Nutrient intake, digestibility and growth rate of rabbits fed varying levels of cassava leaf meal

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Abstract

Forty young rabbits were fed on five diets varying in cassava leaf meal (CLM) levels from 0% to 60%. Dry matter and nutrient intake and digestibility, weight gain and economics of CLM inclusion were determined. The DMI (g/d) ranged from 44.24 (60% CLM) to 66.85 (15% CLM); daily live weight gain (LWG, g/d) from 8.43 (60% CLM) to 21.36 (15% CLM); feed conversion ratio (FCR) from 3.13 (15% CLM) to 5.27 (45% CLM). Differences between treatments in these production criteria were significant ($P < 0.01$). Water consumption (l/kg) increased with increasing levels of CLM inclusion ($P < 0.05$). The digestibility of dry matter (DMD) and other nutrients decreased with increasing level of CLM inclusion ($P < 0.05$). Economic analysis showed that diet 1 (0% CLM) was the least economical. Feed cost (₦/kg gain) was similar for diets 2 to 5 ($P > 0.05$). It may be concluded that CLM included at between 15 to 30% of the diet is adequate for growing rabbits.

Keywords: Nutrient intake, digestibility, growth rate, cassava leaf meal, rabbit

Introduction

Rabbits require at least 6% fibre in their diets for efficient functioning of the alimentary tract and to prevent enteritis (Davidson and Spreadbury, 1975; Cheeke, 1984). Forages have variable amounts of fibre and are not suitable as sole feed for growing rabbits (Raharjo *et al.*, 1986). Forages combined with concentrates at certain levels gave better performance than either forage or concentrate fed alone (Cheeke, 1984; Aduku *et al.*, 1988).

Cassava leaf meal (CLM) has a protein content of about 32% and crude fibre level of about

17% (Mecha and Adegbola, 1980) and is commonly fed to rabbits. Raharjo *et al.* (1986) and Adegbola and Oduoza (1992) reported that rabbits fed tropical forages including cassava leaves lost weight indicating that growing rabbits could not be sustained on cassava leaves alone as sole feed. Dried forages such as alfalfa (Pote *et al.*, 1980), cowpea hay and groundnut haulms (Aduku *et al.*, 1988) have been included in rabbit diets to give daily weight gains ranging from 15 to 40g. There is paucity of information on the effect of cassava leaf meal inclusion in rabbit diets. The present

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experiment was therefore designed to determine the optimum inclusion level of cassava leaf meal in the diet of growing rabbits. Inclusion of CLM in rabbit diets may also result in appreciable reduction in feed cost.

Materials and methods

Location of experiment

The experiment was conducted in the Animal Production farm of the University of Nigeria, Nsukka. Mean annual minimum temperature ranges from 20°C to 23°C, maximum temperature, 27°C to 33°C, humidity 37% to 80% and annual rainfall 1400 to 1580mm. The dry season usually lasts from November to March and the rainy season from April to October.

Animals and their management

Forty New Zealand White rabbits, 6 to 7 weeks old with an average weight of 580g were randomly allotted to five groups of eight animals per group and housed individually in all-wire metabolism cages which were designed for easy collection of faeces in pans placed beneath the cages. The rabbits were provided feed and water *ad libitum* twice daily at 08.00h and 16.00h. Feed was provided in such a way as to minimise refusal. Faecal samples were collected daily for one week during the third week of the experiment,

oven-dried at 80°C for 48h and stored in sample bottles. Feed intakes and live weights were recorded daily and weekly, respectively for 6 weeks (February 10-March 25).

Diets

Cassava leaf meal was prepared by sun drying cassava leaves (*Manihot esculentum Crants var, otupam*) for five days (February 1-5). The dried leaves were then hammer milled to a length of about 3mm and mixed with other ingredients as shown in Tables 1 and 2.

Chemical analysis

The proximate components of the diets and the faeces were determined by the A.O.A.C. (1980) methods. Gross energy was determined by means of the Parr adiabatic bomb calorimetry.

Statistical analysis

The values obtained for dry matter intake (DMI), nutrient digestibility, daily weight gain (DWG), feed conversion ratio (FCR), protein efficiency ratio (PER) and feed cost N/kg gain were subjected to analysis of variance (ANOVA) and where significant differences between the means were indicated, Duncan's (1955) multiple range test was used to separate the means.

Table 1 Composition of the diets fed to the rabbits

	Diets				
	%CLM				
	0%	15%	30%	45%	60%
Maize	61.0	51.9	42.7	33.6	24.4
Soya bean meal	21.0	17.9	12.7	9.1	4.7
Cassava leaf meal (CLM)	0.0	15.0	30.0	45.0	60.0
Brewer's grains	9.5	6.7	4.3	4.3	3.7
Molasses	6.0	6.0	5.8	5.5	4.7
Bone meal	2.0	2.0	2.0	2.0	2.0
Salt	0.5	0.5	0.5	0.5	0.5
	100.0	100.0	100.0	100.0	100.0

*Rasolvit, a vitamin premix containing the following per 100g was added in water at 5 g/litre. Vit. A (I.U) 1,250,000, Vit. D3 (I.U) 200,000 Vit. E (I.U) 1000, Vit. K₃ (mg) 550, C (mg) 1500, B₁ (mg) 180, B₂ (mg) 210, B₆ (mg) 210, B₁₂ 1000.

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Table 2 Chemical composition of the cassava leaf meal (CLM) and the experimental diets

Components	CLM	Diets % CLM				
		0	15	30	45	60
Crude protein (%)	24.68	16.65	16.93	16.96	16.97	16.98
Crude fibre (%)	14.87	5.20	6.65	8.13	9.60	11.07
Ether extract (%)	7.93	7.40	7.48	7.60	7.76	7.90
Gross energy (MJ/kg)	19.66	17.99	18.24	18.62	18.91	19.33

Table 3 The nutrient intake and growth of rabbits fed varying levels of cassava leaf meal

Measurement	Diets				
	0	15	% CLM [†] 30	45	60
Dry matter intake	53.00 ^b	66.85 ^a	56.76 ^b	55.61 ^b	44.24 ^a
-Dry matter intake (g/d)					
- as % body weight	7.32 ^a	8.44 ^a	7.42 ^a	7.01 ^a	5.46 ^a
Water Intake (ml/kg body weight)	137.42 ^a	170.89 ^a	200.75 ^a	277.68 ^a	243.44 ^a
L/kg dry matter intake	2.92 ^a	3.10 ^a	4.06 ^{ab}	6.10 ^b	5.35 ^b
Crude protein intake (g)	8.82 ^a	11.32 ^a	9.63 ^a	9.44 ^a	7.51 ^a
Gross energy intake (MJ)	0.95 ^a	1.22 ^a	1.06 ^a	1.05 ^a	0.86 ^a
Digestible energy intake (MJ)	0.75 ^a	0.86 ^a	0.75 ^a	0.74 ^a	0.56 ^a
Daily weight gain (g)	11.63 ^b	21.36 ^a	17.05 ^a	10.55 ^b	8.43 ^b
Feed conversion ratio	4.56 ^{ab}	3.13 ^a	3.33 ^{ab}	5.27 ^b	5.25 ^b
Protein efficiency ratio	1.32 ^{bc}	1.89 ^a	1.77 ^{ab}	1.12 ^c	1.12 ^c

[†] Means in a row followed by the same superscript are not significantly different ($P > 0.05$).

Results and discussion

The intake and digestibility of nutrients and the growth performance of the rabbits are presented in Tables 3 and 4. The daily dry matter intakes (DMI) of the diets were less than those of Omole and Onwudike (1983) (60 to 75g) and Aduku *et al.* (1988) (70 to 85g).

The rabbits on the 15% CLM diet had the highest feed consumption ($P < 0.05$) difference between treatments in the intakes of crude protein and energy by the rabbits. The dry matter intake of 5.5 to 8.4% of body weight is adequate for the growth of rabbits according to Joyco *et al.* (1971) who reported values of 4.7%. Energy and protein intakes were also

adequate since the rabbits gained weight on all the diets.

There were significant differences ($P < 0.05$) between treatments in live weight gain (Table 3). Rabbits on the 15% and 30% CLM gained more weight than those on other diets. The marked depression in weight gain at CLM inclusion above 30% was similar to the finding of Omole and Onwudike (1983) using cassava peels. The live weight gains in this study in the humid tropics are much less than 31 to 44g obtained under temperate conditions (Pote *et al.*, 1980). The lower weight gain of rabbits under tropical condition may be due to poorer feed, lower genetic potential of the rabbits or environmental effects such as high ambient

Table 4 Percentage digestibility and digestible energy of diets containing various levels of cassava leaf meal

	Diets				
	% CLM				
Measurement	0	15	30	45	60
Dry matter	81.09 ^a	76.17 ^{ab}	72.12 ^{bc}	73.13 ^{bc}	67.06 ^c
Crude protein	77.50 ^a	67.67 ^{ab}	65.71 ^{bc}	65.11 ^{bc}	64.13 ^b
Crude fibre	44.43 ^a	36.79 ^b	30.70 ^{bc}	29.99 ^{bc}	24.96 ^c
Ether extract	75.65 ^a	66.46 ^b	59.93 ^b	60.73 ^b	48.99 ^c
Energy	79.16 ^a	70.79 ^b	71.14 ^b	70.40 ^b	65.40 ^b
Digestible energy (MJ/kg)	14.24 ^a	12.91 ^a	13.24 ^a	13.21 ^a	12.64 ^a

^a Means in a row followed by the same superscript are not significantly different (P>0.05)

Table 5 Economics of feeding various levels of cassava leaf meal to rabbits

	Diets				
	% CLM				
Measurement	0	15	30	45	60
Total feed intake, (kg)	2.23	2.81	2.38	2.35	1.86
Cost of feed per kg. (₦)	14.07	12.25	10.14	8.01	5.91
Total cost of Feed, (₦)	31.38	34.42	24.13	18.74	10.99
Total weight gain, (g)	488 ^b	897 ^a	716 ^a	443 ^b	354 ^b
Cost of feed per kg weight gain, (₦)	64.30 ^a	38.37 ^b	33.70 ^b	42.30 ^b	31.05 ^b

^a Means in a row followed by the same superscript are not significantly different P>0.05)

temperature. It is known that high ambient temperature depresses feed intake and weight gain in rabbits (Lebas, 1983). However, the weight gain values are similar to those reported for growing rabbits in Nigeria (Omole and Onwudike, 1983; Aduku *et al.* 1988; Adegbola and Oduoza 1992).

Diets with 15% and 30% CLM gave the best FCR of 3.13 and 3.33 respectively which are comparable to other reports (Omole, 1977; 1982; Omole and Onwudike, 1983; Rastogi, 1986; Aduku *et al.*, 1988). This shows that the 15% and 30% CLM diets were efficiently utilized by the rabbits. There were significant differences (P<0.05) among the treatments in the PER of the diets. The PER values on the 15% and 30% CLM diets were similar to other reports (Abdella *et al.*, 1988) and this indicates that the dietary protein in those diets were

utilized efficiently. Water intake (l/kg DMI) increased with increasing level of CLM. The values obtained for 45% and 60% CLM inclusion were higher than the value of 4l/kg DMI recommended for rabbits in warm climates (Lebas, 1983). High levels of water consumption are required under tropical condition for temperature regulation. Much water may also be required for fibre fermentation in the caecum and to convey catabolites (including thiocyanates derived from HCN) from the body (Macfalane and Howard, 1969). Cassava tuber and leaves contain cyanogenic glycosides, linamarin and lotaustralin which on hydrolysis give HCN. Sun drying reduces but does not completely eliminate HCN from cassava (Obioha and Anikwe, 1982).

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The digestibility of the nutrients is presented in Table 4. The values for all the components decreased with increasing level of CLM and crude fibre (CF). The relationship between nutrient digestibility and crude fibre level may be represented by the following regression

$$\begin{aligned} \text{DMD} &= 91.12 - 2.12\text{CF} \quad (r = -0.95 \text{ } P < 0.01) \dots\dots\dots (1) \\ \text{CFD} &= 58.68 - 3.11\text{CF} \quad (r = -0.97 \text{ } P < 0.01) \dots\dots\dots (2) \\ \text{CPD} &= 84.21 - 1.99\text{CF} \quad (r = -0.85 \text{ } P < 0.05) \dots\dots\dots (3) \\ \text{EED} &= 95.02 - 4.02\text{CF} \quad (r = -0.96 \text{ } P < 0.01) \dots\dots\dots (4) \\ \text{ED} &= 86.80 - 1.90\text{CF} \quad (r = -0.89 \text{ } P < 0.01) \dots\dots\dots (5) \end{aligned}$$

The negative correlation coefficients between CF and nutrient digestibility showed that fibre in the diet depresses nutrient digestibility. The digestibility values of DM, crude protein (CP), energy and ether extract were similar to values reported by Adegbola and Akinwande (1981). The digestibility values for crude fibre were lower than those of the other nutrients. Rabbits are less efficient at digesting fibre than sheep or cattle (Slade and Hintz, 1969; Joyce *et al.*, 1971). The decrease in crude fibre digestibility with increasing level of fibre in the diets has been previously reported. The low fibre digestibility could be due to the type of fibre in the diet. Fibres from different sources could vary in the digestibility depending on the proportions of cellulose, hemicellulose and lignin.

The economic analysis of the diets (Table 5) showed that values of feed cost/kg of gain were similar for diets containing 15% to 60% CLM but these were significantly lower ($P < 0.50$) than the value obtained for 0% CLM. This shows that it is economical to include CLM in the diets of rabbits.

Since the daily weight gain, FCR, PER and feed cost/kg weight gain on the 15% CLM and 30% CLM were similar but better than those on 0%, 45% and 60% CLM diets, it may be

equations for digestibilities of dry matter (DMD), crude fibre (CFD), crude protein (CPD), ether extract (EED) and energy (ED).

concluded that a diet comprising between 15-30% CLM is suitable for feeding rabbits.

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