

The effects of graded levels of bovine rumen contents (digesta) supplemented with unripe plantain peels on the growth performance, nutrient digestibility of growing pigs

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ABSTRACT

This study investigated the effects of graded levels of bovine rumen contents (digesta) supplemented with unripe plantain peels on the growth performance, nutrient digestibility of growing pigs. Digesta and unripe plantain 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 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 ad libitum. 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. 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 grower 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.

Key words: Bovine rumen content, Growth rate, unripe plantain peels, Pigs.

1. INTRODUCTION

Animal production and rearing of animals are supposed to be one of the easiest, interesting and profitable areas of agriculture because they are kept on our watch but increment in feeds has been a

major problem to majority of farmers because of fears of loose. More so, even when this feeds are available, they are low in proteins. The protein-energy malnutrition is a serious health issue faced by developing countries, especially with regards to

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animal protein intake [1, 2]. The very low intake of animal protein leads to malnutrition with severe effect especially on children [3]. Low protein consumption is quite common in Nigeria as well as in most developing countries [4]. Therefore, the search for alternative animal protein sources to meet the large population requirement is crucial. There is a stiff competition for the use of conventional ingredients such as grains between man and livestock [5]. It has become important to explore the potentials of various agro-by products (AIBs) to replace the expensive grains [6]. This has prompted the evaluation of less expensive feedstuffs as substitutes [7].

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 [8]. Rumen contents are also important source of energy, minerals and vitamins, especially vitamin B complex [9]. These attributes make rumen contents a potential candidate feed ingredient for livestock [10] 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 [11]. 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 as feedstuff for animals; hence this study was designed to determine the effects of graded levels of bovine rumen contents

(digesta) supplemented with unripe plantain peels on the growth performance, nutrient digestibility of growing pigs.

2. MATERIALS AND METHODS

2.1. Location of study

The experiment was conducted at the Swine unit of the Teaching and Research Farm, University of Uyo, Uyo, Akwa Ibom State. Akwa Ibom state is in Nigeria. It is located in the coastal southern part of the country, lying between latitudes 40321N and 50331N, and longitudes 70251E and 80251E. 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.

2.2. Processing of unripe plantain peel meal and experimental diets

Fresh composite unripe plantain peels were collected from fast food outlets, restaurants, plantain chip and roasted plantain stalls within Uyo metropolis and its environs. The peels were washed and cut into slices of 5-7 mm thick for ease of drying. The cut pieces were spread on clean concrete floor for 7 days and were turned at intervals for even and quick drying to constant weight and later grinded using mortar and pestle and then sieved to remove larger particles. The rumen content was collected fresh from the abattoir at Akpanadem market, Uyo, Akwa Ibom 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 isocaloric and isonitrogenous basis in such a way to consist 2800-2900 kcal ME per kg DM and 16-17% CP for layers (NRC, 1994).

2.3. 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 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. Each treatment group contained 2 replicates of 4 pigs (2male and 2female). These pigs were fed twice daily and water supplied ad libitum. There were five diet groups comprising;

T1 = 0% of digesta and unripe plantain peel meal (DUPPM) (control)

T2 = 20% of digesta and unripe plantain peel meal (DUPPM)

T3 = 40% of DUPPM

T4 = 60% of DUPPM

T5 = 80 of DUPPM

2.4. 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).

3. RESULTS AND DISCUSSIONS

The proximate and energy composition results of the processed forms of DUPPM as shown in Table 2. The nutrient composition of T1 DUPPM 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, T4 and T5 DUPLM obtained in this study (8.93-14.18%) was higher than the values reported by Agbabiaka *et al* (2013) [12] (13.73%) for 0% digesta and unripe plantain peel meal and Uwalaka *et al* (2013) [13]

(10.64%) for unripe plantain peel meal respectively. However, the values of crude protein were comparable with the value 9.86% recorded for 20% of digesta and ripe plantain peels [14]. However, the values of crude fibre, ether extract, nitrogen free extracts (NFE) and metabolizable energy did not agree with the other reports [13, 15]. These differences observed could be due to the variety of plantain, soil and other climatic that influence the availability of nutrients in plants.

Initial live weight of grower 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 unripe plantain 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 unripe plantain 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.

Table 1. 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/unripe plantain peels	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(Kcal/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

* Grower Premix supplied the following per kg diet: Vit A 10,000,000 IU; Vit D32,000,000IU; Vit E 8,000 IU; Vit K 2,000mg; Vit B12,000 mg; Vit B25,500mg; Vit B61,200 mg; Vit B12 12 mg; Biotin30mg; Folic Acid 600 mg; Niacin 10,000 mg; Pantothenic Acid 7,000mg; Choline chloride 500,000 mg; Vit C 10,000mg; Iron 60,000 mg; Mn 80,000 mg; Cu 8,000mg; Zn 50,000 mg; Iodine 2,000 mg; Cobal 450 mg; Selenium 100 mg; Mg 100,000 mg; Anti-Oxidant 6,000 mg; PKC – Palm Kernel Cake, GNC = Groundnut cake, C.P. = Crude protein, ME = Metabolizable energy

The effect of feeding digesta and unripe plantain 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 several reports [16, 2, 17] 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. The cocoyam peels have

positive effect on the performance of weaner pigs [2, 18]. This may have resulted from the ability of pigs to utilize up to 40% of 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. The results of nutrient digestibility of pigs fed processed DUPPM based-diets are shown in Table 4. The digestible nutrients were properly digested by the pigs, due to the high values of nutrient digestibility recorded in

Table 2. Proximate and energy composition of processed Digesta and unripe plantain peel meal (DUPPM)

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)

this study. Significant ($p < 0.05$) differences were observed in all parameters across dietary treatments, this result was in consonance with some finding [2, 4]. However, the results obtained did not agree with some the findings [19] that reported no significant ($p > 0.05$) effect of dietary treatments on growing rabbits fed Albizia saman 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 with DUPPM diet could be due 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 DUPPM diet might be due to low feed intake of the diet as a result of the presence of urea.

4. CONCLUSION

This study was conducted to determine effects of graded levels of bovine rumen contents (digesta) supplemented with unripe plantain peels on the growth performance, nutrient digestibility of growing pigs. A total of 40 grower pigs were used for the study and were fed twice daily and water supplied ad libitum. 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 DUPPM 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% DUPPM) were lowest in dressing percentage whereas counterparts on 80% maize

replacement with DUPPM 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 unripe plantain 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 DUPPM:

1. Organic waste products like digesta and unripe plantain peels 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 harness different unconversional waste products to feedstuffs should be conducted.

5. ACKNOWLEDGEMENT

NA

6. CONFLICT OF INTEREST

The author has declared that there is no conflict of interest.

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