*Nig. J. Anim. Prod. 2008, 35(2): 202 - 209*
*Nigerian Society for Animal Production*


# Effect of graded levels of toasted bambara groundnut (*Voandzeia subterranea L*) waste on performance of growing rabbits

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## Abstract

*The effects of different dietary levels of toasted bambara groundnut (Voandzeia subterranea L) waste on the performance of growing rabbits was studied. Twenty-four, 6-7 weeks old cross bred (Chinchilla x New Zealand white) rabbits with average initial weight of 962g were used for the feeding trial which lasted for 8 weeks. The rabbits were randomly divided into four treatment groups of 6 rabbits each and fed diets containing 0% (control), 10, 20 and 30% toasted bambara groundnut waste (TBGW) using a completely randomized design (CRD). Dry matter, crude protein, crude fibre, ether extract and nitrogen-free extract intake and digestibility, weight gain and economics of TBGW inclusion were determined. Proximate composition of the diets, faeces, raw and toasted samples were also determined. The raw and toasted bambara groundnut waste had 91 and 93% dry matter, 17.0 and 16.27% crude protein, 26 and 24% crude fibre, 5 and 3. 5% ether extract, 2.5 and 4.0% ash, 40.5 and 45.23% nitrogen-free extract, and 4.13 and 3.88 kcal/g energy respectively. Significant differences ($P<0.05$) existed between treatments in feed intake, weight gain, final body weight, and digestibility of dry matter, crude protein, crude fibre and nitrogen-free extract. Feed intake, weight gain, final body weight, and digestibility of dry matter, crude protein and nitrogen-free extract were similar for the control and 30% TBGW diets, and these were significantly ($P<0.05$) lower than that for 10% TBGW diet. The feed cost (₦/kg gain) was similar for 10, 20 and 30% TBGW diets. The result showed that up to 30% toasted bambara groundnut waste can be included in the diets of growing rabbits without any adverse effect on performance.*

**Key words:** toasted bambara groundnut waste, rabbits, performance

## Introduction

The problem of insufficient animal protein in the diet of an average Nigerian has since been reported (FAO, 1997). According to Ani and Okafor (2004), the solution to the problem of animal protein shortage in Nigeria lies in the production of fast maturing animals with the utilization of cheap and locally available feedstuffs. One of such fast maturing animals is the rabbit. Rabbits are known to be highly prolific and their meat is an excellent source of animal protein (Fielding, 1991). Although rabbits can survive on forages alone, their performance can be greatly improved when fed a mixture of forages and concentrates (Abasiekong *et al.*, 2001). The

use of non-conventional protein feed ingredients in rabbit feeding is well documented (Adegbola and Okonkwo, 2002; Ani and Okafor, 2004). One of such non-conventional protein feed ingredients is bambara groundnut waste (BGW) which is obtained during the processing of bambara groundnut (*Voandzeia subterranea L*) into flour.

Bambara groundnut is cultivated in Nigeria in a number of southern and northern states of Nigeria. The dry seeds contain 21.13 – 22.9% crude protein (Ndiokwere, 1982; Apata and Ologhobo, 1994), while the waste contains 14.65 – 16.19% crude protein (Okeke, 2000).

Studies have revealed that both bambara nut and its waste can be used in the feeding of poultry and rabbits (Onwudike and Eguakun, 1992; Olupona *et al.*, 1999; Arijeniwa and Igene, 2002; Ani and Okafor, 2004). However, a great limitation to the use of bambara groundnut and its waste is the presence of some anti nutritional factors like cyanogens, flatulence factors, tannins, trypsin inhibitors and hemaglutinins in the raw seeds (Ensminger *et al.*, 1996). It has been established that heat treatment can drastically reduce, inactivate or completely destroy the anti-nutritional factors in the raw BGW (Onwudike and Eguakun, 1992). However, there is dearth of information on the performance of rabbits fed heated- treated BGW. This study was therefore, carried out to investigate the effect of feeding different dietary levels of toasted bambara groundnut waste on performance of growing rabbits.

## Materials and Methods

The study was conducted at the Rabbittary Unit of Animal Science Research Farm, University of Nigeria, Nsukka. The rabbits, test feedstuff and other ingredients used in the study were procured from local markets in Enugu State. The bambara groundnut waste (BGW) comprising the seed coat, testa and coarse granules of cotyledon was put inside an open pan, placed on fire and toasted at 120°C for 30 minutes when the original cream colour turned to brown. Timing was taken from the point of attainment of 120°C and the heat generated was controlled to maintain a steady temperature. At this time a peculiar bambara aroma was perceivable. The toasted BGW and other ingredients were used to formulate the experimental diets. Four diets were formulated to contain 0%(control diet), 10, 20 and 30% toasted BGW. The composition of diets is shown in Table 1.

Twenty-four crossbreed (Chinchilla x New Zealand white) weaner rabbits, 6-7 weeks old, weighing averagely 962g were randomly divided into four groups of 6 rabbits each, using a completely randomized design (CRD). Each group was randomly assigned to one of the four diets containing 15.91-16.41% crude protein and 11.63 -12.01MJ/kg of ME. Each treatment was replicated 3 times with 2 rabbits per replicate placed in two- tier rabbit hutches, which had a total of 6 units per tier. Each unit measures 15cm x 10cm x 10cm. The hutches were located inside a rabbit building equipped with vents and windows for proper ventilation. Each unit, which accommodated two rabbits was partitioned with metallic sheets and wire mesh and fitted with metallic trays (for collection of faecal droppings), drinkers and feeders. The rabbits were provided with feed and water *ad libitum* twice daily at 0800h and at 1400h for 49 days of the experimental period. The rabbits were also fed equal quantity of fresh forages (*Panicum maximum* and *Centrosema pubescens*) as a supplement to the experimental diets. The rabbits were weighed at the beginning of the experiment and subsequently on weekly basis. Parameters measured were daily feed intake, weekly body weight and final mature weight. Feed conversion ratio (FCR) and protein efficiency ratio (PER) were

**Table 1:** Percentage composition of experimental diets

| Toasted Bambara Groundnut Waste Level (%) | | | | |
|---|---|---|---|---|
| Ingredients | **0** | **10** | **20** | **30** |
| Maize | 54.55 | 45.95 | 37.35 | 28.75 |
| Wheat Offal | 14.00 | 14 .00 | 14.00 | 14.00 |
| Soya Beans | 14.00 | 12.60 | 11.20 | 9.80 |
| Palm kernel Cake | 12.00 | 12.00 | 12.00 | 12.00 |
| Fish meal | 0.95 | 0.95 | 0.95 | 0.95 |
| Toasted Bambara Waste | 0 | 10 | 20 | 30 |
| Bone meal | 4.00 | 4.00 | 4.00 | 4.00 |
| Iodized salt | 0.25 | 0.25 | 0.25 | 0.25 |
| Vit-mineral mix* | 0.25 | 0.25 | 0.25 | 0.25 |
| **Total** | **100** | **100** | **100** | **100** |
| **Calculated Composition:** | | | | |
| Crude Protein (%) | 15.91 | 16.07 | 16.25 | 16.41 |
| Energy (MJ of ME/kg) | 11.63 | 11.63 | 12.01 | 11.97 |

*Contain per kg: Vit. A, 10,000 IU; Vit. B, 2,000 IU; Vit. E, 13,000 IU; Vit. K, 1,500mg; Vit. B12, 10mg; Riboflavin, 5,000mg; Pyridoxine, 1,300mg; Thiamine, 1,300mg; Panthothenic acid; 8,000mg; Nicotinc acid, 28,000mg; Folic acid, 500mg; Biotin, 40mg; Copper, 7,000mg; Managanese, 48,000mg, Iron, 58,000mg; Zinc, 58,000mg; Selenium, 120mg; Iodine, 60mg; Cobalt, 300mg, Choline, 275,000mg.

calculated from weight gain and feed intake values. Feed cost per kg weight gain was calculated as feed cost per kg x FCR (Sonaiya *et al.*, 1986; Ukachukwu and Anugwa, 1995). On the 49th day of the 56 days of experimental period, one rabbit per replicate was put in a metabolism cage and fed *ad libitum* for three days during which period the rabbits got used to the environment. The rabbits were fasted for 24 hours and thereafter fed 90% of their *ad libitum* intake for 5 days. Faeces arising from the 5 days feeding plus that from another 24 hours fasting period were collected. This was to ensure total collection of faecal droppings associated with the feed consumed. Faecal droppings collected each day were oven dried at 60°C, put in a plastic bag and stored in a refrigerator. At the end, all droppings collected from each replicate were pooled together and samples taken for determination of proximate composition.

Experimental feeds and faecal droppings were analyzed for proximate composition using the method of A.O.A.C. (1990). Gross energy of feeds was determined in a Parr oxygen adiabatic bomb calorimeter. All data collected were subjected to analysis of variance (ANOVA) as described by Steel and Torrie (1980). Differences between the treatment means were separated using Duncan's New Multiple Range Test (Duncan, 1955; Obi, 2002).

## Results and Discussion

Table 4: Digestibility coefficients of toasted bambara groundnut waste diets fed to growing rabbits

| | Dietary level of toasted bambara groundnut waste (%) | | | | |
|---|---|---|---|---|---|
| **Parameters** | **0** | **10** | **20** | **30** | **SEM** |
| Dry Matter (%) | 61.02[b] | 72.27[a] | 70.11[a] | 57.04[b] | ± 2.41 |
| Crude protein (%) | 51.19[b] | 69.21[a] | 71.12[a] | 53.20[b] | ±3.56 |
| Crude fiber (%) | 62.47[a] | 70.10[a] | 67.55[a] | 44.34[c] | ±3.84 |
| Ether extract (%) | 84.23 | 95.33 | 87.78 | 95.37 | ±5.16 |
| Nitrogen-free extract (%) | 64.17[b] | 71.55[a] | 69.89[a] | 59.28[b] | ±1.73 |

[a, b, c, d] Means with different superscripts in the samerow are significantly (P < 0.0.5) different
SEM = Standard error of mean.

that it is economical to include up to 30% toasted BGW in the diets of rabbits.

*Digestibility of nutrients*

Table 4 shows the nutrient digestibility of the dietary treatments. There were significant differences (P< 0.05) in dry matter (DM), crude protein (CP), crude fibre (CF) and nitrogen- free extract (NFE) values among treatments. Rabbits fed 10 and 20% toasted BGW diets had similar DM, CP and NFE digestibility values and these values were significantly (P<0.05) higher than those of rabbits fed 0% (control) and 30% which were themselves similar. Rabbits fed 0, 10 and 20% toasted BGW diets had similar CF digestibility values that were significantly (P< 0.05) higher than the digestibility value of rabbits fed 30% toasted BGW diet. The DM, CP and NFE digestibility values obtained in this study show that toasting of raw BGW played a significant role in improving the nutritive value of raw BGW, by inactivating the anti-nutritional factors which are known to cause reduction in nutrient digestibility and to accentuate digestive losses (Liener, 1986; Faris and Singh, 1990). However, there was a significant decrease in CF digestibility value as the level of toasted BGW in the diet increased to 30%. The observed decrease may be attributed to the increase in dietary CF (Table 2) with increase in the level of toasted BGW in the diets. Similarly, Amaefule *et al.* (2004) reported a reduction in CF digestibility coefficients at 30% level of raw pigeon pea seed inclusion in the diets of weaner rabbits and attributed the reduction to the increase in CF in the diets. The decrease in CF digestibility with increasing level of fibre in the diets of rabbits has also been reported (Adegbola and Okonkwo, 2002). However, ether extract digestibility values were not significantly (P> 0.05) affected by toasted BGW inclusion levels in the diets.

## Conclusion

It is evident from this study that daily feed intake, daily weight gain, FCR, PER and feed cost per kg weight gain of rabbits fed 30% toasted BGW were not inferior to those of rabbits on control diet. The result has shown that toasted BGW improved the performance of rabbits at different dietary inclusion levels without any adverse effect.

## Acknowledgement

The author wishes to thank Miss Chinwe Udemezue for her assistance in data collection.

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