JORMAR 3(2) 2006, 31 – 37 ISSN: 1597 - 3204

Evaluation of bovine rumen waste supplemented with nutrase xyla as a replacement for maize in pig weaner diets

Adeniji*, A. A., Kazeem, E.A. and Odeniya, A.J.
Department of Animal Production, Faculty of Agriculture, University of Ilorin Ilorin, Nigeria.

ABSTRACT
Thirty-six weeks old male weaner pigs were used in this study to assess the replacement value of rumen content supplemented with nutrase xyla (enzyme) in replacement for maize in the diets of weaner pigs. There were five dietary treatments such that the test ingredient which is rumen content (RC) was supplemented with nutrase xyla and fed to replace 0,12.5, 25, 37.5 and 50% of dietary maize (40%). There was a decrease ($p<0.05$) in the final body weight of the experimental pigs as the level of rumen content supplemented with nutrase xyla (RC-NX) increased in their diets. The pigs on the control diet had comparable ($p>0.05$) fed intake values with the pigs fed on the 50% RC-NX maize replacement diet and these were lower ($p<0.05$) than the feed intake on other diets. The weight gain values decreased ($p<0.05$) with the increase in the level of RC-NX maize replacement in their diets. The feed to gain ratio were comparable for all diets except for the 37.5% RC-NX maize replacement diet that was higher ($p<0.05$).

Key words: Maize, Nutrase Xyla, Rumen Content, Pig, Diets.

INTRODUCTION

Pigs (*Sus scrofa domesticus*) depend largely on cereal grains (mainly maize) and root tubers (mainly cassava) as energy sources in their diets. Maize and cassava (energy concentrates) are readily available but are very expensive [1]. In Nigeria the high price of maize is negatively influencing profit margins in the livestock farming. The largest share of maize production is used for animal feed of which poultry and piggery take the greater percentage share. Though maize can be substituted to some level by wheat, barley and sorghum, such is not economical.

*corresponding author

The bovine rumen content is an abattoir waste, which is readily available year round, not sold, and causing disposal problems in the abattoirs of most Third World countries. It is easy to process into feedstuff [2], but contain high fibre level (35.64%). The pig is a monogastric animal and is poor in the digestion and utilization of fibre.

The nutrase xyla is an enzyme prepared based on the bacterial xylanase produced by *Bacillus subtilis* [3]. It is rich in endo-xylanase activity, with optimal activity at neutral pH, better heat stability, lower sensitivity for xylanase inhibitors and higher activity on insoluble arabinoxylans [3]. The assumption is that enzyme activities of nutrase xyla may hydrolyze the non-starch polysaccharides contained in the rumen content, thus improving nutrient absorption and leading to increased

metabolizable energy (M.E) and better growth performance of the fed animals.

This study was therefore designed to replace maize in the diets of weaner pigs with rumen content supplemented with the enzyme nutrase xyla .

MATERIALS AND METHODS

The bovine rumen content was collected at the abattoir at the time of slaughtering. Immediately the visceral was opened and the rumen split open, the rumen content (RC) was collected into clean container. The RC was cooked in a drum at 100^{0}C for about 2 ½ hours with intermittent stirring to avoid burning. The boiled RC was sun dried until the moisture content was below 12% and later ground with crusher for particle size reduction and used for pig feed mixing. The RC fed contained on analysis 17.83% crude protein, 35.67% crude fibre and 11.60% ether extract.

Thirty, six-week old male weaner pigs were used for the feeding trial. There were five dietary treatments Table 1, such that the test ingredient (RC) was supplement with nutrase xyla (enzyme) at the rate of 100g enzyme to a tonne of feed and then fed to replace 0, 12.5, 25, 37.5 and 50% of the dietary maize (40%). Each of the treatment had three replicates and two (2) pigs were allocated to each of the replicates. The enzyme fed (Nutrase xyla) is a product of Nutrex- Belgium, containing Baterial endo-1, 4-β- xylanase (IUB 3.2.1.8). The feeding trial lasted for 56 days.

The metabolizable energy (ME) trial to determine effect of the enzyme supplemented on the M.E of rumen content was carried out, by the method of Hill and Anderson[4]. There were three diets, that is, the control and two RC- containing test diets. Test diet 1 contained 20% RC replacing the control while Test diet 2 was of the same composition but had nutrase xyla supplementation.

Before the experiment commenced, the piglets were dewormed using ivomec injection and allowed one-week adaptation to the pens. During the experimental period, the pigs were allowed feed and water *ad-libitum*.

Records of initial body weight, weekly weight gain and daily feed intake were taken. At the last week of the experiment the pigs were transferred into cages for ease of faecal and urinary collection for the determination of nitrogen digestibility. Test feedstuff, all diets, faecal and urinary samples were subjected to proximate analysis by the method described by A.D.A.C. [5]. All data collected were subjected to analysis of variance using model for the Randomized Complete Block Design (RCBD). Blocking was done against the varied initial body weight and where significant, differences between means were compared using the Duncan's multiple range test [6].

RESULTS

The growth performance data for the experimental period are presented in Table 2. There was a significant effect of the treatment on the observed final body weight of the experimental pigs. The pigs on the 0, 12.5 and 25% Rumen content supplemented with nutrase xyla replacement for maize (RC-NXRM) diets had comparable ($p>0.05$) final body weights which were significantly ($p<0.05$) higher than the final body weight values obtained from the pigs fed on the 37.5 and 50% RC-NXRM diets. The final body weights tended to be decreasing as the RC-NX level increased in the diet.

The pigs fed on the 12.5 and 25% RC-NXRM diets consumed significantly

more ($p<0.05$) of their feed (1.44 and 1.42kg/ pig/ day respectively) than the pigs on the control and higher RC-NXRM diets The feed intake by the pigs on the control and 37.5% RC-NXRM diets were comparable but significantly higher than ($p>0.05$) the feed consumed by the pigs on the 50% RC-NXRM diet, which had the lowest feed intake out of all the experimental diets (1.18kg/pig/day).

The pigs on the control, 12.5 and 25% RC-NXRM diets had highly comparable ($p>0.05$) weight gain values of 0.52 and 0.53kg/pig/day respectively; these values are significantly higher than the weight gain values for the pigs on the 37.5 and 50% RC-NXRM diets with 0.41 and 0.42kg/pig/day respectively.

All the feed to weight gain ratios were comparable ($p>0.05$) except for the pigs on the 37.5% RC-NXRM diet that was significantly ($p<0.05$) higher than those of the other diets.

There were no significant effect of treatment ($p>0.05$) on nitrogen intake, urinary nitrogen, faecal nitrogen and nitrogen retained (Table 3). The nitrogen digestibility value for the control was comparable ($p>0.05$) with that for the pigs fed on the 50% RC-NXRM diet (54.27 and 52.51% respectively), these were significantly lower than the values for the other enzyme -supplemented diets.

The results of the effects of enzyme supplementation on the metabolizable energy value of rumen content are presented in Table 4. The pigs had comparable ($p>0.0.5$) feed intake values, but had significantly different ($p>0.0.5$) faecal and urinary output values. The pigs fed on the basal diet (RC-RB) had comparable ($p>0.05$) feacal output values with those fed on the 20% RC to replace basal (RC-RB) without enzyme supplementation, while the 20%RC-RB with enzyme supplementation had the lowest feacal output of 0.37kg. The gross energy of feed intake and feacal output were comparable for the three diets. The gross energy of urinary output dropped ($p<0.05$) with RC replacing basal. The total energy retained was comparable for the pigs on the 3 diets. The basal had the highest M.E, which was significantly ($p<0.05$) higher than the M.E of the two RC replaced diets. The 20% RC-RB with enzyme supplementation was greater ($p<0.05$) than that of 20% RC-RB without enzyme inclusion.

DISCUSSION

The increased feed intake by the pigs on the 12.5 and 25% RC-NXRM diets supports the reports of Tuleun *et. al.* [7] that enzyme supplementation enhanced better feed intake; as enzyme are believed to improve feed acceptability as they add flavour to the feed thereby increasing feed intake at the lower levels of the rumen content (RC) inclusion. The reduced feed intake in the 37.5 and 50% RC-NXRM diets might be attributed to the high inclusion of RC, which resulted in high fibre level of the diets. RC is also noted as a bulky ingredient with low weight hence, the animal ate little and the gastro intestinal tract (GIT) is filled. Similarly, Adeniji and Balogun [8] reported that RC has an inherent repulsive odour and pigs being more sensitive to odour would easily react by decreasing feed intake at higher levels of RC in their diet.

The increased feed intake at the lower levels of RC inclusion allowed for more consumption (since it was already mixed with their diet) thereby giving room for more enzyme action on the feed. Thus, the weight gain and feed to weight gain ratio obtained on the RC diets were comparable to those on the

control diet. This study has supported the reports of Broz[9] that specific enzyme complexes used as feed additives may offer a practical means of enhancing the nutritive quality of various low-energy feedstuffs for livestock.

Some producers aim at producing high quality (low fat deposit) pork meat in a short a time as possible, and at minimal cost. The rapid growth to be achieved necessitates that they be fed on high quality diets, but quality concentrates (both energy and protein) are very expensive [10].

Adding exogenous enzymes to poor quality feedstuffs, will allow for the use of otherwise inexpensive and locally available ingredients like the RC in the diets of animals. In effect, the addition of dietary enzymes has the ability to increase the nutritional value of certain ingredients [11, 12].

Based on the high current price of maize has given up to N42/kg (January 2008), utilization of high levels of maize tends to make the cost of feed very high and breaking even becomes difficult.

The 50% RC-NXRM diet is recommended for weaner pigs. The pigs fed on the 50% RC-NXRM diet had a comparable weight to gain ratio and nitrogen digestibility with the pigs on the control.

Table 1: **Composition of Weaner Pig Diets (kg/1000kg)**

Ingredients	1	2	3	4	5
Maize	400.00	350.00	300.00	250.00	200.00
Rumen content	0.00	50.00	100.00	150.00	200.00
Corn bran	150.00	154.90	161.90	168.90	174.90
Soybean meal	150.00	150.00	150.00	150.00	150.00
Wheat offal	119.50	119.00	119.50	119.50	119.50
Palm kernel cake	100.00	100.00	100.00	100.00	100.00
Blood meal	40.00	35.00	28.00	21.00	15.00
Bone meal	25.00	25.00	25.00	25.00	25.00
Oyster shell	10.00	10.00	10.00	10.00	10.00
Salt	3.00	3.00	3.00	3.00	3.00
*Vitamin-mineral mix	2.50	2.50	2.50	2.50	2.50
Nutrase xyla	0.00	0.10	0.10	0.10	0.10
Total	1000.00	1000.00	1000.00	1000.00	1000.00

*The vitamin-mineral mix used contained the following: vit A-12,000 I.U; Vit D_3 1,200 I.U; E 3.6 I.U; Vit D-K 1.8mg; Vit B_2 3.6mg, Nicotinate 18mg; 12mg; Choline Chloride 120mg; Chlortetracycline 4.8mg; Mn 124mg; Fe 48mg; ; Zn 96mg; Copper 60mg; I 1.8mg; Co 48mg.

Table 2: **Results of Proximate Analysis of the Formulated Diets**

Diet	Proximate composition Crude protein (%)	Crude fibre (%)	Ether Extract (%)	Ash (%)	Metabolizable Energy (Kcal/Kg)
Diet 1 (Control)	18.79	5.99	3.55	2.96	2596
Diet 2	18.90	7.98	4.05	3.55	2432
Diet 3	19.02	9.39	3.25	4.13	2268
Diet 4	18.96	11.10	3.55	4.72	2103
Diet 5	18.76	11.89	3.42	5.35	1939

*Calculated Values

Table 3: **Effects Of Replacing Maize With Nutrase Xyla Supplemented Rumen Content On The Performance Of Weaner Pigs.**

Treatment (Diet)	Response Criteria Feed intake (kg/pig/day)	Weigh gain (kg/pig/day)	Feed:gain ratio	Feed cost (N/kg)
Diet 1 (0% RC)	1.32^{b}	0.52^{a}	2.57^{a}	24.84
Diet 2 (5% RC)	1.44^{c}	0.52^{a}	2.78^{a}	23.77
Diet 3 (10% RC)	1.42^{c}	0.53^{a}	2.67^{a}	21.34
Diet 4 (15% RC)	1.29^{b}	0.41^{b}	3.15^{b}	20.91
Diet 5 (20% RC)	1.18^{a}	0.42^{b}	2.83^{a}	19.48
SEM	0.09	0.04	0.08	

Means in the same column, with the same Superscript letter are not significantly different. (p>0.05)
*Determined based on the market price at the time the experiment was conducted (April, 2003).

Table 4: **Effects of Replacing Maize with Nutrase Xyla Supplemented Rumen Content on Nitrogen Digestibility of Weaner Pigs.**

Treatment (Diet)	Response Criteria Nitrogen intake(g)	Urinary Nitrogen(g)	Faecal Nitrogen(g)	Total Nitrogen output(g)	Nitrogen retained(g)	Nitrogen digestibility(%)
Diet 1 (0% RC)	33.60	5.47	9.96	15.43	18.17	54.27^{b}
Diet 2 (5% RC)	38.16	3.33	12.98	16.31	21.85	57.19^{a}
Diet 3 (10% RC)	38.97	5.00	10.27	15.27	23.70	60.78^{a}
Diet 4 (15% RC)	33.90	3.67	10.18	13.85	20.05	59.13^{a}
Diet 5 (20% RC)	34.00	3.30	12.84	16.14	17.86	52.51^{b}
SEM	1.09	1.29NS	1.03NS		1.70NS	4.10

NS – Not Significant
Means in the same column with the same superscript letter are not significantly different. (p>0.05)

Table 5: **Effects of Enzyme Supplementation on the Metabolizable Energy Value of Rumen Content.**

Treatment (Diet)	Response Criteria								
	Feed Intake (kg)	Faecal output (kg)	Urinary output (kg)	Gross Energy of feed intake (kcal)	Gross Energy of faecal output (kcal)	Gross Energy of urinary output (kcal)	Total Energy output (kcal)	Total Energy retained (kcal)	Metabolizable energy (kcal)
Control (basal)	1.63	0.54[a]	0.24[a]	5150	2167	344.6[a]	2511.6	2638.4	2638.4[a]
20% RC	1.56	0.61[a]	0.04[c]	4836	2337	54.27[c]	2391.27	2444.73	1640
20% RC + Enzyme	1.56	0.37[b]	0.10[b]	4783	2118	147.26[b]	2265.26	2517.74	2001[b]
SEM	0.6	0.05	0.07	25.13	20.48	6.44		1.18	22.55

Means in the same column with the same superscript letter are not significantly different ($p>0.05$)

REFERENCES

1. Dijk, A.V (1996) Will there be enough corn to feed birds. *World Poultry Misset* 12 (6): 34-35.

2. Adeniji, A.A (2001). The potential of bovine blood-rumen content meal as a feedstuff for livestock. *Tropical Animal. Prod. Invest.* 4:151-156

3. Mierop, L.V.D (2002) Feed enzymes, an overview. A paper delivered at the 2nd Faculty of Agriculture Lecture, University of Ilorin, Ilorin, Nigeria.

4. Hill, F.N and Anderson, D.L (1988). Comparison of metabolizable energy and productive energy determinations with growing chicks. *J.Nutrition* 64: 587-603

5. A.O.A.C (1980) Association of Official Analysis Chemist. Official Method of Analysis of Analytical chemist. 11th Ed. Washing D.C

6. Steel, R.G.D and Torrie, J.H (1980). Principle and procedures of statistics. A biometric approach 2nd Ed. McGraw Hill book. New York

7. Tuleun, C.D., Njoku, P.C and Yaakugh, D.I (2001). The performance response of growing pullets fed roxazyme in rice offal based diets. Proceedings of 26th conference of Nig. Soc. Animal prod. Held at ABU Zaria, 19-22 March, pg 219-221.

8. Adeniji, A.A and Balogun, O.O (2002). Utilization of flavour treated blood-rumen content mixture in the diets of laying hens. *Nig. J. Animal Production* 29(1): 34-39

9. Broz, J. (1993). Enzyme as feed additives in poultry nutrition current application and future trends. *Vet. Med*: 48: 213-217

10. Acamovic, T (2001). Commercial application of enzyme technology for poultry production. World's Poultry Sci. Journal 57: 225-242

11. Naveed, A., Acamovoic, T, and Bedford, M.R (1999). The influence of carbohydrase and protease supplementation on amino acid digestibility of lupin-based diets for broiler chicks. *Proceedings of the Australian Poultry Science Symposium* 11: 93-96

12. Bach-Knudsen, K.E.C.(2000). Digestibility of the lupin by monogastrics and enzyme treatment: improvement of the nutritive valve of white lupins for monogastric animals by means of exogenous enzymes. In: Proceedings of the EU LUPINE Meeting. INRA, Paris, France, 14-15 February.