J. Appl. Anim. Res. 14 (1998): 93-98

Nutrient Utilisation and Growth Performance of Rabbits Fed Diets Based on Maize, Cassava or Their By-products

A.A. Onifade*, O.A. Abu, O.N. Akande, O.T.F. Abanikannda

Department of Animal Science
University of Ibadan, Ibadan, Nigeria

(Received July 9, 1997; accepted February 4, 1998)

Abstract

Onifade, A.A., Abu, O.A., Akande, O.N. and Abanikannda, O.T.F. 1998. Nutrient utilisation and growth performance of rabbits fed diets based on maize, cassava or their by-products. J. Appl. Anim. Res., 14: 93-98.

A 70-day feeding trial was conducted to evaluate nutrient intake, digestibility and growth characteristics of rabbits fed maize grain (mg), maize offal (mo), cassava tuber (ct) or cassava peel (cp) based diets. The four test ingredients were included at 30.84% in diets supplying 17% crude protein. The consumption of dry matter, crude protein and crude fibre were higher (P<0.05) in mo and cp based diets, while apparent digestibilities were better (P<0.05) in rabbits fed mg and ct based diets. Rabbits fed mo attained the highest (P<0.05) body weight gain, followed by those fed mg and ct and the group fed cp gained the least. Feed consumption was higher (P<0.05) in rabbits fed cp and mo than mg and ct diets; and the gain:feed ratio was the reverse of the feed intake. It is concluded that mo and ct are effective substitutes for mg, however, diets based on cp would require nutrient supplementation.

Key words : Rabbits, maize, cassava, by-products, nutrient utilisation, growth performance.

*For correspondence : Department of Biological Sciences, Botany and Microbiology Division, Kuwait University, P.O. Box 5969, Safat 13060, Kuwait.

J. Appl. Anim. Res. 0971-2119/98/$05.00 © GSP, India

Introduction

Cheeke (1986) prescribed investigations into efficient feeding systems for rabbits in the tropics and sub-tropics. A conceivable study, therefore, involves research into alternatives for maize being the choice energetic ingredient in rabbit diets.

Root and tuber crops, like cassava because of their comparable calorie density and higher calorie production per hectare are veritable substitutes. Abu (1997) further suggested the optimisation of under-utilised crops like sweet potato, cocoyam, banana and plantain in rabbit diets. He proffered and evaluated some biotechnological methods for protein and nutrient enrichment of sweet potato to be more compatible with maize.

In the tropics and sub-tropics, maize grain (*Zea mays*) and cassava (*Manihot esculenta*) are consumed in various processed forms, thus making available their by-products as potential feedstuffs. Previous investigations (Abu and Ekpenyong, 1993; Onifade and Tewe, 1993) have established rabbit's satisfactory utilisation of various by-product feed resources. However, studies on the comparative implications of feeding diets based on maize – a conventional feed ingredient or cassava- a substitute or their by-products (not consumed by human beings) on quantitative nutrient intake, estimation of nutrient digestibility and the resultant growth performance need to be further established.

Materials and Methods

Experimental ingredients and diet formulations

Four energetic ingredients namely; maize grain (mg), maize offal (mo), cassava tuber meal (ct) and cassava peel (cp) (Table 1) were equiponderantly (on percentage basis) incorporated into a full-fat soybean based diets (Table 2). Maize offal was obtained as a by-product of local maize-milling factory. It consists essentially of the aleurone layer (bran) and some broken particles of the endosperm. Cassava root meal was prepared from harvested tubers of various varieties. The tubers were washed, grated and put in bags for 48 hours to allow for fermentation necessary for the detoxification of the native cyanogenic glucoside. Fresh cassava peels were collected from cassava processing factory and sun-dried for five days before incorporation into the diets. Four isonitrogenous (17% CP) full-fat soybean based diets were formulated to contain each of the energetic ingredients at 30.84%.

Table 1
Proximate composition of the experimental ingredients (dry matter basis)

	Maize	Maize offal	Cassava root	Cassava peel
Dry matter	90.75	91.30	90.32	92.15
Crude protein	9.89	12.40	2.25	5.52
Ether extract	2.43	2.11	0.85	0.56
Crude fibre	3.86	8.80	3.40	15.78
Ash	1.53	3.42	1.35	5.29
Gross energy (Kcal/kg)	4370	3640	4115	3580

Table 2
Ingredients and proximate composition of experimental diets

Treatments	Maize	Maize offal	Cassava root	Cassava peel
Maize	30.84	—	—	—
Maize offal	—	30.84	—	—
Cassava root meal	—	—	30.84	—
Cassava peel meal	—	—	—	30.84
Brewers' dried grains	30.00	33.80	25.46	25.26
Full-fat soybean meal	20.86	17.28	25.40	24.60
Palm kernel meal	15.00	15.00	15.00	15.00
Salt	0.50	0.50	0.50	0.50
Vit-min premix[a]	0.30	0.30	0.30	0.30
Oyster shell	1.50	1.50	1.50	1.50
Bone meal	1.00	1.00	1.00	1.00
Chemical composition (dry matter basis)				
Dry matter	88.05	87.98	87.78	88.24
Crude protein	18.24	17.28	18.1'3	18.97
Ether extract	3.00	4.60	3.80	4.10
Ash	5.70	8.22	7.24	9.90
Crude fibre	5.50	9.10	6.94	11.18
Gross energy (Kcal/kg)	4320	3950	4110	3850

[a]Roche Uni-vit 15 premix per kg provides : Vitamins : A 8,000,000 I.U., E 3,000 I.U.; K_3 3g; B_2 2.5g; Nicotinic acid 8g; D-Pantothenate 3 g; B_6 0.3g; B_{12} 8 mg; Minerals : Mn 10g; Fe 5g; Zn 4.5g; Cu 0.2g; I_2 0.15g; Co 0.02g; Se 0.01g.

Management of rabbits

Twenty-four New Zealand White rabbits (5-6 wk, 604g) were randomly allocated to four dietary treatments. Rabbits were individually accommodated in metal cages with *ad libitum* feed and water throughout the seventy days experimental period. Daily feed intake and weekly body weights and feed conversion (gain:feed) were computed for each rabbit. During the last seven days total faecal collection for determination of apparent nutrient digestibility was carried out for each rabbit.

Chemical analysis

Proximate analysis of the ingredients, diets and faeces were carried out according to AOAC (1980). Gross energy of the sample was determined by bomb calorimeter.

Statistical analysis

Data obtained during the study were subjected to analysis of variance (Steel and Torrie, 1980) and means were separated by Duncan's multiple range test (Duncan, 1955).

Results and Discussion

Intake of dry matter, crude protein and crude fibre (Table 3) were higher ($P<0.05$) in rabbits fed mo and cp, however, rabbit fed mg and ct had superior ($P<0.05$) digestibilities. The above pattern could be explained by the negative implications (Onifade and Tewe, 1993) of high dietary fibre intake. Dietary fat intake and excretion by rabbits on the treatments were different ($P<0.05$), however, the comparably ($P<0.05$) high digestibilities computed for rabbits on the treatments are consistent with antecedent reports (Onifade and Tewe,

Table 3

Nutrient intake and apparent digestibility in rabbits fed diets based on maize, cassava or their by products[1]

Energy source :	mg	mo	ct	cp	SEM
Diets	1	2	3	4	
Dry matter					
Intake, g day^{-1}	53.93^{b}	60.71^{a}	53.29^{b}	62.99^{a}	0.86
Digestibility, %	86.06^{a}	76.82^{b}	83.11^{a}	77.54^{b}	0.75
Crude protein					
Intake, g day^{-1}	11.54^{b}	11.93^{b}	11.01^{b}	13.54^{a}	0.15
Digestibility, %	82.88^{a}	72.65^{b}	81.94^{a}	75.11^{b}	0.87
Fat					
Intake, g day^{-1}	1.84^{c}	3.18^{a}	2.31^{b}	2.93^{ab}	0.08
Digestibility, %	76.49^{a}	71.80^{ab}	78.43^{a}	71.12^{b}	0.61
Crude fibre					
Intake, g day^{-1}	3.37^{c}	6.29^{b}	4.21^{c}	7.98^{a}	0.31
Digestibility, %	55.61^{a}	39.60^{b}	53.43^{a}	33.08^{c}	1.85
Energy					
Intake, g day^{-1}	176.50^{a}	171.20^{a}	162.50^{b}	167.30^{b}	1.02
Digestibility, %	74.36^{a}	70.25^{ab}	73.12^{ab}	68.18^{b}	0.47

^{a,b,c}Means with different superscripts in a row are different ($P<0.05$).

[1]Mean values are averge across 7d collection period from 6 rabbits.

1993; Abu and Ekpenyong, 1993). There were no variation in digestible energy intake in consonance with earlier findings (Cheeke *et al.*, 1987; Onifade and Tewe, 1993).

Rabbits fed mo attained the highest ($P<0.05$) weight gain followed by those fed mg and ct and the cp group had the least ($P<0.05$) body weight gain (Table 4). Total feed consumption was higher ($P<0.05$) in rabbits fed mo and cp than those fed mg and ct because of the fibrous nature of the former ingredients and the demonstrated capacity of rabbit to eat primarily to satisfy energy requirement. The gain : feed was the reverse of the feed intake being significantly poor on the cp diet. The inferior growth characteristics of rabbits fed cp diet substantiates the inferior nutritive quality of cp (Onifade and Tewe, 1993), rather than a deficit of dietary energy intake and/or utilisation. These authors have variously recommended adequate protein and sulphur amino acids suplementation of cp based diets for rabbits. Aletor (1993) indicated that sulphur amino acids deficiency may be created and exacerbated on cp (a cyanide containing feedstuff); because the amino acids are utilised in the rhodanase detoxification pathway.

Table 4
Performance characteristics of rabbits fed diets based on maize or cassava or their by-products

Energy source :	mg	mo	ct	cp	SEM
Diets :	1	2	3	4	
Initial body weight, g	587	617	605	607	
body weight gain, g	938^{b}	993^{a}	940^{b}	908^{c}	6.25
Feed consumption, g	4288^{b}	4835^{a}	4250^{b}	4998^{a}	67.19
Gain : Feed, g Kg^{-1}	219^{a}	205^{b}	221^{a}	182^{c}	3.17

^{a,b,c}Means with different superscripts in a row are different ($P<0.05$).

The outstanding performance of rabbits fed mo most probably suggest the achievement of the delicate balance amongst nutrient : dietary fibre : digestible energy requisite for optimal growth. Cheeke *et al.* (1987) documented that optimal growth of rabbits is obtained when adequate nutrient is supplied, moderate fibre and sufficient digestible energy are consumed. Carbohydrate overloading of the hindgut, low fibre intake and highly digestible carbohydrate in mg and ct might have caused the comparatively less growth performance of rabbits.

In conclusion, the current data indicate maize offal and cassava tuber as effective substitutes for maize grain in rabbit diet; while cassava peel would require dietary fortification with good quality protein and sulphur amino acids to achieve comparable performance.

References

Abu, O.A. 1997. Biochemical characterisation and utilisation of sweet potato (*Ipomoea batatas*) (L) Lam for rabbit feeding. Ph.D Thesis, Department of Animal Science, University of Ibadan, Ibadan, Nigeria.

Abu, O.A. and Ekpenyong, T.E. 1993. Utilisation of dried palmoil mill effluent by young growing rabbits. World Rabbit Science, 1: 11-15.

Aletor, V.A. 1993. Allelochemicals in plant food and feedingstuffs. 1: Nutritional biochemical and physiopathological aspects in animal production. Veterinary and Human Toxicology, 38: 57-67.

AOAC 1980. *Official Methods of Analysis*. 13th edn., Association of Official Analytical Chemists. Washington, D.C.

Cheeke, P.R. 1986. Potentials of rabbit production in tropical and subtropical agricultural systems. J. Anim. Sci., 63: 1581-1586.

Cheeke, P.R., Patton, N.M., Lukefahr, S.D. and McNitt, J.I. 1987. *Rabbit Production*. The Interstate Printers and Publishers, Illinois, U.S.A.

Duncan, D.B. 1955. Multiple Range and Multiple F. Tests. Biometrics, 1: 1- 42.

Onifade, A.A. and Tewe, O.O. 1993. Alternative tropical energy feed resources in rabbit diets : growth performance, diet's digestibility and blood composition. World Rabbit Science, 1: 17-24.

ए0 ए0 ओनीफडे, ओ0 ए0 अबू, ओ0 एन0 अकान्डे, ओ0 टी0 एफ0 अबानिकान्नडा । मक्का, कसावा और उनके उपोत्पादों पर आधारित आहार प्राशन से शशकों में पोष्य उपयोगिता तथा वर्धन निष्पादन ।

मक्का (म), मक्का उच्छिष्ट (मउ), कसावा मूल (क) एवं कसावा छिलका (कछ) आधारित आहारों के प्राशन पर शशकों में पोष्य उपभोग, पाच्यता एवं वर्धन गुणों के मापन हेतु एक 70 दिवसीय प्राशन परीक्षण किया गया। लगभग 17 प्रतिशत प्रोटीन युक्त आहार में परीक्षणीय घटकों का 30.84 प्रतिशत मिश्रित किया गया। मउ तथा कछ आधारित आहारों से शुष्क पदार्थ, अपरिष्कृत प्रोटीन और रेशे का उपभोग सार्थकतः अधिक था, जबकि दृष्टिगत पाच्यता अन्य दो आहारों की अच्छी थी। मउ भक्षित शशकों में सर्वाधिक शरीर भार वृद्धि हुई जो क्रमशः म, क और कुछ वर्गों में घटती गई। म तथा क आहार की अपेक्षा कछ और मउ युक्त आहारों का भक्षण अधिक था परन्तु आहार : भार वृद्धि अनुपात उल्टा था। निष्कर्ष यह निकला कि मउ तथा क से म सफलतापूर्वक शशक आहार में विस्थापित किया जा सकता है परन्तु कछ उपयोग के साथ ऊर्जा समृद्ध खाद्य देना पड़ेगा।