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Growth Performance of Pigs Fed Diets Containing Fermented Mixture of Cassava Root Pulp and Palm Kernel Cake as Replacement for Maize

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Abstract
The need to improve the nutritive value of lignocellulosidic feed materials for monogastric feeding has led to interest solid state fermentation (SSF) in recent years. In this study, 40 weaner pigs were used to evaluate the efficacy of SSF to improve the nutritive value of mixture of grated cassava roots and palm kernel cake for pig feeding. The piglets were randomly allotted to five treatment groups (TA to TE) and fed experimental diets in which the maize in TA was replaced with fermented mixture of grated cassava root and palm kernel cake (FEMCARPP) in treatment TB (50%) and TC (100%). In treatments TD and TE, maize was replaced with a 1:1 blend of cassava meal and PKC. Data was collected on weekly on the live-weight, weight gain, feed intake and feed conversion ratio. The results show that piglets on dietary FEMCARPP consumed less feed, had superior weight gain and similar feed conversion ratio when compared to the control fed maize based diets. The piglets fed dietary CSM-PKC consumed significantly more feed and were less efficient in utilizing their feed. It is therefore concluded that solid state fermentation improved the nutritive value of the mixture of grated cassava roots and palm kernel cake for swine feeding.

Keywords: Solid state fermentation, weaner pigs, cassava, palm kernel cake

Introduction

Interest in the use of fermented feed for pigs is growing worldwide due to growing health concerns about these AGPs (Hu *et al*., 2008, Montagne *et al*., 2003) and fears of possible extension of the ban on in-feed antibiotic growth promoters (AGPs) in the EU (Williams *et al*., 2005)to sub-Saharan Africa. Fermented feeds are rich in lactic acid bacteria (LAB) and short chain fatty acids (SCFAs) which may confer on them some probiotic and prebiotic potentials (Niba *et al*., 2009, Brooks *et al*., 2008; Heres *et al*., 2003). The potentials of solid state fermentation as a technical tool for improving the quality of livestock feed materials and the safety of animal food products has been reported (Aladi *et al*., 2017; Chukwukaelo *et al*., 2017). According to these authors, a solid state fermented mixture of grated cassava tubers and palm kernel cake was effective in replacing maize in broilers diets (Aladi *et al*., 2017) and improve gastrointestinal health (Chukwukaelo *et al*., 2017). There is need to extend the product to pig feeding.

This work was therefore designed to evaluate the performance and haematology of weaner pigs fed dietary levels of FEMCARPP.

Materials and Methods

A total of 40 piglets weaned at 40 days of age were randomly allocated to five treatments groups with two replicates of 4 males and 4 females each. All piglets within a replicate were housed and fed together in one pen with dimensions (2m x 4 m). The fermented mixture of cassava root pulp and palm kernel cake (FEMCARRP) was produced following the method described Aladi *et al*. (2013). 3:1 mixture of grated peeled cassava tubers and PKC was fed into plastic drums (50 l), compressed to exclude air, firmly covered and allowed to spontaneously ferment for 6 days in an anaerobic condition. The moisture content of the fermenting mass was determined to be 55% and the fermentation was carried out at room temperature under ambient conditions. After this, five experimental weaner rations were formulated as shown in Table 1. Diet A (control) contained 44 % maize and in diets B and C, FEMCARPP was used to replace 50 % and 100 % respectively of the maize in Diet A. In diet D and E, maize was replaced with a 1:1 blend of cassava root meal and PKC at 50 % and 100% respectively. Each treatment replicate was allowed a daily supply of feed equivalent to 5 % of their body weights. Data was collected on live weight, feed intake weight gain and feed conversion ratio on replicate basis each week.

All data collected from the experiment was subjected to analysis of variance (ANOVA) in a Completely Randomized Design (CRD), while significantly different means were separated using Least Significant Difference (LSD).as described by Little and Hills (1974).

Table 3.6: Ingredients and calculated chemical composition of swine weaners' diets

	Maize	FEMCARPP		CSM-PKC mix	
	A	B	C	D	E
Ingredients (%)	(100%)	(50 %)	(100%)	(50%)	(100%)
Maize	44.00	22.00	0.00	22.00	0.00
Cassava meal	0.00	0.00	0.00	11.00	22.00
Palm Kernel Cake	0.00	0.00	0.00	11.00	22.00
FECARPP	0.00	22.00	44.00	0.00	0.00
Soya bean meal	20.00	20.00	20.00	20.00	20.00
Wheat offal	28.00	28.00	28.00	28.00	28.00
Fish meal	4.00	4.00	4.00	4.00	4.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Lysine	0.25	0.25	0.25	0.25	0.25
Methimine	0.25	0.25	0.25	0.25	0.25
Min / Vitamin premix*	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00

*Formulated to provide per kg of feed, Vit A 10,000,000IU; Vit D3 2,000,000IU; Vit E8,000IU; Vit K 2,000,mg; Vit B1 2,000mg; Vit B2 5,500mg; Vit B6 1,2000mg; Vit B12 12 mg; Biotin 30mg; Folic Acid 600mg; Niacin 10,000mg; Pantothenic Acid 7,000mg; Choline Chloride 500 mg; Vit 10,000mg; Iron

Results and Discussion

The performance of experimental weaner pigs fed diets containing maize; FEMCARPP and CSM-PKC mix are shown in Table 2. The live weights of pigs fed diets containing FEMCARPP (9.86 and 9.42 for diets B and C respectively) were significantly higher ($p < 0.05$) than that of control (8.56 kg) which was in turn higher than those fed dietary CSM-PKC mix (92 and 8.03). Similar pattern was also observed for the average daily weight gain of the experimental pigs. Pigs on the CSM-PKC based diet consumed significantly ($p < 0.05$) more feed (283.06 g) than the control (246.33 g) which in turn consumed more than those fed FEMCARPP (222.45 g) based diets. The weekly plot of the mean weight gain (Figure I) shows that the weight gains of weaner pigs fed FEMCARPP (50 and 100 %) were consistently higher than those on control and CSM-PKC based diets.

Table 2: Performance of weaner pigs fed FEMCARPP or mixture of PKC and cassava root meal as replacement for maize

Parameters	Maize	FEMCARPP		CSM-PKC mix		SEM
	A	B	C	D	E	
		(50 %)	(100 %)	(50 %)	(100 %)	
Live Weight (Kg)	4.66	4.80	4.72	4.66	4.91	0.154
Final live weight (kg)	8.57^{c}	9.86^{a}	9.42^{b}	7.92^{e}	8.03^{d}	0.133
Average daily weight gain (g/d/pig)	79.80^{c}	103.27^{a}	95.92^{b}	66.53^{d}	63.67^{d}	4.219
Average daily feed intake (g/d/pig)	246.33	276.33	222.45	294.49	283.06	10.32
Feed conversion ratio	3.09^{a}	2.68^{a}	2.32^{a}	4.43^{b}	4.45^{b}	0,231

$^{a, b, c,}$ and ^{d} -values with different superscript are significantly different

The graph of average feed intake against age (Figure II) showed that pigs on FEMCARPP (50 and 100 %) consistently consumed lower amount of feed than the control and CSM-PKC based rations throughout the experiment and were more efficient in utilizing their feed. The feed conversion ratio of pigs on control diet (3.09) was similar ($p>0.05$) to those fed FEMCARPP based diets (2.68 and 2.32), which were superior to those fed the CSM-PKC based diets ($p<0.05$). The superior performances of pigs on dietary FEMCARPP indicate the SSF of the mixture improved the nutrients assimilation from it irrespective of the apparently lower metabolizable energy content of these rations. This must have resulted from enhanced physicochemical characteristics of cassava and palm kernel cake such as reduction in cyanogenic glucoside levels, degradation of mannan and other structural polysaccharides in PKC, improved enzymatic activity, possible probiotic effect of metabolites of SSF process and higher protein turnover.

The weekly feed conversion ratio of the experimental pigs is shown in Figure III. The superior FCR values shown by pigs on FEMCARPP show that, they adapted faster to the rations. The microbes implicated in the fermentation process *Aspergillus oryzae, Aspergillus niger*, *Rhizopus spp. Lactobacillus plantarum* and

Bifidobacterium spp. (Aladi, 2016) are reported to have probiotic activity (Heres *et al*. 2003; Niba *et al*. 2009, Aladi *et al*., 2017).

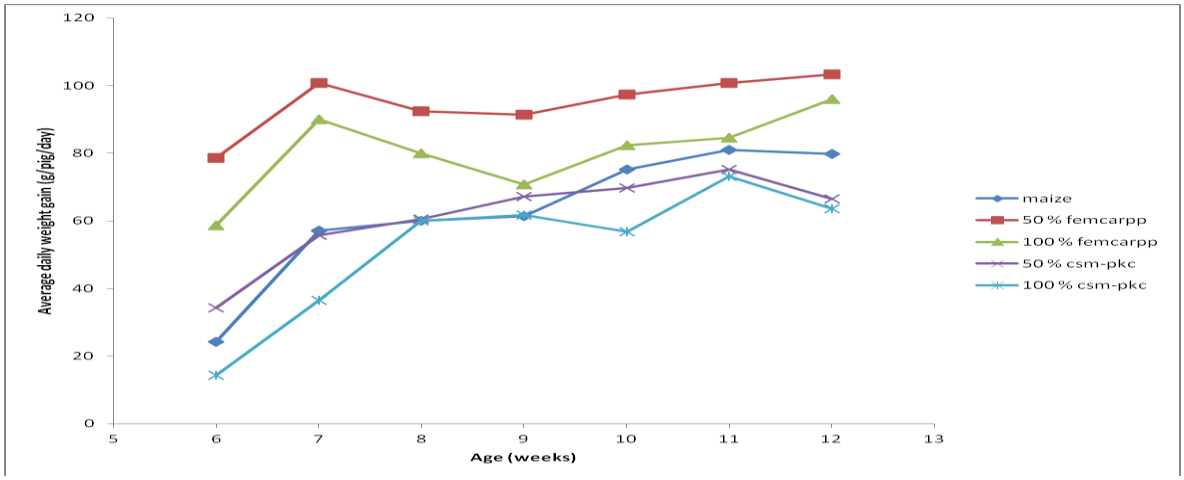

Fig. I: Average daily weight of pigs fed experimental rations with age

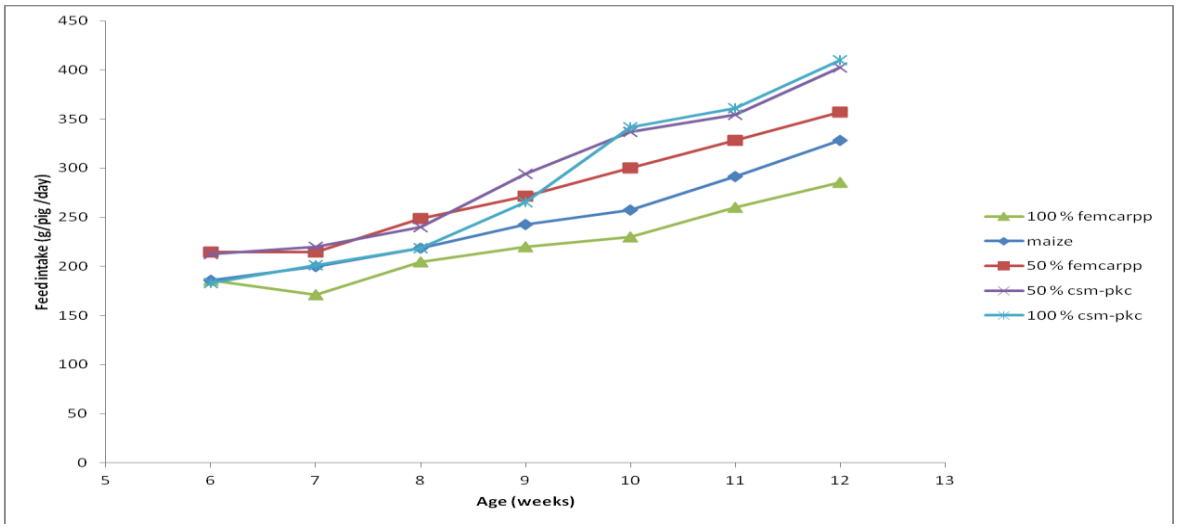

Fig.II: Graph of average daily feed intake of weaner pigs fed experimental rations plotted against age

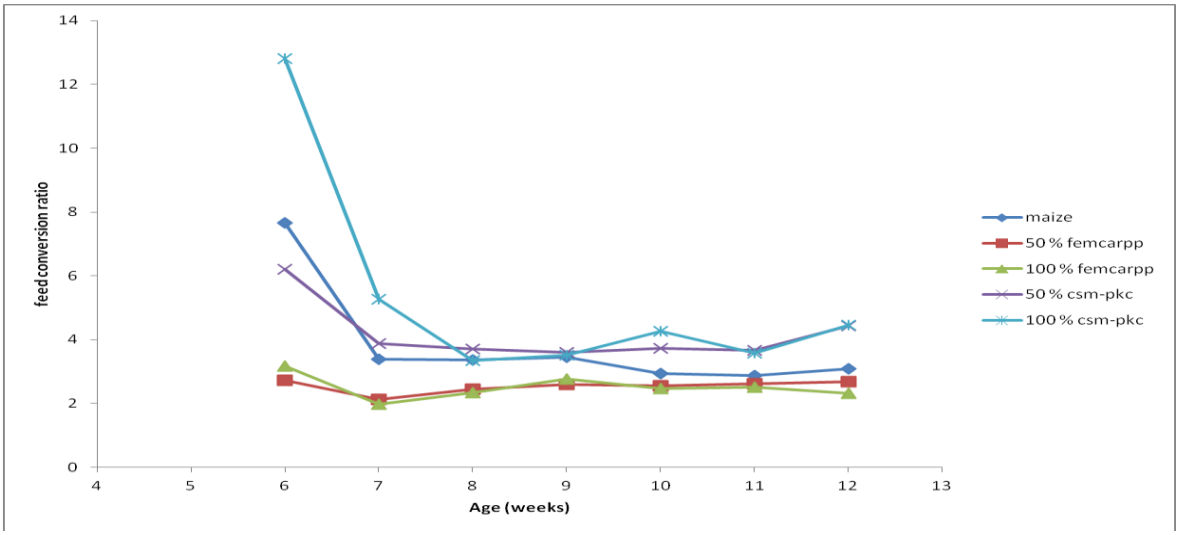

Fig. III: Graph of feed conversion ratio of weaner pigs fed experimental diets plotted against age

Conclusion and Recommendation

It is concluded that solid state fermented mixture of grated cassava tubers and palm kernel can effectively replace maize in diets of weaner pig. Further research is therefore needed to extend the study to the growing finisher phase.

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