39.51[a]	39.94[a]	39.82[a]	43.09[b]	2.802
Yolk index	0.67	0.68	0.67	0..68	0.78	0.012
Haugh unit	196.00	196.6	196.00	197.00	196.00	0.88

[abc]Row means with different superscript are significantly different (P<0.05), SEM: standard error of the mean

Table 4: Economic Efficiency of Feeding TBO to Laying Hens

	Dietary levels of TBO					
Parameters	0	5	10	15	20	SEM
Cost/kg of feed (₦)[(a)]	43.28[d]	41.74[c]	39.91[b]	37.50[a]	36.11[a]	0.406
Total feed intake/bird(kg)[(b)]	13.30	13.39	13.43	13.50	13.63	0.083
Cost of feed consumed/bird (₦)[(c)]	575.62[c]	558.89[c]	535.99[b]	506.25[a]	492.18[a]	1.397
Total egg produced/bird[(d)]	113.05[b]	112.39[b]	111.72[b]	106.4[a]	105.07[a]	0.455
Revenue from egg (₦)[(e)]	1695.75[b]	1685.85[b]	1675.80[b]	15.00[a]	1596.05[a]	1.666
Profit (₦)[(f)]	1120.13[b]	1126.96[b]	1139.81[c]	1089.75[a]	1083.87[a]	1.164

[(a)]Calculated from prevailing market prices of the feedstuffs in Nsukka town as at February, 2007 (maize, ₦35/kg; soyabean meal, ₦64/kg; Bambara offal ₦10/kg; palm kernel cake, N9/kg; wheat offal, ₦20/kg; fish meal, ₦200/kg, Oyster shell, ₦20/kg; Bone meal, ₦25/kg; L-Lysine, ₦600/kg; DL-Methionine, ₦700/kg; NaCl, ₦20/kg; Vitamin mineral premix, ₦400/kg), [(b)]Cumulative feed intake/bird for the 133 days the study lasted, [(c)]Cost/kg feed multiplied by the total feed intake/bird, [(d)]Total number of egg laid by a hen for the 133 days the study lasted, [(e)]Total number of eggs multiplied by ₦15 (The prevailing market price per egg was ₦15), [(f)]Revenue from egg minus-cost of feed consumed/bird (other costs were assumed to be constant for all the treatments)

than the others. Egg yolk comprises 30 to 33 percent of the total egg weight, whereas the albumen (White) is approximately 60% of the total egg weight. It is thus expected that these values will increase with increasing egg weight. This is in line with the view of Arkbar *et al.* (1983) that increased concentration of dietary protein resulted in the increased in yolk weight and the population of yolk in a group of hens producing larger eggs. Another important observation in this study is the fact that the inclusion of TBO in the diets did not have any significant effects (p>0.05) on the shell thickness of eggs produced by hens on the various treatments. The shell thickness recorded for the treatments is above the minimal requirement. It is estimated that a shell thickness of 0.33 mm is needed if the egg is to have a more than 50 percent chance of moving through normal market handling without breaking (Stadelman, 1997).

The economic efficiency of feeding toasted bambara offal to the birds is presented in Table 4. Cost/kg of feed decreased significantly (P<0.05) as the inclusion levels of TBO increased from 0 to 20 percent. The control treatment had significantly (P<0.05) higher cost/kg of feed. The price of a kg of bambara offal in Nsukka market at the time of this study was ₦10/kg as against ₦35/kg for maize and ₦64/kg for soyabean meal. This reduction in cost/kg of feed as level of TBO in the diets increased is in harmony with the view of earlier workers that bambara offal can lead to a reduction in cost/kg of feed (Onyimonyi and Onukwufor, 2003; Ekenyem and Onyeagoro, 2006). It also conforms with the earlier report of Aletor (1986) that the high cost of the commonly used cereal grains had generated much interest in the use of cheaper but poorer alternative ingredients, mainly agro-industrial by products in place of maize. The cost of feed consumed per bird decreased significantly (P<0.05) as level of TBO in the diet increased. This decrease could be attributed to the reduced cost/kg of feed earlier observed as level of TBO increased.

The total egg number produced/bird decreased as level of TBO in the diets increased. Birds on the control, 5 and 10 percent TBO diets did not differ in the number of eggs laid/bird (p>0.05). However, they differed significantly (P<0.05) from birds on 15 and 20 percent diets. The revenue from sale of eggs was significantly (P<0.05) higher for birds on the control, 5 and 10 percent diets as compared to values obtained for birds on the 15 and 20 percent diets. Profit showed a progressive increase up to the 10 percent level of TBO diet where it peaked and subsequently dropped from the 15 percent diet. The birds on the 10 percent diet had significantly higher

return on investment than the others. The observed highest profit at the 10 percent level of inclusion of TBO is suggestive that laying birds can tolerate this level of TBO for optimum productive and economic efficiency.

Conclusion: The observed result in this study showed that incorporating 10 percent of toasted bambara offal in the diets of laying hens could improved laying performance at cheaper cost, thus enhancing better returns to the farmers.

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