EVALUATION OF THE NUTRITIVE VALUE OF WHOLE CASSAVA PLANT AS A REPLACEMENT FOR MAIZE IN THE DIETS OF GROWING PIGS IN THE TROPICS

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ABSTRACT

The study was carried out to evaluate the effect of replacement of whole cassava plant meal for maize in diets on performance and blood parameters of growing pigs for eight weeks. Three diets were formulated. Diet 1 was maize based and served as the control. Diet 2 had 50% of maize in diet 1 replaced with whole cassava plant meal (WCPM) while diet 3 had 100% replacement of maize with WCPM. WCPM (which had a crude protein value of about 9.0%) was developed with the ratio of 2.5:1 of unpeeled cassava tuber to cassava leaves plus tender stems, while the ratio of cassava leaves to tender stems was 5:1. A total of 24 growing pigs (large white) with an initial mean weight of 20.89+0.7kg were used in this study in a completely randomized design. There were four replicates per treatment and each replicate had two pigs.

The results of this study show that average final body weight (38.83 – 41.00kg), feed to gain ratio (2.5-3.00) and other growth parameters were not significantly (P>0.05) influenced by the dietary treatments. The haematological indices such as Red blood cell (7.07-7.39x106/mol3), Packed cell volume (40-42.35%), Haemoglobin (13.27-14.00g/dl) and White blood cell were not significantly (P>0.05) affected by the dietary treatments. The serum metabolites showed no significant differences (P>0.05) among the WCPM based diets.

The results of this study showed that the nutritive value of WCPM is sufficiently adequate to replace maize wholly or partially in the diets of growing pigs without adversely affecting growth, serum metabolites and haemotological indices.

1.0 Introduction

The high cost and scarcity of feed have been the most important factors militating against increased commercial pig production in Nigeria. The high cost of procuring feed ingredients such as maize could be attributed especially to tight competition between man and livestock for maize (Dada et.al, 2001). Therefore, to increase commercial pig production in Nigeria, it is important to investigate the nutritive value of feedstuff,

which could replace maize. One of such feedstuffs is cassava.

Presently in Nigeria, cassava is under utilized, most especially at the level of the peels, leaves and tender stems as they are often left to rot away after harvest on farms and homesteads where it is grown. Cassava being a multipurpose plant because of the usefulness of all its parts (pulp, peels, leaves and tender stems) can be relied upon to provide the needed succour against the ever increasing cost of feeding which has been conveniently put at 60-80% of the total cost of production in an intensively reared stock (Fajimi et. al., 1993, Tewe 1997).

There had been several studies by different researchers (Iyayi and Tewe, 1994; Ravindran 1990 andTewe and Oke 1983) on the potentials of cassava meal as a substitute for maize for all classes of pigs. In most of these studies, emphasis had been more on the use of cassava flour or peels or leaves. There had been attempts lately to incorporate whole cassava plant meal (pulp, peels, leaves and tender stems) in the diets of pigs (Akinfala et. al. 1999, Akinfala and Tewe 2001) Findings from those studies stimulated the present investigation. Cassava by-products such as peels, leaves and tender-stems may be unsuitable to monogastric animals (especially pigs if they are not well processed) because of their physical forms, unpalatability, high fiber content and anti-nutritional factors such as hydrocyanic acid (HCN). HCN from potentially toxic varieties had been reported to have been reduced to safe level due to proper processing.

In view of the predicted world shortage of cereal grains, because of competing needs for the expanding human population and the diminishing food production capacity of the earth's surface (Brown and Kane; 1994), it is argued that a major priority is to develop livestock feed systems which do not depend on cereal grains (Preston 1995).

Hence, the objective of this study is to evaluate the effect of replacement of whole cassava plant meal for maize in diets on performance and blood parameters of growing pigs.

2.0. Materials and Methods

2.1 Collection and Processing of Test Ingredients

The unpeeled cassava tubers, the leaves with tender stems of sweat varieties were collected from harvested mature cassava plants. The fresh cassava tubers (root with peels) were washed and sliced into pieces for ease of drying. The cut pieces were spread on clean cement floor and were raked at intervals for even and quick drying. The drying was done to about 10% moisture content for about 5-7 days depending on the intensity of the sunlight. The dried tubers were milled with a grinding machine and packed in polythene bags.

The fresh cassava leaves with tender stems were spread on clean concrete floor immediately after harvesting. The tender stems were carefully removed and chopped into bits with the aid of cutlass to hasten drying. The leaves were sun-dried for about 2 days while the tender stems were sun-dried for about 4-6 days depending on the intensity of the sunlight. The dried leaves and tender stem were then milled with a grinding machine and packed in separate polythene bags.

Whole cassava plant meal (WCPM) was developed to have a crude protein of about 9%, which was considered to be close to 10% reported for maize. To get WCPM to crude protein level of about 9%, the milled cassava tuber was mixed with milled leaves plus tender stems at the ratio of2.5:1 while the milled leaves was mixed with milled tender stems at the ratio of5:1.

2.2 Experimental Diets.

Three experimental diets that had about 18% crude protein and 2.7 Kcal/g of digestible energy were formulated (Table 1). Diet 1 was

maize based and served as the control. Diet 2, had 50% of maize in diet 1 replaced with WCPM, while diet 3, had 100% replacement of maize with WCPM.

2.3. Management of Experimental Animals.
Twenty-four growing pigs (large white) with an initial mean body weight of 20.89+0.08kg were assigned randomly to three dietary treatments. The experiment was conducted for eight weeks. The animals were housed individually on concrete floored pens equipped with watering and feeding facilities. The animals were fed at about 4% of their body weight; water was supplied to the animals ad libitum. Routine management practices were followed. Records of feed consumption and weight gained each week were kept on dietary treatment basis.

2.4. Blood Collection.
This was done at the end of the eighth week of the study. Four animals were randomly selected from each dietary treatment for the purpose of blood collection. Blood samples were collected from individual animals with the aid of sterilized 10-guage needles through the anterior vena cava of the pigs. The bleeding was done in the morning before feeding. Ethylene di amine tetra acetic acid (EDTA) an anticoagulant was added to the test tubes used for haematological indices such as packed cell volume, heamoglobin, red blood cell and white blood cell. Haematological measurements were determined using the methods outlined by Kelly (1979). The blood samples in the tubes meant for biochemical assays were allowed to clot before centrifuging to obtain serum used in the determination of some serum metabolites using standard chemical procedures.

2.5 Chemical and Statistical Analysis.
Samples of the diets were dried in a forced draught oven at 60oC for 24hr and ground in a laboratory hammer mill before proximate analysis using methods outlined by AOAC (1995) was carried out. The data were subjected to statistical analysis using computer soft ware package SAS (2000).

Results

Proximate Composition of Experimental Diets.

As shown in Table 2, percentage crude protein ranged from 18.04 to 18.16. The crude fibre content increased with the addition of whole cassava plant meal to the diets and ranged from 10.00%-14.41%.The ether extract ranged from 0.65% to 1.38% with cassava plant meal based diets having highest values. The ash contents of the of the diets ranged from 10.93%-15.94%.The cassava plant based diets had highest values.

Performance Characteristics.

As shown in Table 3, the average weight gain per pig per week ranged from 2.19kg to 2.50kg with diet 1 having the highest value though non-significant (P>0.05). The average feed intake per pig per day ranged from 0.89kg to 0.96kg with diet 3 having the highest value. The feed to gain ratio ranged from 2.50 for pigs in diet 1 to 3.00 for pigs in diet 2. Values were not significantly different (P>0.05).
Serum Metabolites.

The values for serum metabolite concentration of the experimental animals are shown in Table 4. There were no significant differences (P>0.05) in the concentrations of all the serum metabolites of the experimental animals monitored. The serum total protein ranged from 56.33g/l for diet 2 to 60.00g/l for diet 3 while serum albumin concentration ranged from 34.67g/l for diet 1 to 36.67g/l for diet 3. The creatinine concentration ranged from 115.30 mml/l for diet 1 to 140.60 mmol/l for diet 3. The cholesterol concentration ranged from 4.63 mmol/l for diet 2 to 4.90 mmol/l for diet 3.The urea concentration ranged from 5.47 mmol/l for diet 1 to 6.07 mmol/l for diet 2
Haematological Indices.

The haematological indices as shown in Table 5 showed no significant difference (P>0.05) in all

the parameters monitored. The packed cell volume (PCV) ranged from 40.00% for diet 3 to 42.33% for diet 1. The red blood cell (RBC) ranged from 7.07x106/mol3 for diet 3 to 7.39x106/mol3 for diet 2. The haemoglobin (Hb) ranged from 13.27g/dl for diet 3 to 14.20g/dl for diet 1. The white blood cell (WBC) ranged from 9,600x103 for diet 1 to 11,316.7x103 for diet 2.

Discussion

The crude protein values which ranged from 18.04% to 18.16% fall within the range recommended by Balogun and Fetuga (1990) for growing pigs in the tropics. The crude fibre of the diets (10.00-14.41%) was however higher than those recommended by Balogun and Fetuga (1990); Adesehinwa (1997) and Akinfala and Tewe (2001) for growing pigs. The ash content increased with increasing level of WCPM. Ash content of a diet had been associated with the fibre content (Babatunde et. al. 1979).

The growth rate, feed intake and feed conversion parameters were not significantly influenced (P>0.05) by the dietary treatments (Table 3). Nonetheless, the results obtained in this study were not satisfactory. This could be as a result of the fibrous nature of the diets. Having a high fibre in the diet of growing pigs as it appears in this study (which may be due to level of palm kernel cake) can lead to decrease in digestibility of dietary nutrients and increased fecal production in pig. However, the results obtained showed that pigs on either maize or cassava based diet wholly performed better though not significantly to the diet that had the mixture of maize and cassava. This is not in agreement with earlier findings (Akinfala and Tewe, 2001). The increase in average daily feed consumption with increasing WCPM is probably due to a lowering of the energy concentration of the diets that contained WCPM. The analytical values of these diets showed total ash of diet 1 to be 10.95%, diet 2, 13.29% and diet 3, 19.44%, The crude fibre in diet 1 was 10.00%, diet 2, 12.55% and diet 3, 14.41%. Crude fibre is known to be low in available energy and ash fraction, which may be predominantly silica, contained no energy (Babatunde et. al. 1979).

The Cyanide level of the diets though not determined in this study appeared not to have negative effects on the growth indices monitored. This may be due to the adequacy of protein in the diets that contained WCPM which had been reported to be the major factor of concern rather than cyanide in feed intake and growth (Tewe and Egbunike 1992).

Serum metabolites particularly proteins, urea, creatinine etc are good indicators, on one hand of the components of digested diet and on the other hand, of the state of health of body tissues and organs. These parameters are indicators of protein reserves in the animals and can be specifically influenced by protein shortage (Gouache et. al. 1991). The non-significant difference (P>0.05) in the concentration of serum metabolites of experimental animals may be as a result of adequacy of dietary protein and energy offered by WCPM which probably limits tissue protein degradation and a consequent rise in serum urea and creatinine levels.

The total replacement of maize with WCPM led to reduction in the metabolisible energy of the diet. This could be explained by the fact that in the presence of sufficient amount of carbohydrate, the use of lipid based moieties for energy generation is of limited value. The cholesterol concentration is likely to rise as a result of reduced body assimilation. Although, there was no definite trend in the serum metabolites of the experimental animals fed with a mixture of maize and cassava, the mixture appeared to represent a mid way between two extremes and a more balanced dietary pattern. Although cyanide had been implicated to affect the values of proteins as well as the utilization (Iyayi and Tewe 1994), its

effect in this study was not obvious

The haematological indices showed non-significant differences (P>0.05) in the experimental animals. This is at variance with earlier studies by Akinfala and Tewe (2001). The interesting trend in the haematological indices monitored showed that increasing level of WCPM in the diets brought about the lowering of these indices. The probable reason for this observed trend may be due to presence of residual cyanide, which had been reported to cause haematological changes in all the indices monitored in this study (Tewe 1991). However, all the values obtained were within the range recommended for healthy pigs by Duke (1975) and Schalm et. al.(1975).

Conclusion

The results of this study showed that higher fibre content could lead to unsatisfactory growth rate. Besides, the results obtained also showed that the nutritive value of cassava plant meal is sufficiently adequate to replace maize wholly or partially in the diets of growing pigs without adversely affecting growth, serum metabolites and haematological indices.

Acknowledgment: We wish to appreciate the financial support by URC of Obafemi Awolowo University,Ile-Ife, Nigeria for this study.

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Table 1: Gross Composition of Experimental Diets

Ingredients(%)	1	2	3
Maize	40.0	20.0	-
Whole Cassava plant Meal (unpeeled tuber + Leaves + tender stem)	-	20.0	40.0
Groundnut Cake	18.0	18.0	18.0
Palm Kernel Cake	35.0	35.0	35.0
Fish meal	2.0	2.0	2.0
Bone meal	1.5	1.5	1.5
Oyster shell	3.0	3.0	3.0
*Premix (Vit/mm)	0.25	0.25	0.25
Salt	0.25	0.25	0.25
Total	100.0	100.0	100.0
Calculated Values			
Dry Matter (DM)	89.15	89.67	90.18
*ME Kcal/Kg	2786.6	2616.6	2446.6
Crude Protein %	19.42	19.22	19.02
Crude Fibre %	8.20	8.81	9.43

*Premix supplied the following per kg diet: 4,000,000 iu vit.A, 800,000 iu vit. D3, 2,500 iu vit. E, 1000mg Vit.K, 750mg vit. B1,750mg vit. B6, 7,500mg Niacm, 5mg vit. B12,2,500mg pantothence acid, 250mg folic acid, 10mg Brotin,100mg chloride, 62.5mg anti oxidant, 40g manganese, 25g zmc, 10g ton, 2.5g copper, 0.6g Iodine, 100mg selenium, 100mg cobalt.

*ME: Metabolisable Energy

Table 2: Proximate Composition of Experimental Diets

Parameters (%)	Diets 1	2	3
Dry matter	92.06	92.16	93.71
Crude protein	18.04	18.16	18.04
Crude fibre	10.00	12.55	14.41
Ether Extract	0.65	0.86	1.38
Ash	10.93	13.29	15.94
NFE	52.34	47/30	43.94

Table 3: Performance Characteristics of growing pigs fed experimental diets

Parameters	Diets 1	2	3	Rmks
Average Initial body Weight (kg)	21.02±0.06	21.6±0.17	19.98±0.01	NS
Average Final body Weight (kg)	41.00±0.76	39.17±0.93	38.83±1.96	NS
Average Weight gain/day(kg)	0.36±0.09	0.31±0.09	0.34±0.24	NS
Average Feed Intake/day(kg)	0.89	0.94	0.94	NS
Feed to gain ratio	2.50	3.00	2.78	NS

*NS: Not Significant (p>0.05)

Table 4: Serum metabolites of growing pigs fed experimental diets

Parameters	Diets 1	2	3	Rmks
Total protein(g/L)	57.67±1.45	56.33±2.85	60.00±1.15	NS
Albumin(gL)	34.67±1.20	35.67±1.33	36.67±1.45	NS
Globulin(g/L)	23.00±1.15	20.67±4.18	23.33±0.33	NS
Urea (mmo/L)	5.47±0.09	6.07±0.23	5.73±0.54	NS
Creatinine(mmol/L)	115.3±16.33	140.60±0.72	129.67±3.28	NS
Cholesterol(mmol/L)	4.73+0.12	4.63+0.15	4.90+0.10	NS

*NS: Not Significant at (p>0.05)

Table 5: Haematological Indices of growing pigs fed experimental diets

Parameters	Diets 1	2	3	Rmks
Packed cell volume (PCV)%	42.33±0.33	40.67±2.91	40.00±0.58	NS
Red Blood Cell (RBC)x10^6/ml^3	7.38±0.01	7.39±0.36	7.07±0.07	NS
Haemoglobin (Hb). g/dl	14.20±0.01	13.53±0.91	13.27±0.18	NS
White Blood Cell (WBC)x10^{-3}/ul	9,600+229.13	11,316.7+915.76	9,733.3+216.67	NS

*NS: Not Significant (p>0.05)