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PERFORMANCE OF GROWING RABBITS FED GRADED LEVELS OF SWEET POTATO (*Ipomea batatas*) PEEL MEAL DIETS SUPPLEMENTED WITH AND WITHOUT MOLASSES

A.A. Malik, Y.S. Kudu, M.J. Ibrahim, A.A. Agunbiade, and M.T. Oyedepo
Department of Animal Production, Federal University of Technology, Minna, Niger State
Corresponding Author's e-mail: delemalik@yahoo.com

Abstract
24 growing rabbits of mixed breeds of average weight of 896±56g were fed graded levels of sweet potato peel meal (SPPM) in place of maize-based diets with and without molasses. The animals were divided into 6 treatments (with 2 replicates per treatment and 2 animals per replicate) and designated as follows: 0% replacement of maize by SPPM, without molasses (T1); 0% replacement of maize by SPPM, with molasses (T2); 25% replacement of maize by SPPM, without molasses (T3); 25% replacement of maize by SPPM, with molasses (T4); 50% replacement of maize by SPPM, without molasses (T5); and 50% replacement of maize by SPPM, with molasses (T6). The diets were offered ad-libitum *to the animals for a period of 56 days. There was no significant ($p>0.05$) difference in feed intake, weight gain and feed conversion ratio among the dietary treatments. Also, digestibility of dry matter, crude protein, ether extract, nitrogen free extract (NFE) as well as total digestible nutrient (TDN) showed no significant ($p>0.05$) difference among the different treatments; but the digestibility of crude fibre and ash were significantly ($p<0.05$) different among the dietary treatments. Hence, sweet potato peel meal can replace 50% of maize in the diets of growing rabbits without any detrimental effect on growth performance and digestibility of nutrients.*

Introduction

The world population is estimated to be about 7 billion and is growing at an exponential rate. This calls for an aggressive approach towards food production to feed the already high human population, and prevent malnutrition. The availability of animal protein on sustainable basis has been the major concern of the livestock industry in Nigeria. Hence, there is the intensive search for alternative feed sources to improve the level of animal production at reduced cost.

The rabbit (*Oryctolagus cuniculus*) is a monogastric herbivore that has the capacity to efficiently utilize forages and industrial by-products as feed sources (Aduku and Olukosi, 1990). As a source of meat, it is well disposed to early breed back; and is one of the farm animals that combine high efficiency and high rate of feed conversion with faster rate of maturity (Fielding 1991). Considering this quality in addition to its high reproductive capability and fast growth rate, the potential of rabbit in alleviating the shortage of animal protein is enormous and calls for development.

Sweet potato (*Ipomea batatas*) is grown for its edible tuber. It ranks fourth in production and importance after cassava, yam and cocoyam (Ikwelle *et al.*, 2003). It is also used as filler in canning and sauces for the manufacture of starch flour, glucose, syrup and alcohol; the young leaves are used as vegetable and the fresh vines as well as the tubers are often fed to livestock (Williams and Rajaratnam, 1987). Sweet potato plant is a creeping annual plant. The tuber is rich in starch and also contains some sugar, protein and fat. It contains about 6.3% crude protein and metabolizable energy of about 3411 kCal/kg (Jansen, 1989). The peel meal is readily available and cheap to procure. According to Kays (1985), the sweet potato peel is devoid of most of the anti-nutritional factors present in plant materials such as protease inhibitors, phytates, glucosinolates, saponins, tannins, lectins, cyanogens, mimosine, canaranine and oligosaccharides, etc. because it usually stores these chemicals in its tubers.

Molasses is a by-product of the processing of sugarcane or sugar beet into sugar. The quality of the molasses depends on the maturity of sugarcane or sugar beets, the amount of sugar extracted and the method of extraction (McDonald *et al.*, 1989). Molasses is a laxative food and normally given to animals in small quantities. It is added to animal feed as a sweeter and feed binder.

Hence, the main objective of this research study was to determine the growth performance and nutrient digestibility of growing rabbits fed graded levels of sweet potato peel meal diets, supplemented with and without molasses.

Materials and Methods

The Experimental Diets

The sweet potato peels were obtained from the yam and potato fryers at Bida, Niger State. They were collected, sundried, and milled to obtain the sweet potato peel meal. This was then mixed together with other ingredients obtained from feed ingredients depots in Minna, to formulate the experimental diets as shown in Table 1 below. After proper mixing, the obtained mash diets were pelletized.

The Experimental Animals and their Management

A total of 24 growing rabbits were used for this research study carried out at the Teaching and Research Farm of the Federal University of Technology, Minna, Niger State. The animals were mainly hybrids of New Zealand and California White rabbits plus other crosses obtained from Minna Central Market. The animals were housed intensively in hutches; the back, right, and left sides of the hutches were fully covered with galvanized iron sheets while the bottom and front floors were made of ½″ wire mesh. The hutches were thoroughly washed and disinfected before the commencement of the experiment. The rabbits were then randomly distributed into six (6) experimental treatments of two replicates per treatment, with 2 rabbits per replicate.

Some of the routine management practices carried out during the experiment included weighing of the animals on arrival, before the commencement of the experiment and subsequently at weekly intervals. Feed and water were supplied *ad libitum*, and records of mortality, weekly weight gain and feed intake were

kept. Fresh *Tridax procumbens* leaves were collected daily, air-dried and fed to the rabbits in the evening of the following day. The hutches were thoroughly cleaned every morning, including feeders and waterers, before feed and fresh water were given.

Digestibility Studies

At the end of the 7th week, digestibility studies were carried out on the rabbits. The animals were kept off feed for 12 hours but with water supplied constantly; this was to evacuate their gut of the residual feed eaten. Fresh feed of known weights were then given to the rabbits. The left-over uneaten feeds were collected the following day and weighed. Faecal samples were collected daily, sun-dried and later oven-dried at 80°C for 24 hours before they were stored separately in plastic containers. This process of faecal collection lasted for 5 days at the end of which each replicate samples were bulked together. They were then separately analyzed for their proximate composition according to the procedures of AOAC (2000). From the data obtained, digestibility of nutrients and TDN were calculated as follows:

$$\%\text{Digestibility (of a nutrient)} = \frac{\text{amount of nutrient in feed} - \text{amount of nutrient in faeces}}{\text{Amount of nutrient in feed}} \times 100\%$$

Total Digestible Nutrient (TDN) = Digestible Crude Protein + Digestible NFE + 2.25 X Digestible Ether Extract.

Chemical Analysis

The sweet potato peel meal, the experimental diets and the faecal samples collected were analyzed for moisture, crude protein, crude fibre, ether extract, ash and nitrogen free extracts using the procedures of AOAC (2000).

Statistical Analysis

The data obtained from this research study was subjected to a one-way analysis of variance (ANOVA) according to the Completely Randomized Design (CRD) model using the SPSS Package (Statistical Package for the Social Sciences). Where treatment means were significant, they were separated using the Duncan Multiple Range Test (Duncan, 1955).

Results and Discussion

The proximate composition of sweet potato meal is shown in Table 2. It has a crude protein content of 7.70%; ash, 7.50% and NFE, 65.90%; which is comparable to 6.34%, 4.58% and 87.42% obtained for crude protein, ash and NFE respectively by Akinmutimi and Osuagwu (2008). The proximate composition of the experimental diets is shown in Table 3, showing that the diets were formulated according to the standard recommendations of Aduku and Olukosi (1990) for growing rabbits in the tropics.

There was no significant ($p>0.05$) difference in feed intake, initial weight, final weight, weight gain and feed conversion ratio among the rabbits fed graded levels of sweet potato peel meal (SPPM) in replacement for maize; though the daily weight gain seemed to decrease as the inclusion level of SPPM increased (Table 4). This is in agreement with the earlier report of Okereke *et al.* (2009) who reported that the overall performance of rabbits fed various levels of Hausa potato meals in substitution for maize at 10%, 20%, and 30% were not significant. This could be a further improvement on the research work carried out by Akinmutimi and Osuagwu (2008) who determined that sweet potato peel meal can be substituted for maize in the diets of weaner rabbits up to 33.33%.

Molasses inclusion in the diet did not exert any significant effect on the growth performance of the rabbits. This may be due to the low level of anti-nutritional factors present in SPPM as reported by Akinmutimi and Anakebe (2008), hence not making the sweetening effect of the molasses on the diets significant.

The crude protein (CP), ether extract (EE) and nitrogen free extract (NFE) digestibilities as well as total digestible nutrient (TDN) showed no significant difference ($p>0.05$) among the different diets. Only crude fibre (CF) and ash were significant ($p<0.05$) among the diets (Table 5). This may be due to the fact that rabbits are less efficient than ruminants in the digestibility of fibre (Anugwa *et al.*, 1998).

Conclusion

From the results of growth performance and digestibility studies above, sweet potato peel can be used to replace up to 50% of maize in the diets of growing rabbits, with or without the addition of molasses. It is an agro-industrial by-product that is cheaper when compared to maize.

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Table 1: % Composition of the experimental diets

Feed ingredients	Diets T_1	T_2	T_3	T_4	T_4	T_5
Maize	50.00	50.00	37.50	37.50	25.00	25.00
SPPM	0.00	0.00	12.50	12.50	25.00	25.00
GNC	22.05	22.05	22.05	22.05	22.05	22.05
PKC	14.00	14.00	14.00	14.00	14.00	14.00
Molasses	0.00	5.00	0.00	5.00	0.00	5.00
Wheat offal	5.00	2.00	5.00	2.00	5.00	2.00
Rice husk	4.00	2.00	4.00	2.00	4.00	2.00
Methionine	0.10	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10	0.10
Salt	0.50	0.50	0.50	0.50	0.50	0.50
Bone meal	2.00	2.00	2.00	2.00	2.00	2.00
Lime stone	2.00	2.00	2.00	2.00	2.00	2.00
Premix	0.25	0.25	025	0.25	0.25	0.25
Total	100.00	100.00	100,00	100.00	100.00	100.00

GNC= Groundnut cake PKC= Palm kernel cake SPPM= Sweet potato peel meal

T_1 = 0% replacement of maize by SPPM, without molasses.

T_2 = 0% replacement of maize by SPPM, with molasses.

T_3 = 25% replacement of maize by SPPM, without molasses.

T_4 = 25% replacement of maize by SPPM , with molasses.

T_5 = 50% replacement of maize by SPPM, without molasses.

T_6 = 50% replacement of maize by SPPM, with molasses.

Table 2: Proximate composition of sweet potato peel meal

Parameter	% Composition
Moisture	8.90
Dry matter	91.10
Crude protein	7.70
Ether extract	6.00
Crude fibre	4.00
Ash	7.50
Nitrogen free extract (NFE)	65.90
Total	100.00

Table 3: Proximate composition of the experimental diets

Parameter	Diets					
	T_1	T_2	T_3	T_4	T_5	T_6
Moisture	4.20	3.80	4.00	5.60	6.00	5.80
Dry matter	95.80	96.20	96.00	94.40	94.00	94.20
Crude protein	18.05	17.80	17.65	17.55	17.64	17.58
Ether extract	6.00	7.50	8.50	8.50	7.00	7.00
Crude fibre	5.33	4.66	4.61	4.00	4.00	3.30
Ash	9.00	5.00	8.50	9.00	9.00	10.00
Nitrogen free extract	57.42	61.24	56.74	55.35	56.36	55.32
Total	100.00	100.00	100.00	100.00	100.00	100.00

Table 4: Growth performance of growing rabbits fed graded levels of sweet potato peel meal diets, with and without molasses

PARAMETERS	Diets							
	T_1	T_2	T_3	T_4	T_5	T_6	SEM	LS
Initial weight (g)	903.00	1020.00	857.50	995.00	797.50	805.00	56.38	NS
Final live weight (g)	1507.50	1487.50	1335.00	1045.00	1420.00	1440.00	69.82	NS
Feed intake/rabbit/day (g)	67.71	66.51	63.20	70.16	67.76	66.58	10.30	NS
Weight gain/rabbit/day (g)	10.80	13.48	10.67	9.55	9.55	8.74	3.41	NS
Feed conversion ratio	8.17	6.17	7.42	9.10	8.88	8.58	0.45	NS

Table 5: Digestibility of feed nutrients by growing rabbits fed graded levels of sweet potato peel meal diets , with and without molasses

PARAMETERS	Diets							
	T_1	T_2	T_3	T_4	T_5	T_6	SEM	LS
Dry matter	84.29	81.05	88.73	87.27	84.94	87.84	1.19	NS
Crude protein	85.29	87.78	86.93	85.83	85.75	87.44	1.05	NS
Crude fibre	69.92^{ab}	51.09^{b}	74.71^{ab}	71.12^{ab}	69.16^{ab}	77.92^{a}	3.18	*
Ether extract	82.35	79.18	89.90	88.52	82.85	89.00	1.59	NS
Ash	72.76^{ab}	53.57^{b}	72.13^{ab}	68.42^{ab}	66.53^{ab}	78.07^{a}	2.95	*
Nitrogen free extract	87.32	85.59	92.73	91.77	88.98	90.17	1.05	NS
Total digestible nutrient	76.66	80.34	82.78	82.78	78.33	81.27	1.12	NS

Total digestible nutrient

SEM = Standard error of mean

LS = Level of significance

T_1 = 0% replacement of maize by sweet potato peel meal (SPPM), without molasses.

T_2 = 0% replacement of maize by SPPM, with molasses.

T_3 = 25% replacement of maize by SPPM, without molasses

T_4 = 25% replacement of maize by SPPM, with molasses.

T_5 = 50% replacement of maize by SPPM, without molasses

T_6 = 50% replacement of maize by SPPM, with molasses.