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THE EFFECT OF ENZYMES SUPPLEMENTATION OF BOILED CASSAVA PEEL AND RUMEN DIGESTA ON PIG PERFORMANCE

Author's Name: R. P. Obongekpe
Affiliation: Department of Animal Science, University of Uyo, Uyo, Nigeria
E-Mail: obongekperichard2@gmail.com

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Abstract

The study examined the effect of enzyms supplementation of boiled cassava peel meal and rumen digestaon the growth performance, nutrient digestibility of growing pigs.The experiment was conducted at the Swine unit of the Teaching and Research Farm, University of Uyo, Uyo, AkwaIbom State. Digesta and boiled cassava peel meal were mixed in the ration of 3:1 and allowed to ferment in an air tight environment for six days and after that was sundried. The product was referred to as DBCPM. A total of 40 grower pigs of large white were used for the study. The pigs were divided into 5 groups based on average initial weights (20-25kg) and each group of grower pigs were respectively allocated to each of the five treatment diets using a completely randomized design (CRD). Each treatment group contained 2 replicates of 4 pigs (2male and 2 female). These pigs were fed twice daily and water supplied adlibitium. The treatment diets consisted of the following of DUPPM at 0% (controlled), 20%, 40%, 60% & and 80% (controlled) replacement of maize in the control diet were formulated. The 50:50 ratio of digesta and boiled cassava peel meal was derived by equal weighing (kg) of the two test ingredients percentage in the diet using a manual scale, all diets were formulated to be iso-nitrogenous and iso-caloric. During the feeding trial, weekly feed consumption, weight changes, and nutrient digestibility 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. The results from the study shows significant ($p<0.05$) differences on the performance characteristics of weaner pigs, while animals on 80%% diet gave the best compared to other diets in final weight gain, feed conversion ratio and protein efficiency ratio (25.67kg, 2.06 and 2.52) respectively. There were significant differences ($P>0.05$) on the nutrient digestibility of the pigs. It was concluded that DUPPM could completely replace maize without adversely affecting the overall growth performance of the pigs. Implications and recommendations were made from the findings of the study.

Keywords: *Cassava Peels, Growth Performance, Rumen Digesta,Pigs.*

INTRODUCTION

The cost of animal feeds has motivated farmers to start looking for alternative feeds from locally available resources, and cheap industrial by-products, novel crops and animal wastes as feed ingredients. Most of these discoveries are the recycles of some crop and animal waste to form animal waste.

Swine production is a growing enterprise in Nigeria, but the major constraint has been the high cost of feeding because of the high cost and inconsistent availability of the conventional energy and protein sources. This could be as high as up to 75-80% in the fattening herd and 60-65% in the breeding herd (Tewe, 1997 as cited in Adesehinwa, 2008). This situation is partly the result of competition between man and livestock for some food and feed ingredients, particularly, energy sources, such as maize. It would therefore be economically expedient to explore the use of non-conventional feed resources (NCFR) or agro-industrial by-product (AIBP), like cassava

peel, digesta content, coconut cake etc which are abundant and cheap (Okai, Abora, Davis & Martin, 2005).

Cassava (*Manihotesculenta*) is an all-season crop ofthe humid tropics and ranks among the top 10 food crops in the world (Oyebimpe, Fanimo, Oduguwa&Biobaku, 2006). It is the highest supplier of carbohydrates among staple crops (FAO, 1995). Annual production estimate in Nigeria was 34 million tonnes in 2002 (FAO, 2002). Cassava roots contain 30 to 40% dry matter, more than most roots and tubers. This depends on factors such as variety, soil type, moisture, climatic conditions and the age of the root at harvest. Starch and sugar are the predominant components of the dry matter, approximately 90%, with starch being the most important (FAO, 2002). Cassava is a high yielding tropical root crop, thrives well under relatively low soil fertility and survives remarkably under wide climatic variations. Cassava flour waste/root meal is another agro-industrial by-product that could be exploited as animal feed. It is however, noteworthy that Nigeria is the leading world producer of cassava (Orunmuyi, Bawa, Adeyinka, Daudu&Adeyinka, 2006) and its vailability in Nigeria is non-seasonal. Several researchers had earlier confirmed the suitability of cassava for pig feeding and the potential of cassava meal as a feed substitute for maize, for all classes of pigs (Adesehinwa, 2008; Adesehinwa, Dafwang, Ogunmodede, &Tegbe, 1998). However, certain precautions need be taken to guarantee satisfactory performance of animals on cassava meal diets. These was reported to include the removal of cyanide through boiling, drying, grating, soaking, fermenting or a combination of these processes to produce final products containing not more than 100 ppm HCN, and the prevention of microbial activity during sun-drying, particularly in a humid environment (Tewe&Egbunike, 1988). High cyanide levels and the presence of microorganisms have been demonstrated to reduce performance and induce hematological changes of growing pigs fed sun-dried cassava based rations (Tewe, 2006). Cassava meal is the powdered residue of the chips and roots after processing to extract edible starch. It is generally inferior in quality to chips, pellets and broken roots with lower starch content (Tewe, 2006). Lack of protein and essential fatty acids that characterize the cassava flour can be amply enriched with PKC. A mixture of PKC and CFW at the ratio of 1:1 or 2:1 is being experimented as a replacement for maize, the conventional energy source, in an attempt to meet the meet the need of small-scale farmers who produce their own feedstuff.

Rumen content is partially digested feed found in the fore stomach of ruminants. They are fairly rich in crude protein as they contain microbial protein from bacteria, fungi, and protozoa (Agbabiaka et al., 2012). Rumen contents are also important source of energy, minerals and vitamins, especially vitamin B complex (Ravindra et al., 2017; Sakaba et al., 2017). These attributes make rumen contents a potential candidate feed ingredient for livestock (Cherdthong, 2019) and could also be vital in reducing the competition between man and animal for food. Despite these attributes that make rumen content a potential livestock feed ingredient, it is still largely underutilized which complicates its efficient disposal and therefore making it a potential environmental pollutant. Also, many agricultural wastes including plantain peels are abundant in the remote areas of South- South geo-political zone of Nigeria, especially Cross River State where they are under-utilized by small holder farmers (Kalio, Ayuk&Agwunobi, 2013). Nutritional studies have shown that unripe plantain peels contain 13.73% crude protein, 9.46% crude fat, 51.86 % total carbohydrate, 10.30% ash and 6% crude fiber. There is paucity of research information on the potential of plantain peels supplemented with rumen contents as

feedstuff for animals; hence this study was designed to determine the effects of enzyme supplementation of boiled cassava peel meal and rumen digesta on pig performance.

METHODS AND MATERIALS

Site of study

This was carried out at the Swine unit of the Teaching and Research Farm, University of Uyo, Uyo, AkwaIbom State. AkwaIbom state is in Nigeria. It is located in the coastal southern part of the country, lying between latitudes $4^{0}32^{1}$N and $5^{0}33^{1}$N, and longitudes $7^{0}25^{1}$E and $8^{0}25^{1}$E. The state is located in the south-South geographical zone, and is bordered on the east by Cross River State, on the west by Abia State, and on the south by Atlantic Ocean and the south most tip of Cross Rivers State.

Processing of Boiled Cassava peel meal and experimental diets

Fresh composite cassava peels were collected from Garr production company in Uyo. The peels were washed and boiled for 20minutes and was later spread on clean concrete floor for 5 days and were turned at intervals for even and quick drying to constant weight and later grinded using motar and pistle and then sieved to remove larger particles. The rumen content was collected fresh from the abattoir at Akpanadem market, Uyo,AkwaIbom state and sun dried for 7 days depending on the intensity of the sun and grinded and sieved. The ingredients were then mixed based on their chemical composition to prepare the compound experimental rations. The four treatment rations used in this study were formulated on an is caloric and is nitrogenous basis in such a way to consist 2800-2900 kcal ME per kg DM and 16-17% CP for layers (NRC, 1994).

Experimental Design and Treatments

The design of the experiment was a completely randomized design (CRD) with 4 dietary treatments each with three replications. A total of 40 weaner pigs of large white were used for the study. The pigs were divided into 5 groups based on average initial weights (20-25kg) and each group of weaner pigs were respectively allocated to each of the five treatment diets. Each treatment group contained 2 replicates of 4 pigs (2male and 2female). These pigs were fed twice daily and water supplied adlibitium. There were five diet groups comprising;

T1 = 0% of digesta and boiled cassava meal(DBCM) (control)
T2 = 20% of digesta and boiled cassava meal(DBCM)
T3 = 40% of DBCM
T4 = 60% of DBCM
T5 = 80 of DBCM

Statistical analysis

Data were subjected to analysis of variance using the procedure outlined by SAS (2002) and significantly different means were separated using the multiple range test by Duncan (1955).

RESULT AND DISCUSSION

Table1.Composition of Experimental Diet for growers Pig'

Ingredients	T1 (0%)	T2 (20%)	T3 (40%)	T4 (60%)	T% (80%)
Maize	50.00	10.00	20.00	30.00	40.00
Bovin rumen/boiled cassava peel meal	0.00	15.00	30.00	32.00	33.30
Ground Nut Cake	25.60	26.78	27.92	29.06	30.21

Wheat Offal	14.10	40.72	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 (%)	**25.00**	**25.00**	**25.00**	**25.00**	**25.00**
ME(Keal/Kg)	**2878**	**2847**	**2815**	**2810**	**2781**
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

The table above shows the proximate composition of digesta and boiled cassava peel meal.

Table 2:Proximate and energy composition of processed Digesta and Boiled cassava peel meal (DBCPM)

Ingredients	T1 (0%)	T2 (20%)	T3 (40%)	T4 (60%)	T% (80%)	SEM
Dry matter(%)	79.49b	86.90b	87.39c	88.10a	89.53	0.03
Crude protein (%)	8.39d	9.87c	10.18a	12.85b	14.18a	0.01
Crude fibre (%)	9.98c	12.59a	7.94d	10.52b	7.94d	0.21
Ether Extract (%)	4.72a	5.12c	5.33b	5.71a	5.33b	0.02
Ash (%)	5.78d	14.80b	12.78c	17.53a	12.78c	0.06
NFE (%)	44.55d	43.86b	52.27a	50.94b	52.27a	1.17
Metabolized energy Kcal/100g	2617.00	2290.00	2832.00	0.25	2718.00	11.40

a,b,c,d Means on the same row with different superscripts are significantly different ($p<0.05$).

Table 2 shows the results of the proximate and energy composition of the processed forms of DBCPM. The nutrient composition of T1DBCPM was significantly lower than that of other processed forms. The crude protein of fermented DUPPM was significantly ($p<0.05$) higher than that of other forms. The range of crude protein in T1, T2, T3, T4and T5DUPLMobtained in this study (8.93-14.18%) was higher than the values reported by Agbabiaka et al (2013) (13.73%) for 0%digesta and unripe plantain peel meal and Uwalakaet al (2013) (10.64%) for boiled cassava peel meal respectively. However, the values of crude protein were comparable with the value 9.86% recorded for 20% of digesta andboiled cassava peel meal reported by Akinmutimiet al (2006). However,the values of crude fibre, ether extract, nitrogen free extracts (NFE) and metabolizable energy did not agree with the reports of Uwalakaet al (2013) and Ighodaro, (2012). These differences observed could be due to the variety of cassava, soil and other climaticthat influence the availability of nutrients in plants.

Table 3.Growth Performance characteristics of weaner pigs fed experimental die*t*

	Levels of inclusion (%)					
	T1 (0%)	T2 (20%)	T3 (40%)	T4 (60%)	T% (80%)	
Parameters	**1**	**2**	**3**	**4**	**5**	**SEM (±)**
Ave. initial weight(kg)	10.05	10.08	10.00	10.01	10.00	
Ave. final weight(kg)	28.84^{b}	30.67^{a}	35.00^{c}	38.50^{d}	40.84^{d}	0.03
Ave. total weight gain(kg)	12.52^{b}	23.79^{a}	26.00^{d}	30.50^{cd}	15.84^{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 at her, Ave: Average, SEM: Standard error of mean.

Initial live weight of weaner pigs ranged from 10.00kg to 10.08kg, average final weight gain of the grower pigs obtained are shown in table 3 revealed that, experimental animals were significantly (P<0.05) affected by the experimental diets. Increasing levels of digesta and boiled cassava peel meal resulted in steady increase in body weight of 30.67g, 35.50g, 38.50g and 40.84 for pigs on diets 2, 3, 4 and 5 respectively. Weight gains of pigs fed concentrate feed deprived of forage (Diet 1) dropped significantly (P<0.05) to 28.84g. Therefore, 80% digesta supplemented with boiled cassava peel meal supplementation supported the highest daily live weight gain in the pigs respectively. Feed intake values were not significantly affected at grower phase; results were the same across the groups.

Feed conversion ratio differed significantly (P<0.05) in the experimental animals, while animals on 20% (2.06) diet gave the best compared to other diets with corresponding values of 10(2.41), 14(2.69), 16(2.80) and 116% (2.96) respectively. Protein efficiency ratio of weaner pigs was significantly (P<0.05) influenced by the experimental diets, highest value was recorded in 20 %(2.52) diet, followed by 0% (2.18), 40%(1.95), 60%(1.88) and 80% (1.78) in that order. There was no mortality throughout this phase of feeding trial.
The effect of feeding digesta and boiled cassava peel meal resulted in steady increase on the Performance characteristics such as average final weight, average total weight gain, average weekly weight gain, feed conversion ratio and protein efficiency. However, the study is in agreement with the reports of Arnold et al (1980), Olabanji et al (2007), Duwa et al (2014) and Robert et al (2020) who observed feeding digesta and unripe plantain peel meal aid in growth increment but when higher than 50% usually resulted to decrease in feed conversion efficiency. Also Ramchurn et al., (2000) and Robert et al (2020)posited that inclusion of cocoyam peels have positive effect on the performance of weaner pigs. This may have resulted from the ability of pigs to utilize up to 40% 0f the protein in the forage plants and the natural tendency to ferment forages in their enlarged caeca and thus able to release the nutrients including protein from the crude fiber.

Table 4: Nutrient digestibility of pigs fed processed UPPM based-diets

Ingredients	T1 (0%)	T2 (20%)	T3 (40%)	T4 (60%)	T% (80%)	SEM
Dry matter(%)	96.49b	97.90b	97.39c	98.10a	99.53	0.03
Crude protein (%)	72.39d	67.87c	67.18a	98.85b	63.18a	0.01
Crude fibre (%)	80.98c	71.59a	75.94d	81.52b	69.94d	0.21
Ether Extract (%)	93.72a	86.12c	89.33b	90.71a	85.33b	0.02
Ash (%)	83.78d	76.80b	90.78c	77.53a	72.78c	0.06

a,b,c,d Means on the same row with different superscripts are significantly different (p<0.05).

The results of nutrient digestibility of pigs fed processed DBCPM based-diets is presented in Table 4. The digestible nutrients were properly digested by the pigs, due to the high values of nutrient digestibility recorded in this study. Significant (p<0.05) differences were observed in all parameters across dietary treatments. This result was in consonance with the finding of Ajayi et al (2007) and Robert et al (2020) . However, the results obtained did not agree with the findings of Iyayiet al (2006) who reported no significant (p>0.05) effect of dietary treatments on growing rabbits fed Albiziasaman pod based-diets. The disparity in digestibility responses could be attributed to the different test ingredients used in the separate studies. The faster growth rate observed in pigs fed withDUPPM diet could bedue to increased digestibility of nutrients, which might have resulted in better utilization of nutrients for better growth performance recorded in this study. The nutrient digestibility of pigs fed with 0% and 20% diets were

comparable, the consistent decrease in nutrient digestibility of rabbits fed the urea-treated DBCPM diet might be due to low feed intake of the diet as a result of the presence of urea.

CONCLUSION

This study was carried out to examine the effects of enzymes supplementation of boiled cassava peel meal and rumen digesta on the growth performance, nutrient digestibility of growing pigs. A total of 40 grower pigs of large white were randomly selected at the Swine unit of the Teaching and Research Farm, University of Uyo, Uyo, AkwaIbom State and used for the study. The pigs were divided into 5 groups based on average initial weights (20-25kg) and each group of weaner pigs were respectively allocated to each of the five treatment diets in a completely randomized design (CRD). Each treatment group contained 2 replicates of 4 pigs (2male and 2female). These pigs were fed twice daily and water supplied adlibitium. The treatment diets consisted of the following of DUPPM at 0% (control), 20%, 40%, 60% and 80% replacement of conversional feeds stuffs in the control diet were formulated. The study utilized a randomized design and the statistics used in analyzing the result in the study were mean+ stem and one way Analysis of variance (ANOVA). The following were the concluded:

Total (100%) replacement of maize with DBCPM was significant with the growth, economic evaluation, and growth performance of pigs (P = 0.05). Dietary treatment had effect on the feed conversion ratio and feed cost per unit weight gain. Pigs fed the control diet (0% DBCPM) were lowest in dressing percentage whereas counterparts on 80% maize replacement with DBCPM where highest in abdominal fat compared to pigs on other dietary treatments. Results also showed that there was a high digestibility when DUPPM was replaced with maize meal.

The findings of this study therefore implies that digesta and boiled cassava peel meal can be a great meal in for all monogastric animals as it will increase the body weight, aid growth and promote large meat production. Also, it will reduce the cost expenses on the farmers as the cost of making or getting this feed is relatively easy and low. It is therefore recommended that DBCPM;

1. Organic waste products like digesta and boiled cassava peel meal should be used in pigs nutrition to reduce over dependence on conversional feedstuffs by our farmers which have led to high cost of raising pigs thereby discouraging farmers from investing in the swine business.
2. Public extension/ advisory staff should be mobilized to convey these results to practicing farmers.
3. Further studies on how to harnessed different unconversional waste products to feedstuffs should be conducted.
4. Rumen digesta and boiled cassava peel meal are really growth feed concentrate for feed as shown in this study and is therefore recommended to farmers for use.

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