Inter. J. Anim. Sci. 14 (2) : 197-201 (1999) 0970-2857/99/0.50+1.00 $

PERFORMANCE, NUTRIENT DIGESTIBILITY AND CARCASS CHARACTERISTICS OF RABBIT FED SWEET POTATO BASED DIETS

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ABSTRACT

The performance, nutrient digestibility and carcass characteristics of rabbits fed dehydrated sweet potato tops and sweet potato root meal in proportions of 100 : 0, 90 : 10, 80 : 20, 70 : 30, 60 : 40 and 50 : 50 were investigated. There was no significant difference (P>0.05) in daily feed intake. However, rabbits fed diets in proportion of 80 : 20 (T_3) recorded the highest daily weight gain and was significantly different (P<0.05) from other dietary treatments. No significant difference (P>0.05) was reported for the apparent digestibility of crude fibre and ash. Rabbits on diets T_3 (80 : 20) and T_4 (70 : 30) had the highest killing out per cent and head weights. No mortality was recorded throughout the duration of this study.

INTRODUCTION

The sweet potato (*Ipomoea batatas*) is a high-yielding, short-cycle crop that is adaptable to an ecological range of 0-2000 m above sea level between 30°N and 30°S (Hahn, 1984). This crop also thrives in drier regions of the tropical environment (Rowland, 1993). The use of the sweet potato tubers has been found as suitable substitute for maize in livestock feeding (Job *et al.*, 1979; Teguia *et al.*, 1993; Asumugba and Ukachukwu, 1996; Abu, 1997). In Nigeria, small scale rabbit producers feed fresh sweet potato foliage as the major ingredients to their rabbits. The sweet potato foliage is higher than the tuber in protein, minerals and vitamins, but performance of rabbits fed sweet potato foliage is usually low. The objective of this study was, therefore, to determne the best proportion of dehydrated sweet potato tops to sweet potato root meal, supplemented with minerals and vitamins, that will result in optimal performance of rabbits so fed.

MATERIALS AND METHODS

Ration Preparation

Sweet potato tops were harvested at three months after planting, sun-dried for about one week and further over dried at 60°C for 24 h. They were ground using a plate mill before incorporation with other ingredients. The sweet potato tops and dehydrated sweet potato root meal were mixed in proportions of 100 : 0, 90 : 10, 80 : 20, 70 : 30, 60 : 40 and 50 : 50 (W/W). No attempt was made to make the diets isocaloric or isonitrogenous. The feed ingredients were then supplemented with salt, minerals and vitamins to preclude any nutritional deficiencies that may arise as a result of the absence or insufficiency of these minerals and vitamins. The rations were then pelleted in a manual pelleting machine designed and fabricated by the post-harvest unit of the International Institute for Tropical Agriculture (IITA), Ibadan, Nigeria. The pellets were sun-dried on wood-framed trays with wire

Table 1. Nutritive value of sweet potato tops

Composition*	Percentage
Moisture	13.82±0.05
Crude protein	19.29±0.25
Crude fibre	23.53±1.22
Ether extractives	5.29±0.03
Nitrogen free extract	41.75±2.32
Ash	10.14±0.25
Ca	1.32±0.002
Total phosphorus	0.26±0.004

*Values obtained are the means of triplicate analyses.

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Table 2. Composition of experimental rations

Ingredients	Rations (%)					
	T_1	T_2	T_3	T_4	T_5	T_6
Dehydrated sweet potato tops : root meal	100 : 0	90 : 10	80 : 20	70 : 30	60 : 40	50 : 50
Dehydrated sweet potato tops	96.0	86.40	76.80	67.20	57.60	48.0
Sweet potato root meal	0.0	9.60	19.20	28.80	38.40	48.0
Bone meal	2.0	2.0	2.0	2.0	2.0	2.0
Oyster shell	1.0	1.0	1.0	1.0	1.0	1.0
Premix*	0.5	0.5	0.5	0.5	0.5	0.5
Salt (Sodium chloride)	0.5	0.5	0.5	0.5	0.5	0.5
Total	100	100	100	100	100	100

*Supplying per kg diet : Vit A, 4,000,00 IU; Vit D_3, 1,200,000 IU; Vit E, 3,200 IU; Vit B_{12}, 4.8 mg; Biotin, 12 mg; Pantothenic acid, 2,800 mg; Folic acid, 240 mg; Choline chloride, 200,000 mg ; Vit C, 4,000 mg; Fe, 2,400 mg; Mn, 32,000 mg; Copper, 3,200 mg; Zn, 20,000 mg; Co, 180 mg; Iodine, 800 mg; Selenium, 40 mg, Anti-oxidant, 2,400 mg; Calcium carbonate, Q. S., 1000 mg.

mesh bottom. Table 1 shows the nutritive value of dehydrated sweet potato tops, while Table 2 shows the composition of the compounded rations.

Feeding Trials

Forty-two crossbred rabbits of between 5-6 weeks old, averaging 608.75 g were randomly allotted to six different dietary treatments (T_1-T_6) of seven rabbits per treatment, with each rabbit confined to individual cages. The rabbits were fed experimental ration for one week adjustment period. The feeding trial lasted for 10 weeks. Feed and water were provided *ad libitum*. Weight gain and feed intake were recorded weekly. Digestibility trial was conducted at the end of the eighth week of the experiment. A 7-day faecal collection trial was carried out by Ridzwan *et al.* (1993). At the end of the trial, the rabbits were slaughtered by cervical dislocation and internal organs removed and weighed warm. The carcass was weighed and split into wholesale cuts.

Chemical Analysis

All the ration and faecal samples were analysed according to AOAC methods (Association of Official Agricultural Chemists, 1980) on a dry matter basis for crude protein, crude fibre, ether extractives and ash. Digestibility of dry matter, crude protein, crude fibre, ether extractives and ash was calculated based on the dry feed consumed and dry feaces.

Statistical Analysis

Treatment means were subjected to one-way analysis of variance as described by Steel and Torrie (1980).

RESULTS AND DISCUSSION

The proximate analyses of the rations are presented in Table 3. All the diets are sufficient to meet the recommended fibre requirements of young growin rabbits. However, diets T_1-T_3, and not diets T_4-T_6 met the recommended protein requirement for young rabbits. In spite of the shortfall in protein levels in T_4-T_6 average daily feed intake for rabbits showed no significant difference ($P>0.05$) for all the dietary treatments. Rabbits placed on diets containing dehydrated sweet potato tops and sweet potato roots meal in the ratio of 80 : 20 (T_3) the best daily weight gain of 12.70±0.17 g (Table 4) and this

Table 3. Proximate analysis of rations

Composition	Rations (%)					
	T_1	T_2	T_3	T_4	T_5	T_6
Dry matter	88.25	85.52	86.33	89.75	89.75	90.00
Crude protein	18.50	16.85	15.08	14.20	13.15	10.98
Crude fibre	22.95	20.22	18.32	16.50	12.95	11.89
Ether extractives	5.35	5.10	4.92	4.53	4.82	4.78
Nitrogen free extracts	41.66	40.22	41.53	39.76	39.22	35.43
Ash	13.57	11.68	14.19	14.35	14.90	15.50
Ca	2.53	1.40	1.89	1.99	0.56	0.19
Total phosphorus	0.97	0.81	0.86	0.71	0.82	0.65
Gross energy (Kcal/g)	3.30	3.36	3.41	3.46	3.51	3.56

Table 4. Performance of rabbits in feeding trials

Parameters	Rations					
	T_1	T_2	T_3	T_4	T_5	T_6
Average daily feed intake (g)	84.75±1.17	78.41±0.88	78.11±0.46	80.08±0.86	78.41±0.77	81.68±1.09
Average daily gain (g)	9.39±0.13^c	10.81±0.08^b	12.70±0.17^a	10.08±0.12^c	9.32±0.15^c	9.25±0.13^c
Feed conversion efficiency	0.11±-0.02^c	0.14±0.02	.16±0.001^a	0.13±0.03^b	0.12±0.003^c	0.11±0.003^c
Mortality	Nil	Nil	Nil	Nil	Nil	Nil

Means in the same row with different superscripts are significantly different (P<0.05).

value was significantly different (P<0.05) from values obtained for other treatments. Average daily gain upto 24 g has been reported in literature (Raharjo *et al.*, 1986; Ridzwan *et al.*, 1993). Quality of protein fed may possibly account for the observed differences. Rabbits on diet T_3 also recorded the highest feed conversion efficiency (P<0.05). The apparent digestibility of dry matter, crude protein, crude fibre, ether extractives and ash are presented in Table 5. No clear uniform treatment pattern was shown for the apparent digestibility of all the investigated. However, apart from digestibility of crude fibre and ash rabbits on diet T_3 appeared to have promising digestibility of all the nutrients. There was no significant dietary treatment (P>0.05) for crude fibre. Carcass and organ characteristics of the rabbits are shown in Table 6. Rabbits on diets T_3 and T_4 recorded the best killing out per cent and fresh pelt. But rabbits on diet T_3 had the highest abdominal fat and livers and these values were significantly different (P<0.05) from values obtained for other treatments. There were, however, no significant treatments (P>0.05) for head, distal forelegs, distal hind legs, heart, lungs, kidney, fat and spleen. Rabbit fed diet T_4 had the highest kidney weight of 0.74 g and this value was significantly different (P<0.05) for values obtained from other dietary treatments. Table 7 shows the wholesale cuts of the rabbits fed sweet potato based diets. Rabbit on diet T_3 had the highest ribcage value of 20.75±0.52% and this was significantly different (P<0.05) from values obtained for other dietary treatments. There was, however, no significant treatment (P>0.05) among treatment means for loin.

Table 5. Apparent digestibility obtained in digestion

Parameters	Rations (%)					
	T_1	T_2	T_3	T_4	T_5	T_6
Dry matter	50.88±0.53^{b}	52.23±1.00^{b}	60.51±0.89^{a}	51.31±0.92^{b}	56.83±1.28^{a}	52.55±2.84^{b}
Crude protein	66.49±0.54^{b}	72.07±0.87^{a}	74.77±0.89^{b}	63.79±2.79^{b}	61.88±1.66^{b}	65.77±0.79^{b}
Crude fibre	30.68±1.18	31.85±-1.67	32.16±3.20	34.88±1.74	33.29±2.37	32.51±1.23
Ether extractives	81.84±0.88^{b}	80.40±0.7^{b}	84.40±3.18^{ab}	87.26±0.86^{a}	79.67±0.42^{b}	80.12±0.32^{b}
Ash	64.40±0.80^{a}	58.04±1.69^{c}	61.24±0.64^{b}	55.38±1.72^{d}	86.31±1.93^{a}	52.92±1.18^{d}

Means in the same row with different superscripts are significantly different (P<0.05).

Table 6. Carcass and organ characteristics of rabbits fed diets containing various levels of dehydrated sweet potato tops and sweet potato root meal

Parameters	Rations					
	T_1	T_2	T_3	T_4	T_5	T_6
No. of animals	4	4	4	4	4	4
Live wt. at slaughter (g)	1280.99	1362.11	1494.81	1313.90	1259.10	1251.90
Warm carcass wt. (g)	622.45	648.34	741.90	655.73	548.02	609.64
Killing out (%)	48.60^{b}	47.60^{b}	49.63^{a}	49.91^{a}	46.38^{c}	48.70^{b}
Organ wt. (% of body weight)						
Fresh pelt	10.79^{b}	11.46^{b}	13.96^{a}	13.82^{a}	9.82^{b}	10.79^{b}
Head	10.24	11.61	11.08	10.16	10.47	10.43
Distal forelegs	1.14	1.16	1.15	1.34	1.41	1.32
Distal hind legs	2.51	2.63	2.23	2.26	2.38	2.27
Heart	0.33	0.33	0.31	0.30	0.31	0.34
Lungs	0.64	0.64	0.59	0.63	0.64	0.66
Kidneys	0.63^{c}	0.69^{b}	0.66^{c}	0.74^{a}	0.69^{b}	0.69^{b}
Kidney fat	0.07	0.07	0.07	0.07	0.07	0.08
Abdominal fat	0.30^{d}	0.33^{c}	0.47^{a}	0.37^{b}	0.31^{cd}	0.26^{e}
Liver	2.53^{b}	2.51^{bc}	3.45^{a}	2.32^{bc}	2.80^{b}	2.39^{c}
Spleen	0.11^{a}	0.09^{b}	0.07^{c}	0.09^{bc}	0.10^{ab}	0.13^{abc}

Means in the same row with different superscripts are significantly different (P<0.05).

Table 7. Wholesale cuts of rabbits fed various levels of sweet potato tops (dry matter basis) fed to young growing rabbits

Parameters	Rations (%)					
	T_1	T_2	T_3	T_4	T_5	T_6
Ribcage	20.19±0.40^{b}	18.75±0.17^{c}	20.75±0.52^{a}	19.06±0.25^{bc}	18.25±0.83^{c}	18.23±0.10^{c}
Loin	25.07±0.06	24.89±0.29	24.33±0.99	26.26±0.67	25.03±0.37	24.01±0.65
Rump	10.22±0.04	10.06±0.39	10.93±0.18	10.35±0.20	10.52±0.11	10.54±0.11
Forelegs	18.03±0.27	18.27±0.22	17.90±0.23	17.93±0.18	17.97±0.24	17.77±0.22
Hindlegs	26.49±0.57^{c}	28.03±0.54^{b}	26.13±0.51^{c}	26.40±0.78^{c}	28.44±0.57^{ab}	29.44±0.84^{a}

Means in the same row with different superscripts are significantly different (P<0.05).

rump and forelegs. But rabbits on treatments T_2, T_5 and T_6 had the highest lung legs and were significantly different ($P<0.05$) from those of other dietary treatments.

No mortality was recorded in this experiment. We, therefore, conclude that it is best to combine dehydrated sweet potato tops and sweet potato root meal in the proportion of 80 : 20 for optimum utilization by growing rabbits.

ACKNOWLEDGEMENTS

The authors wish to thank the Post-Harvest Unit of the International Institue for Tropical Agriculture (IITA), Ibadan, Nigeria for making available the manual pelleting machine used in this study. Special thanks go to Dr Y. W. Jeon of the unit for his guidance in the use of the pelleting machine.

REFERENCES

Abu, O. A. (1997). Biochemical characterisation and utilization of processed sweet potato (*Ipomoea batatas*) for rabbit feeding. Ph. D. thesis submitted to the Department of Animal Science, University of Ibadan, Ibadan, Nigeria. 248 pp.

Association of Official Agricultural Chemists (1980). *Official Methods of Analysis. 13th edition.* Washington, DC, 1018 pp.

Asumugba, G. N. and Ukachukwu, S. N. (1997). Economic potential of unmarketable sweet potato tubers as energy substitute in livestock feed production. An abstract of paper presented at the 22nd Annual Conference of the Nigerian Society for Animal Production held at Abubakar Tafawa Balewa University, Bauchi, 23-27 March, 1997.

Hahn. S. K. (1984). Tropical root crops, their improvement and utilization. Ibadan, Nigeria. IITA.

Job. T. A., Oluyemi, J. A. and Entonu, S. (1979). Replacing maize with sweet potato in diets of chicks. *Brit. Poult.* **20** : 515-519.

Raharjo, Y. C., Cheeke, P. R. and Patton, N. M. (1986). Growth and reproductive performance of rabbits on a moderately low crude protein diet or without methionine or urea supplementation. *J. Anim. Sci.* **63** : 795-803.

Ridzwan, B. H., Fadzli, M. K., Rozali, M. B. O., Chin. D. T. F., Ibrahim, B. M. and Faridnordin (1993). Evaluation of cocoa-pod husks on performance of rabbits. *Anim. Feed Sci. Tech.* 40 : 267-272.

Rowland, J. (1993) Root crops. In : *Dryland Farming in Africa,* Rowland, J. (ed.). Published by MacMillan Press Ltd., London and Basingstroke. 336 pp.

Steel, R. G. D. and Torrie, J. H. (1980). *Principles and Procedures of Statistics.* McGraw Hill. New York.

Teguia, A., Tchoumboue, J., Mayaka, B. T. and Tankou, C. M. (1993). The growth of broiler chickens as affected by the replacement of graded levels of maize by sweet potato leaves (*Ipomoea batatas*) or Ndole (*Vernonia* sp.) in the finisher diet. *Anim. Feed Sci. Tech.* **40** : 233-237.