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Effect of Enzyme Treated Cassava Peel Meal Based Diets on Growth Performance and Nutrient Digestibility of Weaner Pigs

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***Abstract*—** *The experiment was conducted to evaluate the growth performance and nutrient digestibility of weaner-grower pigs fed diets containing 0 %, 50 %, 75 % and 100 % levels of cassava peel meal treated with 0.035g Natuzyme®/100g CPM. Sixteen (16) pure bred male Landrace weaner-grower pigs, averaging 13.33kg were allotted to four dietary treatments in a completely randomized design such that each pig was housed and fed individually as a replicate. Four experimental diets T_1, T_2, T_3 and T_4 were formulated and 0 %, 50 %, 75 % and 100 % maize was replaced with Natuzyme® treated cassava peel meal and fed for a period of 42days. At the end of the feeding trial, two pigs from each dietary treatment were randomly selected and starved for 24hours; faecal samples were collected for seven days, oven dried, weighed and sampled for digestibility analysis. Final weight, feed intake, weight gain and feed cost per kg live weight gain of pigs fed test diets decreased ($p<0.05$) while, feed conversion ratio increased ($p<0.05$) compared with the control. Nutrient digestibility of dry matter, crude fibre, crude protein, ash and nitrogen free extract decreased ($p<0.05$) while ether extract digestibility increased ($p>0.05$). 100% maize replacement with CPM treated with 0.035g of Natuzyme® in 100g of feed for weaner-grower pigs proved cheaper though with a slow growth rate.*

***Keywords*— cassava peel meal, Natuzyme®, growth performance, nutrient digestibility, pigs.**

Abbreviations: CPM- cassava peel meal

I. INTRODUCTION

The pig has been noted to compete with human beings for available cereal and grains (Adesehinwa *et al*., 1998). In view of this development animal researchers have shifted their attention to materials that are available but underutilized as feed ingredients for livestock. One of such materials is the cassava peel, which is underutilized in Nigeria because it is often burnt or left to rot away on farms and homesteads after harvesting and processing of the tubers (Akinfala and Tewe, 2001). Cassava peel meal contains up to 5% crude protein, 20% crude fibre depending on the variety (Aro *et al*., 2010). The fibrous content of cassava peel meal has limited its use in monogastric nutrition. Hydrocyanic acid, an anti-nutritional factor is also present in cassava peel. However, sun drying appreciably reduces its level in the material (Aletor *et al*., 1997). Dietary addition of exogenous enzyme like Natuzyme® has been reported to enhance the breaking down of fibre encapsulating the more soluble constituents so that digestion can be effective. Effects on performance of weaner-grower pigs fed varying levels of cassava peel meal without exogenous enzyme have been investigated (Ikurior *et.al.*, 1996). This study was conducted to investigate the effects of varying levels of cassava peel meal diets supplemented with Natuzyme® on growth performance and nutrient digestibility of weaner-grower pigs.

II. MATERIALS AND METHODS

The experiment was carried out at the Pig production unit on the Livestock Teaching and Research Farm, University of Agriculture, Makurdi, Benue State of Nigeria. Cassava peels were obtained from garri processing agro-allied small-scale industries in Makurdi metropolis. The peels were washed and sun dried for seven (7) days to reduce the moisture content to about 10%. The peels were then crushed using a hammer mill to obtain cassava peel meal (CPM), sampled for analysis and stored in bags until included in the diets.

Experimental diets

Four experimental diets T1, T2, T3, and T4 were formulated as presented in Table 1. T1 contained 0% cassava peel meal (CPM) without Natuzyme® and diets T2, T3 and T4 contained CPM treated with 0.035g

Natuzyme®/100g at 50%, 75% and 100%, respectively as replacement for dietary maize.

Table.1: Ingredient Composition of Weaner-Grower Pigs Diets (g/100g)

	Dietary Treatments			
	T1	**T2**	**T3**	**T4**
	Levels of Cassava Peel Meal Replacement			
Ingredients	**0 %**	**50 %**	**75 %**	**100 %**
Maize	50.00	25.00	12.50	0.00
Cassava Peel Meal	0.00	25.00	37.50	50.00
Full fat soya beans	32.00	32.00	32.00	32.00
Dried brewers grains	10.00	10.00	10.00	10.00
Rice offal	4.75	4.75	4.75	4.75
Bone meal	2.50	2.50	2.50	2.50
Common salt	0.50	0.50	0.50	0.50
Vitamins/Minerals premix[a]	0.25	0.25	0.25	0.25
Natuzyme® [+ +]	-	++	++	++
Zinc oxide[b]	+	+	+	+
Total	100.00	100.00	100.00	100.00
Calculated Nutrients:				
Metabolizable energy (Kcal/Kg)	3135.45	2786.45	2611.45	2437.45
Crude protein (%)	19.55	18.55	18.05	17.55
Dietary cost (₦/kg)	76.65	61.38	53.50	45.63

[a]Biomix premix supplied the following per kg of diet: vitamin A 12,000,000I.U ,vitamin D33,000,000 I.U, vitamin E 30,000 mg, vitamin K3 2,500 mg, folic acid 1,000 mg, niacin 40,000 mg, calpan 10,000 mg, vitamin B 25,000 mg,vitamin B12 20 mg, vitamin B1 2,000 mg, vitamin B6 3,500 mg, biotin 80 mg, antioxidant 125,000 mg, cobalt 250 mg, selenium 250 mg, iodine 1,200 mg, iron 40,000 mg, manganese 70,000 mg, copper 8,000 mg, zinc 80,000 mg, choline chloride 200,000 mg.

[b] zinc oxide 0.0125 g/100 g, Natuzyme- 0.035 g/100 g.

+ = zinc oxide

++ = Natuzyme

Experimental design and management

Sixteen (16) male weaner pigs were randomly allotted to four dietary treatments each of which had four replicates. Each pig was served drinking water *ad libitum.* Daily routine management activities were cleaning of pens, provision of experimental diets and drinking water, observation of each animal to know their health status. Each experimental animal was housed in a 183x75x106cm welded iron pipe, wire mesh, individual concrete floored pens while, each pen housed four individual crates provided with concrete feeding and watering troughs measuring 52x29x21cm and 47x37x26cm, respectively. The experiment was a completely randomized design.

Data collection

The mean weekly body weights and feed intake were recorded throughout the experimental period of 42days. Feed conversion ratio was calculated from feed intake and body weight gain. Feed cost/kg gain and feed cost/kg diet were calculated from prevailing local market price of feed materials.

Nutrient digestibility was determined by the use of two (2) pigs from each dietary treatment which were randomly selected and starved for 24 hours. A weighed amount of feed was offered daily and feacal samples collected for seven days, oven dried, milled and analyzed for dry matter, crude fibre, crude protein, ether extract, ash and nitrogen free extract using standard methods (AOAC, 1995) The proximate analysis of the experimental diets was also carried out using the same standard methods.

All data collected were subjected to analysis of variance using the procedure of Steel and Torrie (1980) and where significant differences were observed treatment means were separated using Duncan multiple range test (Duncan, 1955)

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III. RESULTS AND DISCUSSION

The experimental diets contained between 18-20 % crude protein (Table 1) in order to meet the protein requirement of weaner pigs recommended by NRC (1997). Similarly, the metabolizable energy of the diets (2,437.45 - 3,135.45 kcal/kg) though reducing as the level of treated CPM increased in diet, were also within the energy requirement of weaner pigs.

Table.2: Effect of Diets containing CPM treated with Natuzyme® on performance of Weaner-Grower Pig.

	Dietary Treatments					
	T1	T2	T3	T4		
	Levels of cassava peel meal replacement					
Performance indices	**0 %**	**50 %**	**75 %**	**100 %**	**SEM**	**LOS**
Number of pigs	4	4	4	4		
Average initial live weight (kg)	13.33	13.43	13.28	13.25	0.45	NS
Average final live weight (kg)	32.60^{a}	27.55^{a}	24.73^{b}	24.15^{b}	1.13	*
Average daily feed consumption (kg)	0.98^{a}	0.84^{ab}	0.78^{b}	0.78^{b}	0.03	*
Average daily weight gain (kg)	0.46^{a}	0.34^{b}	0.28^{bc}	0.26^{c}	0.02	*
Feed conversion ratio	2.16^{a}	2.51^{b}	2.85^{c}	3.06^{c}	0.10	*
Feed cost/kg live weight gain (₦)	165.56^{a}	154.06^{ab}	152.48^{ab}	138.63^{b}	3.63	*
Average number of days fed	42	42	42	42		

^{a,b,c} Means within same row with different superscripts differ (P<0.05) NS= Not Significant (P>0.05)
*Significant differences between means in rows (P<0.05) LOS = Level of significance SEM = Standard error of mean

The effect of the experimental diets on the growth response of weaner-grower pigs is presented in Table 2. It was observed that the diets had significant effect (p<0.05) on the live body weight, weight gain, feed intake and feed conversion ratio. Significant effect (p<0.05) was also observed for the feed cost/ kg live weight gain. These performance indices decreased as percent dietary maize replaced by CPM increased. This probably was due to CPM effect which increased the bulk of the feed thereby lowering the energy density of the diets and causing decrease in feed intake, weight gain and increase in feed conversion ratio. This observed performance can be attributed to the inability of the weaner pigs to digest the high fibre diets despite the supplementation with Natuzyme® and the low or poor quality amino acids in CPM. This is in agreement with the findings of Medel *et al*. (2000) who reported that the physical nature of a diet or of its ingredients has a large influence on feed intake and on its nutritional value which may have beneficial or adverse effect on the use and efficacy of enzymes. This is also in agreement with findings of Ikurior *et al*. (1996), who reported that as animals grow older they tend to handle fibre more efficiently due to their developed digestive system. The feed cost/kg live weight gain decreased (p<0.05) at higher levels of CPM in the diets. Therefore, it was cheaper to feed pigs on Natuzyme® treated CPM diets than the control diet. This agrees with the findings of Adesehinwa *et al*. (2008) who reported significant reduction in feed cost per kilogram live weight gain as a result of replacing maize in control diet with cassava peel supplemented with exogenous enzyme.

Table 3 presents the digestibility coefficient of weaner-grower pigs. Decrease (p<0.05) in nutrient digestibility occurred as CPM replacement of maize increased in diets of weaner pigs. This was observed particularly in crude fiber and ash digestibility and diet (T4) was mostly affected. Digestibility value ranged between 30-73 %. However, digestibility of ether extract increased (p>0.05).This decreased nutrient digestibility of weaner pigs could be attributed to the inability of the weaner pigs to handle fibre efficiently, among other inherent factors associated with CPM based diets. This is in agreement with findings of Thacker (2001) who reported that the extent and consistency of response of enzyme supplementation in pigs has been related to age of the animal, enzyme activity and dietary fibre level. CPM may also contain certain compounds that act as antioxidants and anti carcinogens which may interfere with nutrient absorption and utilization. Such compounds may also bind proteins preventing their complete enzymatic digestion (Montagac *et al*., 2009). In line with this report Van de Mierop (2001) reported that although enzymes are already in use for over two decades, a lot still has to be explained on why, how and to what extent an enzyme influences the digestibility of nutrients.

Table.3: Effect of Diets containing CPM treated with Natuzyme ® on Apparent Nutrients Digestibility Coefficients of Weaner-Grower Pigs

	Dietary Treatments					
	T1	T2	T3	T4		
	Levels of cassava peels replacement					
Nutrients	0 %	50 %	75 %	100 %	**SEM**	**LOS**
Dry Matter (%)	85.20^{a}	78.05^{b}	77.06^{b}	70.27^{c}	1.00	*
Crude Fibre (%)	74.45^{a}	70.57^{a}	69.40^{a}	52.92^{b}	3.45	*
Crude Protein (%)	89.12^{a}	87.77^{ab}	86.87^{ab}	82.59^{b}	1.08	*
Ash (%)	57.89^{a}	52.55^{a}	55.80^{a}	32.74^{b}	3.85	*
Ether Extract (%)	86.24	86.56	83.78	89.61	1.30	NS
NFE (%)	89.46^{a}	79.85^{b}	77.94^{bc}	73.22^{c}	2.28	*

$^{a.b.c}$ Means on the same row with different superscripts are statistically different ($p<0.05$), NS = Not significant
* = Significant ($p<0.05$), NFE= Nitrogen free extract, LOS= Level of Significance, SEM=Standard error of mean

IV. CONCLUSION AND RECOMMENDATION

In conclusion, the study revealed that treated CPM can be used to replace maize to lower production cost but should be used preferably in older pigs (grower-finisher) to enhance the utilization of the exogenous enzyme. Further study is hereby recommended on the utilization of CPM based diets treated with Natuzyme® in weaner pigs (weaner-grower) to evaluate the effectiveness or efficacy of Natuzyme®.

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