REPLACING MAIZE WITH CASSAVA ROOT MEAL OR ITS MIXTURE WITH BREWERS YEAST SLURRY IN RABBIT DIETS

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ABSTRACT

Three diets were evaluated for their effect on the performance, carcass yield and organ measurements of finisher rabbits. The control was maize-based (MC) while, in the other two diets, cassava root meal (CR) or its mixture with brewers yeast slurry (CYS) replaced the maize. Five approximately 9-week old crossbred (Chinchilla X California X New Zealand White) rabbits which averaged 930g liveweight, were allocated to each diet and fed individually for 70 days. The rabbits were then slaughtered and their dressed carcasses and organs weighed. At 70 days of feeding, the average liveweights of rabbits fed MC, CR and CYS were 2120g, 2026g and 2098g respectively. Average daily feed intake, average daily gain and feed conversion ratio were 66.80g, 64.92g and 60.70g, 15.65g and 16.29g, and 3.92, 4.15 and 3.64 for the respective diets. Warm dressing % and organ weights as percent of empty carcass weight did not differ significantly ($P > 0.05$) among the diets. Kidney fat weight was lower ($P < 0.05$) for CYS than for MC and CR. Replacement of maize with CR in the diet lowered ($P < 0.05$) rabbit performance, while that with CYS allowed for more efficient utilization of the diet, and for leaner carcasses of rabbits.

Key words: Cassava, brewers yeast slurry, rabbits.

INTRODUCTION

In many of the less developed tropical regions, shortages in cereal grain supplies have persisted into the terminal years of the 20th Century. Under such circumstance, the proportion of the grains usable in non-ruminant animal feeding dwindles, while feeding cost increases, in a corresponding persistent manner. Cassava products have for

long been used as major energy sources, in place of cereal grains, for livestock (Khajaren *et al.*, 1977; Walker, 1983). There is every likelihood of continued increasing use of cassava in animal feeding in the 21st Century and beyond. However due to low protein content in cassava root relative to that contained in maize grain, replacement of dietary maize with cassava usually results in wide protein deficits in such diets. Formulation of diets to eliminate the protein deficits requires incorporating higher quantities of good quality protein concentrates which are usually more expensive and scarce. While developing an inexpensive on-farm adaptable technology to preserve brewers yeast slurry (BYS), Ikurior, (1995) found that mixing cassava root meal with BYS at 1:1 ratio (w/w) resulted in an approximately 8% crude protein mixture. This associative enhancement of cassava root meal protein allowed its favourable comparison with maize grain on quantitative basis. The cassava root meal/BYS mixture was included in rations at the expense of maize grain and fed to growing (Ikurior *et al.*, 1995), and growing-finishing (Ikurior and Achadu, 1995) pigs. In both studies this mixture effected, significantly, less costly, and somewhat better performance, of pigs; and their carcasses had the same characteristics as those fed the maize control diet.

This study was therefore planned to evaluate the effect of cassava root meal and cassava root meal/BYS mixture as maize replacers in the diets of finishing rabbits.

MATERIALS AND METHODS

Preparation of Cassava Root Meal (CRM)

Composite cassava roots were purchased from surrounding village farms. The fresh roots were cleaned of soil and other particles, and then chipped whole. The chips were

TABLE 1: PROXIMATE CHEMICAL COMPOSITION OF CRM, BYS AND THE SUN-DRIED MIXTURE OF BYS AND CRM

Chemical Component	Dry Matter%	(% of Dry matter)			Ash	Nitrogen free extract ^b
		Crude Protein	Crude fibre	Ether extract		
Ingredient						
Maize grain	89.05	9.52	2.08	4.10	1.86	82.44
CRM	93.01	2.41	4.17	0.58	3.11	89.73
BYS	15.22	43.30	4.63	0.82	8.76	42.49
CRM/BYS mixture (CYS)	91.88	7.80	4.30	0.66	3.74	83.40

^a Means of 5 determinations^b Calculated as 100 - (sum of crude protein, crude fibre, ether extract, ash).

CRM = cassava root meal

BYS = brewers yeast slurry

BYS/CRM = mixture of BYS and CR at 1:1 ratio, w/w.

sun-dried on concrete slabs for 7 days after which they were milled and sampled for the determination of proximate chemical composition (Table 1) using A.O.A.C. (1984) methods. The material was stored in polythene bags prior to its use.

TABLE 2: PERCENTAGE COMPOSITION OF THE TEST DIETS

DIETS	MC	CR	CYS
Ingredients			
Maize	55.0	-	-
Cassava root meal	-	48.0	-
CRM-BYS Mixture ^a	-	55.0	-
Soyabean (full-fat)	10.0	23.0	13.0
Brewers dried grain	28.0	22.0	25.0
Bone meal	2.5	2.5	2.5
Sugar	2.0	2.0	2.0
Palm oil	2.0	2.0	2.0
Salt (NaCl)	0.5	0.5	0.5
Min-Vit-premix ^b	+	+	+
Coccidiostat ^c	+	+	+

^aMixture, contained on dry basis, 84.32% cassava root meal, 15.68%, brewers yeast slurry, 7.80% CP.^bContaining per kg: 10,000,000IU Vit.A, 2,000,000IU Vit. D3, 0.75g Vit. B1, 5.0g Vit.B2, 25g Nicotinic acid, 12.5g Calcium pantothenate, 0.01g Vit. B12, 2.5g Vit. K3, 25g Vit. E, 0.05g Biotin, 1g Folic acid, 250g Choline, 0.4g Cobalt, B Copper, 32g Iron, 0.8g Iodine, 64g Manganese, 40g Zinc, 100g Flavomycin, 5g Spiramycin, 50g DL-Methionine, 0.16g Selenium, 120g L-Lysine, 5g BHT. Inclusion rate = 1g/kg diet.^cContaining 15g Sulphoquinolaxaline, 10g nitrofurazone, and included at 1g/kg diet.

Brewers Yeast Slurry Preservation

Brewers yeast slurry (BYS) was obtained in two 40-l plastic containers from Benue Brewery Ltd., Makurdi, and immediately sampled for chemical analysis. It was then mixed with CRM at 1:1 ratio w/w, and the mixture sun-dried for about 4 days, to a moisture content of 10% or less. The dried material was sampled for proximate chemical composition (Table 1) using A.O.A.C. (1984) methods. It was stored in polythene bags until incorporated in the test diet.

Experimental Diets

Three test diets were formulated such that all the maize grains contained in the control diet (MC) were replaced by either sole cassava root meal (CR) or its mixture with BYS (CYS). Full-fat soyabean which had been boiled for 45 minutes and sun-dried, provided the major protein which balanced each diet at approximately 16% crude protein. The percentage composition of the test diets is given in Table 2. The diets were fortified with a coccidiostat and min-vit premix. They were analysed for chemical composition according to A.O.A.C. (1984) methods, which, along with calculated values of some components, is presented in Table 3.

Experimental Animals

Growing-finishing crossbred (Chichilla X California X New Zealand White) rabbits

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TABLE 3: CHEMICAL COMPOSITION OF THE TEST DIETS (% DM, UNLESS OTHERWISE STATED).

DIETS	MC	CR	CYS
PARAMETERS			
Dry matter	89.10	91.33	90.82
Crude protein	16.88	16.37	16.75
Crude fibre	6.21	6.00	6.34
Ether extract	8.09	7.47	6.98
Ash	4.00	4.51	6.50
Nitrogen free extract ^a	64.82	65.65	63.43
Calcium ^b	0.94	1.05	1.05
Phosphorus (available) ^b	0.58	0.59	0.60
Lysine ^b	0.71	0.88	0.99
Methionine + Cystine ^b	0.53	0.47	0.51
Metabolizable energy (Kcal/kg) ^b	2837	2774	2696

^aNitrogen free extract = 100 - (sum of CP, CF, EE, ash).

^bCalculated values based on Jurgens (1978) and The Nutrient Master Plan. Nutrient Levels of Feed Ingredients by Pfizer Livestock Feeds Plc, Ikeja, Lagos.

Performance parameters were thus calculated. The experiment lasted 70 days by then all the rabbits had reached^a at least 2000g liveweight. The rabbits were then starved for 18 hr and slaughtered by twisting their necks. They were skinned, eviscerated and decapitated prior to their empty body weights being recorded. The organs, liver, kidneys, hearts, lungs and trachea and empty stomach, were separated carefully and their fresh weights recorded, including kidney fat.

The data were analysed by the single-factor analysis of variance, and Duncan's Multiple Range Test was used to separate significant means, according to procedures described by Steel and Torrie (1980).

RESULTS AND DISCUSSION

Performance of the rabbits is summarized in Table 4. At 70 days, all rabbits fed the

TABLE 4: BREWERS' YEAST SLURRY AND CASSAVA ROOT MEAL IN DIETS OF FINISHING RABBITS. PERFORMANCE OF RABBITS.

DIETS	MC	CR	CYS	SEM
PARAMETERS				
Number of rabbits	5	5	5	
Average initial liveweight (g)	928	931	930	
Average final liveweights (g)	2120 ^a	2026 ^b	2098 ^{ab}	3.44
Daily feed consumption (g)	66.80 ^a	64.92 ^a	60.70 ^b	0.92
Daily gain (g)	17.02 ^a	15.65 ^b	16.69 ^{ab}	0.42
Feed Conversion ratio	3.92 ^{ab}	4.15 ^a	3.64 ^b	0.25

a,b means with different superscripts are significantly different (P < 0.05).

which were approximately 9 weeks old, were used in the experiment. The rabbits which averaged 930g liveweight, were allocated in groups of five on the basis of liveweight, to each of the test diets. They were housed in hutches measuring 1 x 0.6 x 0.4m (LxWxH) where they received their appropriate diet individually.

Experimental Procedure

The rabbits were weighed initially and weekly thereafter while on the experiment. They received weighed amounts of the diets daily and feed consumption was measured as the difference between the amount offered and the left-over portions weighed 24 hour later. Water was made available *ad libitum*.

different test diets attained liveweights slightly above 2000g. Growth rate and terminal liveweights recorded for rabbits fed the maize-based control diet were significantly (P < 0.05) higher than those recorded for rabbits fed CR and, though they were also higher than those fed CYS diet, the differences were not significant (P > 0.05). Daily consumption of CYS diet was less (P < 0.05) than that of both CR and MC. The bitter flavour of BYS has been said to be responsible for reduced voluntary intake of rations containing the material (Avila *et al.*, 1985). The conversion of CYS diet was better (P < 0.05) than that of CR. Ikurior *et al.*, (1995) and Ikurior and Achadu, (1995) had

TABLE 5: BREWERS YEAST SLURRY AND CASSAVA ROOT MEAL IN DIETS OF FINISHING RABBITS. WARM DRESSING PERCENT AND ORGAN MEASUREMENTS.

DIETS	MC	CR	CYS	SEM
Parameter				
Number of rabbits	5	5	5	
Warm dressing (%)	61.87	62.16	62.62	0.31 NS
%of empty carcass weight;				
Kidney fat	3.53	3.25	2.80	0.32 NS
Liver	2.83	2.95	2.80	0.15 NS
Heart	0.31	0.36	0.32	0.08 NS
Lungs and trachea	0.90	0.88	0.92	0.07 NS
Kidneys	0.67	0.66	0.69	0.06 NS
Empty stomach	1.01	1.08	0.98	0.11 NS
Head	10.55	9.8	11.00	0.38 NS
Skin	11.12	11.33	11.60	0.26 NS
Feet	2.30	2.46	2.40	0.15 NS

NS = Not significant ($P > 0.05$).

similarly observed growing pigs to utilize diets containing CRM/BYS better than they did sole cassava root meal and maize - based diets. It is probable that a better balanced amino acid profile in CYS (Table 3) may have resulted in its enhanced utilization relative to the other two diets. Cassava as sole energy source, has been reported to reduce conversion efficiency of diets by non-ruminant animals (Oke, 1978) due to its high contents of ash and crude fibre (Muller *et al.*, 1974). The performance of rabbits fed the three test diets in the present study was generally better than has been reported by other workers in the same global sub-region (Abu and Ekpenyong, 1993; Esonu and Udedibie, 1993).

The warm dressing percent of rabbits (Table 5) did not differ significantly ($P > 0.05$) among diets. Kidney fat as percent of empty carcass weight was significantly less ($P < 0.05$) for rabbits fed CYS than for those fed CR and MC. The kidney fat weight which also related directly with daily feed consumption, could be regarded as a measure of carcass fattiness (Ikurior and Achadu, (1995). Thus the sole cassava root meal diet (CR), which was least utilized, tended to result in fatter rabbit carcasses, since body fat deposition is a less efficient physiological process than lean tissue deposition (Hammond *et al.*, 1971). None of the organs was significantly affected ($P > 0.05$) by dietary treatment.

SUMMARY AND CONCLUSION

Replacement of dietary maize with sole cassava root meal resulted in lowered growth rate and feed efficiency of finisher rabbits; while that with BYS mixture resulted in better feed utilization. The wide protein content differential of maize (9.5%) and cassava root meal (2.4%) was substantially narrowed (7.8%) by mixing the cassava root meal with BYS. Thus the economic value of utilizing BYS in rabbit feeding in the present study was that whereas replacing dietary maize with sole cassava root meal required 130% more soybean to equilibrate the protein content of the diets, the replacement with the mixture of CRM and BYS required only 30% more soyabean. Since BYS as an industrial waste product did not attract a market price (except transportation and preservation handling charges), its inclusion in the diet amounted to a reduced production cost input relative to maize and CRM. Where suitably located therefore, tropical rabbit producers could obtain enhanced production efficiency from feeding brewers yeast slurry mixture with cassava root meal.

REFERENCES

- ABU O.A., and EKPENYONG T.E. (1993). Utilization of dried palm oil mill effluent by young growing rabbits. *World Rabbit Sci.*

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1(1). 11 - 15.

- A.O.A.C., (1984). Official Methods of Analysis (14th edn). Association of Official Analytical Chemists, Washington D.C., U.S.A.
- AVILA F.P. DeC., HERNANDEZ S.A.L., and REYES G.A., (1985). Use of yeast culture in the feeding of pigs during fattening. *Acta Agron*, 35, 92 - 103.
- ESONU B.O., and UDEDIBLE A.B.I., (1993). The effect of replacing maize with cassava peel meal on the performance of weaned rabbits. *Nig. J. Anim. Prod.* 20, 81 - 85.
- HAMMOND, J. JR. MASON, I.L., and ROBINSON, T.J. (1971). *Hammonds' Farm Animals*, 4th ed., Edward Arnold, Londong, pp 136 - 138.
- IKURIOR S.A., (1995). Preservation of brewers yeast slurry by a simple on-farm adaptable technology and its effect on performance of weaner pigs. *Anim. Feed Sci. Technol.* 53, 353 - 358.
- IKURIOR S.A., and ACHADU G.A., (1995). Replacement of maize with cassava root meal either alone or mixed with brewers yeast slurry in diets for growing-finishing pigs. *Nig. J. Anim. Prod.* 22 (2): 158 - 163.
- IKURIOR S.A., KAANKUKA F.G., and DAVID S.I., (1995). Response of weaner-grower pigs to diets containing sun-dried mixtures of brewers yeast slurry with maize grain and cassava root meal. *Nig. J. Anim. Prod.* 22 : (1) 56 - 63.
- JURGENS, M.H. (1978). In: *Animal Feeding and Nutrition* (4th Edn) Dendall/Hunt Publishing Co., Dubuque, IA, U.S.A.
- KHAJARERN S., KHAJARERN J.M., KITPANTNIK N. and MULLER Z.O., (1977). Cassava in the nutrition of swine. *Cassava as Animal Feed*. Eds Nestel B., Graham M. Proceedings of a workshop held at the University of Guelph, 18 - 20 April 1977, Ottawa IDRC - 095e, 56 - 64.
- MULLER Z., CHOU K.C., and NAH K.C., (1974). Cassava as a total substitute in livestock and poultry rations. *World Anim. Rev.* 12(1), 19 - 24.
- OKE O.L., (1979). Problems in the use of cassava as animal feed. *Anim. Feed Sci. Technol.*, 3: 345 - 380.
- STEEL R.G.D., and TORRIE J.M., (1980). *Principles and procedures of Statistics* (2nd edn), McGraw-Hill Kogakusha.
- WALKER N., (1983). Cereal replacers as alternative sources of energy for pigs. In, Heresign W. ed, *Recent Advances in Animal Nutrition*, Butterworth, London.