REPLACEMENT VALUE OF SPROUTED SORREL (Hibiscus sabdariffa) SEED MEAL FOR GROUNDNUT CAKE IN THE DIET OF GROWING RABBITS

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ABSTRACT

In a six-week feeding trial, the effect of replacing groundnut cake (GNC) with sprouted sorrel seed meal (SSM) on the performance of growing rabbits was investigated. Twenty cross-bred rabbits (Dutch × New Zealand white) aged 6 weeks were randomly assigned to four dietary treatments. The SSM replaced GNC at 0 %(control), 10%, 20%, and 30% levels in diets 1, 2, 3, and 4 respectively. The diets and clean drinking water were offered ad-libitum throughout the period of the experiment. Data were collected on the growth and haematological parameters. It was discovered among others that there was no significant dietary effect on feed intake and feed conversion ratio. However, a significantly higher daily gain was recorded on the 20% compared to the control and the 30% replacement diets, daily gain had the poorest value on the 30% replacement diet. The cost of the feed was linearly reduced as the level of SSM increased. Based on the findings of this study, it was concluded that replacing 20% of the GNC in the diet of growing rabbits with SSM will reduce the cost of rabbit meat production without adverse effects on the growth and haematological indices of the rabbits.

Key words: *Sprouted sorrel seed meal, groundnut cake, growing rabbits*

INTRODUCTION

The huge animal protein deficit in the diet of Nigerians (Ademosun & Kalango, 1987, FMANR, 1997, Oyawoye, 2002) can be addressed by placing emphasis on the production of highly prolific and short cycle animal species such as the rabbit. The meat production per mother rabbit is reported to be higher than in all herbivorous farm animals (Scholaut, 1985). Rabbits however, require a good balance of dietary protein for their maximum performance. According to Scholaut (1985) rations for rabbit should contain 15-17% top digestible crude protein. Groundnut cake and soyabean which are proven sources of protein are short in supply and highly consumed by humans in Nigeria. This constitutes a major setback to increased rabbit production in the country and calls for research into less conventional sources of protein for rabbit feeding.

Sorrel (Hibiscus sabdarifffa) is a crop well-adapted to many ecological zones in Nigeria and mostly grown as border crop. The leaves are used for making soup and the calyxes for making a local drink known as "zobo". The seeds have little or no food and industrial uses at the moment. Sorrel seed is reported to contain between 21.40 - 35.90% crude protein (Price, Hagerman & Butler, 1980; Bressani, Elias & Braham, 1982; Dashak & Nwanegbo, 2002; Isidahomen, Kwari, Adejumo & Igwebuike, 2006), 7.12 - 15.00% crude fibre, 10.14% ether extract and 10.09 - 23.0% ash (Dashak & Nwanegbo, 2002; Isidahomen et al., 2006).

The protein of the seed contains 1.63 - 2.73% lysine and 0.4 - 1.41% methionine (Dashak & Nwanegbo, 2002 Isidahomen et al., 2006). The seed is however, reported to contain tannins (an antinutritional factor) (Duke, 1983, Paterson, 1993, Kwari et al., 2004, Kwari, 2009) which could be reduced by sprouting (Kwari, 2009). Despite these attributes, there is little documented information on the use of sorrel seed in rabbit feeding. This paper reports the effect of graded levels of sprouted sorrel seed meal as a replacement for groundnut cake on the performance of growing rabbits.

MATERIALS AND METHODS

Source and processing of sorrel seed meal: Sorrel seed was purchased from Gamboru market in Maiduguri Metropolitan Council, Maiduguri,

Nigeria, soaked in tape water for 24 hours, removed and covered with a jute sack and allowed to sprout after 72hours. The sprouted seed was sun-dried for 72 hours, milled in a hammer mill and then labeled sprouted sorrel seed meal (SSM).

Experimental animals and management: Twenty (20) growing crossbred (Dutch x New Zealand white) rabbits aged 6 weeks and weighing 689.50g ± 0.80 were used for the experiment at the livestock unit of the University of Maiduguri Teaching and Research Farm, Maiduguri, Nigeria. At the beginning of the experiment the rabbits were weighed individually and randomly assigned to four diets (treatments) with 5 rabbits per diet. The rabbits were individually housed in cages measuring 33cm x 36cm x 45cm (width x length x height) and equipped with feeding and watering troughs. Feed and clean water were supplied ad-libitum throughout the experiment which lasted for 42 days.

Experimental diets: Four diets were formulated for the experiment (Table 1). Diet 1 (control) was based on groundnut cake (GNC) as source of protein. In diets 2, 3 and 4, sprouted sorrel seed meal (SSM) replaced GNC at 10%, 20% and 30% levels respectively.

Data collection and analysis: Data were collected on growth performance (feed consumption, weight gain and feed conversion ratio) and haematological parameters. A weighed quantity of feed was fed daily and the left-over deducted from the quantity fed the previous day to account for the feed consumed. The rabbits were weighed at the beginning of the experiment and weekly thereafter to determine the weight gain per week. The daily weight gain was calculated by dividing the weekly value by 7 (number of days in the week). Feed conversion ratio (FCR) was calculated as the ratio of feed consumed (g) to the weight gained (g). The cost of the kg feed was calculated using the market price of the ingredients used in the formulations. The feed cost of meat production (N/kg gain) was derived by multiplying the cost of the kg feed by the FCR. Mortality was recorded as it occurred.

At the end of the experiment, three (3) rabbits were randomly selected per treatment fasted overnight and used for haematological studies. Early in the morning (6.00 a.m.), blood samples were collected from the ear vein, using a 21 gauge needle, into sample bottles containing dipotasium salt of ethylene diamine tetra-acetic acid (EDTA-K2+) as anticoagulant.

The packed cell volume (PCV), red blood cell (RBC) count, white blood cell (WBC) count and haemoglobin (Hb) concentration formed the haematological responses evaluated. Packed cell volume (PCV) was determined by micro-hematocrit, while RBC, WBC and Hb were determined by the improved Neubauer haematocytometer and cyanomethemoglobin methods respectively. The erythrocyte indices, i.e. mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were calculated according to Jain (1986) as shown below:

$$\text{MCV (fl)} = \frac{\text{PCV (\%) x 10}}{\text{RBC (106/mm}^3\text{)}}$$

$$\text{MCH (Pg)} = \frac{\text{Hb (g/dl) x 10}}{\text{RBC (106/mm}^3\text{)}}$$

$$\text{MCHC (\%)} = \frac{\text{Hb (g/dl) x 100}}{\text{PCV (\%)}}$$

The diets were analyzed for proximate composition (AOAC, 1990). Analysis of variance (Steel and Torrie, 1980) was carried out on data collected using the randomized complete block design and significant differences separated using the Least Significant Differences (LSD).

RESULTS AND DISCUSSION

Growth performance: The performance characteristics of the rabbits (Table 2) showed no significant ($P>0.05$) dietary effects on feed intake and feed conversion ratio. A significantly ($P<0.05$) higher daily gain was recorded on the 20% compared to the control and the 30% replacement diets. Daily gain had the poorest ($P<0.05$) value on the 30% replacement diet. The cost of the feed was linearly reduced as the level of SSM increased. The feed cost of meat production was significantly ($P<0.05$) reduced on the SSM-based diets compared to the control.

The price difference between GNC/kg and SSM/kg at the time of the experiment (June to July, 2008) was the reason for the reduced feed cost as the level of SSM increased. The daily weight gain recorded in this experiment is lower than the range reported in the tropics by Aduku &

Olukosi (1980). Daily feed intakes were also lower than the values reported by Igwebuike *et al* (2008) in rabbits fed concentrate diets. The mean ambient temperature during the period of the experiment was 38^{o}C. This might have contributed to the reduced feed intake as high ambient temperatures are reported to exert a negative effect on feed intake (Stephen, 1980; Scholaut, 1985). Scholaut (1985) observed that only 60 -70% feed was consumed by rabbits at 30^{o}C compared to 20^{o}C which was further reduced by 15% with a temperature increase of only 5^{o}C. The value for feed conversion ratio on all the diets fall within the range (5.70 - 9.44) obtained by Abu & Ekpenyong (1993) in rabbits fed with palm oil mill effluent and rabbits reared in simailr environment by other workers (Igwebuike et al., 2008).

Haematology: The haematological indices (Table 3) showed a significant ($P<0.05$) dietary effect on PCV, Hb, RBC and MCV. The 20% replacement diet had the highest ($P<0.05$) PCV, Hb and RBC, while the highest values for MCV were recorded on the 10% and 30% replacement diets. The 30% replacement diet had the lowest ($P<0.05$) values of PCV and Hb. The elevated MCV and MCH values on the 30% replacement diet may indicate the presence of macrocytic anemia (Bush, 1975). Similarly, Oluwole et al. (2001) found fairly low RBC values coupled with exaggerated MCV values to be haematological features of macrocytosis (regenerative anemia). These haematological responses may further explain the lower daily gain of rabbits on the 30% replacement diet. The haematological values of the control, the 10% and 20% replacement diets were within the ranges reported as normal for growing rabbits (Anon, 1980). No mortality was recorded on any of diets.

CONCLCUSION

A six-week feeding trial on the effect of replacing groundnut cake (GNC) with sprouted sorrel seed meal (SSM) on the performance of growing rabbits was conducted. Twenty cross-bred rabbits (Dutch × New Zealand white) aged 6 weeks were randomly assigned to 4 dietary treatments with 5 rabbits per treatment. The diets and clean drinking water were offered ad-libitum throughout the period of the experiment. Data were collected on the growth and haematological parameters show that there were no significant dietary effects on feed intake and feed conversion ratio. The

cost of the feed (N/kg) was linearly reduced as the level of SSM increased. The 20% replacement diet had the highest packed cell volume (PCV), haemoglobin (Hb) and red blood cell (RBC), while the lowest values of PCV and Hb were observed on the 30% replacement. The highest values for mean corpuscular volume (MCV) were recorded on the 10% and 30% replacement diets. Based on the results of this study, it is concluded that replacing 20% of the GNC in the diet of growing rabbits with SSM will reduce the cost of rabbit meat production without adverse effects on the growth and haematological indices of the rabbits.

Table 1: Ingredient composition of the experimental diets

Ingredients	Replacement level of sorrel seed meal for groundnut cake (%)				
	0.00	10.00	20.00	30.00	
Maize	40.00	40.00	40.00	40.00	
Groundnut cake (GNC)	20.25	13.47	6.79	0.00	
Sprouted sorrel seed meal (SSM)	0.00	6.79	13.47	20.25	
Groundnut haulms	17.00	17.00	17.00	17.00	
Wheat offal	15.00	15.00	15.00	15.00	
Fish meal	5.00	5.00	5.00	5.00	
Bone meal	2.00	2.00	2.00	2.00	
Salt	0.50	0.50	0.50	0.50	
*Premix	0.25	0.25	0.25	0.25	
Total	100.00	100.00	100.00	100.00	
Calculated analysis					SSSM
Dry matter (DM)	94.28	94.21	93.95	93.5	91.14
Crude protein (CP)	19.40	18.22	17.06	15.87	22.56
Crude fibre (CF)	11.41	12.19	13.50	14.95	15.84
Ether extract (EE)	5.27	5.00	4.87	4.55	5.73
Ash	6.10	7.00	7.05	7.18	5.11
Nitrogen free extract (NFE)	52.10	51.80	51.47	50.96	41.76
ME (Kcal/kg)	2890.05	2814.44	2749.94	2662.90	2647.59

ME = Metabolizable energy; SSM = Sprouted sorrel seed meal

*Premix (Grow Fast) from Animal Care supplied/kg: Vit A=3,200,000.00IU; Vit D3= 610,000.00IU; Vit E= 2,000.00IU; Vit K= 800mg; Vit B1= 600mg; B2= 1,600.00mg; B6= 600.00mg; Niacin= 6,000.00mg; Folic acid= 2,000.00mg; Biotin= 8.00mg; Choline chloride= 80.00g; Manganese= 32.00g; Zinc= 20.00g; Iron= 8.00g; Copper= 2.00g; Iodine= 0.18g; Selenium= 80.00mg; Cobalt= 80.00mg and Antioxidant= 50.00mg

Table 2: Performance Characteristics of Rabbits Fed Graded Levels of Sprouted sorrel seed meal (SSM)

Parameters	Replacement level of sorrel seed meal for groundnut cake (%)				
	0.00	10.00	20.00	30.00	SEM
Number of rabbits	5	5	5	5	-
Initial body weight (g/rabbit)	690.50	689.50	689.50	688.80	90.36NS
Final body weight (g/rabbit)	1107.50	1211.25	1025.00	1032.50	113.34NS
Daily intake (g/rabbit)	51.11	52.63	53.99	49.87	2.55NS
Daily gain (g/rabbit)	10.54b	11.62ab	12.00a	8.90c	0.19*
Feed conversion ratio (feed: gain)	4.85	4.53	4.50	5.60	0.98NS
Cost of feed (N/kg)	28.72	27.77	26.84	25.89	-
Feed cost (N /kg gain)	139.29b	125.80c	120.78c	145.07a	1.72*
Mortality	0	0	0	0	-

a,b,c= Means within the row bearing different superscripts differ significantly (P< 0.05);
NS= not significant (P> 0.05);
SEM= standard error of the mean;
*=Significant (P< 0.05).

Table 3: Some haematological indices of rabbits fed graded levels of sprouted sorrel seed meal (SSM)

Parameters	Replacement level of sorrel seed meal for groundnut cake (%)				
	0.00	10.00	20.00	30.00	SEM
PCV (%)	34.67b	34.00b	38.00a	32.33c	0.74*
Hb conc. (g/100ml)	11.33ab	10.90b	12.46a	9.70bc	0.42*
RBC count (106/mm3)	2.77b	2.67b	4.08a	2.50b	0.22*
WBC count (103/mm3)	17.33	18.33	19.10	16.70	0.91NS
MCV (fl)	92.12b	129.14a	93.14b	129.36a	9.68*
MCH (Pg)	36.15	41.57	35.98	38.80	3.77 NS
MCHC (%)	32.70	32.007	33.23	30.00	1.10 NS

a,b,c= Means within the row bearing different superscripts differ significantly (P< 0.05);
NS= not significant (P> 0.05);
SEM= standard error of the mean;
*=Significant (P< 0.05).

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