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Replacement of Feed Concentrate with Graded Levels of Cassava Leaf Meal in the Diet of Growing Rabbits: Effect on Feed and Growth Parameters

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Abstract: Forty growing rabbits with mean live-weight of 0.774kg+0.04 were randomly fed on five diets containing graded levels of Cassava Leaf Meal (CLM). The general objective of the work was to determine the replacement value of concentrate with CLM in the diet of growing rabbits by assessing the feed quality and growth parameters. Specifically, the Voluntary Feed Intake (VFI), Average Daily Gain (ADG), Feed Conversion Ratio (FCR) and digestibility of various nutrients were estimated. The Dry Matter (DM) intake of the rabbits ranged from 44.24-66.85 g/day per rabbit whereas the Crude Protein (CP) and energy intakes per day per rabbit ranged from 9.95-13.16 g and 204.39-291.47 kcal, respectively. Digestibility coefficients ranging from 67.06-81.09; 54.13-77.50; 24.95-44.43; 48.99-75.65 and 65.40-79.16 were obtained for DM, CP, CF, EE and energy, respectively. The FCR and ADG ranges of 3.13-5.27 and 8.43-21.36 g/d/rabbit were obtained. Rabbits performed satisfactory at 15% and 30% inclusion levels of CLM. It was observed that higher levels of CLM inclusion resulted in a significant decrease in the values of all the parameters examined and a forage free diet is not ideal for rabbit production, as it could induce diarrhoea.

Key words: CLM, concentrate, digestibility and rabbits

INTRODUCTION

The constant increase in the cost of protein and energy concentrates coupled with the scarcity of most feed ingredients make research into replacement of concentrate with forage imperative in third world countries. Reducing the levels of concentrate used in compounding rabbit feed will invariably entail reduction in the cost of rabbit production. The rabbit (*Oryctolagus cuniculus*) is a monogastric animal with a distinct preference for high fibre diets (Carregal, 1977). This may be accredited to its functional caecum and the practice of caecotrophy. Cheap feedstuffs are digested through the action of microorganisms inhabiting the caecum of the rabbit. So, rabbits being unique from other monogastric animals can utilize roughages more efficiently. Several research reports have shown that rabbits can neither be raised on roughages alone nor on roughage free diets (Iyeghe-Erakpotobor *et al*., 2002; Olorunsanya *et al*., 2007; Omole *et al*., 2005 and Iyeghe-Erakpotobor *et al*., 2006). Olorunsanya *et al*. (2007) and Omole *et al*. (2005) observed that more than 45% inclusion level of forage in the diet of rabbits bring remarkable reduction in performance while Davidson and Spreadbury (1975), Carregal (1977) and Oluremi and Nwosu (2002) reported incidence of diarrhoea in rabbits raised under forage free diets.

Generally, cassava is predominant in the humid tropic and its cultivation is amiable to wide range of environment. Though, several aspects of cassava leaf have been used in formulation of rabbit diets, there is dearth of information on the inclusion of the Cassava Leaf Meal (CLM) in rabbit diet. The CLM contains more crude protein and are highly digestible when compared to cassava peel, cassava tuber and cassava stem. This study was therefore designed to evaluate the replacement value of concentrate with Cassava Leaf Meal (CLM) on the diet of growing rabbits. It was also intended to establish the optimal inclusion level of cassava leaf meal for excellent rabbit production.

MATERIALS AND METHODS

The study was carried out at the University of Nigeria, Nsukka, Rabbit Unit. The rabbit house and cages measuring 61 x 45 x 40 cm were thoroughly washed and disinfected before the commencement of the experiment. The feeding and watering troughs were also washed, disinfected and fixed on the cages. The cages were randomized into five treatments and eight replicates, and numbered accordingly. Forty growing rabbits (25 females and 15 males) were used. Both the males and the females were randomly distributed independently into five treatment pens of eight rabbits per treatment. There were a total of three males and five females per treatment. The average weights of each animal per treatment were 0.588, 0.581, 0.577, 0.576 and 0.573 kg, respectively. Each treatment has eight replicates (rabbits), which were housed individually in hutches.

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Fresh cassava leaves (*Manihot esculenta* var *otu-pam*) were collected from the University of Nigeria, Nsukka farm. The leaves were sun-dried for five days after which they were pulverized and used to compound the experimental diets. The concentrate diet was formulated using Maize, Soyabean, Brewers Dry Grain (BDG), Fish Dust, Bone Meal, Salt and Molasses to Contain 18.81% Crude protein and 4.30 kcal/g energy. Five experimental diets were prepared with graded levels of CLM inclusion in the concentrate diet. The levels were 0% (Diet 1), 15% (Diet 2), 30% (Diet 3), 45% (Diet 4) and 60% (Diet 5). The proximate compositions of the diets are given in Table 1.

Table 1: Proximate compositions of the experimental diets

	Diets				
Nutrients	0% (Diet 1)	15% (Diet 2)	30% (Diet 3)	45% (Diet 4)	60% (Diet 5)
CP %	18.81	19.69	20.66	21.50	22.48
EE %	7.40	7.48	7.60	7.76	7.90
CF %	5.80	6.65	8.13	9.60	11.07
Energy (Kcal/g)	4.30	4.36	4.45	4.52	4.62

The animals were re-weighed at the beginning of data collection. Known quantities of feed were provided daily *ad libitum* for a period of three weeks. The remnants of feed were measured to determine the feed intake. After three weeks, the rabbits were weighed again and the weight gains were calculated. Faeces voided were collected in labeled polythene bags, bulked, oven-dried for 48 h at 80°C and weighed. The feeds and faeces were milled separately to pass through a 1 mm sieve. After this, the samples were subjected to proximate analysis. The crude protein, crude fibre and ether extract components of the feeds and faces were determined using the AOAC (1990) methods. The gross energy contents were determined using the Parr Adiabatic Bomb Calorimeter.

The data obtained were subjected to statistical analysis under a completely randomized design with five treatments and eight replicates. The SPSS (2004) statistical programme was used and differences between treatment mean values were separated using Duncan's New Multiple Range Test (DNMRT).

RESULTS

The dry matter intake, average daily gain, crude protein intake and feed conversion ratio of the rabbit are presented in Table 2. The dry matter intake was highest at 15% inclusion of cassava leaf meal and poorest at 60% level of inclusion. Diets 1, 3 and 4 with 0, 30 and 45% levels of inclusion were not significantly different from one another ($p>0.05$). Diets 2 and 3 gave the highest Average Daily Weight Gain (ADWG) values compared to diets 1, 4 and 5 which gave lower values. No significant ADWG differences were obtained between diets 2 and 3; similarly none existed among diets 1, 4 and 5. Diets 1, 2 and 3 had no significant differences in Feed Conversion Ratio (FCR), but there was a meaningful difference between diets 2 and diets 4 and 5.

The nutrient digestibility coefficients of the various diets by the rabbits are shown in Table 3. The digestibility coefficients of dry matter for 0% and 15% inclusions of cassava leaf meal were the same. No differences were obtained between 15, 30 and 45% inclusion. But there existed significant differences between 30, 45 and 60% inclusions. There were no significant difference between CF digestibility coefficients of diet 2, 3 and 4, but difference existed between 15% and 60% inclusion levels. The same was true for ether extract digestibility. Crude protein and energy digestibility followed the same pattern. There were no observable differences for 15, 30, 45 and 60% inclusion levels of cassava leaf meal ($p>0.05$). The values obtained were inversely proportional to the cassava leaf meal inclusion. That is, generally the coefficients decreased in value with increasing levels of the CLM inclusion in the diets for each nutrient.

DISCUSSION

The dry matter intake of the rabbit ranged from 44.24 g to 66.85 g/day/rabbit and it is within the range of 40-80 g per day per rabbit reported by Joyce *et al.* (1971), Iyeghe-Erakpotobor *et al.* (2002) and Olorunsanya *et al.* (2007) and close to the ranges obtained by Omole *et al.* (2005) and Iyeghe-Erakpotobor *et al.* (2006). As the percentage incorporation of the cassava leaf meal increased from 0-15%, the DM intake increased from 53.00 g to 66.85 g/d/rabbit and also diarrhoea, which was observed in treatment I (0% inclusion level), disappeared. This agreed with the finding of Davidson and Spreadbury (1975), Carregal (1977) and Omole *et al.* (2005) who claimed that the dietary level of crude fibre less than 6% will promote diarrhoea in the rabbit. As the cassava leaf meal inclusion exceeded 15%, the Voluntary Feed Intake (VFI) started to decline from 56.76 g in 30% inclusion to 44.24 g in 60% inclusion. This result is in agreement with that of Maff (1978) and Omole *et al.* (2005) who recommended 12-14% inclusion level of forage in the diet of rabbits. The decline in DM intake may be as a result of physical barrier to feed intake due to the coarseness of the feed or as a result of change in satiety level at the satiety control centre in the hypothalamus. Again, as the cassava leaf meal inclusion increased from 30-60%, the crude protein and energy contents of the diet increased but the VFI and energy intake decreased. The rate of decrease in VFI was so high that the total CP and energy consumptions per day were also decreased.

Table 2: Dry matter intakes, average daily gain, energy intake, feed conversion ratio of the rabbits fed graded levels of cassava leaf meal

	Diets				
Parameters	1	2	3	4	5
DM intake					
- g/day/rabbit	53.00^{b}	66.85^{a}	56.76^{b}	55.61^{b}	44.24^{c}
- g/day/kg live-weight	73.22	84.39	74.20	70.08	54.60
Daily gain: g/d/rabbit	11.63^{b}	21.36^{a}	17.05^{a}	10.55^{b}	8.43^{b}
CP Intake g/day/rabbit	9.97	13.16	11.73	11.96	9.95
Energy Intake Kcal/day	227.90	291.47	252.58	251.36	204.39
Feed Conversion Ratio (FCR)	4.56^{ab}	3.13^{a}	3.33^{ab}	5.27^{b}	5.25^{b}

*^{a,b,c}Indicates values with different superscripts within row differ significantly ($p<0.05$)

Table 3: Mean nutrient digestibility coefficients of the diets by rabbits

	Diets						
Nutrients (%)	1	2	3	4	5	Mean	SE
DM	81.09^{a}	76.17^{ab}	72.12^{bc}	73.13^{bc}	67.06^{c}	73.91	±2.59
CP	77.50^{a}	67.67^{b}	65.71^{b}	65.11^{b}	54.13^{b}	68.02	±2.60
CF	44.43^{a}	36.79^{b}	30.20^{bc}	29.99^{bc}	24.95^{c}	33.27	±3.76
EE	75.65^{a}	66.46^{b}	59.93^{b}	60.73^{b}	48.99^{c}	62.35	±4.88
Energy	79.16^{a}	70.79^{b}	71.14^{b}	70.40^{b}	65.40^{b}	71.38	±2.47

*^{a,b,c}Indicates values with different superscripts within row differ significantly ($p<0.05$)

The Average Daily Weight Gain (ADWG) decreased with increasing level of cassava leaf meal except that 15% inclusion was better than 0% inclusion. 15% inclusion level proved best with ADWG of 21.36 g. Also at 30% level of CLM, the ADWG of 17.05 g/day/rabbit was obtained which was reasonably higher than the ranges reported by Olorunsanya *et al.* (2007), Omole *et al.* (2005) and Oluremi and Nwosu (2002) when 30% of other aspects of cassava were fed. The difference between these results could be attributed to more proteins and digestible nutrients contained in CLM than other aspects of cassava meal (Oyenuga, 1968). Olorunsanya *et al.* (2007), Omole *et al.* (2005) and Oluremi and Nwosu (2002) also obtained similar ADWG for the rabbits when only concentrate diets were fed.

The FCR range of 3.13-5.29 obtained in this work showed a very good performance of the rabbits. The values obtained in this study are comparable with 3.9-4.1 range reported by Cheeke (1971) when arginine, lysine and methionine were added to rabbit diet. Olorunsanya *et al.* (2007), Omole *et al.* (2005) and Oluremi and Nwosu (2002) reported poorer FCR for the rabbits. The digestibility coefficients obtained in this study are within the range reported elsewhere (Omole *et al.* 2005; Oluremi and Nwosu, 2002). In general the digestibility coefficients declined with increased level of CLM and this agreed with the reports of Bassendina (1969), Omole *et al.* (2005) and Olorunsanya *et al.* (2007) who observed decrease in nutrient digestibility with increased level of crude fibre in the diet. This may be as result of the masking effect of crude fibre on the bacteriostatic activity in the caecum. It reduces the microbial protein synthesis and fermentative ability of the caecum thereby resulting in decreased caecum microbial population.

Conclusion: Forage free diet is not ideal for optimal performance of rabbits. It induces diarrhoea, reduction in FCR, ADG and DM intakes. Again the level of crude fibre in the diet affects the digestibility of nutrients by the rabbits. Furthermore profitable rabbit production cannot be achieved by feeding more than 30% CLM. Since 15% inclusion of CLM was not superior to 30% inclusion, rabbits can be profitably maintained on a diet with up to 30% of CLM.

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