EFFECT OF *NUTRASE XYLA®* ENZYME SUPPLEMENTATION ON GROWTH PERFORMANCE OF WEANER PIGS FED LOW OR HIGH FIBRE DIETS

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Abstract

A 49–day feeding trial was conducted to determine the effects of fibre and Nutrase Xyla® enzyme supplementation on the growth performance of weaner pigs. Sixteen weaned crosses of Landrace X Large white piglets were used in a 2 x 2 factorial arrangement having 2 enzyme levels (0 and 100 ppm) and 2 dietary fibre levels (5 and 10 %). Four isonitrogenous (20 % CP) experimental diets with marginal variation in caloric content tagged T_1, T_2, T_3, and T_4 were compounded. Treatments 1 and 2 contained 5 % crude fibre level (low fibre), while treatments 3 and 4 contained about 10 % crude fiber level (high fibre). Treatments 1 and 3 served as the control diets for treatments 2 and 4, respectively. Performance data such as feed intake, initial weight, and final weight were recorded and used to calculate weight gain, feed conversion ratio, protein efficiency ratio, feed cost/kg and feed cost/ unit weight gain. There were no significant ($P > 0.05$) effects of dietary fibre levels and enzyme supplementation on average daily feed intake, feed: gain ration, protein efficiency ratio, and feed cost per unit weight gain. The interactive effect of dietary fibre and enzyme supplementation on performance indices did not show significant ($P > 0.05$) effect. The economic analysis in revealed that the use of Nutrase Xyla® at 100 ppm in these diets resulted in increased feed cost, but higher level of dietary fibre reduced the cost of feed. Farmers can include up to 18% rice offal with 100 ppm Nutrase Xyla® without adversely affecting the performance of weaner pigs.

Key words: *Nutrase xyla®, fibre, weaner pigs, rice offal.*

INTRODUCTION

In the course of producing livestock intensively in Nigeria, it has been estimated that feed cost is over 70 % of total cost of producing livestock (Oluyemi, 1984); and maize being the conventional source of energy in the livestock feed, averaging between 45–60 % in a balanced livestock ration depending on dietary type is the most expensive ingredient in animal ration. But its importance in livestock feed cannot be over emphasized. Therefore, this has led to the continued search for alternative feed resources for monogastric animals. This search has led to the discovery of the importance in the use of farm and agro–industrial by–products amongst which are rice offal, rice bran, rice husk etc. Many of these agro–industrial by–products are fibrous in nature and their use in farm animals' diets is therefore limited due to the fibre handling abilities of the livestock, which is about 5–7 percent for monogastric (NRC, 1977; Olomu, 1979). These fibrous feedstuffs have been shown to result in increased feed intake, lowering the weight of live weight gain and in poorer feed conversion ratios when they replace maize in diets (Nelson 1984; Maisamari, 1986; Atteh *et al*., 1993; Tuleun *et al*., 1998; Oluolokun & Olaloku, 1999).

There is evidence that pre–digestion or any attempt to initiate the hydrolysis of feed components often enhances the digestibility and utilization when fed in animal diets. One of such technique is the use of exogenous treatment of feedstuff with enzymes preparations (Bio–ingredients Ltd, 2004). Although the use of commercial feed enzymes has gained world–wide acceptability, its use is still not popular. This study intends to therefore, investigate the effects of *Nutrase xyla®* enzyme supplementation on growth performance of weaner pigs fed high or low fibre diets.

MATERIALS AND METHODS

Study location

The study was carried out at the Piggery Unit of the Teaching and Research Farm of the University of Agriculture Makurdi. Makurdi, the capital of Benue State is located between longitude 6–10^0 East and latitudes 6–8^0 North. Situated along River Benue, Makurdi is very warm with a temperature range of 21^0C to 35^0C and annual rainfall ranges between 508 and 1041 mm.

Experimental Diets

Four isonitrogenous experimental diets tagged T_1, T_2, T_3, and T_4 containing 20 % crude proteins were compounded. Treatments 1 and 2 contained 5 percent crude fibre level (low fibre), while treatments 3 and 4 contained about 10 percent crude fiber level (high fibre). Treatments 1 and 3 served as the control diets for treatments 2 and 4, respectively. All the four treatment diets varied marginally in calorie content. Treatments 2 and 4 contained 100 ppm of the enzyme (*Nutrase xyla®*). The

percentage composition of the experimental diets is shown in Table 1. The soybean was toasted using an open–dry pan at about 80^0C for 20 minutes and then crushed in order to improve its utilization by the pigs and to destroy its anti–nutritional factors such as lipoxygenase activity, hemagglutinin, trypsin inhibitor, lectin, phytic, goitrogen urease and genistein. Palm oil was added to increase energy level of the diet, reduce dustiness and improve palatability. The blood meal was added to meet the crude protein requirement of the animal, while the bone meal was included to supply the needed calcium. The chemical composition of the diets is shown in Table 2.

Experimental Animals and Management

Sixteen Landrace x Large white crossbred pigs with an average live weight of 10.9 kg were obtained from the University of Agriculture Research Farm for the experiment which lasted for 49 days. The animals were randomly assigned into four treatments and were equalized for sex; each treatment had four individually fed pigs. Weighed amount feed and watered were provided *ad libitum* throughout the period of the experiment.

Data Collection

Body weight gain was measured as the difference between the final weight and the initial weight of the pigs, feed intake was measured as the difference between the amount of feed fed and the leftover while feed conversion ratio was calculated as the rate of feed intake to live weight gain. The protein efficiency ratio was calculated as the gain in body weight to the protein consumed; the economics of production using this commercial enzyme (*Nutrase xyla*®) was calculated. The cost/kg of each experimental diet and cost of feeding the pigs on a particular diet for the period of study was computed by multiplying the cost/kg of the diet by the amount consumed.

Experimental Design and Statistical Analysis

The experimental design was a 2 x 2 factorial and all data collected were subjected to analysis of variance (ANOVA) using the procedure of Steel & Torrie (1980). When significant difference was observed, treatment means were separated using the Duncan's Multiple Rage Test (Duncan, 1955).

RESULTS AND DISCUSSION

The chemical composition of the experimental diets and that of the proximate and energy composition of the experimental diets are presented in Tables 1 and 2 respectively. The calculated metabolizable energy from the proximate composition data of the diets using the formula of Pauzenga (1985); ME kcal/kg = 37 X%CP + %EE + 35.5 X NFE, was in the range of 3217 to 3278 kcal/kg and it is adequate for weaner pigs (NRC, 1979). Similarly, the crude protein of 20 % was normal for nutrition of weaner pigs.

Table 1: Percent formulation and calculated chemical composition of experimental diets

Feed Ingredients	**$T_{1\ (-\ ELF)}$**	**$T_{2\ (+\ ELF)}$**	**$T_{3\ (-\ EHF)}$**	**$T_{4\ -\ (HEF)}$**
Maize	53.12	53.12	42.28	42.28
Full–fat soybean	33.53	33.53	32.37	32.37
Rice offal	6.00	6.00	18.00	18.00
Blood meal	2.00	2.00	2.00	2.00
Palm oil	2.00	2.00	2.00	2.00
Bone meal	2.50	2.50	2.50	2.50
Salt	0.40	0.40	0.40	0.40
Vitamin–mineral Premix *	0.25	0.25	0.25	0.25
Methionine	0.20	0.20	0.20	0.20
Nutrase xyla®	–	+	–	+
Total	**100.00**	**100.00**	**100.00**	**100.00**
Calculated nutrients and energy composition				
ME (Kcal kg^{-1})	3307.17	3307.17	3240.06	3240.06
Crude protein (%)	20.00	20.00	20.00	20.00
Crude fibre (%)	5.13	5.13	9.29	9.29
Calcium (%)	1.03	1.03	1.02	1.02
Phosphorus (%)	0.66	0.66	0.70	0.70
Ca; P	1.56	1.56	1.46	1.46
Cost of feed (₦/kg)	60.65	61.93	54.93	55.23

The vitamin – mineral premix supplied the following per 100 kg of diet: Vitamin A 15,000 I.U, Vitamin D_3 300,000 I.U., Vitamin E 3,000 I.U., Vitamin K 2.50 mg, Thiamin, (B_1) 200 mg, Riboflavin (B_2) 600 mg, Pyridoxine (B_6) 600 mg, Niacin 40.0 mg, Vitamin B_{12} 2 mg, Pantothenic acid 10.0 mg, Folic acid, 100 mg, Biotin 8 mg, Choline

Table 2: proximate and chemical composition of the weaner diets (% DM)

Nutrients	T_1 (– ELF)	T_2 (+ ELF)	T_3 (– EHF)	T_4 – (HEF)
Dry matter	90.02	89.96	90.01	90.05
Crude Protein	20.05	20.05	20.03	20.03
Crude Fiber	5.00	5.00	10.00	10.00
Ether Extract	5.13	5.02	5.42	5.25
Ash	7.62	7.93	8.21	8.03
NFE	58.89	58.40	57.74	57.96
[a]Calcium	1.03	1.03	1.02	1.02
[a]Phosphorus	0.66	0.66	0.70	0.70
[b]ME (Kcal/kg)	3273.13.	3260.50	3217.21	3222.10

[a]Calculated from NRC (1979); [b]Calculation from Pauzenga (1985)

The result of the effect of fibre and enzyme supplementation on the performance of weaner pigs is presented in Table 3. Final weight gain, feed intake, feed–gain ratio, and protein efficiency ratio were not significantly (P > 0.05) affected by dietary fibre. Feed cost per weight gain did not also vary significantly (P > 0.05) but decreased slightly (319.02 vs. 309.00 N/kg) at the higher fibre level. The results of the trials have shown that increasing fibre level from 5 to 10 % increased feed intake slightly. This result is in agreement with the findings of Tuleun *et al.* (1998), Atteh (2000); Thompson & Webs (1981) who observed increase in feed intake as dietary fibre levels increased in the diets of starter chicks. Increased feed intake, which has linked to low energy diets, is associated with high level fibre diets. The calculated feed analysis showed that all essential nutrients were adequate. The only major variables in the experimental diets were the dietary fibre and the enzyme supplementation. It is known that one of the general effects of fibre is depressed digestibility and reduced availability of nutrients. It is therefore possible that the pigs on the high fibre diets ate more to compensate for the reduced energy density of the diet. The nutrients derived from diets are what determine weight gains when absorbed and deposited. Thus, any phenomenon that reduces nutrient availability to the animal would result to depressed performance. Birketveldt *et al.* (2000) indicated that high fibre intake resulted in significantly reduced serum concentration of cholesterol and triglycerides, which are indicative of reduced body weight gains.

Table 3: The effect of dietary fibre and enzyme supplementation on performance indices of weaner pigs

Performance Indices	Main Treatment Means		
	Low Fibre (–Enzyme)	High Fibre (+ Enzyme)	SEM
Initial weight (kg)	10.94 (10.96)	10.89 (10.88)	0.05 ns (0.09 ns)
Final weight (kg)	30.45 (29.67)	28.97 (29.75)	1.49 ns (0.09 ns)
Daily weight gain (kg)	0.40 (0.38)	0.37 (0.39)	0.03 ns (0.0 1 ns)
Daily feed intake (kg)	0.88 (0.89)	0.90 (0.89)	0.02 ns (0.0 2 ns)
Feed/gain ratio	2.20 (2.34)	2.43 (2.28)	0.11 ns (0.2 1 ns)
Protein efficiency ratio	2.20 (2.11)	2.04 (2.13)	0.16 ns (0.0 2 ns)
Feed cost/weight grain (₦/kg)	319.02 (312.82)	309.00 (315.20)	10.35 ns (3.48 ns)

NB: Values in parenthesis are enzyme effect, SEM–Standard error of mean, ns–not significant (P > 0.05)

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Dietary enzyme supplementation did not affect final weight gain, feed intake, and protein efficiency ratio. The feed cost per weight gain did not vary significantly (P > 0.05) but increased (312.82 vs. 315.20 N/kg) slightly at the high enzyme level of supplementation. Atteh (2000) investigated the response of broilers to diets in which brewer's dried grain replaced maize with or without *Nutrase xyla*® and noted that feed intake was not significantly affected although the birds on enzyme treatments ate slightly higher than non–enzyme diets. This was not in agreement with the findings of Tajudeen & Eruvbetine (2002) who investigated the effect of *Nutrase xyla*® inclusion in unpeeled cassava root meal and observed that enzyme application produced faster growth rate and enhanced feed consumption. Atteh (2002) also fed *Nutrase xyla*® at 0, 50 and 100 ppm in laying hens diets containing 0, 25 and 50% wheat bran and observed that increased level of dietary *Nutrase xyla*® had no significant effect on feed intake. Beauchemin *et al.* (2003), in a review on the use of exogenous enzymes by ruminants further indicated that the effect of enzymes is most pronounced when dietary energy is a limiting factor. Thus the use of enzyme with low energy, high fibre diets would be beneficial through the release of more energy from the fibre.

The interactive effects of fibre and *Nutrase xyla*® enzyme supplementation on the performance of weaner pigs is shown in Table 4. The final weights, weight gain, feed intake, protein efficiency ratio, feed: gain ratio and feed cost per weight gain of animals fed the low fibre diets did not differ significantly (P > 0.05) among treatments. Feed cost per kg weight gain increased at low fibre with enzyme with supplementation (303.17 vs. 334.87 N/kg) while the feed cost improved at high fibre with enzyme supplementation (322.46 vs. 295.53 N/kg). There was no mortality recorded in this phase of the trial. The interactive effects of dietary fibre and enzyme supplementation on feed intake slightly increased the amount of feed consumed both low and high fibre levels. Atteh (2000) investigated the response of broilers to diets in which brewer's dried grain replaced maize with or without *Nutrase Xyla*® and noted that feed intake was not significantly affected although the birds on enzyme treatments ate slightly higher than non–enzyme diets.

Table 4: The interactive effects of fibre and *Nutrase xyla*® enzyme supplementation on performance of weaner pigs

Performance Indices	Main Treatment Means				
	T_1 (– ELF)	T_2 (+ ELF)	T_3 (– EHF)	T_4+ (HEF)	SEM
Initial weight (kg)	10.98	10.90	10.93	10.85	0.41 ns
Final weight (kg)	31.20	29.70	28.13	29.80	1.42 ns
Daily weight gain (kg)	0.41	0.38	0.35	0.39	0.03 ns
Daily feed intake (kg)	0.88	0.88	0.90	0.90	0.07 ns
Feed/gain ratio	2.21	2.43	2.65	2.42	0.17 ns
PER	2.28	2.12	1.94	2.14	0.13 ns
FC/weight gain (₦ /kg)	303.17	334.87	322.46	295.5	23.07 ns

SEM = Standard error of mean, ns–not significant (P > 0.05); **PER =** Protein efficiency ratio; **FC =** feed cost

CONCLUSION

From the results of this study it was consistently observed that between the 2 dietary fibre levels (low and high); the fibre levels gave the optimum performance when enzyme was supplemented. Economic use of the feed (feed conversion ratio) was best at the high fibre level when enzyme was supplemented; thus *Nutrase Xyla*® enzyme supplementation at 100 ppm in rice offal–based fibrous diets resulted in better performance and economically profitable. Rice offal is valuable and a qualitative alternative feed ingredient for the pig feeding. Farmers can include up to 18 % (for weaner) rice offal with 100 ppm *Nutrase Xyla*® without adversely affecting the performance of pigs.

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