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EFFECT OF FEEDING GRADED LEVELS OF RAW BAMBARA GROUNDNUT (*Vigna subterranea* (L) Verdc) WASTE ON GROWTH PERFORMANCE AND HAEMATHOLOGICAL TRAITS OF WEANER RABBITS

Ani, A. O

Department of Animal Science, University of Nigeria, Nsukka, Nigeria

ABSTRACT

Twenty-four weaner rabbits with initial liveweight of 0.83kg were used to determine the effect of feeding graded levels of raw bambara groundnut waste (BGW) on the growth performance and haematological parameters of weaner rabbits. The rabbits were randomly divided into four treatment groups of 6 rabbits each, using a completely randomized design (CRD). The groups were fed four diets containing 0, 10, 20 and 30% raw BGW for 8 weeks. Measurements taken were live weight gain, final body weight, feed intake, feed conversion ratio (FCR), protein efficiency ratio (PER), cost of daily feed intake and cost of feed per kg weight gain.The packed cell volume (PCV),red blood cell(RBC) count, white blood cell(WBC) count, haemoglobin concentration (Hb),mean corpuscular haemoglobin concentration (MCHC), mean corpuscular haemoglobin(MCH) and mean corpuscular volume(MCV) were also measured .Results showed that there were significant (P<0.05) differences among treatments in feed intake, weight gain, final body weight, cost of daily feed intake and cost of feed per kg weight gain. Rabbits fed 0 and 10% raw BGW diet had significantly higher (P<0.05) feed intake and cost of feed per kg weight gain than those fed 20 and 30% raw BGW diets. Rabbits fed 20 and 30% raw BGW had significantly lower (P<0.05) feed intake and final body weight than those on other diets. The lowest (P<0.05) cost of daily feed intake and cost of feed per kg weight gain was recorded in treatment 4 (30% BGW diet). There were no significant (P>0.05) differences among treatments in FCR, PER, PCV,RBC, WBC, Hb ,MCHC, MCH and MCV. The results of the study indicate that up to 10% raw BGW can be included in the rations of weaner rabbits without any adverse effect on the performance of the rabbits.

Keywords: Bambara nut waste, growth performance, haemathology, weaner rabbits

INTRODUCTION

Animal protein consumption is very essential for meeting the protein requirement of man. The level of meat and animal protein consumption was estimated at 8g per caput per day, and this is about 20g less than the minimum requirement recommended by the National Research Council of the United States of America (FAO, 1997). The decline in animal protein consumption may be attributed to the declining productivity occasioned by high cost of production. The solution to the problem of animal protein shortage in Nigeria, therefore, lies in the production of fast maturing animals like rabbits with the utilization of cheap and locally available feedstuffs in order to produce them at an affordable cost. Rabbits have been reported to thrive on non-conventional feedstuffs and forages (Cheeke, 1983). However their ability to utilize large forage diets is limited by the fact that fibre digestion is post gastric in the caecum (Davidson and Spreadbury, 1975). Rabbits have short gestation period of 28 – 32 days and short generation interval. They are highly prolific and good feed converters (Aduku and Olukosi, 1990; Fielding, 1991). The feeding of concentrate to rabbits increases feed consumption and crude fibre digestion (Butcher *et al.*, 1981). The use of conventional protein feed ingredients such as soybean meal and groundnut cake in livestock feeding tends to increase production cost. There is need, therefore, to find alternative protein sources in livestock feeding. One of such alternative sources of protein is bambara groundnut waste (BGW). Bambara nut (*Vigna subterranea* L.) is an indigenous African grain legume, which is grown for its edible grain (Rachie and Roberts, 1974). Ndiokwere (1982) reported that dry bambara groundnut seeds contained 21.13% crude protein, while the raw bambara nut waste contained 16.19% crude protein (Okeke, 2000). In Nigeria, the cultivation of bambara nut is widely distributed in a number of southern and middle belt states and in most of these states, the dried mature seeds are converted into paste, steamed and eaten in the form of moi-moi (Enwere, 1998). Studies in animal nutrition have shown that bamabara nut can be used in the feeding of poultry and rabbits (Onwudike and Eguakun, 1994; Olupona, *et al.*, 1999). Raw BGW has been used in the feeding of poultry and rabbits (Okeke, 2000; Ani and Okafor, 2004). However the use of bambara nut and its waste is limited because of the presence of such anti-nutritive factors as cyanogens, flatulence factors, tannins, trypsin inhibitors and hemaglutinins in raw bambara nut (Doku and Karikari, 1981; Ensminger *et al.*, 1990). This study was carried out to determine the effect of feeding graded levels of raw bambara groundnut waste on the performance and haematological parameters of weaner rabbits.

MATERIALS AND METHODS

The rabbits, feedstuffs and ingredients used in the study were purchased from Orba market near Nsukka, Enugu State. Maize and bambara groundnut waste used in the study were milled and used to compound four experimental diets as shown in Table 1.

Table 1. Percentage Composition of experimental diets

Ingredients	Dietary level of raw bambara groundnut waste (%)			
	0	10	20	30
Maize	41.4	34.80	28.10	21.00
Palm kernel meal	7.90	13.90	14.30	18.30
Wheat offal	27.6	23.20	19.35	14.00
Fish meal	5.30	5.50	5.70	6.10
Soyabean meal	13.30	8.30	7.95	6.10
Raw bambara nut waste	0	10.00	20.00	30.00
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 (%)	16.75	16.82	16.90	17.01
Metabolizable energy (MJ/kg)	12.68	12.64	12.76	12.84

*Vit A – 10,000.00 iu, D_3-2,000 iu, B1-0.75g, B_2-5g, Nicotinic acid – 25g, Calcium pantothenate 12.5g, B_{12} – 0.015g, K_3-2.5g, E-25g, Biotin 0.050g, Folic acid – 1g, Manganese 64g, Choline chloride 250g, Cobalt – 0.8g, Copper 8g, Manganese 64g, Iron – 32G, Zn-40g, Iodine-0.8g, Flavomycin-100g, Spiramycin 5g, Dl-methionie-50g, Selenium 0.6g, Lysine 120g, BAT-5g.

Animals and experimental diets

Twenty-four hybrid (Chinchilla x New Zealand white) weaner rabbits, 6-7 weeks old, weighing averagely 0.83kg were randomly divided into four groups of 6 rabbits each, using a completely randomized design. Each group was randomly assigned to one of five isonitrogenous (16.87% crude protein) and isocaloric (12.73MJ/kg of ME) diets (1, 2, 3 and 4) containing 0% (control), 10, 20 and 30% raw bambara groundnut waste (BGW), respectively. Each treatment was replicated 3 times with 2 rabbits per replicate placed in four-tier rabbit cages, which had a total of 12 hutches per tier. Each hutch measures 0.6m x 0.5m x 0.4m. The cages were located inside a rabbit building equipped with vents and windows for proper ventilation. Each hutch, which accommodated 2 rabbits, was partitioned with metallic sheets and wire mesh and fitted with metallic trays (for collection of faecal droppings) and with stainless feeders and drinkers. The rabbits were provided feed and water *ad libitum* twice daily at 08.00h and 16.00h for 56 days of the experimental period. The rabbits were also fed equal quantity of fresh forage (*Centrosema pubescens*) as a supplement to the experimental diets. The rabbits were weighed at the beginning of the experimental feeding and subsequently on a weekly basis.

Parameters measured were daily feed intake and daily weight gain, while feed conversion ratio and protein efficiency ratio were calculated from weight gain and feed intake values.

Blood collection and evaluation

During the 8th week of the experiment, two rabbits were randomly selected from each treatment group and blood samples were collected from their jugular veins with sterile needles.The blood samples were collected into properly labeled sterilized bottles containing EDTA(Ethylene diamine tetra-acetic acid) for haematological analysis.Packed cell volume(PCV) and haemoglobin concentration(Hb) were determined by the methods described by Lamb(1991).Red blood cell(RBC) and total white blood cell(WBC) counts were estimated using the haemocytometer, while mean corpuscular volume(MCV) and mean corpuscular haemoglobin(MCH) were calculated according to Mitruka and Rawnsley(1977).

Proximate and statistical analyses

Experimental diets were analyzed for proximate composition using the methods of A O A C (1990). Data

collected were subjected to analysis of variance (ANOVA) for a CRD (Steel and Torrie, 1980) and differences between the treatment means were separated using Duncan's New Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Table 3 shows the growth performance of rabbits fed varying dietary levels of raw bambara groundnut waste (BGW). There were significant ($P<0.05$) differences among treatments in final body weight, daily weight gain and daily feed intake. Rabbits on the 0 and 10% raw BGW diets had significantly higher ($P<0.05$) feed intake than those on other diets. Rabbits on the 30% raw BGW diet had the lowest feed intake ($P<0.05$) but this was not lower ($P>0.05$) than that of rabbits on 20% raw BGW diet. Feed intake and weight gain declined as the level of raw BGW in the diets increased beyond 20%. The significant depression in feed intake as the raw BGW levels increased might have resulted from the anti-nutritive factors – cyanogens, tannins and trypsin inhibitors in raw bambara groundnut (Liener, 1975). This suggestion is in agreement with the reported finding of Ensminger (1990) that tannins can decrease voluntary feed intake, digestibility and weight gain. The significant depression in feed intake may also be attributed to the high fibre contents of the BGW – containing diets, which probably led to early gut-fill. McDonald *et al.* (1995) reported that fibrous feeds tend to spend a longtime in the digestive tract thereby resulting in reduced feed intake.

Table2: Proximate composition of the experimental diets

	Dietary level of raw bambara groundnut waste (%)			
Components (%)	0	10	20	30
Dry matter	95.00	94.00	92.00	96.50
Crude protein	15.65	14.65	15.65	16.50
Crude fibre	8.50	12.00	12.50	16.50
Ether extract	3.00	3.50	4.00	4.50
Ash	12.00	14.00	12.50	12.00
Nitrogen-free extract	55.85	49.85	47.35	45.70
23Gross energy (Mj/kg)	12.03	11.79	11.55	11.37

Table 3. Performance of weaner rabbits fed graded levels of raw bambara groundnut waste

Parameters	Dietary level of raw bambara groundnut waste (%)				
	0	10	20	30	SEM
Initial live weight (kg)	0.88	0.74	0.81	0.84	± 0.08
Final live weight (kg)	1.63^{a}	1.45^{ab}	1.40^{b}	1.30^{b}	± 0.06
Daily weight gain (g)	14.28^{a}	13.93^{a}	12.17^{ab}	10.68^{b}	± 0.76
Daily feed intake (g)	91.58^{a}	88.17^{a}	47^{b}	65.5^{b}	± 3.49
Feed conversion ratio	6.42	6.44	6.21	5.85	± 0.49
Protein efficiency ratio	1.00	1.08	1.03	1.05	± 0.39

a, b, c, d = Means on the same row with different superscripts are significantly different ($P<0.05$). SEM = Standard error of mean .

Table 4: Cost of feeding graded levels of raw bambara groundnut waste to weaner rabbits

Parameters	0	10	20	30	SEM
Total feed intake (g)	5.13[a]	4.94[a]	3.46[b]	2.56[b]	±0.37
Cost of feed per kg (₦)	32.12	29.39	27.60	25.43	-
Cost of total feed consumed (₦)	164.78[a]	145.19[b]	95.50[c]	65.10[c]	±11.90
Total weight gain (kg)	0.80[a]	0.78[a]	0.68[b]	0.60[b]	±.02
Cost of daily feed intake (₦)	2.94[a]	2.59[b]	2.08[c]	1.59[d]	±0.09
Cost of feed per kg weight gain (₦)	206.39[a]	189.12[a]	140.89[b]	108.96[c]	±9.72

Means on the same row with different superscripts are significantly (P<0.05) different.
SEM=standard error of mean.

Table 5: Effect of raw bambara groundnut on haematological parameters of weaner rabbits

Parameters	Dietary level of raw bambara groundnut waste (%)				
	0	10	20	30	SEM
Packed cell volume (%)	36.00	37.00	37.00	31.00	±2.17
Haemoglobin concentration (g/100ml)	11.50	11.97	12.17	10.27	±0.73
Red blood cell (mm^3x10^6)	2.74	2.70	2.70	2.44	±1.58
White blood cell (mm^3x10^3)	8.13	7.57	5.97	5.6	±1.34
Mean cell haemoglobin concentration (%)	32.00	32.00	33.00	32.33	±0.37
Mean cell haemoglobin (%).	42.00	44.33	44.66	42.00	±2.88
Mean cell volume (μm^3)	133.00	136.33	136.33	129.00	±8.71

Means on the same row are not significantly (P>0.05) different
SEM= standard error of the mean

Rabbits fed 0% (control) and 10% raw BGW diets had higher (P<0.05) weight gain than those on 30% raw BGW diet. The result showed that levels of raw bambara groundnut waste above 20% depressed weight gain. This result is in agreement with the reported finding of Sklan *et al.* (1975) that ingestion of raw oil bean meal caused growth inhibition. Feed intake is a major factor which influences weight gain. The decline in weight gain at 30% level of raw BGW inclusion may as well be attributed to depressed feed intake. This is because the metabolic and production requirements of the rabbits could not be satisfied as the level of raw BGW in the diet increased to 30% with the resultant decline in feed intake. Ani and Okeke (2002) made a similar suggestion. Ani and Okafor (2004) had also attributed growth depression in rabbits to reduced feed intake. The final body weight of rabbits fed the experimental diets followed the same pattern with daily weight gain (Table 3). There were no significant (P>0.05) differences among treatments in feed conversion ratio and protein efficiency ratio. . There was a case of rabbit mortality before the termination of the experiment. About 5.56% of rabbits on 20% and 30% raw BGW diets died. The death could be due probably to the presence of anti-nutritive factors especially cyanogenic glycosides in the raw bambara groundnut waste which

might have increased in concentration and toxicity as the level of raw BGW in diets increased to 20%. This suggestion agrees with the reported finding of Liener (1986) that raw soybean, field bean and kidney bean elicit certain physio-pathological changes, which could result in death. Ensminger *et al.* (1990) also reported that cyanide (from cyanogenic glycosides) is very toxic at low concentrations to human beings and animals.The cost of feeding graded levels of raw BGW to weaner rabbits is presented in Table 4. There were significant ($P<0.05$) differences among treatments in total weight gain, cost of daily feed intake and in cost of feed per kg weight gain. Rabbits fed 0 and 10% raw BGW diets had similar total weight gain with those fed the 20% raw BGW diets and this was significantly ($P<0.05$) higher than that of rabbits fed the 30% raw BGW diets. Rabbits fed 30% raw BGW had a significantly lower ($P<0.05$) daily feed cost and cost of feed per kg weight than those on other diets. It could be observed (Table 4) that increase in the level of raw BGW in the diets resulted in progressive decline in the daily feed cost and in cost of feed per kg weight gain of rabbits. This shows that it is economical to include BGW in the diets of rabbits, provided it is properly detoxified. Table 5 shows the effect of graded levels of raw BGW on haematological values of weaner rabbits. There were no significant ($P>0.05$) differences among treatments in all the parameters measured. The result tends to suggest that dietary raw BGW had no adverse effect on haematology of weaner rabbits.

CONCLUSION

The results obtained in this study indicate that up to 10% raw BGW can be incorporated into the diet of growing rabbits without deleterious effect on the rabbits.

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