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Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorijps@gmail.com

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Performance of Broiler Chicks Fed Graded Levels of Heat - Treated Bambarra Groundnut [*Voandzia subterranean (L) thouars*] Offals

E.K. Asaniyan[1] and V.O. Akinduro[2]
[1]Department of Animal Science and Production, Joseph Ayo Babalola University,
P.M.B. 5006, Ikeji - Arakeji, Nigeria
[2]Department of Animal Production and Health, Federal University of Technology, P.M.B. 704, Akure, Nigeria

Abstract: Bambarra groundnut (*Voandzia subterranean (L) thouars*) offals (BGO) steamed for 30 minutes (heat treated) to remove any trypsin inhibitory activity that could occur. The steamed offals were incorporated into broiler starter diets at five different levels of 0%, 15%, 30%, 45% and 60%. Incorporation was at the expense of corn. One hundred and fifty, one-week old Anak broiler chicks were randomly divided among the five treatments and each treatment group of birds was replicated three times with ten birds per replicate. The replacement of corn completely by bambarra offals (60% offal) significantly ($P < 0.05$) reduced weight gain and significantly ($P < 0.05$) increased the grammes of feed required per gramme of weight gain. The cost of feed required for a gramme of weight gain significantly ($P < 0.05$) decreased as quantity of BGO fed increases, with 45% inclusion level showed slightly optimal cost. Feed intake was not significantly ($P > 0.05$) increased as the percentage inclusion of BGO fed to the birds increased. In all, broiler starter birds can utilize up to 45% BGO inclusion in replacement of maize without any deleterious effect on their performance.

Key words: Broiler chicks, heat-treated, bambarra groundnut and performance

Introduction

Global threat of bird flu to poultry industry has brought a setback to the industry through loss of stocks and undue psychological effects on the consumers in Nigeria. Efforts in stemming the impact of bird flu coupled with the high cost of poultry production tend to make the industry unfriendly. However, the high stocking density per rearing area of poultry species and as the smallest sized livestock that could convert plant protein to animal protein of higher biological value make it difficult for the industry to be quitted. The protein needs of family of six could be met by five eggs a day or one 2kg chicken a week (Smith, 2001). Though providing protein in this way may be difficult because of the competition between man and his livestock for the available grains (Tegbe *et al*., 1994), still as global attention is being focused on stamping out bird flu, focus must not be shifted away from bringing down the high percentage level accounted for by feed in the total cost of poultry production. Harnessing the potentials of underutilized legumes as invaluable sources of starch and protein concentrates could be a way out (Adebowale *et al*., 2002; Adebowale and Lawal 2003). One of such legumes is bambarra groundnut; its seed contains 24% crude protein, 6.60% and 1.30% lysine and methionine respectively (Poulter, 1981; Temple and Aliyu, 1994) and about 60% carbohydrate (Brough *et al*., 1993). It is grown for its underground seeds (Stephens, 1994). Bambara groundnut, though underutilized African legume, has wide availability especially in hostile tropical environments (Heller *et al*., 1997). Bambarra groundnut is one of the indigenous grains of sub - saharan Africa, favoured in terms of nutritional value and tolerance to adverse environmental conditions. It is grown mainly in the middle belt and eastern part of Nigeria (Doku and Karikari, 1971). The bambarra seeds are normally milled and sieved to realize uniformly smooth flour, which is commonly prepared into pudding locally called *okpa* (Ibo Tribe), which is a nutritive human food. The sieved off part of the milled seeds, called offal is normally disposed off as waste. Bambarra groundnut offal could be evaluated as ingredient substitute in broiler diets. The offal contains 21.16% CP, 5.29% CF and 12.44 MJ/Kg gross energy (Amaefule and Iroanya, 2004). Onwudike and Eguakun (1994) reported that raw Bambarra groundnut seeds did not support weight gain of broiler chicks but gave a negative protein efficiency value. This was attributed to the presence of trypsin inhibitor, haemagglutinin, tannic acid, phytic acid and oxalate present in the raw seeds (Apata and Ologhobo, 1997). However, Onwudike and Eguakun (1992) had earlier confirmed that 30 minutes steaming will completely remove all trypsin inhibitory activities and releases the 'locked up' cystine. They reported that such heat treatment did not significantly affect the proximate contents of bambarra groundnut except for the ash, lysine and arginine values which were significantly reduced. Hence, prevents pancreatic hypertrophy and growth inhibition in chicks. The available scientific information showed that growing pullet (Onyimonyi and Onukwufor, 2003) and broiler (Amaefule and Iroanya, 2004) can be fed with bambarra groundnut offal. Agwu

Table 1: Composition of the Experimental Diets (Air-dry Basis)

	Graded levels of BGO (%)				
Ingredients	0	15	30	45	60
Corn	60.00	45.00	30.00	15.00	0.00
BGO	0.00	15.00	30.00	45.00	60.00
Soya bean meal	24.50	24.50	24.50	24.50	24.50
Fish meal	7.00	7.00	7.00	7.00	7.00
Brewers dry grain	5.00	5.00	5.00	5.00	5.00
Bone meal	2.45	2.45	2.45	2.45	2.45
Vitamin/Mineral premix	0.50	0.50	0.50	0.50	0.50
Salt	0.50	0.50	0.50	0.50	0.50
Amprolium	0.05	0.05	0.05	0.05	0.05
Total	100	100	100	100	100
Analysis					
Crude Protein (%)	22.48	23.48	23.48	24.28	24.88
Crude fibre (%)	3.68	3.74	3.77	3.82	3.89
ME(Kcal/kg)	2888	2785	2683	2480	2378
Calcium (%)	1.01	1.01	1.02	1.03	1.03
Available P (%)	0.59	0.58	0.58	0.57	0.57

BGO = Bambarra Groundnut Offals

Table 2: Performance of broiler starter birds fed various levels of heat treated bambarra groundnut offals

	Inclusion levels of bambarra groundnut offals					
	0%	15%	30%	45%	60%	SEM
Average daily weight gain (g)	27.77^{a}	27.39^{a}	28.09^{a}	27.18^{ab}	25.02^{b}	0.69
Average daily feed intake (g)	64.72	64.20	64.75	65.23	66.76	1.00
Feed intake/weight gain ratio	2.33^{b}	2.34^{b}	2.31^{b}	2.40^{b}	2.67^{a}	0.06
Cost of feed (N/g)	0.05	0.05	0.04	0.04	0.03	-
Cost of feed/g gain (N)	0.12^{a}	0.12^{a}	0.09^{b}	0.10^{b}	0.08^{b}	0.45
Mortality (%)	0.00	0.00	0.00	0.00	6.67	2.98

ab: Means in the same row without the same superscript are significantly (P<0.05) different

(1992) reported that raw bambarra groundnut offals can be included in broiler starter diet up to 45% without reducing performance while Amaefule and Osuagwu (2005) reported 5% inclusion level in pullet diets.

This study was therefore carried out to determine the optimal level of replacing corn with heat-treated bambarra groundnut offals in broiler starter diets.

Materials and Methods

Procurement and preparation of bambarra groundnut offal: Bambarra groundnut offals were procured from one of the local grain millers in Umuahia, Abia State of the Eastern Nigeria. The offal was heat-treated (steamed) for a period of 30 minutes to remove possible residue of trypsin inhibitor (Onwudike and Eguakun, 1992). The steaming arrangement involved heating of water in a big pot to boiling point (100^{o}C), thereafter the offal in a jute bag was then suspended inside the pot without touching the boiling water and left to stay for 30 minutes in an enclosed form. After which the offal was brought out and sun-dried.

Experimental layout: A total of one hundred and fifty, one-week old Anak broiler-chicks were used for the experiment. This study was carried out in the Teaching and Research Farm of Federal University of Technology, Owerri. The birds were randomly divided into five equal treatment groups of 30 birds each and the chicks were similar in weight. Birds in each group were further sub-divided into three replicates with 10 birds per replicate. The basal composition of the five dietary treatments (Table 1) contained 0%, 15%, 30%, 45% and 60% levels of heat-treated bambarra groundnut offals respectively, the offals were added at expense of corn. Samples of the experimental diets were analyzed for proximate composition as described by AOAC (1995) methods.

The experimental diets and water were provided *ad-libitum*. The experiment lasted four weeks. The parameters taken were the weekly feed intake and weight gain of the birds.

Statistical analysis: Data collected were subjected to analysis of variance (Steel and Torrie, 1981) and means separated by Duncan's multiple range test (Duncan, 1995).

Results

The performance data of the birds fed the graded levels of heat-treated bambarra groundnut offals are presented in Table 2. The feeding of heat treated bambarra groundnut offals to starter broilers up to 60% level significantly (P<0.05) reduced the weight gain per bird per day when compared to those birds on the 0%, 15%, and 30% levels in the diet. The weight gain of birds fed

45% BGO level was not significantly (P>0.05) different from those fed 0%, 15%, 30% levels and 60% levels.

There was no significant (P>0.05) difference in feed intake for birds fed different levels of heat treated bambarra offals. The general trend however was that birds on the higher dietary offal levels show apparently increasing feed intake.

The feeding up to 60% dietary bambarra offal significantly (P<0.05) increased the quantity of feed required per unit weight gain. The feed required per unit weight gain for the birds fed 0%, 15%, 30% or 45% levels of dietary offal was not significantly (P>0.05) different from one another. Also, mortality was not significantly (P>0.05) affected by any of the levels of dietary bambarra offal.

The cost of feed/g weight gain was highest for the birds which received no bambarra offals. The value for the birds on the 0% and 15% bambarra offal were significantly (P<0.05) higher than the values for the birds on the 15%, 30%, 45% and 60% dietary bambarra offal. The cost of feed/g of weight gain for the birds fed the 30%, 45% and 60% levels of offal were not significantly (P>0.05) different from one another. In all, the birds fed 60% offal gave the lowest cost of feed per kg gain. The feeding of bambarra offal reduced the cost of producing a unit weight of meat.

Discussion

The incorporation of heat treated bambarra offals at five different levels into broiler starter diets show that up to 45% of heat treated bambarra offal can be fed to broiler starter birds without any deleterious effect on performance. This 45% dietary level of bambarra offal also gave a slightly optimum cost per gramme of weight gain and so could be inferred to be most economical of the diets based on birds' weight gain. Hence 45% dietary level of heat treated bambarra offal gave the best cost effective formulation. The greater economic advantage seen with inclusion of offal in the diet at the expense of corn partly derived from the fact that 100kg of corn costs about N3700:00 (The Nation, 2007), the same quantity of bambarra offal cost only about N186:00 (Personal communication). Replacement of the same quantity of corn by offal therefore substantially reduced cost of a unit weight of the compounded ration.

Agwu (1992) reported that up to 45% of raw offal could be fed to starter broiler birds. Coincidentally from this study, in which starter birds were able to utilize up to 45% heat treated offal; it means that no advantage is gained by heat treating the offal for poultry feeding. This may be because the amount of trypsin inhibitory activity in the raw offal is very negligible when compared to the amount present in the whole bambarra meal (Onwudike and Eguakun, 1992). The observation that birds fed increasing levels of the offal consumed more feed may be because of the attempt by the birds to obtain enough energy from the diet (Smith, 2001). Hence bambarra offal is lower in metabolizable energy than corn, and as the offal replaced corn in the diet the energy level of the diet decreased. Animals usually eat to satisfy their energy requirements; the birds on the higher levels of dietary offal would consume more feed in an attempt to satisfy their energy requirements. The inability of the diet with 60% offal to bring about neither highest nor optimal weight gain comparable with the other lower levels of dietary offal (0-45%) may be due to the inability of the birds on the 60% offal to obtain enough energy from the feed they consumed or steaming could not adequately remove the trypsin to the tolerable level for the birds, hence hindered proper utilization of the diet that brought about the low weight gain and the percentage mortality. Even though the birds increased feed intake as the offal level increased, there is a limit to the stomach capacity and to what the stomach can therefore hold. The results show that it is economically advantageous to feed up to 45% bambarra offal to broiler starter birds at the expense of corn.

Therefore heat-treated bambarra groundnut offal can be incorporated into broiler starter diet up to an optimal level of 45% in replacement of corn. This 45% offal gave optimal performance in terms of feed intake, weight gain, feed conversion ratio and percentage mortality. Since broiler starter birds could utilize up to 45% raw bambarra offal (Agwu, 1992), it appears that there is no advantage in heat treating the offal at 45% inclusion level before feeding it to the birds. Also, above this 45% BGO level, better treatment than steaming should be applied into the offal.

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