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Growth Performance of Weaner Pigs Fed Enzyme Supplemented High Fibre Diets

Dr. Geoffrey Nkwocha A.

Senior Lecturer, Department of Animal Production and Health Technology,
Animal Nutrition and Biochemistry, Imo State Polytechnic, Umuagwo-Ohaji, Owerri, Imo State, Nigeria

Dr. Anukam, K. U.

Chief Lecturer, Department of Animal Production and Health Technology, Veterinary Medicine,
Animal Management, Imo State Polytechnic, Umuagwo-Ohaji, Owerri, Imo State, Nigeria

O. I. Prudent

Lecturer, Department of Agricultural Technology, Animal Health and Livestock Management,
Bayelsa State College of Arts and Science (BYCAS), Yenagoa, Nigeria

Abstract:

The effect of rice bran supplemented with xylanase enzyme on the growth performance of weanling pigs was determined in a 35-day feeding trial using thirty-two large white x Duroc weaner pigs with mean body weight of 10.2 ± 0.3 kg. Weaner pigs were assigned to four diets (CP= 18%) in which rice bran and xylanase was included at 0% (0g), 30% (50g), 30% (100g) and 30% (150g) dietary levels in a completely randomized design. Weaner pigs were randomly divided into four groups of 8 pigs. Each group was sub-divided into four replicates of 2 pigs/ replicate and assigned to the experimental diets respectively. Data collected revealed that weaner pigs on the control diet (T_1) recorded the best performance in all the parameters measured while pigs on enzymes supplemented high fibre based diets showed significantly ($P < 0.05$) lower performance in all the growth indices measured. Again, the cost of feed to produce a kilogram pork significantly ($P < 0.05$) increased linearly as dietary levels of xylanase enzyme increased in fibre based diets. The result of this study indicated that pigs on rice bran based diets were unable to metabolize the nutrients compact in these diets probably because of the resistance imposed by the NSP components. Rice bran should not be included upto 30% in the ration of weanling pigs for optimum degradation and metabolism.

Keywords: Growth performance, Weaner pigs, enzyme supplementation, high fibre diets, rice bran.

1. Introduction

Pig production has increased significantly over the years to accommodate rising demand in animal protein intake due to geometrical increase in human population. (Madubuike, 2012; Nkwocha *et al.*, 2014).

There is need therefore to encourage the production of pigs in the third world countries considering its potentials as an omnivorous polytococcus, fast growing animal with very high mortgage value (Nkwocha and Anukam, 2012; Agbabiaka *et al.*, 2013a).

In the millennium of dwindling oil economy, the use of rice bran an agro-industrial by-product is a panacea to sustainable livestock development in a quasi-agrarian society like Nigeria.

Rice bran, a promising industrial by-product of rice milling is brown outer layer of rice kernel mainly comprised of pericarp, aleurone, subaleurone layer and germ (Singh *et al.*, 2013; Qureshi *et al.*, 2000). It has potential to be used as a food ingredient, since it has good amount of nutrients like protein, fat and dietary fibre (Singh *et al.*, 2013; Dafwan and sharmen, 1996).

Presence of antioxidants like tocopherols, tocotrienols and Y-oryanol brighten prospects of rice utilization for human and animals (moldenhauer *et al.*, 2013).

Rice bran contains dietary fibre which plays important role in pig and poultry diets and a minimum level of dietary fibre has to be included to maintain normal psychological function in the digestive tract (Wenk, 2001). A major concern when including fibre in the diet of pigs is that high dietary fibre content is associated with decreased nutrient utilization and low net energy values (Noblet and Le Goff, 2001; kung *et al.*, 2000). However, fibre inclusion in the diet of pigs have some other positive effects such as to stipulate gut health, increase the satiety, affect behaviour and overall improvement in animal well being (De leeuw *et al.*, 2008, De lange *et al.*, 2010).

In view of the fact, that pigs cannot utilize high fibre diets effectively, it becomes imperative for the incorporation of exogenous enzymes into their diets to facilitate the breakdown of the non-starch polysaccharides (NSPs) present in these fibre laden diets.

Addition of enzyme like amylase to pig diet can help increase nutrient absorption, reduce viscosity of ingest in the intestine and improving growth rate (leczniesky, 2008).

The principal objective of this study is therefore to evaluate the growth performance of weaner pigs fed enzyme supplemented high fibre diet.

2. Materials and methods

2.1. Experimental Site

The experiment was carried out at the piggery unit of Teaching and Research farm, Imo State Polytechnic, Umuagwo-Ohaji Local Government Area of Imo State, South-Eastern Nigeria. The climatic data of the area showed that the average annual rainfall ranges between (2000-2500mm), the institution is situated on latitude 6⁰ N and longitude 7⁰E of the equator with the temperature ranging from (27.5-32⁰ C) and humidity of (70-80%). The soil is sandy loamy and slightly acidic (Nig. Federal Ministry of Aviation, 2012).

2.2. Experimental Animals and Design

Thirty-two (32) strains of cross-bred (Large white X Duroc) weaner pigs with average weights of 10.2 ± 0.3kg of different sexes were used. Pigs were acclimatized in the study area by feeding control diet and water supplied ad libitum for a week, within which time, routine management practices notably deworming against endoparasites and oxytetracycline injection were administered accordingly. After equilibration, initial weight assessment was conducted using the ruminant scale (0-50kg) before the commencement of the experiment and weekly thereafter to determine the body weight changes. The pigs were divided into 4 groups of 8 pigs each in a Completely Randomized Design (CRD).

| Parameters | Composition (%) |
|------------------------|-----------------|
| Moisture | 13.35 |
| Crude protein | 13.00 |
| Ether extract | 11.00 |
| Crude fibre | 13.50 |
| Ash | 9.62 |
| Nitrogen free extracts | 39.53 |

Table 1: Proximate Composition of rice bran (% Dry matter)
 $ME(kcal/kg) = 37\%CP + 81x\%EE + 35.5x\%NFE$ (Pauzenga.1985)

2.3. Housing and Management

The pigs were housed in pens with total areas measuring 22.4m² divided into 16 compartments, each measuring 1.4 x 1.0m. The piggery house consists of a concrete floor with dwarf wall in which the open part was covered with chicken wire mesh. The roof was covered with corrugated iron sheets. The pens were washed and disinfected with germicide "Isol" a week before the commencement of the experiment.

2.4. Feed Preparation and Feeding

The rice bran and xylanase enzyme used were obtained from Fidelity Agro services, Egbu road, Owerri. The rice bran was produced mechanically by first separating the rice from the shaft (cover) and then sieving or blowing off the bran with the aid of electrical fan and milled accordingly.

The sample of milled rice bran was analyzed for proximate composition (AOAC, 2000) and used in the formulation of four isonitrogenous (CP=18.00±0.40) and isocaloric (ME=2884 Kcal/kg) accordingly and stored at room temperature. Treatment diets were also analyzed for nutrients assay (AOAC, 2000). Xylanase enzyme was injected into the treatment diet at 0%, 0.05%, 0.10% and 0.15% accordingly.

Each treatment was replicated four times, i.e. 2 pigs each, in a cubicle system of production and randomly allotted to the four experimental diets. Clean water and feed were served ad libitum. Feed intake was recorded daily by computing the difference between the feed offered and feed left over throughout the duration of the experiment which lasted for 35 days.

| Ingredients | High fibre rice bran T ₁ (0) | High fibre rice bran dietary levels T ₂ (50gm) | T ₃ (100gm) | T ₄ (150gm) |
|-------------------|--|--|------------------------|------------------------|
| Maize meal | 57 | 27 | 27 | 27 |
| Enzyme | 0 | 0.05 | 0.10 | 0.15 |
| Rice bran | 0 | 30 | 30 | 30 |
| Ground nut cake | 15.5 | 15.5 | 15.5 | 15.5 |
| Cassava meal | 5 | 5 | 5 | 5 |
| Wheat offal | 7 | 7 | 7 | 7 |
| Palm kernel cake | 8 | 8 | 8 | 8 |
| Fish meal | 5 | 5 | 5 | 5 |
| Vit/min premix | 0.25 | 0.25 | 0.25 | 0.25 |
| Salt | 0.25 | 0.25 | 0.25 | 0.25 |
| Bone meal | 2.0 | 2.0 | 2.0 | 2.0 |
| Total | 100 | 100 | 100 | 100 |
| Crude protein (%) | 17.80 | 17.80 | 17.80 | 17.80 |
| ME (kcal/kg) | 2900 | 2700 | 2700 | 2700 |
| Crude fibre | 3.94 | 6.99 | 6.99 | 6.99 |
| Ether extract | 3.68 | 6.23 | 6.23 | 6.23 |

Table 2: Ingredient composition of the experimental diets

To provide the following per kilogramme diet

Vit. A: 1000iu: VitE: iu: Vit K: 2.5mg; Riboflavin. 5.5mg; Vitamin 12.0.01mg; Vitamin 6.0101mg Pathothenic acid. 6mg. Niacin. 5mg; Chloring. 3mg Folic acid. 4mg mn.8mg; Zinc. 0.5mg. Iodine.1.0m; Cu. 10mg.20mg

2.5. Evaluation of Apparent Dry Matter Digestibility

During the last week of the feeding trial, one weaner pig was randomly selected and transferred to metabolic cages for feeding and fecal collection trial. The selected pigs were fed and fecal samples were collected for three days, weighed, air dried, thoroughly mixed and subjected to digestibility test. The mean difference between the daily feed intake and daily fecal droppings was computed for three days.

2.6. Data Analysis

All the data generated from the study were subjected to one-way analysis of variance (Steel and Torrie, 1980), while difference in treatment means were separated using Duncan's New Multiple Range test as described by Obi, (1990)

3. Results and Discussion

The nutrients assessment of Rice bran showed that the ingredient contained 13.0% crude protein, the values of 11.00, 13.50, 9.62 and 39.53% were recorded for ether extracts, crude fibre, ash and nitrogen free extract respectively (Table 1). The crude protein concentration tallies with the value of (13%) obtained by Ambreen *et al.*, (2006) while the ether extracts, crude fibre, carbohydrates and total ash contents varied with the present study. The variation in nutrient composition may be due to the varieties, harvesting conditions of the plant, method of analysis and processing techniques employed.

Table 3 shows the data on growth performance of experiment weaner pigs placed on enzyme supplemented high fibre diets. From the data, it could be observed that weaner pigs on the control diet (T₁) recorded the highest daily weight gain of 0.19kg while the weight gain of pig's place on enzyme supplemented fibre diets ranges between 0.13- 0.15kg accordingly. Pigs fed on enzyme supplemented high fibre based diets showed significantly (P<0.05) lower performance in terms of average daily weight gain, feed conversion ratio and cost benefit ratios compared with the control group. The same trend of excellent performance was observed in the live weight and apparent dry matter digestibility of weaner pigs on the control diet. The inclusion of single exogenous xylanase did not increase the dry matter digestibility of rice bran based diets and this opposed the reports of Ojebiyi *et al.*, (2016), and li *et al*; (2002) that digestibility of rice husk based diets was higher with enzyme supplementation. Rice bran based diets contains arabino xylan, pectin and galactose containing oligasaccharides and these appears to impact on digestibility negatively (Kofod *et al.*, 2000; Noblet and le Goff, 2001, kim *et al.*, 2005).

The exogenous xylanase included at graded levels (50-150g) was unable to disrupt the cell wall structure of the bran which would have increased nutrients availability and changes in the physical properties of NSPs, such as water binding capacity and viscosity (Jensen *et al.*, 1998 and O'Connell *et al.*, 2005). According to Ngoc *et al.*, (2011), degradation of complex polysaccharides like rice bran could only be achieved with multi-enzyme mixture i.e. (mixture of α - amylase β -glucanase cellulase and protease for enhanced growth performance and nutrient utilization.

Furthermore, the relative economic benefit of enzyme supplementation on rice bran based diets on weaner pigs was insignificant (P>0.05) judging from the poor consumption pattern of 4% post weaning period (Zimmerman, 1986).

Feed cost of the rice bran based diets increased significantly (P<0.05) as dietary levels of exogenous xylanase increased respectively. The cheapest cost of ₦357/kg pork was obtained from the control diet (T₁) while the highest cost of ₦452.00 was recorded by T₄

(150g inclusion rate of xylanase). The result of the study is not in agreement with Close (1993) which recorded impressive cost benefit when enzyme was used on fibrous diet for pigs.

| Parameters | High fibre Rice bran dietary levels (%) | | | | SEM |
|---------------------------------------|---|----------------------------------|----------------------------------|----------------------------------|------|
| | T ₁ (0) | T ₂ (50gm) | T ₃ (100gm) | T ₄ (150gm) | |
| Average initial body weight (kg) | 9.45 ^a | 10.18 ^a | 9.85 ^a | 9.98 ^a | 0.18 |
| Average final body weight (kg) | 16.23 ^a | 14.78 ^b | 15.08 ^b | 14.93 ^b | 0.36 |
| Average daily feed intake (kg) | 0.70 ^a | 0.65 ^b | 0.66 ^b | 0.69 ^a | 0.01 |
| Average daily weight gain (kg) | 0.19 ^a | 0.13 ^b | 0.15 ^b | 0.14 ^b | 0.02 |
| Apparent dry matter digestibility (%) | 80.00 ^a | 71.00 ^c | 78.00 ^b | 76.00 ^b | 2.25 |
| Feed conversion ratio | 3.68 ^b | 5.00 ^a | 4.40 ^a | 4.93 ^a | 0.33 |
| Cost benefit ratio | N 357.00 ^b | N 442.99 ^a | N 442.00 ^a | N 452.00 ^a | 5.02 |

^{abc} Means within the row having the same superscript do not differ significantly (P>0.05)

Table 3: The growth performance of weaner pigs fed enzyme supplemented high fibre diet

4. Conclusion

Feeding weaner pigs with 30% rice bran supplemented with xylanase enzyme (100g inclusion rate) seems not to be promising but maximum efficiency could be realized if cocktail of enzymes (multi-enzymes) are employed to breakdown the chemical and physical bonds between the NSP components. Result of the present study indicated that rice bran should not be included upto 30% in weaner pigs ration for optimum degradation and metabolism.

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