USE OF FERMENTED CASSAVA, PALM KERNEL CAKE AND DRIED BREWER'S GRAINS TO PRODUCE MAIZE-FREE LOW-COST DIETS FOR YOUNG GROWING PIGS

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ABSTRACT

An experiment was carried out to determine the performance of young growing pigs fed maize-free diets based on combinations of fermented cassava tuber meal (FCTM), palm kernel cake (PKC) and dried brewers' grains (DBG) as source of energy. Diet I (control) contained maize as the main source of energy while diets 2, 3, 4, 5 and 6 contained FCTM, PKC and DBG at percentages of 30, 20, 20; 30, 25, 15; 30, 15, 25; 25, 25, 20 and 25, 20, 25, respectively, completely eliminating maize. Each diet was fed to a group of 6 young grower pigs for 12 weeks, using completely randomized design (CRD). The group on diet 6 (25% FCTM, 20% PKC and 25% DBG) consumed significantly ($P<0.05$) less feed than the other groups while the group on the control diet consumed significantly ($P<0.05$) more feed and gained significantly ($P<0.05$) more body weight. The control group and those on diets 3, 4, 5 and 6 had similar feed conversion ratio ($P>0.05$). Internal organ weights were not affected by the treatments ($P>0.05$). Feed cost of production (feed cost/kg x feed conversion ratio) was least for the pigs on diet 5, ₦187.17/kg gain as against ₦247.14/kg gain for the pigs on the control diet.

Keywords: Young grower pigs, maize-free diets, dietary energy

INTRODUCTION

Pig production has depended on maize as the source of dietary energy. However, cost of maize has been escalating within the last 20 years because of the demand pressure arising from its use as staple food for humans, feed for livestock and raw material for some industries (Udedibie, 2003). This has adversely affected pig production in the country due to unbearable increase in feed cost and its concomitant effects on the cost of pig products. There is the need therefore to look for cheaper alternatives to maize if pig enterprise in the country must be sustained.

Currently, Nigeria is the largest producer of cassava in the world with production capacity of 38.2 million metric tonnes per annum (FAO, 2005). Although its use as feedstuff is limited by its content of cyanogenetic glucosides, linamarin and lotaustralin (Nartly, 1973; Hill, 1977), Udedibie *et al.* (2004) have demonstrated that this could be eliminated through fermentation. It is also low in crude protein (about 3%) but this could be remedied through supplementation with high protein feeds.

Palm kernel cake is the by-product of palm kernel extraction industry and is abundant in many tropical countries including Nigeria. It contains about 20% crude protein and has been shown to support satisfactory egg production at up to 40 % dietary inclusion for laying hens (Onwudike, 1988) and body weight gain of broilers (Meremikwu, 2009).

Another by-product that is abundant in Nigeria is dried brewers' gains, the by-product of the breweries. Brewers' grains is 'spent' with regard to its starch content but it contains proportionally more valuable vitamins, minerals, fat, fiber and protein than were contained in the original cereal grains used (Kingsell *et al*, 1979). It is rich in essential fatty acids (Singh, 1988) and crude protein (Udedibie, 1984).

Considering the various attributes of fermented cassava tuber meal, palm kernel cake and dried brewers' grains, it would appear that their appropriate combinations can be used to produce maize-free and cheap diets that can be efficient in promoting performance of pigs.

This paper reports the performance of young growing pigs fed maize-free low-cost diets based on various combinations of fermented cassava

tuber meal, palm kernel cake and dried brewers' grains.

MATERIALS AND METHODS

Experimental Site

The experiment was conducted at the swine section of the Teaching and Research Farm of the Federal University of Technology, Owerri-Nigeria. Owerri is the Capital of Imo State. It lies between latitude 4^0 $4^1$and 6^0 3^1 and longitude 6^0 15^1 and 8^0 15^1. It has an average annual rainfall of 2500 mm and mean annual temperature range 0f 26.5 – 27.5 ^{0}C. The mean annual humidity range is 70 - 80% with dry season duration of 3 months. The annual evapotranspiration is 1450 mm and the soil is essentially sandy loam with average pH of 5.5 (Imo State Atlas, 1984).

Sources and Processing of Feed Ingredients

The fresh cassava tubers used in the study were brought from a local market in Ideato North Local Government Area of Imo State. They were washed, cut into pieces and put in vats filled with water and left to ferment under atmospheric temperature for 5 days. Thereafter, they were put in sacs and hand-pressed to remove water and then spread in the sun to dry. The dried fermented cassava tubers were then milled to produce fermented cassava tuber meal (FCTM).

Wet brewers' grains was brought from the Consolidated Brewery Limited, Awo-omama, the brewers of 33 export lagar beer, dried in the sun and milled to homogenize it to produce dried brewers' grains (DBG).

The other ingredients (PKC, maize, local fish meal, blood meal, wheat offal, soyabean meal, salt, vitamin/trace mineral premix, lysine and methionine) were bought from a local feed dealer. The FCTM, PKC, DBG, local fish meal were subjected to proximate analysis according to AOAC (1995). Fresh cassava tubers and the FCTM were analyzed for HCN according to Bradbury *et al* (1999).

Experimental Diets

Six experimental diets were formulated such that the control diet (diet 1) contained maize as the main source of energy while diets 2, 3, 4, 5 and 6 contained FCTM, PKC and DBG at the following percentages: 30%, 20%, 20%; 30%, 25%, 15%; 30%, 15%, 25%; 25%, 25%, 20% and 25%, 20%, 25%, respectively, completely replacing maize. Ingredient composition of the diets is shown in Table 1.

Table 1. Ingredient Composition of the Experimental Diets

Ingredients(%)	Diet 1 (Control)	Diets 2	Diet 3	Diet 4	Diets 5	Diets 6
Maize	50.00	-	-	-	-	-
FCTM*	0.00	30.00	30.00	30.00	25.00	25.00
Palm kernel cake	10.00	20.00	25.00	15.00	25.00	20.00
Brewers' dried grains	10.00	20.00	15.00	25.00	20.00	25.00
Soyabean meal	15.00	15.00	15.00	15.00	15.00	15.00
Wheat offal	4.00	4.00	4.00	4.00	4.00	4.00
Fish meal (local)	4.00	4.00	4.00	4.00	4.00	4.00
Blood meal	3.00	3.00	3.00	3.00	3.00	3.00
Bone meal	3.00	3.00	3.00	3.00	3.00	3.00
Vit/mineral premix**	0.25	0.25	0.25	0.25	0.25	0.25
Common salt	0.25	0.25	0.25	0.25	0.25	0.25
L-lysine	0.25	0.25	0.25	0.25	0.25	0.25
L-Methionine	0.25	0.25	0.25	0.25	0.25	0.25
Calculated Nutrient Composition (%dm)						
Crude protein	19.97	18.89	19.78	19.69	20.59	20.69
Crude fibre	4.72	8.09	8.29	8.26	8.46	8.09
Ether extract	3.82	2.49	2.50	2.83	2.85	2.54
Ash	3.58	4.52	4.52	4.52	4.66	4.66
Calcium	1.25	1.34	1.35	1.35	1.35	1.36
Phosphorus	1.03	1.03	1.07	1.53	1.11	1.11
ME (kcal/g)	2.80	2.66	2.65	2.70	2.69	2.66

*Fermented cassava tuber meal

** To provide the following per kg of feed: Vit. A., 2,000 iu; vit. D_3, 4,000 iu; vit. E, 80g; vit. K, 0.4g; vit. B_1, 0.39; vit. B_2, 1.0g; folic acid, 2g; biotin, 8.0mg;

choline, 48g; BHT, 32g; Mg, 16g; Fe., 8g; Zn, 7.2g; Cu, 0.32g; I, 0.2g; Co, 36mg; Se, 16mg.

Experimental Animals and Design

A total of 36 weaner pigs of Large White breed were used. They were individually weighed, divided into 6 groups of 6 pigs each and randomly assigned to the 6 experimental diets, using completely randomized design (CRD). Each group was further sub-divided into 2 replicates of 3 pigs each and each replicate housed in a 2 m x 3 m pen and fed the experimental diet for 12 weeks. Feed was given at 4% of body weight while water was provided *ad libitum.*

Data Collection and Analysis

The pigs were weighed at the beginning of the trial to obtain their initial body weights and weekly thereafter to obtain their body weight changes. Feed offered was adjusted every week in accordance with body weight changes. Feed intake was determined by subtracting the weight of the left-over feed from the weight of the feed offered the previous day. Feed conversion ratio was determined by dividing daily feed intake by daily weight gain. Cost of production (₦/kg wt. gain) was determined by multiplying feed cost (₦/kg) by feed conversion ratio.

At the end of the feeding trial, 4 biggest pigs from each group were selected, starved of feed but not water overnight, weighed and then slaughtered. They were then scalded with hot water and eviscerated and their dressed carcass and internal organs (heat, lung, liver, kidney) weighed and expressed as percentage of live-weight.

Data generated were subjected to analysis of variance as outlined by Snedecor and Cochran (1978). Where analysis of variance indicated significant treatment effects, means were compared using Duncan's New Multiple Range Test as outlined by Snedecor and Cochran (1978).

RESULTS AND DISCUSSION

Hydrocyanide and Proximate Composition of the Cassava Tubers and FCTM

Data on the HCN and proximate composition of the fresh and fermented cassava tuber meals are presented in Table 2. The HCN content of the fresh cassava tuber meal was 800 ppm as against zero value obtained from FCTM. This is in agreement with the report of Udedibie *et al* (2004) that fermentation is a very effective means of detoxifying cassava tubers. Earlier reports by Okeke *et al* (1984) and Odukwe (1994) showed that sun-drying, cooking or addition of palm oil are not quite as effective as methods of processing cassava for use as animal feed.

There were not much differences in the proximate composition of the 2 samples on dry matter basis. The very high values of nitrogen-free extract of the samples is an indication that cassava tuber meal is essentially an energy feed.

Performance of the Experimental Pigs

Data on the performance of the experimental pigs are presented in Table 3. The pigs on the control diet consumed significantly ($P<0.05$) more feed than the pigs on the maize-free diets. This tended to show that pigs unlike birds do not eat to satisfy their energy need since the control diet was higher in energy than the maize-free diets. In terms of body weight, the pigs on the control diet gained significantly ($P<0.05$) more body weight than those on the maize-free diets although the pigs on diet 5 performed almost as well. The feed conversion ratio was similar for the pigs on the control diet and those on diets 3, 4, 4, 5 and 6 ($P>0.05$). However, in terms of cost of production, all the maize-free diets performed much better with diet 5 costing ₦187.17 to produce 1 kg of pork as against ₦247.14 for the control.

Table 2: Hydrocyanide and Proximate Composition of Fresh and Fermented Cassava Tuber Meals (DM Basis)

Parameters	Fresh tuber meal	Fermented tuber meal
Cyanide (ppm)	800.0	0.00
Crude protein	2.51	2.46
Crude fibre	2.31	2.06
Total ash	1.62	2.11
Ether extract	0.84	1.20
Nitrogen-free extract	92.17	92.72

Table 3: Performance of the Experimental Pigs

Parameters	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5	Diet 6	SEM
Av. initial body wt. (kg)	7.20	7.20	7.41	7.23	6.10	7.20	0.18
Av. final body wt. (kg)	23.60[a]	17.53[c]	20.66[b]	19.93[b]	20.67[b]	20.63[b]	0.73
Av. total body wt. gain (kg)	16.40[a]	10.33[c]	13.25[b]	12.70[c]	14.57[ab]	13.43[b]	0.75
Av. daily body wt. gain (kg)	0.20[a]	0.12[c]	0.16[b]	0.15[b]	0.17[ab]	0.16[b]	0.01
Av. daily feed intake (g)	700.00[a]	570.0[c]	660.00[b]	640.00[b]	620.00[b]	610.00[b]	20.12
Feed conv. ratio (kg feed/kg gain)	3.59[a]	4.64[b]	4.18[ab]	4.13[ab]	3.58[a]	3.82[a]	0.43
Cost of feed (₦/kg)	68.84	54.34	53.59	55.08	52.84	53.59	-
Cost of feed/kg wt. gain (₦)	247.14	252.14	224.01	227.48	189.17	204.71	-

[abc]Means within a row with different superscripts are significantly different (P<0.05)

Carcass and Organ Weights

The carcass and organ weights of the pigs are presented in Table 4. The dressing percentage of the groups ranged from 49.63 - 58.05%, with the group on diet 2 having the least value. The weights of the visceral organs were not affected by the treatments (P>0.05). The similarity in the weights of the visceral organs, particularly the liver, is an indication that the diets did not inflict any serious toxicity on the pigs.

Table 4: Carcass and Visceral Organ Weights

Parameters (%LW)	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5	Diet 6	SEM
Live-weight (kg)	23.60[a]	17.53[c]	20.66[b]	19.93[c]	20.67[b]	20.63[b]	0.74
Dressed weight	58.05[a]	49.63[bc]	52.03[b]	54.84[ab]	50.70[b]	52.01[b]	1.15
Heart	0.57	0.47	0.43	0.48	0.48	0.73	0.05
Liver	3.04	3.24	2.96	2.62	2.98	3.39	0.01
Spleen	0.18	0.20	0.16	0.14	0.20	0.24	0.01
Kidney	0.56	0.43	0.41	0.47	0.48	0.57	0.04
Lungs	1.58	1.70	1.41	1.38	1.29	1.54	0.06

[abc]Means within a row with different superscripts are significantly different (P<0.05)

LW= Live-weight

CONCLUSION

The results of the trial have demonstrated that appropriate combinations of fermented cassava tuber meal, palm kernel cake and dried brewers' grains can be used to produce maize-free, low-cost feed for young growing pigs. Any of the combinations in diets 3, 4, 5, and 6 can be used but the best among them is diet 5 (25% FCTM, 25% PKC and 20% DBG). Pig farmers are therefore advised to use this combination in the event of high cost of maize due to high demand.

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