Comparative effect of feeding sundried sweet potato (*Ipomoea batatas* (L) Lam) meal and its whole meal to weaner rabbits

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Abstract

An experiment was conducted to evaluate the comparative effect of feeding sundried sweet potato and its whole meal to weaner rabbits. The proximate analysis conducted revealed that sundried sweet potato meal and whole sundried sweet potato meal samples were rather low in protein contents as compared to maize. Twenty seven Weaner rabbits averaging 0.35kg were randomly allotted to 3 treatment groups in a completely randomized design. Each treatment group was replicated 3 times. Sundried Sweet potato meal and its whole meal replaced maize at 20% inclusion level. Treatments 1, 2, and 3 contained the control, sundried sweet potato meal (SSPM) and whole sundried sweet potato meal (WSSPM) respectively at 20% levels of inclusion. The weaner rabbits were fed ad-libitum throughout the experimental period. Significant differences ($p < 0.05$) were observed for growth performance of the rabbits in average daily weight gain, average daily feed intake and feed conversion ratio in the weaner rabbits using sundried sweet potato and its whole meal. The values of mean daily weight gain ranged from 16.33g in treatment 2 (SSPM) to 18.47g in treatment 1 (control). Treatment 3 (WSSPM) gave a higher value that is comparable ($p > 0.05$) to that of the control diet but better ($p < 0.05$) than that of treatment 2 (SSPM). The values of average daily feed intake also ranged from 43g in treatment 2 (SSPM) to 50g in treatment 1 (control). WSSPM was consumed more than ($p < 0.05$) than the SSPM which however influenced the cost of total feed consumed. Moreover, the values of feed conversion ratio (FCR) ranged from 2.54 in treatment 3 (WSSPM) to 2.70 in treatment 1 (control). Significant differences ($p < 0.05$) were also observed in bio-economics of production of weaner rabbits using the test diets. The cost per kg feed, cost of total feed consumed per rabbit, cost per kg weight gain and revenue of the rabbits fed the test diets were significantly lower than the control diet however, the cost per kg weight gain was lower ($p < 0.05$) for treatment 3 (WSSPM). For gross margin, WSSPM value was significantly higher ($p < 0.05$) than SSPM value and the control diet. It was concluded that whole sundried sweet potato meal can be a good feed ingredient in rabbit diet.

keywords: Comparative effect, sundried, sweet potato meal, performance, weaner rabbits

Introduction

Sweet potato (*Ipomoea batatas* (L) Lam) is a tropical crop with a relatively short vegetative cycle, the tubers of which are usually for both human and animal consumption (Woolfe, 1992). Sweet potato is now used mainly as feed for animals. Both forage and tuber have been used widely as an alternative feed for livestock in tropical countries. The roots have low protein, fat and fibre content, but high

nitrogen-free extract, which thus indicates their potential value, mainly as an energy source. The vines have low carbohydrate content but are higher in fibre and protein, and their principal value is as a source of vitamins and protein. The chemical composition of the leaves, stems and tubers varies depending on the time of harvesting as well as on genotypic differences. The leaves have superior contents of DM and CP compared with stems (An, 2003). Crude

*Comparative effect of feeding sundried sweet potato (*Ipomoea batatas* (L) Lam)*

protein content in DM of sweet potato vines ranges from 16% to 29% (Dung, 2001). There is competition between man and livestock for maize in Nigeria. Maize serves as a staple food for Nigerians and also as good energy source for livestock. Due to this competition and its scarcity as a result of low production level in Nigeria (Durunna *et al.*, 2000) maize is costly resulting in high cost of livestock feeds. Maize is the major source of energy in monogastric animals' feeds because of its high starch content giving it about 3400 kcal/kg feed metabolisable energy (Olomu, 1995). If the problem of low protein intake of Nigerians, which is less than the recommended 35g/head/day (FAO, 1982) is to be solved through accelerated animal production, there is the need to replace maize with alternative feedstuff such as sweet potato meal processed in different forms, Sun-dried Sweet Potato Meal (SSPM), Boiled Sweet Potato Meal (BSPM), Whole Sun-dried Sweet Potato Meal (WSSPM), Whole Boiled Sweet Potato Meal (WBSPM). These could be considered as alternatives to maize in formulating diets for animals especially rabbit because it is relatively less costly than maize. Maize a major energy source and conventional feed ingredient is most times very expensive and contributes to high cost of animal products, consequently discouraging livestock farmers from venturing into the enterprise. Rabbit being a white meat of low cholesterol content and highly prolific is highly desired for meat by many people in Nigeria. Njike (1998) reported that for Nigeria to be able to meet up with its protein intake requirement there should be increased production of animal protein annually. Rabbits are the most favourable choice to meet the protein needs of Nigerians. They are highly prolific, have short gestation period, and grow very fast with high feed conversion efficiency and provide quickest return on investment

(Aduku and Olukosi 1990). This informs the choice of rabbit as experimental animal for this trial. The objective of this study was to determine the effect of sweet potato meal and Whole sweet potato meal based diets on performance of weaner rabbits and the economics of production of rabbits fed such diets.

Materials and methods

The experiment was carried out at the Rabbitry unit of National Root Crops Research Institute, Umudike. The sweet potato used in this study was also obtained from the same institute. The sweet potato was harvested washed and divided into two parts. One part was chipped, sun-dried and then milled (Sun-dried Sweet Potato Meal (SSPM)). The second part was chipped, sun-dried milled and then mixed with milled sun-dried sweet potato leaves at the ratio of 5:3 (whole sun-dried Sweet potato Meal) (WSSPM). The resulting samples which partially replaced maize in the diets at 20% levels in treatments 2, and 3 were then incorporated into the diets which were presented as mash. While treatment 1 (control) contained no sweet potato. Samples of the feeds fed were collected and analyzed for their proximate compositions according to AOAC (1990) methods.

Determination of nutritional content

The samples were analyzed for **proximate composition** (crude protein, ether extract, ash, crude fibre and nitrogen free extract). The ether extract content was extracted with petroleum ether (40-60°C) using a soxhlet apparatus for 6 h. The Micro-Kjedahl procedure was adopted for the determination of protein. All **proximate composition** were analyzed in triplicate.

Experimental animals

Twenty seven weaner rabbits averaging 0.35kg were randomly allotted into three treatment groups of nine (9) rabbits each. Each treatment group was replicated thrice

with three (3) rabbits per replicate. The groups were randomly assigned to three (3) isocaloric and isonitrogenous diets in completely randomized design (CRD), three (3) experimental diets were formulated such that Treatment 1 (control) contained no sweet potato meal, Treatment 2 contained sundried sweet potato meal (SSPM) and Treatment 3 contained whole sundried sweet potato meal (WSSPM). Other fixed ingredients were added to meet the needs of weaner rabbits for vitamins and minerals. All experimental rabbits were given feed and water *ad-libitum*. Records of mean final weight gain, average daily weight gain, average daily feed intake, and feed conversion ratio were taken. The experimental diets were fed for 10 weeks.

Economics of the diets

Economics of the diets were determined as described by Ukachukwu and Anugwa

(1995), and modified by Ekwu (2008). It involves:

Cost/kg feed=

$\frac{\text{Total cost of producing 100kg of feed}}{100}$

100

Cost of feed consumed (>) = Cost/kg of feed × total feed consumed

Cost/kg weight gain = Cost/kg of feed × feed conversion ratio

Revenue = Price of 1kg meat × mean weight gain

Gross margin = Revenue – Cost of production

Data analysis

The data collected on growth performance and parameters of economics of production were subjected to analysis of variance (ANOVA) and means separated where there were significant differences by Duncan multiple range-test as outlined by Steel and Torrie (1980). The package used was SPSS.

Table 1: Percentage composition of experimental diets

INGREDIENTS	T1 Control	T2 SSPM	T3 WSSPM
Maize	32.00	12.00	12.00
Sun-dried sweet potato Meal (SSPM)	-	20.00	-
Whole Sun-dried sweet potato Meal (WSSPM)	-	-	20.00
Wheat offal	50.00	50.00	50.00
Groundnut meal	14.20	14.20	14.20
Bone Meal	3.00	3.00	3.00
Salt	0.50	0.50	0.50
Vit.min. premix	0.30	0.30	0.30
Total	100	100	100
Calculated Composition			
Crude protein(%)	18.09	17.83	17.93
Crude Fibre(%)	3.35	5.75	6.55
Energy(ME/Kcal)	2409	2206	2202

Results and discussion

Proximate composition of sundried sweet potato meal and whole sundried sweet potato meals

The result of the proximate analysis in table 2 have revealed that sundried sweet potato meal and whole sundried sweet potato meal samples were rather low in protein contents as compared to maize. Higher content of protein was observed in the whole sundried sweet potato meal sample in this work was

in conformity with Hiroshi *et al.* (2000). Most plant foods have poor and incomplete protein. The values of whole sundried sweet potato meal sample compared favourably well with the maize sample significantly. The ether extract content observed in the sundried sweet potato meal compared very well ($p < 0.05$) with whole sundried sweet potato meal and both are significantly higher ($p < 0.05$) than that of maize.

Comparative effect of feeding sundried sweet potato (*Ipomoea batatas* (L) Lam)

Table 2: Proximate composition of sundried sweet potato meal and whole sundried sweet potato meals

NUTRIENTS	Maize	SSPM	WSSPM	SEM
Crude Protein	9.87 ^a	8.68 ^c	9.19 ^b	0.043
Crude Fibre	2.50 ^c	8.16 ^b	9.90 ^a	0.047
Ether Extract	3.80 ^b	9.19 ^a	9.00 ^a	0.038
Nitrogen Free Extract	76.59 ^a	64.78 ^c	69.00 ^b	0.051

The crude fibre content of maize is lower ($p<0.05$) compared to that of sundried sweet potato meal that was also lower than that of whole sundried sweet potato meal. The result is supported by the work of Hiroshi *et al.* (2000). The higher crude fibre value observed for whole sundried sweet potato meal could be as a result of the presence of the sweet potato vine included in the sample. Table 2 represents the proximate composition of sundried sweet potato meal (SSPM) and whole sundried sweet potato meals (WSSPM). From the result of the analysis,

Growth performance of the weaner rabbits

The growth performance (Table 3) showed significant differences ($p<0.05$) among the

treatments for average daily weight gain, average daily feed intake and Feed conversion ratio. There was a significant difference ($p<0.05$) among the treatments for average daily weight gain. Treatment 1 (control) was significantly ($p<0.05$) gave the highest value than Treatment 3 (WSSPM) (17.89g) which was also higher ($p<0.05$) than treatment 2 (SSPM) (16.33g). Raw sweet potato tubers contain medium levels of trypsin inhibitors that are sufficient to decrease protein digestibility (Bradbury *et al.*, 1992) which could consequently affect the weight gain of the rabbits. Better average daily weight gain observed for WSSPM could be as a result of the leaves incorporated in the diet that encouraged better nutrient availability.

Table 3: Growth performance of weaner rabbits fed differently processed sweet potato meal based diet

Parameters	(T1) CONTROL	(T2) SSPM	(T3) WSSPM	SEM
Mean initial live weight (kg)	0.35	0.35	0.36	0.023
Mean final live weight(kg)	1.65 ^a	1.50 ^b	1.61 ^a	0.020
Average Daily weight gain(g)	18.47 ^a	16.33 ^c	17.89 ^b	0.046
Average Daily feed intake(g)	50.00 ^a	43.00 ^c	45.00 ^b	0.035
Feed conversion ratio	2.70 ^a	2.62 ^b	2.54 ^c	0.044

Letters with different superscripts are significantly different from each other

Significant differences ($p<0.05$) were observed for average daily feed intake. Treatment 1 (Control) (50g) was significantly higher than treatments 3 (WSSPM) (45g) and 2(SSPM) 43g that were themselves different ($P<0.05$) from each other. The higher feed intake values observed in treatments 3 (WSSPM) when compared with treatment 2 (SSPM) could be as a result of the leaves incorporated in the diets. This agrees with the report of Olorunnisomo (2007) mixing sweet potato

forage and roots resulted in better intake and weight gain. The feed conversion ratio (FCR) shows significant differences ($P<0.05$) in the treatment means and varies from 2.70 to 2.54 with the control diet (treatment 1) having the poorest value (2.70) and the WSSPM (treatment 3) having the best value 2.54. The best value observed for WSSPM could be as a result of the leaf meal included in the diet. This agrees with the report of Hoanget *al.* (2004) that root mixed with vine meal improves

feed efficiency.

Economics of production of the weaner rabbits

Significant differences ($p < 0.05$) were observed for all the parameters of bio-economics of production among the treatments means (Table 4). The values of cost per kg feed, cost of total feed consumed per rabbit and cost/kg weight gain followed

the same pattern, treatment 1 (control) was significantly higher ($p < 0.05$) than treatments 2, and 3 which were themselves similar ($P > 0.05$). The costs observed in treatments 2 and 3 were lower than that of the control diet. This is in line with the report of Ukachukwu and Anugwa (1995) that least cost feed formulation seeks to achieve cost input minimization and output maximization.

Table 4: Bio-economic of production of weaner rabbits fed sweet potato meal and composite sweet potato meal based diets

Parameters	T1 Control	T2 SSPM	T3 WSSPM	SEM
Cost/kg Feed (₦)	66.06 ^a	42.06 ^b	42.16 ^b	0.033
Cost of Total Feed Consumed/ rabbit (₦)	218.87 ^a	116.60 ^b	132.80 ^b	0.042
Cost/kg weight gain (₦)	178.36 ^a	110.47 ^b	107.22 ^c	0.037
Revenue (₦)	336.26 ^a	297.26 ^c	325.86 ^b	0.054
Gross Margin (₦)	117.39 ^c	180.66 ^b	193.06 ^a	0.045

In cost per kg weight gain, treatment 3 (WSSPM) gave the lowest cost value despite the fact that it was consumed more than the SSPM. This reflected in the revenue since WSSPM gave better average daily weight gain than SSPM nevertheless, the control diet gave the highest cost per kg feed, cost per kg weight gain and revenue. In terms of gross margin, treatment 3 (₦193.06) was significantly higher ($p < 0.05$) than treatment 2 (₦180.66) and treatment 1 (₦117.39) respectively. Treatments 3 (WSSPM) yielded better economic gains than treatments 2 (SSPM) and the control.

Conclusion and recommendation

From the observed result, sundried sweet potato meal and whole sundried sweet potato meal seems to be a promising least cost diet in rabbit production. Therefore, use of sundried sweet potato meal and whole sundried sweet potato meal based diet should be encouraged in rabbit production in order to minimize cost and maximize profit. Since whole sundried sweet potato meal was observed to be better

than sundried sweet potato meal is therefore recommended to be used as feed ingredient in rabbit production.

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Comparative effect of feeding sundried sweet potato (Ipomoea batatas (L) Lam)

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