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Performance of pullets fed on graded levels of rice offal supplemented with Roxazyme G® enzyme

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ABSTRACT

Objective: To evaluate the performance of growing pullets fed on rice offal based diets supplemented with Roxazyme G® enzyme.

Methodology and results: A seventy-day feeding trial was conducted. Eight iso-nitrogenous diets were formulated which contained rice offal at 0, 20, 40 and 60% levels without or with 150mg/kg enzyme supplementation. Two hundred and eighty-eight ten-week old Rhode Island Red pullets were divided into eight groups of thirty-six birds each and randomly assigned to the eight dietary treatments in a 2x4 factorial arrangement. Each treatment was replicated three times with twelve birds/replicate. Results showed that average feed intake significantly ($P<0.05$) increased as dietary inclusion of rice offal increased without and with enzyme supplementation. Body weight gain and feed conversion ratio significantly ($p<0.05$) decreased as the dietary rice offal increased without or with enzyme supplementation. However, the depression was significantly ($p<0.05$) less in the groups supplemented with enzyme. Increased dietary rice offal resulted in delay in laying time but this was reduced with enzyme supplementation. Dietary inclusion of rice offal without enzymes linearly reduced cost of feed and cost of production in terms of feed cost per unit weight gain. Although enzyme supplementation increased the cost per kilogram of formulated diet by 0.67%, it remarkably affected percent feed cost savings by 23.61 and 27.80 naira per kilogram for the 20, 40 and 60% rice offal diets.

Conclusion and application of findings: The results suggest that supplementation of diets containing rice offal at 60 % level with Roxazyme G® could improve the nutritive value of rice offal for pullet, reduce the rearing period and is also profitable as regards the feed cost per kg body weight gain, with a cost saving of 34.68%.

Key words: rice offal, enzyme supplementation, pullet performance

INTRODUCTION

The escalating cost of conventional feedstuffs for poultry has been a prime stimulant for the continuing search for alternative feedstuff to reduce cost of poultry production (Joseph *et al*., 2000; Emenalom, 2004; Esonu *et al*., 2004).

Rice offal is an agro-industrial by-product that could contribute to poultry feeding. It is available in large quantities all year round in many towns in the rice growing areas of Nigeria. These areas have over one hundred small-scale rice mills that are used to process parboiled rice into grains

and offal (Dafwang & Damang, 1995). The offal makes up about 40% of the parboiled rice and contains husk, bran polishing and small quantities of broken grains. The use of rice offal to replace cereals in poultry diets has been studied (Obeka, 1985; Dafwang & Damang, 1995; Carew *et al*., 2005).

High levels of inclusion of high fibre non-conventional feedstuff in poultry diets yielded negative responses because of increased fibre levels which reduce nutrient utilization and precipitate metabolic dysfunction with attendant growth depression when ingested by non-ruminants (Aletor, 1999; Onyimonyi, 2005). In order to enhance utilization of these high fibre non-conventional feedstuffs, nutritionists have resorted to using exogenous enzymes for poultry. Acamovic (2001) reported that enzymes increase the digestibility of feed ingredients and reduce the incidence of wet droppings which may result from the presence of fibrous polysaccharides in the diets. Nevertheless, the use of rice offal with Roxazyme G®, an exogenous glucanase is envisaged to enhance the breakdown of non-starchy polysaccharides and utilization and thus increase the potential use of rice offal in poultry diets.

Roxazyme G® is an enzyme complex derived from *Trichoderma viride* with glucanase and xylanase activity that has been developed to complement the digestive enzyme of poultry (Broz & Frigg, 1990; McNab & Smithland, 1992) so that polysaccharides in cereal offal can be broken down into simpler molecules which can be digested and utilized. This study evaluated the effects of Roxazyme G® supplementation on the utilization of rice offal-based diets by growing pullets.

MATERIALS AND METHODS

Experiment layout: Two hundred and eighty-eight day-old Rhode Ireland Red pullet chicks were purchased from the National Animal Production Research Institute (NAPRI), Shika Zaria, Nigeria and raised for the study at the Teaching and Research Farm of the University of Agriculture, Makurdi, Nigeria. At 10 weeks of age, they were assigned to eight dietary treatment groups with thirty six (36) pullets each in a 2x4 factorial arrangement. The treatments consisted of two levels of Roxazyme G® enzyme (0 or 150mg/kg) incorporated into four dietary levels of rice offal (0, 200, 400 and 600g/kg). Each treatment was further divided into three replicates of twelve (12) birds each and kept in compartments measuring 3m x 2.4m. Roxazyme G®, the exogenous cellulolytic enzyme, was procured from a feed store in Lagos at a cost of N1200/kg and used directly. All experimental diets were iso-nitrogenous (Table 1). Experimental diets and water were provided *ad-libitum*, and routine vaccination/ medication program was administered throughout the ten week experimental period.

Data recorded: Prior to commencement of the experiment, the birds were weighed initially on a replicate basis and thereafter they were weighed on a weekly basis. Feed intake was measured weekly. Data obtained for feed intake and live weights were used to calculate weight gains and feed: gain ratio. Other parameters determined included age at first egg lay and mortality rate. Cost of feed per kilogramme, cost of feed consumed per bird for the period and cost of feed per kilogramme gain were compared based on the market cost of the feed ingredients at the time of the experiment.

Data analyses: Data collected were subjected to analysis of variance and mean separation using the model for factorial design. Where significant differences ($p<0.05$) were observed, means were subjected to least significant difference (LSD) procedure (Steel & Torrie, 1980).

RESULTS AND DISCUSSION

The calculated nutrient composition of experimental diets (Table 1) shows that the crude fibre values of the diets increased as the dietary inclusion of rice offal level increased. The energy values progressively decreased with increase in the level of rice offal in the diets.

There were significant ($p<0.05$) interactions between the dietary levels of rice offal and enzyme supplementation on final body weight, feed intake, weight gain, feed conversion efficiency and mortality (Table 2). Increasing dietary rice offal levels caused a significant ($p<0.05$) increase in the feed intake of the birds. However, there was a significant ($p<0.05$)

reduction in the rate of increase in feed intake of the birds fed the enzyme supplemented diets compared to the unsupplemented groups.

The increased feed intake of birds on the diets containing rice offal levels is within expectation. Rice offal contains high fibre, which tends to increase the total fibre content of the diet, decrease energy density and dilute other nutrients. Birds therefore would have to eat more to meet their energy requirements to sustain growth and development, hence the increased feed intake. This result agrees with earlier reports of Anyachie and Madubuike (2004), Esonu *et al.* (2004), and Alawa *et al.* (1990) indicating that the enhanced feed intake at higher fibre levels was to compensate for the reduced energy density of such diets. Aduku (1993) also opined that dietary fibre has a laxative effect and therefore it increases the rate of gastric evacuation in the birds. High rates of gastric evacuation are usually compensated for by increased feed intake.

TABLE 1: Nutrient composition analyses comprising of experimental diets fed to pullets.

	DIETARY LEVEL OF RICE OFFAL (%)							
	No Enzyme Supplementation (mg/kg)				Enzyme Supplementation (150mg/kg)			
Ingredients	0	20	40	60	0	20	40	60
Maize	70.08	48.02	17.95	3.89	70.08	48.02	17.95	3.89
Rice Offal	0.00	20.00	40.00	60.00	0.00	20.00	40.00	60.00
Groundnut cake	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Full fat soybean meal	19.82	21.88	23.95	26.01	19.82	21.88	23.95	26.01
Bone meal	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Lime stone	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Salt	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Vit/Min premix*	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Roxazyme**	-	-	-	-	+	+	+	+
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Calculated Analysis								
Crude protein, %	15.82	15.82	15.82	15.82	15.82	15.82	15.82	15.82
Crude fibre, %	3.07	10.09	16.89	24.28	3.07	10.09	16.89	24.28
Lysine, %	0.75	0.84	0.91	1.02	0.75	0.84	0.91	1.02
Meth + cyst, %	0.53	0.53	0.50	0.52	0.53	0.53	0.50	0.52
Ca, %	1.71	1.74	1.75	1.76	1.71	1.74	1.75	1.76
P, (total)%	0.85	0.90	0.92	0.99	0.85	0.90	0.92	0.99
M.E. (Kcal/kg)	3186	2760	2060	1909	3186	2760	2060	1909
Feed cost, ₦/kg***	41.60	33.28	24.96	16.65	41.78	33.46	25.14	16.83

* To provide the following per kg of diet: Vit. A 1200 iu; vit D_3 2640 iu; vit. E 121 iu; vit. K2. 4mg; vit. B_1., 0.6mg; vit. B_2, 5. 4mg; vit B6, 3.6mg; Nicotinic acid, 26.4mg; calcium pantothenate, 9.6mg; vit: B_{12}, 14.4mg; choline chloride, 2.4mg; manganese, 120mg; iron, 60mg, zinc, 54mg; copper, 2.4mg, Iodine, 1.86mg, cobalt, 0.27mg; selenium 0.12mg. ** Roxazyme GR Enzyme complex (from *Trichoderma viridae*), (product of Roche (Nig) Ltd.) added at 150mg/kg test diets. *** Cost of feed ingredients at June, 2007.

The final live weight and body weight gains of birds reduced with increasing inclusion of rice offal, though there were better weight gains with enzyme supplement ($p<0.05$) at same rice offal levels. The marked decrease in weight gain with increase in the level of rice offal in the diet without enzyme supplementation could be attributed to the high content of fibre that may have led to dilution of the energy concentration of the diets, reduced digestibility and nutrient utilization. The observed improvement in the weight gains of the enzyme supplemented group may be explained by the fact that exogenous enzymes supplement the digestive enzymes of monogastric animals by aiding the breakdown of non-starchy polysaccharides, protein and antinutritional factors thereby increasing their nutritional value (Broz & Frigg, 1990; Broz *et al*., 1994; Apata & Ojo, 2000; Chot, 2006).

Dietary levels of rice offal and enzyme supplementation also affected feed conversion ratio. Diets with 60% rice offal without enzyme

supplementation had the poorest feed conversion ratio while those fed 20% rice offal had similar utilization to those fed on the control diets. The birds given the enzyme–supplemented diets improved their feed conversion by 4.8% compared to those in groups without supplement. These observations are in line with those of Broz and Volker (1990), Apata and Ojo (2000), Ohwota (2001) and Nnenna *et al.* (2006).

TABLE 2: Effects of supplementing rice offal diets with Roxazyme G enzyme on performance of pullets.

Interaction (Enzyme x Ro)	Initial Weight (g)	Final Weight (g)	Weight gain (g)	Feed Intake (g)	FCR	Age @ First egg (days)	Mortality (%)
0 : 0	743.33	1570.30^{a}	826.97^{a}	5990^{f}	7.24^{a}	152	0.00^{a}
0: 20	744.33	1533.30^{d}	788.97^{d}	5630^{e}	7.29^{b}	149	1.19^{b}
0 : 40	744.00	1435.00^{f}	691.00^{f}	6540^{c}	9.47^{d}	156	2.78^{c}
0 : 60	744.33	1289.00^{h}	544.67^{h}	6910^{a}	12.67^{f}	167	5.85^{e}
150 : 0	744.00	1546.00^{b}	802.00^{b}	5950^{f}	7.42^{b}	151	0.00^{a}
150 : 20	744.00	1536.70^{c}	792.70^{c}	5650^{e}	7.08^{a}	147	0.00^{a}
150 : 40	743.33	1444.70^{e}	701.37^{e}	6100^{d}	8.71^{c}	151	2.69^{c}
150:60	744.33	1310.00^{g}	565.67^{g}	6610^{b}	11.69^{e}	159	4.87^{d}
Effect	NS	**	**	*	*	NS	*
SED	2.21	20.21	17.32	0.02	0.05	2.99	0.03

$^{abcdefg;}$ Means followed by different superscripts within columns are significantly different at * ($p<0.05$) or ** ($p<0.01$), RO. = Rice Offal.

FCR: Feed Conversion ratio, SED: Standard error of difference

The age at first egg lay was not significantly ($p>0.05$) influenced by dietary treatments. However, birds fed on 60% rice offal diet with enzyme supplementation reached age at first egg lay 8 days earlier compared to those on the same rice offal level but without enzyme supplementation. The delay in attaining first lay could be attributed to the decreased nutrient digestibility and utilization as the rice offal level increased in the diets. Worthy of note is the fact that the onset of egg formation and lay may be related to the adequacy of nutrient accumulation in the body of the birds.

Birds fed on lower level of rice offal tended to lay early because their diets were more digestible and thus released more nutrients for maintenance, growth and reproduction. The effect of enzyme inclusion is often related to enhanced digestibility of high fibre diets and thus this effect is seen in early egg deposition at all levels of rice offal inclusion in the diets. Our finding is in line with the report of Ajala *et al*. (2003) that high fibre content of diets decreased nutrient utilization and precipitates metabolic dysfunction associated with weight reduction in monogastric animal. Furthermore, An (1994) reported that when birds are starved or when energy levels drop below body requirements, birds tend to mobilize body energy reserves for maintenance. Oldalle and Hoffman (1996) observed that diets supplemented with enzymes had their metabolized energy increased by 10%.

Enzyme supplementation had considerable reduction on mortality rate of pullets with increase dietary rice offal inclusion. The feed cost analysis (Table 3) showed that as dietary level of rice offal increased, feed cost per kilogramme of diet linearly decreased, invariably reflecting in the cost/kg weight gain. However, the cost of enzyme increased the cost per kilogram of diets containing it. Nonetheless, supplementing the diets with 150mg of Roxazyme G per kilogramme of diet resulted in cheaper cost/kilogramme weight gain compared to the unsupplemented groups. This outcome favours inclusion of the enzyme, since the desire of every investor is to maximize profit and productivity at the least cost.

The use of rice offal in pullet diets has shown that high levels (60%) of inclusion increased feed intake, decreased weight gain and decreased feed conversion efficiency. However, Roxazyme G supplementation at 150mg/kg feed in pullet diet effectively reduced the age at first egg lay and had a better feed cost/kg weight gain saving. Hence, Roxazyme has practical advantages and is strongly recommended for use in high rice offal diets.

TABLE 3: Economic analyses of feeding pullets on experimental diets supplemented with Roxazyme G enzyme.

Interaction (Enzyme x R.O.)	Cost of Feed (₦/kg)	Cost of Feed intake (₦/Kg)	Feed cost/kg weight gain (₦)	Feed cost saving (₦)	Feed cost savings (%)
0 : 0	41.60	249.18	301.18	-	-
0 : 20	33.28	187.37	242.61	-58.57	-19.45
0: 40	24.96	163.24	236.37	-64.81	-21.52
0 : 60	16.65	115.05	211.29	-89.89	-29.85
150 : 0	41.78	248.59	310.01	+8.83	+2.93
150 : 20	33.46	189.05	236.70	-64.49	-21.41
150 : 40	25.14	153.35	218.97	-82.21	-27.30
150 : 60	16.83	111.25	196.74	-104.44	-A34.68
Effect	-	-	-	-	-
SED	-	-	-	-	-

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