FORTIFICATION OF CASSAVA PEEL MEALS IN BALANCED DIETS FOR RABBITS

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ABSTRACT

An eight-week feeding trial was conducted with twenty-four individually caged growing rabbits weighing initially 300–380g. Six experimental diets were formulated such that diet 1 was a maize-soyabean based control while in diets 2, 3, 4, 5 and 6, cassava peel meal totally replaced maize. There was also a stepwise reduction in the quantity of soyabean meal utilised in diets 3, 4 and 5 while the quantity of palm kernel cake was increased. Diet 6 was an extruded version of diet 4. The diets were fortified with palm oil for energy and soyabean and palm kernel cake for protein. Each diet was fed to four replicates of rabbits consisting of one rabbit per replicate and water was supplied *ad libitum*. Feed intake, weight-gain and feed cost/unit weight-gain were significantly affected by dietary treatments ($P < 0.05$) while treatments had no effect on water intake and Feed: Gain ratio ($P > 0.05$). The feed cost was reduced to ₦13.8/kg in diet 5 compared with ₦17.8 in the control diet. The extrusion process was not efficient in all indices of measurement as rabbits on the diet showed poor performance. A major finding of the study is that up to 50% of the protein supplied by soyabean meal when fed in conjunction with cassava peel meal can be replaced with palm kernel cake without adverse effects. It is recommended that future studies look into alternatives to palm oil as energy booster in diets containing cassava peel meal so as to further improve the economy of feed utilization.

Keywords: Rabbit performance, cassava peel meal, palm kernel cake, soyabeans, extrusion.

INTRODUCTION

Rabbits are beginning to make a useful contribution to meat supply in Nigeria where there is a shortage of animal protein. Taiwo *et al.* (1999) observed that amongst domesticated animals, rabbits are the most efficient converters of feed to flesh. In spite of this favourable attribute of the rabbit, projecting it as a target species for rapidly stemming the prevailing tide of protein malnutrition is not hitch-free because the cost of rabbit production is still high owing largely to the cost of feed (Bitto and Shidi, 1999).

The most important and expensive feed items are the energy concentrates, usually grains in non-ruminant and pseudo-ruminant diets. The high cost of grains especially maize is brought about by the declining production and the stiff competition for it by man, industries and the livestock sector. It is now a general consensus that while the encouragement of increased production of cereals may be the most obvious solution, the use of alternative energy sources should be explored. One of such alternative energy ingredients is cassava peel meal, an abundant by-product of local and industrial cassava processing (Agunbiade *et al.*, 1999).

Tewe and Kasali (1986) observed that peels account for between 10-13% of cassava tuber by weight. Recent data (Ikwelli, 1999) put Nigeria as the current world leading producer of cassava with 33 million metric tonnes/year. The increasing production of cassava is expected to continue in years to come.

Cassava peel meal (CPM) however has moderate energy content and very low protein value, hence its use in non-ruminant diets has necessitated the fortification of such diets for energy and protein (Obioha and Anikwe, 1982 and Obioha *et al.*, 1984). Agunbiade and Bello (1997) observed that when palm oil and soyabean meal were used to fortify CPM diets for rabbits, the unit cost of feed escalated to almost the same level as in the maize based control diet such that the objective of cost reduction was not completely achieved.

The present study was designed sequel to the earlier work of Agunbiade and Bello (1997), with the objective of determining the nutritional worth of replacing the more expensive soyabean meal (SBM) with palm kernel cake (PKC) as protein concentrate and the use of palm oil as energy booster in CPM based diets for rabbits.

MATERIALS AND METHODS

Processing of experimental cassava peels

Cassava peels of the variety TMS 30572, from a 14-month old plant was collected fresh from the 'Gari' processing pavillion of the Teaching and Research Farm of Ogun State University, Ago-Iwoye. The peels were sundried on a concrete platform for five days with occasional turning during the period. They were then milled using a 2-mm screen and bagged before storage in a cool, dry condition as dried cassava peel meal (DCPM) until ready for use.

Experimental Procedure

Twenty-four growing rabbits of mixed breeds (Californian, Chinchilla and New Zealand white) and sexes with initial weights of 300 – 380g were randomly allocated to six treatment groups after balancing for weight with four individually caged rabbits serving as replicates for each treatment group. Five experimental diets were formulated as shown in Table 1. Diet 1 was a maize-soyabean control while

TABLE 1: COMPOSITION OF EXPERIMENTAL DIETS (g kg⁻¹)

Ingredients	1	2	3	4	5	6
Maize	500	-	-	-	-	-
Cassava Peel Meal ¹	-	497.9	486.7	414.4	342.5	414.7
Soybean-meal	120	260.0	200.0	133.4	66.7	133.4
Rice Husk	278	74.5	-	-	-	-
Blood-meal	18.8	15.5	16.1	22.0	28.0	22.0
Palm Kernel Cake	-	-	161.1	322.1	483.2	322.1
Palm Oil	-	110.0	94.0	65.3	37.3	65.3
Fish meal	40	-	-	-	-	-
Oyster Shell	10	10	10	10	10	10
Bone meal	20	20	20	20	20	20
Salt	5	5	5	5	5	5
Vit-Min premix	5	5	5	5	5	5
Methionine	2.9	2.1	2.1	2.5	2.6	2.5
	1000	1000	1000	1000	1000	1000
Analysed Content						
Crude Protein (g kg ⁻¹)	150.3	152.6	152.6	154.0	155.5	154.0
Crude Fibre (g kg ⁻¹)	99.6	122.6	124.5	126.6	128.6	126.6
Digestible Energy(MJ kg ⁻¹)	10.97	10.06	10.52	10.66	10.82	10.66

¹HNC (m kg⁻¹ DM) content of the processed CPM was 25.5

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diet 2 was a cassava peel (CPM)-soyabean control. Diets 3, 4 and 5 were similar to diet 2 in that they were also CPM-soyabean based. The protein supplied by soyabean meal in diet 2 was taken to be 100%. In diets 3, 4 and 5, palm kernel cake (PKC) was used to replace 25%, 50% and 75% of the protein supplied by SBM in diet 2. Diet 6 was an extruded version of diet 4. Rabbits were raised on these diets for 8 weeks during which feed and water were supplied *ad libitum*.

Average daily feed intake (ADFI), average daily water intake (ADWI), average daily weight gain (ADWG), and feed conversion ratio (FCR) were major response criteria studied.

Carcass Evaluation

At the end of the feeding trial, two rabbits whose weights were close to the mean weight of rabbits on each experimental diets were selected and, starved overnight to clear the guts. Live-weight were recorded before stunning and sacrificing by cutting the jugular vein. The tail was cut very close to the base before removing the pelt after removing the head and feet. Evisceration of the rabbit carcasses was carried out and all internal organs were weighed separately and expressed as percentage of dressed carcass weight. The

weights and lengths of the components of the gastro-intestinal tract (GIT) were also taken. The carcasses were then divided into primal parts. Each part was expressed as a percentage of the dressed carcass

Analytical Procedures

Proximate analysis of test materials and experimental diets were carried out using the method of AOAC (1990). Hydrogen cyanide content of CPM was determined using the methods of Zitnak (1973). All data were subjected to analysis of variance employing a completely randomised design as described by Steel and Torrie (1980). An economic appraisal of the study was carried out to determine the efficiency of the various experimental diets in terms of cost per unit live-weight gain.

RESULTS AND DISCUSSION

The proximate composition (g kg⁻¹DM) of CPM used in this study showed crude protein 53.0; ether extract, 12.0; crude fibre, 209; ash, 59; NFE, 687. Hydrocyanic acid (HCN) content of the CPM was 25.5mg kg⁻¹ DM. These values are similar to those reported by Agunbiade and Bello (1997) and Agunbiade *et al.* (1999).

TABLE 2: PERFORMANCE RESPONSE OF RABBITS TO DIETARY TREATMENTS

Dietary Treatments	Average Feed Intake (g/day)	Weight gain (g/day)	Water intake (ml/day)	FCR
1	64.71 ^b	18.39 ^b	103.62	3.52
2	68.21 ^b	16.07 ^{ab}	121.34	4.24
3	64.80 ^b	15.06 ^{ab}	105.87	4.30
4	69.29 ^b	19.08 ^b	107.31	3.63
5	58.22 ^a	13.48 ^a	118.19	4.31
6	59.93 ^a	11.82 ^a	123.04	5.17
SEM ¹	2.711**	2.14*	20.28	0.59

Means within column followed by different superscripts are significantly different (*P<0.05); (**P<0.01)

¹Standard Error of Means.

Table 2 shows the mean values and standard error of mean for the productive performance of rabbits fed the various experimental diets. Dietary treatments significantly affected average daily feed intake (ADFI) ($P < 0.01$) and average daily weight gain ($P < 0.05$). ADFI of rabbits on diets 2, 3, and 4 all of which were CPM-based with palm kernel cake providing 0, 25 and 50% of the protein of soyabean meal respectively were not different ($P > 0.05$) from the maize based control (diet 1). Daily feed intake of rabbit on diet 5 where PKC replaced 75% of the protein supplied by SBM and diet 6, which was an extruded form of diet 4 were however significantly depressed when compared with the other diets ($P < 0.01$). The ADFI of 58.2 – 69.3 g day⁻¹ by rabbits on CPM diet is similar to the values of 60.7 – 71.4 g day⁻¹ reported by Onifade and Tewe (1993) for rabbits on CPM based diet where maize was completely replaced at 30.8% of diet by CPM. The significant drop in feed intake of rabbits on diet 5 could be explained in terms of feed bulkiness as the feed tended to be bulkier at higher PKC inclusion level. The drop in feed intake on diet 6 when compared with diet 4 is contrary to the report of Haythornthwaite (1986) that the dry extrusion process is known to result in increased digestibility, improved nutrient availability and modified physical character of animal feed. Omole (1992) and Esonu and Udedibie (1993) reported depression in feed intake and body weight gain when CPM replaced maize totally in rabbit diet. The gritty nature of palm kernel cake (Babatunde, 1975), could also be the reason for the depressed feed intake.

Crude fibre content of the diets varied from 9.96% on the control to 13.26% or 12.66% in the CPM based diets. Omole (1988) observed that crude fibre content of CPM could have significant effects when up to 40% CPM is incorporated in rabbit diet.

Average daily weight gain of rabbits followed a similar trend as ADFI, suggesting that the reduction in feed intake played an important

role in the reduction of weight gain as the proportion of PKC was increased in the diet. The reduction in ADWG may also be associated with the higher crude fibre content of the CPM-based diets when compared with the control. Omole and Onwudike (1981) reported growth depression in rabbits fed diets containing more than 10% crude fibre.

The ADWG of rabbits on the extruded diet (Diet 6) which was significantly ($P < 0.05$) lower than that recorded for diet 4 negates all known fact on the beneficial effects of extrusion. Smithard and Eyre (1986) observed that dry extrusion process makes available the highest proportion of the nutrient content of feedstuff to the animal. The reason for the poor performance of rabbits on the extruded diet may however not be far-fetched. The original intention was for each of diets 3, 4 and 5 to have extruded versions. The processing technique was however limited to diet 4, following complete charring of diet 3. Extrusion process is known to be a veritable means of improving the utilisation of naturally occurring fibres. An increase was reported in the digestible fibre of wheat flour as a percentage of total fibre when wheat was extruded (Asp and Bjoerck, 1984).

Dietary treatments did not however have effect on Feed: Gain ratio and water intake of rabbits. A similar observation of non-significant effect of dietary treatment was obtained for carcass characteristics (Table 3). Agunbiade *et al.* (1999) also obtained a similar trend when rabbits were fed CPM and CLM diets fortified with palm oil sludge. In addition to the fact that rabbits could tolerate 100% replacement of maize by CPM without adverse effect on growth performance, carcass characteristics and gut functions (Table 4), a major finding of this study is the fact that up to 50% of the protein supplied by soyabean meal when fed in conjunction with CPM can be replaced by PKC protein without adverse effects.

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TABLE 3: EFFECT OF DIETARY TREATMENTS ON CARCASS CHARACTERISTICS (%)

	Dietary Treatments						SEM ¹
	1	2	3	4	5	6	
Dressing Percentage (DP%)	51.47	52.34	45.81	53.42	52.72	53.79	3.07 ^{NS}
Weight of Thigh as % Dressed Weight	29.19	26.63	22.53	28.63	35.08	26.96	3.08 ^{NS}
Weight of Shoulder as % Dressed Weight	24.39	24.83	26.38	24.85	25.25	25.81	3.36 ^{NS}
Weight of Loin as % Dressed Weight	27.93	29.83	25.54	29.54	26.23	29.68	4.66 ^{NS}
Weight of Liver as % Dressed Weight	5.38	5.25	8.84	4.59	5.38	6.11	1.48 ^{NS}

NS = Means in row not significantly different ($P > 0.05$)

¹Standard Error of Means

TABLE 4: EFFECT OF DIETARY TREATMENTS ON FASTED LIVELWEIGHT, GUT WEIGHTS AND DIMENSIONS

Treatment	Fasted Live Weight	Wt. of entire GIT as % of fasted live wt.	Wt. of small intestine as % fasted wt.	Length of GIT (% length of GIT)		
				Small Intestine	Caecum	Large Intestine
1	1465	16.78	2.05	57.82	9.79	23.06
2	1287.5	18.09	2.60	47.18	10.28	27.98
3	1157.5	11.79	1.90	59.25	10.44	25.88
4	1600	16.53	1.40	59.46	12.17	28.98
5	1182.5	21.15	2.32	66.93	11.18	26.27
6	1277.5	17.53	2.71	59.69	10.91	25.15
SEM ¹	115.7 ^{NS}	2.36 ^{NS}	0.51 ^{NS}	8.81 ^{NS}	1.61 ^{NS}	3.66 ^{NS}

NS = Means in the same column are not significantly different ($P > 0.05$)

¹Standard Error of Means

The major objective for incorporating CPM in animal diets, usually, is to reduce cost of animal feed. Most often the need to balance diets for energy and important nutrients especially protein necessitates the use of fairly expensive ingredients such as SBM (protein) and vegetable oil (energy). These will eventually escalate the cost per kilogram of feed and thus lower the economy of feed conversion as observed by Agunbiade and Bello (1997). With the use of less expensive PKC in the current study, the cost per

kilogram of feed was reduced to ₦13.8 in Diet 5 as against ₦17.8 in the control Diet 1 and ₦21.3 for control Diet 2 (Table 5, prices as at November, 1997).

In spite of the dry extrusion of Diet 6, the economic advantage of cost reduction was not achieved; in fact the diet was the most expensive, and being poorly utilised resulted in a significant cost hike attributable to the dry-extrusion process.

TABLE 5: EFFECT OF DIETARY TREATMENT ON ECONOMY OF WEIGHT GAIN¹

Dietary Treatments	Cost/kg feed ⁺ (₦)	Cost/kg Weight gain ⁺ (₦)
1	17.79	64.40 ^a
2	21.33	93.38 ^b
3	20.87	90.53 ^b
4	17.80	65.42 ^a
5	13.75	64.15 ^a
6	23.36	120.66 ^c
SEM [*]	-	10.54**

Means within same column followed by different superscripts indicate significant differences (P<0.01)

⁺ Based on November 1997 prices

^{*}Standard Error of Means

Despite the current attempt to replace the more expensive SBM with much of the less expensive PKC, it was not possible to bring down the cost of converting feed to body weight gain below that of the control diet I. It would appear that to bring about an improvement in feed economy, a cheaper alternative to palm oil as energy booster in diets containing CPM will have to be found. This would warrant exploration of cheaper feed resources in future studies in order to bring down the cost of producing a unit weight of rabbit meat.

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