Online Journal of Animal and Feed Research

Volume 3, Issue 1: 23-27 (2013) *ISSN 2228-7701*

THE INFLUENCE AN EXOGENOUS ENZYMES-PROBIOTICS COMPLEX ON THE GROWTH PERFORMANCE AND CARCASS TRAITS OF ALBINO RATS FED DIETS CONTAINING UP TO 60% RICE BRAN

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ABSTRACT: *The experiment was conducted to determine the effects of varying levels of rice bran supplemented with Xzyme™ (an exogenous enzyme-probiotic complex) on the growth performance and carcass traits of albino rats. Thirty weanling albino rats with average initial liveweight of 66.9±0.3g were randomly allotted to six dietary treatments in a 3 x 2 factorial design (3 levels of rice bran [20, 40 and 60%] by 2 levels [0 and 250mg/kg of diet] of the Xzyme™). There were 5 rats on each treatment which were housed individually in plastic cages. Feed and water were provided ad libitum and their growth performance monitored for 28 days, after which the rats were slaughtered to collect carcass data.The mean values for total feed intake, weekly feed intake and daily weight gain were similar (P>0.05) for all the various dietary treatments. The addition of the Xzyme™ led to an improvement (P>0.05) in feed conversion ratio (FCR) at each level of the rice bran. Both feed cost and feed cost per 100g weight gain values decreased as the level of RB increased despite the extra cost of the added Xzyme™. The carcass characteristics of the albino rats on all the six dietary treatments were similar (P>0.05). The results suggest that albino rats and probably other mono-gastric livestock species can be fed diets containing 60% rice bran plus Xzyme™ without any adverse effect on health, growth performance and carcass characteristics.*

Key words: *Feed, Fibre, Albino rat, Rice bran, Xzyme™*

ORIGINAL ARTICLE

INTRODUCTION

Maize constitutes the predominant ingredient in most swine and poultry diets (Subramanium and Metta, 2000) and is also considered the most important cereal crop produced in Ghana, because it is the most widely consumed staple food in Ghana (Morris et al*.,* 1999). For that reason, feeding monogastric livestock with high maize diets appears unsustainable in the near future, hence to need to resort to the use of cheaper alternatives. Rice bran is one of such alternative which is already receiving attention from poultry and livestock farmers. It is however being used sparingly because of its high fibre content (Farrell, 1994; Adeola and Cowieson, 2011) and considerable variability.

The fibrous fraction of the animal's diet could offer a significant amount of energy which previously would be unavailable for utilization by the animal because it could not be digested due to the lack of the appropriate digestive enzymes. However, the ability of exogenous enzymes to aid the digestion of high fiber diets have been reported by several researchers (Cadogan et al., 2003; Barrerra et al., 2004; Kiarie et al., 2007; Emiola et al*.,* 2009). According to Adeola and Cowieson (2011), enzymes are used in nonruminant animal production to promote growth, improve the efficiency of nutrient utilization and reduce nutrient excretion. They also forecast a promising future for exogenous enzymes utilization in nonruminant nutrition, especially when their roles in promoting health are further understood.

Xzyme™ is a multi-enzyme complex containing *Lactobacillus spp.* and *Saccharomyces cerevisiae* as probiotic organisms. The benefits of enzymes have been clearly established (Cadogan et al., 2003; Barrerra et al., 2004; Kiarie et al., 2007; Emiola et al., 2009), and probiotics reported to aid in allergy prevention, synthesis and the enhancement in the bioavailability of nutrients (Parvez et al*.,* 2006; Sarkar, 2011).

This experiment was conducted to ascertain how the combined effects of the enzymes and probiotics will influence the growth and carcass characteristics of albino rats (*Rattus norvegicus)* fed diets containing varying levels of rice bran with or without Xzyme™.

MATERIALS AND METHODS

To cite this paper: Boateng, M., Okai, D.B. and Amponsah, B.K. 2013. The influence an exogenous enzymes-probiotics complex on the growth performance and carcass traits of albino rats fed diets containing up to 60% rice bran. *Online J. Anim. Feed Res.*, 3(1): 23-27.
Scienceline/Journal homepages: http://www.science-line.com/index/; http://www.ojafr.ir

Location and Duration of Experiment

The study was conducted at the Livestock Section of the Department of Animal Science, Faculty of Agriculture, Kwame Nkrumah University of Science and Technology (KNUST), Kumasi, Ghana. The climatic conditions during the period of the experiment were dry, cold and hazy, with temperature ranging between 24 and 31^{o}C, as the country was experiencing the dry (Harmattan) season.

Animals and Experimental Design

Thirty weanling albino rats (12 males and 18 females) were randomly allotted to six dietary treatments (Table 1) in a 3 x 2 factorial design (3 levels of RB [20, 40 and 60%] by 2 levels of Xzyme™ [0 and 250mg/kg of diet]). There were five rats on a treatment and each rat served as a replicate. The six isonitrogenous (18% CP) dietary treatments were 20% rice bran (RB_{20}); 20% rice bran plus Xzyme™ (RB_{20+}); 40% rice bran (RB_{40}); 40% rice bran plus Xzyme™ (RB_{40+}); 60% rice bran (RB_{60}) and 60% rice bran plus Xzyme™ (RB_{60+}). Feed and water were provided *ad libitum* over the four week-period.

Table 1 - Percentage composition of the Six diets

Feed Ingredients	Dietary Treatments					
	RB_{20}	RB_{20+}	RB_{40}	RB_{40+}	RB_{60}	RB_{60+}
Maize	59.75	59.75	40.95	40.95	22.40	22.40
Rice Bran	20.0	20.0	40.0	40.0	60.0	60.0
Fish meal	9.50	9.50	7.80	7.80	6.10	6.10
Soybean meal	9.50	9.50	9.50	9.50	9.50	9.50
Oyster shell	0.50	0.50	1.00	1.00	1.25	1.25
Common salt	0.25	0.25	0.25	0.25	0.25	0.25
Vit. trace mineral premix	0.25	0.25	0.25	0.25	0.25	0.25
Dicalcium phosphate	0.25	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100	100
Calculated composition, %						
Crude protein	18.01	18.01	18.0	18.0	18.0	18.0
Crude fibre	5.0	5.0	7.04	7.04	9.08	9.08
Calcium	0.81	0.81	0.92	0.92	0.94	0.94
Phosphorus	0.89	0.89	1.10	1.10	1.32	1.32
ME (Kcal/kg)	3234.75	3234.75	3104.67	3104.67	2983.14	2983.14

Vitamins, Provitamins (per kg of diet): Vitamin A (8000 I.U); Vitamin D3 (150I.U); Vitamin E (2.5mg) ; Vitamin K (1mg); Vitamin B2 (2mg); Vitamin B12 (5×10^{-3}mg); Folic Acid (0.5mg); Nicotimic Acid (8mg); Calcium Panthotenate (2mg); Choline Cloruro (50mg), Trace Elements: Mg (50mg); Zn (40mg); Co (0.1mg); Cu (4.5mg); Se (0.1mg). Antioxidants: Butylated Hydroxytoluene (10mg). Carrier: Calcium carbonate q.s.p (2.5kg).

Management of Rats

The rats were housed separately in rectangular plastic cages measuring 27× 21.5 ×15cm, each of which was covered with wire mesh to aid ventilation. Circular metallic feeding troughs were tightly fixed at a corner of each container and a nipple drinker was placed on top of the wire mesh to provide water for the rats. Faeces were collected every morning and disposed off, while any feed that had been spilled was gathered and kept until the end of the week when it was weighed. The rats were given feed and water *ad libitum*.

Parameters measured

In the course of the experiment, weekly feed intake and weekly weight gains were recorded and corresponding average daily feed intake and average daily weight gain and feed conversion ratios were calculated. At the end of the 4 weeks, the rats were chloroformed, dissected and carcass data were collected as described by Boateng et al. (2012).

Statistical analysis

The data collected for the growth performance and carcass components of the rats were subjected to analysis of variance (ANOVA) using GenStat Discovery Edition (9.2) and differences between means were separated by Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

Generally, the health status of the rats was good and there was no record of mortality within any of the dietary treatments. The overall performance of the rats with respect to the parameters measured are presented in Table 2. There were no significant (P>0.05) differences in the mean daily weight gain recorded for all the treatments. However, it is worth noting that there was a trend of increasing daily weight gain with mean daily feed intake values recorded for the various dietary treatments suggesting that there may be a positive relationship

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between the feed intake and the mean daily weight gain values. Increases in mean daily feed intake values with increasing levels of wheat bran in growing pigs has been reported by Rosencrans et al. (1970).

It was also observed that the mean daily weight gain for the rats on dietary treatment RB_{20+} (3.24g), RB_{40+} (2.96g) and RB_{60+} (3.07g) were slightly higher (P>0.05) than for those on treatments RB_{20}, RB_{40} and $RB6_0$ which had mean daily weight gains of 2.96, 2.88 and 2.85g respectively. The slightly higher values in the daily gain for the Xzyme™-supplemented treatments suggest that the Xzyme™ may have helped by making available to the rats nutrients that were locked up in the NSP fraction of the diet.

Table 2. Mean Feed Intake, Growth Performance and Economy of Production

Parameter	Xzyme™ level	Level of Rice bran (%)				Factor	LSD	P
		20	40	60	Mean			
Initial weight, g	0	67.0	67.2	67.2	67.1	RB	6.40	0.991
	1	66.6	67.2	67.0	66.9	RB+	5.23	0.937
	Mean	66.8	67.2	67.1	-	(RB x RB+)	9.05	0.998
Final weight, g	0	149.8	147.8	147.0	148.2	RB	14.40	0.785
	1	157.4	150.2	153.0	153.5	RB+	11.76	0.355
	Mean	153.6	149.0	150.0	-	(RB x RB+)	20.37	0.929
Total feed intake, g	0	305[a]	345[b]	344[b]	331	RB	29.4	0.050
	1	323	332	359	338	RB+	24.0	0.564
	Mean	314	338	351	-	(RB x RB+)	41.5	0.496
Mean daily feed intake, g	0	10.9[a]	12.31[b]	12.27[b]	11.83	RB	1.048	0.047
	1	11.54	11.85	12.81	12.07	RB+	0.856	0.564
	Mean	11.22	12.08	12.54	-	(RB RB+)	1.483	0.496
Mean daily gain, g	0	2.96	2.88	2.85	2.9	RB	0.499	0.738
	1	3.24	2.96	3.07	3.09	RB+	0.407	0.324
	Mean	3.10	2.92	2.96	-	(RB x RB+)	0.706	0.913
FCR	0	3.73[a]	4.37[b]	4.43[b]	4.18	RB	0.517	0.039
	1	3.63	4.10	4.19	3.98	RB+	0.422	0.334
	Mean	3.68	4.23	4.31	-	(RB x RB+)	0.731	0.938
Feed cost, GH¢/100g	0	0.0720	0.0580	0.0470	0.0590	RB	-	-
	1	0.0723	0.0583	0.0473	0.0593	RB+	-	-
	Mean	0.0722	0.0582	0.0472	0.0592	(RB x RB+)	-	-
Cost/100g wt gain, GH¢	0	0.269[a]	0.253[a]	0.208[b]	0.243[a]	RB	0.029	<.001
	1	0.263	0.239	0.198	0.233	RB+	0.024	0.388
	Mean	0.266	0.246	0.203	-	(RB x RB+)	0.041	0.957

[a, b,] Means in the same row with different letters differ significantly (P<0.05) different, L.S.D.: least significant difference. RB+: Rice bran levels p x RB+): Rice bran – Xzyme™ interaction, P: P-value

Anukam et al. (2005) recorded increased feed intake when rats were given feed supplemented with a DFM containing lactobacillus strains. Trials in China have shown that multi-enzyme preparations containing amylase, pectinase, cellulase and protease have a beneficial effect on weight gain of weanling pigs (Deng et al., 1993). The addition of the Xzyme™ led to an improvement in FCR at every level of the rice bran (Table 2). There was also a decreasing trend in feed cost (¢/100g) as the level of rice bran increased. The decreasing trend observed as the rice bran levels were increased suggests that it was more economical to obtain a unit gain in live weight in rats using the diets with higher levels of rice bran plus the Xzyme™.

Carcass Characteristics

Table 3 presents a summary of the carcass characteristics of the rats fed the six different experimental diets. The values for the relative weights of the various organs studied were not significantly (P>0.05) different and the values followed no clear trend.

Okyere (1994), working on broiler chickens and using diets containing up to 40% wheat bran but with different type and levels of Optizyme™ observed a similar trend in viscera values. Interestingly these values (Table 3) though not significantly (P>0.05) different, showed a trend towards increases in liver weight as the RB level

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increased. Dietary fibre levels have been shown to affect the size and weight of the gastrointestinal tract as well as that of some internal organs in both pigs and rats (Pond et al., 1988; Anugwa et al. 1989; Hansen et al., 1992).

Table 3. Mean Relative Weights of Viscera, Liver, Spleen and Lungs of the Rats fed Xzyme™ -supplemented diets

Parameter	level	Level of Rice bran (%)				Factor	LSD	P
		20	40	60	Mean			
Relative weight (%)								
Viscera	0	24.47	22.69	22.59	23.25	RB	2.144	0.302
	1	22.85	21.74	24.67	23.09	RB_+	1.751	0.85
	Mean	23.66	22.22	23.63	-	(RB x RB_+)	3.042	0.185
Liver	0	5.8	5.3	4.96	5.36	RB	0.378	0.325
	1	4.99	5.19	5.27	5.15	RB_+	0.309	0.184
	Mean	5.4	5.25	5.12	-	(RB x RB_+)	0.535	0.018
Spleen	0	0.45	0.42	0.31	0.39	RB	0.091	0.178
	1	0.32	0.38	0.33	0.34	RB_+	0.074	0.182
	Mean	0.38	0.4	0.32	-	(RB x RB_+)	0.128	0.31
Lungs	0	0.77	0.87	0.7	0.78	RB	0.173	0.488
	1	0.89	0.75	0.77	0.81	RB_+	0.141	0.728
	Mean	0.83	0.81	0.74	-	(RB x RB_+)	0.244	0.339

L.S.D.: least significant difference. RB_+: Rice bran plus Xzyme™. (RB x RB_+): Rice bran – Xzyme™ interaction, P: P-value

CONCLUSIONS AND RECOMMENDATION

From the results of the experiment, it can be concluded that the various dietary treatments had no significant (P>0.05) effects on the growth performance and carcass characteristics of the albino rats. The rats fed the higher levels of rice bran plus Xzyme™ did equally well as those fed the diets without Xzyme™. Rats on the higher rice bran diets with Xzyme™ also did better in terms of growth though not significantly (P>0.05) different than those on the diets without the supplement. It is concluded that up to 60% rice bran diets with Xzyme™ can be fed to albino rats without any adverse effects on health, growth performance and carcass characteristics. From economic point of view, the same diet (60% rice bran diet with Xzyme™ at 250mg/kg inclusion rate) could be recommended since it costs the least to raise the rats on this treatment. It is however suggested that the inclusion rate for Xzyme™ should be increased in subsequent studies to see of higher levels of the enzyme complex will yield different results.

REFERENCES

Adeola O and Cowieson AJ (2011). Board invited review: Opportunities and challenges in using exogenous enzymes to improve non-ruminant animal production. Journal of Animal Science, 89: 3189–3218.

Anugwa FOI, Varel VH, Dickson JS and Pond WG (1989). Effects of dietary fibre and protein concentration on growth, feed efficiency, visceral organ weights and large intestine microbial populations of swine. Journal of Nutrition 119:879-886.

Anukam KC, Osazuma EO and Reid G (2005). Improved appetite of pregnant rats and increased birth weight of newborns following feeding with probiotics *Lactobacillus rhamnosus* GR-1 and *Lactobacillus fermentum* RC-14. J. Appl. Res., 5(1): 46-52.

Barrera M, Cervantes M, Sauer WC, Araiza AB, Torrentera N and Cervantes M (2004). Ileal amino acid digestibility and performance of growing swine fed wheat-based diets supplemented with xylanase. J. Anim Sci. 82:1997-2003

Boateng M, Okai DB, Salifu ARS and Ewool MB (2012). A comparative study of two normal maize and two Quality Protein Maize varieties – Effects on growth performance and carcass characteristics of albino rats. J. Anim. Sci. Adv., 2(9): 787-792.

Cadogan DJ, Choct M and Campbell R (2003). Effects of storage time and exogenous xylanase supplementation of new season wheats on the performance of young male swine. Can. J. Anim. Sci. 83:105-112.

Deng VL, Zhong JI, Qui ZH and Yuan JK (1993). Comparisons of two multi- enzyme preparations on the performance of early weaned piglets. Chin. J. Anim. Sci. 29: 8-10.

Emiola IA, Opapeju FO, Slominski BA and Nyachoti CM (2009). Growth performance and nutrient digestibility in swine fed wheat distillers dried grains with solubles-based diets supplemented with a multicarbohydrase enzyme. J. Anim Sci. 87:2315-2322

Farrell DJ (1994). Utilization of rice bran in diets for domestic fowl and ducklings. World Poult. Sci. J., 50: 115-131.

Genstat Release 9.2 (PC/windowsxp) (2007). Lawes Agricultural Trust (Rothamsted Experimental Station).

Hansen I, Bach Knudsen KE. and Eggum BO (1992). Gastrointestinal implications in the rat of wheat bran, oat bran and pea fibre. British Journal of Nutrition 68,451-462.

Kiarie E, Nyachoti CM, Slominski BA and Blank G (2007). Growth performance, gastrointestinal microbial activity, and nutrient digestibility in early-weaned swine fed diets containing flaxseed and carbohydrase enzyme. J. Anim. Sci. 85:2982-2993.

Morris ML, Tripp R and Dankyi AA (1999). Adoption and impacts of improved maize production technology. A Case Study of the Ghana Grains Development Project. Economics Program Paper 99-01. Mexico, D.F.: CIMMYT. pp 2.

Okyere ER (1994). The effects of feed enzyme Roxazyme G on performance of broiler chickens. BSc (Hons) Agric. Dissertation, U.S.T. pp 40-45.

Parvez S, Malik KA, Ah Kang S and Kim, H-Y (2006). Probiotics and their fermented food products are beneficial for health. Journal of Applied Microbiology, 100: 1171–1185.

Pond WG, Jung HG and Varel VH (1988). Effect of dietary fiber on young adult genetically lean, obese and contemporary pigs: body weight, carcass measurements, organ weights and digesta content. Journal of Animal Science 66,69-706.

Rosencrans WW, Erickson DO, Harald R and Dinnuson WE (1970). Potato pulp and wheat bran evaluated for swine. Nutr. Abst. And Revs. 40: 1802-1817.

Sarkar S (2011). Probiotics, prebiotics and synbiotics for infant feeding- A review. J Microbial Biochem Technol.Sl:004. http://dx.doi.org/10.4172/1948-5948.sl-004 (Accessed on 29/09/12).

Subramanian V, Metta VC (2000). Sorghum grain for poultry feed. In: Technical and Institution Options for Sorghum Grain Mold Management. Proc. International Consultation. Chandrasher A, Bandyopadhayi R and Hall AJ (eds.). International Crop Research for the Semi-Arid Tropics (ICRISAT). Patacher

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