Original Research Article

Influence of Dietary Levels of Cassava Peels and Palm Kernel Cake on the Performance and Cost Benefits of Weaner Pigs

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Abstract

The objective of this study was to assess the influence of feeding varying levels of a mixture of cassava peels and palm kernel cake (PKC) at a 1:1 ratio (w/w) on the performance of weaner pigs. Forty (40) weaner Large White pigs were divided into 5 treatment groups based on their average initial body weights (8.88 to 9.32kg), and each group allocated to one of five treatment diets in which the cassava peels/PKC mixture replaced 0%, 25% 50% 75% and 100% of the dietary maize in a completely randomized design (CRD). During the feeding trial, weekly feed consumption and weight changes were recorded for all the levels, while weight gain, feed conversion ratio and protein efficiency ratio were estimated to assess performance of the weaner pigs. There were significant ($p<0.05$) differences in the performance characteristics of the weaner pigs among treatments. Pigs fed diets with the 25% maize replacement diet exhibited superior final weight gain, feed conversion ratio and protein efficiency ratio (25.67kg, 2.06 and 2.52) respectively. However, the dietary inclusion of cassava peels/PKC in diets of the weaner pigs as an alternative energy source at 25% maize replacement level yielded the highest profit per pig of ₦2191.30, and proved to be the most efficient and cost effective ration in this study.

Keywords: Weaner pigs, Growth performance, Cassava peels and palm kernel cake and cost benefits

Introduction

In the world's widening search for cheap sources of energy and protein-rich foods, increasing attention has been focused on home-grown under-exploited crops whose products and by-products contain relatively high amounts of energy or protein that can be used to improve the diets of vast majority of the populace. Africa is currently plagued with food crisis, due partly to unprecedented rise in human population, and alarming drop in per capital food production in the last decades. Our

inability to produce more food to feed ourselves, and bring down the rising prices of foodstuffs in the market has compounded the poverty level of Nigerians, as reflected in the deterioration of the quality and quantity of their animal protein intake. Nigeria is richly endowed with a variety of animal protein sources; 19 million cattle, 72.5 million goats, 41.3 million sheep, 7.1 million pigs, 145 million poultry, 11.6 million ducks 2.1 million turkey, donkeys etc (FMARD, 2011; Oboh, 2016). These values will continue to increase annually, and result in higher consumption of meat, eggs and milk, due principally to accelerated growth of urban and sub-urban settlements, changes in income and in the level of education of the populace, in line with the report of FAO (2012) that the world would consume 73% more meat and 58% more milk by 2050. FAO (1991) estimates that about 89.5g of protein is required by humans in their diets for normal functioning of the body on a daily basis, of which 34g should be obtained from animal sources. It is noteworthy that meat consumption is often an indication of economic status of a country or individual (Ososanya, 2004). In classification of countries, as either developed or developing, two major criteria are often used: per capita income and per caput animal protein consumption. The existing low intake of protein of animal origin in Nigeria can be attributed to its high cost, due to high costs of conventional feed ingredients which, unfortunately, are also used by man as food. Animal proteins are therefore largely unaffordable to most of the people. To change this situation, effort must be made to source cheaper alternative feed ingredients such as crop by-products which are not consumed by man for our livestock. Utilization of agricultural by-products of crops such as cassava, yam, sweet potatoes, maize, wheat, rice, groundnut, soya bean and their products that are under-utilized by humans for food, will help to reduce costs.

Thus, the objective of this study was to evaluate the influences of dietary levels of cassava peels and palm kernel cake on growth performance and cost benefits of rearing weaner pigs.

Materials and Methods

The research was carried out at the piggery unit of the Teaching and Research Farm of the Faculty of Agriculture, Ambrose Alli University, Ekpoma, Nigeria. The farm is located in Esan West Local Government Area Council of Edo State, Nigeria, with an annual rainfall of 1500-2000mm per annum. Relative humidity is 75%, and average temperature is 32^0C. The research was carried out for a period of ten weeks.

A total of 40 Large White weaner pigs were used for the study. The pigs were divided into 5 groups based on their average initial weights (8.88-9.32kg), and each group allocated to one of five treatment diets in a completely randomized design (CRD). Each treatment group contained 2 replicates of 4 pigs (2 male and 2 female). The pigs were fed twice daily, and water supplied *ad libitum*. The treatment diets consisted of a mixture of dried cassava peels and PKC (in a 1:1 ratio, w/w) at 0, 25, 50, 75 and 100% replacement of maize in the control (corresponding to Treatments 1, 2, 3, 4 and 5 respectively) The 1:1 ratio of cassava peels to palm kernel cake was derived by mixing equal weights (kg) of the two test ingredients. All diets were formulated to be iso-nitrogenous and iso-caloric.

During the feeding trial, weekly feed consumption and weight changes were recorded, while feed conversion ratio and protein efficiency ratio were estimated to assess performance of the weaner

pigs. The data collected on various parameters were analyzed using Statistix (2003) package, and differences in treatment means were separated using Duncan's New multiple range test as outlined by Obi (2002).

The formulae for calculating the different parameters were:

i. Feed intake = weight of feed given – weight of leftover feed
ii. Feed conversion ratio = Feed consumed/Weight gain
iii. Weight gain = Final body weight - initial body weight
iv. Protein efficiency ratio = Gain in weight/Protein consumed

Table 1: Composition of the experimental diets for weaner pig

	Cassava peels/PKC mixture				
Ingredients	**0**	**25%**	**50%**	**75%**	**100%**
Maize	55.00	41.25	27.50	13.75	-
Cassava peels/PKC	-	13.75	27.50	41.25	55.00
Ground Nut Cake	25.60	26.78	27.92	29.06	30.21
Wheat Offal	14.10	12.72	11.51	10.26	9.02
Bone Meal	1.50	1.50	1.50	1.50	1.50
Limestone	2.00	2.00	2.00	2.00	2.00
Palm Oil	1.00	2.00	2.20	2.40	2.60
Weaner Premix*	0.25	0.25	0.25	0.25	0.25
Salt	0.35	0.35	0.35	0.35	0.35
Ronozyme**	0.20	0.20	0.20	0.20	0.20
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated Analysis:					
Crude Protein (%)	**19.00**	**19.00**	**19.00**	**19.00**	**19.00**
ME(Keal/Kg)	**2878**	**2857**	**2835**	**2813**	**2791**
Fibre (%)	5.35	6.99	8.63	10.26	11.90
Ash (%)	5.94	9.11	12.34	15.57	18.80
Calcium (%)	0.80	0.80	0.80	0.80	0.80
Starch (%)	39.20	36.14	32.99	29.85	26.70
Fat (%)	6.48	7.74	8.99	10.25	11.50

*Premix supplied per kg diet 4,000,000 I.U Vit. A, 800,000 I.U Vit. D3, 12,000 I.U. Vit E, 0.80g Vit K, 0.60g Vit B1, 2.0g Vit B2, 1.40g pantothenic acid, 20.00mg biotin, 0.40g folic acid, 120.0g choline chloride, 8.0g zinc bacitracin, 40.0g manganese, 20.0g iron, 18.0g zinc, 0.80g copper, 0.60g iodine, 0.09g cobalt, 0.04g selenium, 36.0g lasalocid (Avatec). PKC = Palm Kernel Cake, GNC = Groundnut cake, C.P. = Crude protein, ME = Metabolizable energy.

**Ronozyme Composition of the product, sodium sulfate (52.7%), calcium carbonate (15%), kaolin (9%), dextrin and sucrose (8%), cellulose (6%) and vegetable oil (7%). bulk density of 1,100 kg/m^3. The particle size distribution of the product showed that 98% of the particles was between 150 and 1,200 μm in diameter and less than 1% of particles are below 150 μm.

Results

Performance of the weaner pigs

Table 2 shows the effects of feeding varying levels of cassava peels/PKC to weaner pigs on their performance. Mean initial live weight of the weaner pigs were similar (P>0.05), and ranged from 8.88kg to 9.32kg. Average final weight gain of the weaner pigs were significantly (P<0.05) affected by the experimental diets. Animal fed the diet in which 25% of its maize was replaced with cassava peels/Pkc meal gave the highest final weight (25.67kg), followed by the control (23.84kg), while values obtained for 50, 75 and 100% levels of maize replacement with cassava peels/PKC decreased with increased replacement levels. However, significant (P<0.05) differences were also recorded in average total weight gain and weekly weight gain of the weaner pigs fed experimental diets that ranged from 25(16.79) to 100%(11.84kg) and 25(2.40) to 100%(1.69kg) respectively. Feed intake values were not significantly affected.

Table 2: Performance characteristics of weaner pigs fed experimental diets

	Levels of maize replacement (%) with Cassava peels/PKC					
Parameters	**0**	**25**	**50**	**75**	**100**	**SEM**
Ave. initial weight(kg)	9.32	8.88	9.00	9.00	9.00	
Ave. final weight(kg)	23.84^{b}	25.67^{a}	22.00^{c}	21.50^{d}	20.84^{d}	0.46
Ave. total weight gain(kg)	14.52^{b}	16.79^{a}	13.00^{d}	12.50^{cd}	11.84^{d}	0.44
Ave. weekly weight gain(kg)	2.07^{b}	2.40^{a}	1.86^{c}	1.78^{cd}	1.69^{d}	0.64
Feed intake(kg)	35.00	35.00	35.00	35.00	35.00	0.01
Feed conversion ratio	2.41^{c}	2.06^{d}	2.69^{b}	2.80^{b}	2.96^{a}	0.68
Protein efficiency ratio	2.18^{b}	2.52^{a}	1.95^{c}	1.88^{cd}	1.78^{d}	0.08
Mortality (%)	-	-	-	-	-	-

a,b,c,d,e: means along the same row with different superscripts are significantly ($p< 0.05$) different from each other; Ave = Average; SEM = Standard error of mean.

Feed conversion ratio differed significantly (P<0.05) in the experimental animals. Replacing 25% of the dietary maize with the test ingredient resulted in the best feed conversion ratio (2.06) compared to other diets with corresponding values of 2.41 for the control diet, and 2.69, 2.80 and 2.96 for 50, 75 and 100% maize replacement levels respectively. Protein efficiency ratio of the weaner pigs was significantly (P<0.05) influenced by the experimental diets; highest value was recorded in 25% replacement diet (2.52), followed by control (2.18), 50% (1.95), 75% (1.88) and 100% (1.78) maize replacement in that order.

Economics and efficiency of feeding the experimental diets to the weaner pigs are shown in Table 3. Feed cost (₦/kg) was higher in diet containing maize, followed by diet 2, 3, 4 and 5 with corresponding values of ₦99.91, ₦ 90.90, ₦79.86, ₦66.40 and ₦56.50 respectively. total cost of feed per weight gain per pig were ₦3496.75, ₦3181.50, ₦2795.40, ₦2325.40 and ₦1977.50 for

diet 1, 2, 3, 4 and 5, figures shows that maize based diet was the highest, followed by diet 2, 3, 4, and 5 in that order.

Revenue/total live weight gain/pig (₦) ranged from ₦5372.80 in diet 2 to ₦3788.80 in diet 5. Highest revenue was obtained in diet 2 with 25% inclusion of experimental diet as the alternative energy source, also on the gross profit/pig (₦), pigs in diet 2 yielded highest and profit were ₦2191.30, ₦1811.30, ₦1674.90, ₦1364.60 and ₦1149.55 for diet 2, 5, 4, 3 and 1 respectively.

Table 3: Economics and efficiency of weaner pigs fed experimental diets

Parameters	Levels of maize replacement (%) with Cassava peels/PKC				
	0	**25**	**50**	**75**	**100**
Mean total weight gain(kg)	14.52	16.79	13.00	12.50	11.84
Feed costs (₦/kg)	99.91	90.90	79.86	66.44	56.50
Total feed consumed/pig (kg)	35.00	35.00	35.00	35.00	35.00
Total cost (₦) of feed/pig live weight gain	3496.75	3181.50	2795.40	2325.40	1977.50
Revenue (₦)/total live weight gain/pig	4646.40	5372.80	4160.00	4000.00	3788.80
Gross profit/pig (₦)	1149.55	2191.30	1364.60	1674.90	1811.30

Discussion

The effect of feeding cassava peels/PKC meal on the mean final weight, total weight gain, weekly weight gain, feed conversion ratio and protein efficiency experienced a gradual falls in values as the levels of cassava peels/PKC meal increased, and this fall was critical at complete replacement of maize with cassava peels/PKC at 100%. However, these findings are in agreement with that of Igene (2006) who observed that the uses of cassava in feeding pigs at level higher than 50% usually resulted to decrease in both live weight and feed conversion efficiency. Also Amaefule *et al.* (2006) posited that inclusion of cassava peels above 60% will also have a deleterious effect on the performance of weaner pigs. The decreased in average weekly body weight gain with increased levels of cassava peels/PKC in the diets may be attributed to the tendency of cassava peels/PKC in pig diets to decrease the level of fat deposited in the tissues on account of its higher fibre content when compared with maize. The poor results noticed with high cassava peels/PKC meal in the diet may also ascribed to the techniques of processing cassava peels/PKC meal, which is in accordance with Ubalua (2007) who reported that digestive disturbance have been frequently noticed when large amounts of cassava peels are fed to certain animals due to its cyanogenic potential and the presence of high variable fibre contents in cassava peels which increased the osmotic pressure in the gastro-intestinal trait and subsequently caused digestion disturbances. Increased levels of cassava peels/PKC meal in the diets could also cause a decrease in feed intake as a result of high dehydration and increased salivation in the weaners, resulting in decreased body weight. Also, the dustiness of cassava peels/PKC meal has contributed to the decrease in feed intake as a result of nasal disorder caused by high levels of cassava peels in the diet. Higher inclusion of the by-product

as the sole source of energy in monogastric feeding or formulation is therefore not recommended because its high fibre content,

Feed efficiency was found to increase with increased levels of cassava peels/PKC in the diets, indicating a lower efficiency of utilization of cassava peels/PKC by the weaner pigs in this study. This is in accordance with work of Bimrew (2014) who showed that early weaned pigs had limited amylase, protease and lipase activity, and enhancement of the extent of digestion of nutrients improved performance and reduced the incidence of the diarrhea that resulted from fermentation undigested nutrients reaching the gut by bacteria.

In terms of the economics and efficiency of production of weaner pigs fed the experimental diets assessed by cost per kg feed (₦), total cost of feed consumed (₦/kg), and cost of feed per kilogram pig, values generally decreased as the levels of inclusion of cassava peels/PKC meal in the diets increased. Profit/pig (₦) revealed that 25% maize replacement diet was the most cost-effective for producing weaner pigs. Feed cost/kg was least at 100% maize replacement (₦56.50) and highest (₦99.91) in control diet. Similarly, total cost of feed consumed per pig was least (₦1977.50) in 100% maize replacement with cassava peels/PKC meal, and highest in the control diet (₦3496.75). due to the high cost of maize during the experimental trial. This is in agreement with earlier reports by Balogun and Fetuga (1980), Irekhore *et al*. (2006) and Adesehinwa *et al*. (2011) that cassava peels introduced up to 30% in piglet diets had no effect on growth rate and in pigs above 35kg weight; that replacing as much as 57% or more of the dietary maize in young pig diets has proved to be cost effective. Low cost of feed/kg live weight gain in pigs observed in 25% replacement diet translated to more revenue and profit. Thus, 25% replacement diet was the most efficient and cost effective. The profit derived from the 25% replacement diet was almost twice the one from the control diet.

Oboh (2016) reported that replacement of maize up to 50% level with cassava peels in a weaner pigs diet resulted in higher revenue and profit. However, Oboh *et al.* (2014) also reported that replacement of whole maize with maize offals and brewers dried yeast mixture up to 50% level resulted in higher profits. Damisa and Bawa (2009) further stressed that the inclusion of cassava peels meal up to 38% with 5-4% palm oil, gave a better economic performance than other combinations of peels and palm oil. This study confirmed that cassava peels/PKC meal at 25% maize replacement level as an energy source was the most cost effective among the experimental diets tried in this study. The results of the study are in conformity with reports of earlier authors (Irekhore *et al*., 2006; Adesehinwa *et al*., 2011; Oboh *et al.*, 2014**)** and have justified the need for continuous search for alternative feed ingredients to replace the costlier conventional ingredients.

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