feed additives and whole cassava

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Supplemental effects of feed additives on the utilization of whole cassava plant by growing pigs in Nigeria

This study was carried out to determine the effects of feed additives on pig growth and nutrient utilization of a diet based on the whole cassava plant (with the permission of Livestock Research for Rural Development).

Introduction

The use of additives as supplements in the feed industry and in animal nutrition is a long-standing practice. The additions are made for a variety of reasons, which include addition of colour and flavour to the diet, and at the end, they can alter the efficiency and speed of growth of the animal (Peter et al 1988).

The typical formulation of animal diets is quite variable and is dependent upon cost of ingredients, which in turn is dependent upon their availability. The efficiency of utilisation of some non-conventional ingredients, which are highly fibrous (cassava peels, leaves and tender stems), is often limited by the presence of anti-nutritional factors (ANFS). Such ANFS are commonly referred to as non-starch polysaccharides (NSP) (Bedford 1995). They exert their negative effects on digestion by creation of very large entanglements, which result in an elevation of viscosity of the small intestine. This results in a reduction in rate of digestion and absorption of nutrients, an elevation of microbial activity in the large intestine, a reduction on feed intake and increased moisture in the excreta (Bedford 1995).

The cassava plant (flour, peels, leaves and tender stems) could serve as potential sources of cheap energy and protein but their digestibilities (especially peels, leaves and tender stems) are often lowered because they have a high content of plant cell wall components, which have the attribute of locking up other important nutrients in their matrixes. Fiber, the extent of digestion of which depends on the degree of lignification, is capable of absorbing amino acids and peptides withholding, them from absorption. Beside this, they may form gels thereby obstructing the access of digestive enzymes (Sauer et al 1991; Mitaru and Blair 1984).

Cassava peels, leaves and tender stems are under-utilized in Nigeria because they are often left to rot away on farms and homesteads after harvesting the roots. These materials can go a long way in meeting the feed requirements of pigs if properly processed and supplemented. Hence, the objective of this study was to evaluate the effects of feed additives as supplement in diets based on whole cassava plant meal fed to growing pigs.

Materials and Methods

Experimental diets and test ingredients

Four diets were formulated to contain about 19.0% crude protein and a digestible energy value of about 12.55 MJ/kg. The control diet was whole cassava plant meal. The other three diets were the same as the control except for the addition of additives: 1 contained whole cassava plant meal without feed additive. Diets 2, 3 and 4 had the same composition with diet 1 except for the addition of the following feed additives: oxytetracycline (OXY), Avizyme 1500+ (AVIZ) and Bakers' Yeast (BY) (Table 1). Rates of addition per tonne of feed were: Oxytetracycline 450 g, Avizyme 1 kg and Bakers' Yeast 3 kg.. The whole cassava plant comprised 60% of the diet and was made up of: root flour,peels and leaves and tender stems in the ratio 4:1:1 (DM basis). The ratio of leaves to tender stem was 3:1 (DM basis). The cassava root flour, peels, leaves and tender stems of varying degrees of maturity were collected after harvesting from neighbouring farms around the University of Ibadan Teaching and Research Farm. They were then chopped with a cutlass and sun-dried to about 10% moisture content before milling.

Table 1.
Composition of diets (air-dry basis)

Cassava root flour	40	40	40	40
Cassava peels	10	10	10	10
Cassava leaves, tender stems	10	10	10	10
Palm kernel	11	11	11	11
Groundnut cake	20	20	20	20
Fish meal	1.5	1.5	1.5	1.5
Blood meal	4	4	4	4
Oyster shell	1	1	1	1
Bone meal	1.5	1.5	1.5	1.5
Premix #	0.5	0.5	0.5	0.5
Feed additives ##	-	0.45	1	3

Management of experimental animals

Twenty growing pigs (Large White X Hampshire) with a mean body weight of 13.3±0.5 kg were housed in individual pens and assigned randomly to the four dietary treatments. The experiment was conducted for nine weeks. They were fed at 3.5% of their body weight. Water was supplied ad libitum. The animals were housed in pens with concrete floors, equipped with watering and feeding facilities. Routine management practices were followed. Feed consumption and live weights at weekly intervals were recorded.

Blood collection

Blood was collected from individual animals in the morning with the aid of a 10-gauge needle inserted into the anterior vena cava. Ethylene diamine-tetra-acetic-acid (EDTA) was added to all the test tubes used for the collection. Haematological measurements were determined using methods outlined by Kelly (1979).

Nutrient retention trial

12 pigs with similar weights were selected after eight weeks on each treatment (two per treatment). They were housed in metabolism cages for a 7-day trial period. Total excreta were collected daily during the last 3 days of the metabolic trial. Apparent nutrient retention was calculated as (nutrient intake - nutrient excreted)/nutrient intake and expressed as a percentage.

Chemical and Statistical Analysis

Samples of the diets and faeces were dried in a forced draught oven at 60oC for 24 hr and ground in a laboratory hammer mill before proximate analysis (Table 2) using methods outlined by AOAC (1995). The plant cell wall constituents were determined using methods outlined by Goering and Van Soest (1970).

Table 2:
Proximate composition of the diets (air-dry basis)

Dry matter	92.9	92.7	92.8	92.6
Crude protein	19.3	19.1	19.2	19.3
Crude fibre	8.86	8.73	8.76	8.83
Ether extract	1.4	1.69	1.32	2.03
Ash	13.4	12.0	13.0	11.6

The data were subjected to statistical analysis using the SAS Computer software package (SAS 1988).

Results

The daily live weight gain was lowest on the control diet without feed additives and highest on the diet with brewers' yeast (Table 3). The feed intake and feed to gain ratio were not significantly influenced by the dietary treatments .

Table 3
: Mean values for change in live weight, feed intake and conversion

Live weight, kg					
Initial	12.5	13.5	13.5	13.8	0.5
Final	34.0 b	43.9 a	44.5 a	46.5 a	4.9
Daily gain	0.38 b	0.47 a	0.49 a	0.52 a	0.05
Feed intake, kg/d	0.91	0.95	0.98	0.98	0.03
Feed/gain, kg/kg	2.4	2.07	2	1.9	0.19

ab Means in the same row without common letter are different at P<0.05

Digestibility coefficients for DM, crude protein and fibre tended to be higher (significant for crude fibre) on the diet with supplementary brewers' yeast than on the control, with intermediate values for the other additives (Table 4). This trend was especially noticeable for the cell wall coefficients with very marked differences between the diet with added yeast and the control.

Table 4:
Mean values for apparent digestibility coefficients

Apparent digestibility, %					
Dry matter	80.3	79.6	85.6	87.1	3.03
N*.25	77.2	78.3	83.6	83.9	3.05
Crude fibre	67.1 b	76.7a b	74.ab	81.2 a	5.08
Apparent digestibility of cell wall constituents, %					
NDF	77.6 b	79.2b	79.6b	82.8 a	1.91
ADF	62.3 b	60.9b	63.1b	75.1 a	6.4
Lignin	51.0 b	72.0a	74.8a	77.2 a	10.5
Cellulose	61.2 b	61.9b	64.5a b	76.9 a	6.64
Hemicellulose	84.8 b	91.2a	95.1a	91.9 a	3.71

ab Means in the same row without common letter are different at P<0.05

The packed cell volume (PCV) appeared to be lowest and RBC highest on the diet with brewers' yeast (Table 5).

Table 5:
Mean values for blood indices

PCV, %	35.5ab	39.3a	33.3ab	32.0b	3.56
Hb, g/100ml	10.8ab	12.7a	10.8ab	10.4b	1.12
RBC, x106/Fl	6.75b	7.53a	7.0ab	7.63a	0.39
WBC,x103/Fl	19,000	16,800	18,633	18,453	879

ab Means in the same row without common letter are different at P<0.05

Discussion

The three types of feed additives (oxytetracycline, Avizyme and Brewers' Yeast)O all appeared to have positive effects on growth rate and nutrient utilization, with the most consistent improvements being observed when Brewers' Yeast was the additive. This may have been due to their ability to neutralize deleterious substances or microorganisms from the feed and / or to stimulate the activity of friendly microbes, especially the cellulolytic organisms as has been reported in ruminants by Arambel and Kento (1990), Williams and Newbold (1990) and Williams et al (1991). This would explain the positive effect of the Bakers' Yeast on apparent digestibilities of the cell wall constituents. Bakers' yeast gave a better result numerically compared to the other feed additives in growth rate possibly because, apart from being a growth promoter, it is also a rich source of high quality protein and vitamins (Phillip and Von Tungeln 1984; Cramplen et al 1989).

The use of Bakers' Yeast as a feed additive is the most interesting finding, as the inclusion of antibiotics (eg: oxytetracycline) is now considered to have potential negative consequences in view of the risks of developing microbial resistance and Avizyme is a a commercial product, which is not likely to be available to poor farmers. Further research is necessary to confirm the positive effects of the yeast supplement and to ascertain if this is a specific response encountered only on diets with high levels of cassava plant products.

Conclusions

* The results of this study suggest that the inclusion of Bakers' Yeast in cassava-based diets for

young growing pigs can have beneficial effects on fibre utilization and on growth rate.

* Further research is needed to test if the positive effect of the yeast is manifested mainly on diets based on cassava plant products fed to pigs.

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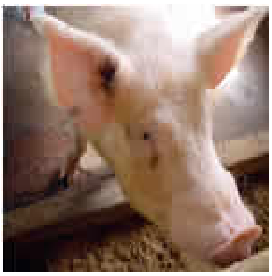 Yes