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Effect of Supplementation of Fiber Degrading Enzymes on Performance of Broiler Chickens Fed Diets Containing De-Oiled Rice Bran

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ABSTRACT

The aim of this trial was to examine the possibilities of effective utilization of de-oiled rice bran by supplementing xylanase enzyme in broiler ration and thereby the performance of broiler chickens. One hundred and sixty unsexed day-old broiler chicks (vencobb) belonging to a single hatch, were purchased from a commercial hatchery, wing banded, weighed and randomly allotted into five experimental groups, comprising two replicates of sixteen chicks each. The experimental diets were T_c-Control (3% CF without xylanase), T_1-3% CF with xylanase, T_2-3.5% CF with xylanase, T_3-4% CF with xylanase and T_4-4.5% CF with xylanase. Xylanase supplemented at the rate of 10 g/100 kg feed. De-oiled rice bran was used as a source of crude fibre. Body weight gain and feed consumption was significantly ($p<0.05$) higher in treatment group, when compared to control group. Mortality rate was significantly ($p<0.05$) lower in enzyme supplemented high fiber group, when compared to control group. There was no significant ($p>0.05$) variation among the treatment and control group in terms of Feed Conversion Ratio (FCR), Protein Efficiency Ratio (PER), Dressing percentage, Eviscerated weight and Abdominal fat pad (percentage). However, breast muscle, thigh muscle and giblet weight (percentage) was significantly ($p<0.05$) higher in enzyme supplemented high fiber diet fed group, when compared to control group. Among the treatment groups, net profit Rs/kg body weight gain was highest in T4 (4.5% CF with xylanase) group. It was concluded that maintaining the maximum fiber level along with incorporation of xylanase as fiber degradable enzyme in feed may have better cost benefit ratio than that of low fiber diet without xylanase.

Key words: Broiler, xylanase, fiber, de-oiled rice bran, performance, cost benefit ratio

INTRODUCTION

One of the most effective ways for a profitable poultry industry is to reduce the input cost. Feed is the major input in poultry production constituting 70-75% of total cost of broiler production. There is a high demand of conventional feed ingredients for human consumption creating a competition between human and poultry for the same ingredients. The production levels of conventional feed ingredients are not proportionate enough to meet this high demand of poultry feed. The exorbitant cost of conventional feed ingredients necessitates formulating cost effective feed for broilers. Utilization of cheaper unconventional or certain locally available feed ingredients

in place of conventional one has been widely advocated and practiced to mitigate this problem. However, the use of unconventional feedstuff for efficient poultry production is limited due to presence of undigestible components like fibre otherwise called as Non Starch Polysaccharides (NSP) (Adebiyi *et al*., 2010). The soluble non starch polysaccharide has an anti nutritive effect in poultry by modifying intestinal viscosity and intestinal transit time. This results in reduction of diffusion and assimilation rates of various nutrients. Poultry being monogastric, lack the ability to produce the enzymes (cellulase, hemi-cellulase and beta-glucanase etc.) which are necessary to digest beta type of linkages in non starch polysaccharides which is rich in cell wall of plant materials (Vooren, 2012). Supplementation of enzymes has been increasingly investigated and applied during the past decade as a means of enhancing production efficiency and increasing the effectiveness of nutrient utilization. Enzyme supplementation counteracts anti nutritional effects of NSP, reduces the intestinal viscosity and the nutrient encapsulating effect of cell wall which in turn could result in increase in protein, starch and energy utilization (Slominski, 2011). The present study was conducted to investigate effect of xylanase enzyme on the effective utilization of crude fibre content of de-oiled rice bran in broiler rations.

MATERIALS AND METHODS

One hundred and sixty unsexed day-old broiler chicks (vencobb) were randomly selected and distributed into five experimental groups, comprising two replicates of sixteen chicks each. They are, T_c control (3% CF without xylanase), T_1 (3% CF with xylanase), T_2 (3.5% CF with xylanase), T_3 (4% CF with xylanase) and T_4 (4.5% CF with xylanase). Xylanase supplemented at the rate of 10 g/100 kg feed. The experimental diets were formulated to meet or exceed BIS (1992) recommendations for all the nutrients (Table 1). Crude fiber content in broiler feed was raised to the respective level by incorporating De-Oiled Rice Bran (DORB). The corresponding energy and protein levels for the five experimental starter diets (T_c, T_1, T_2, T_3 and T_4) were 2921, 2921, 2893, 2872 and 2855 kcal kg^{-1} and 21.58, 21.58, 21.59, 21.62 and 21.50%, respectively. Similarly, the

Table 1: Percent ingredient composition of experimental diets

	Starter					Finisher				
Ingredients	T_c	T_1	T_2	T_3	T_4	T_c	T_1	T_2	T_3	T_4
Maize	59.50	59.50	56.50	52.00	47.80	59.30	59.30	56.60	53.00	49.50
DORB	1.20	1.20	4.50	9.00	13.50	1.00	1.00	4.90	8.80	13.00
Soybean meal	35.00	35.00	34.50	34.00	33.00	34.00	34.00	32.60	32.00	30.80
Oil	1.00	1.00	1.20	1.80	2.40	2.50	2.50	2.70	3.00	3.50
Calcite	1.00	1.00	1.00	1.00	1.00	0.90	0.90	0.90	0.90	0.90
DCP	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
Methionine	0.19	0.19	0.19	0.17	0.20	0.17	0.17	0.17	0.17	0.17
Lysine	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
Soda Bicarbonate	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Salt	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
TM Mix*	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Premix**	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20

TM Mix* contained Fe SO_4, Cu SO_4, Zn SO_4, Mn SO_4, potassium iodide, sodium selenite and DCP as base, Premix** contained necessary vitamins, choline chloride, anticoccidial agents, emulsifiers and acidifiers, DORB: De-oiled rice bran

levels of energy and protein in finisher diets (T_c, T_1, T_2, T_3 and T_4) were 3018, 3018, 2991, 2962 and 2946 kcal kg^{-1} and 19.91, 19.91, 19.70, 19.77 and 19.63%, respectively. All the rations were formulated to be is calorific and is nitrogenous. The enzyme tested was a commercial enzyme premix (Lumifeed xylanase) having the enzyme activity of 70,000 IU g^{-1}.

Weekly body weight of individual birds, replicate wise feed intake and livability were recorded. Feed conversion ratio was calculated on cumulative basis for each replicate. At the end of experiment, one bird from each replicate was randomly selected and slaughtered to study the carcass traits. The Protein Efficiency Ratio (PER) was calculated as the ratio of weight gain to total protein consumed. Experimental diets and DORB were estimated for the proximate principles as per the methods of AOAC (1990). Economic efficiency of live weight gain of broiler chicks was calculated based on the actual cost of individual feed ingredients during study period.

Statistical analysis: Data was analysed by using SPSS™ VERSION (10.0). The Duncan range test was used to determine difference among treatment means for significant dietary effect (Snedecor and Cochran, 2004) with $p<0.05$ considered statistically significant unless otherwise noted.

RESULTS AND DISCUSSION

Body weight gain of broilers fed with treatment diet was greater than that of birds fed with the control diet. The improvement in the body weight due to enzyme supplementation might be attributed to degradation of fiber content of DORB. Raza *et al.* (2009) reported that addition of Grindazyme enzyme to diet containing 10% sunflower and 6% crude fibre significantly improved the body weight in broilers when compared to that of control group fed with same diet without enzyme. Feed intake was significantly ($p<0.05$) higher in treatment group compare to that of control group. Among the treatment groups highest feed consumption was recorded in T_4 followed by T_2, T_3 and T_1. This increased feed consumption in treatment groups can be justified as high crude fibre in the diet limits energy access and also the NSPs in the fibre contacts with water forms a gel that reduces passage time and absorption of nutrients and thus, increases feed consumption to compensate and meet nutritional demands (Tabeidian *et al.*, 2011). Enzyme supplementation had no significant influence ($p>0.05$) on feed efficiency during the overall growth phase. Similarly, Jawale *et al.* (2006) reported that supplementation of enzymes did not have any significant influence over FCR of broilers. Though there was no significant ($p>0.05$) difference was noted in FCR among the various treatment groups some numerical improvement was recorded in T_1 group. Maximum mortality was observed in control group when compared to that of enzyme treated groups. Among the treatment groups highest mortality was observed in T_4. Use of high levels of fiber diets increased the incidence of sticky droppings in broilers (Pettersson, 1987) might be the reason for high mortality. There was no significant ($p>0.05$) difference in PER between the control and enzyme treated groups. However, some numerical improvement was recorded at high fiber diet fed birds which was comparable to that of control diet fed birds. Similar to FCR, the reason for improved PER could be due to enhanced bioavailability of nutrients in the enzyme supplemented group. The data on effect of enzyme supplementation on overall performance of broilers was presented in Table 2.

With regard to slaughter characteristics, dressing percentage was higher in groups fed on enzymatic diet than the control. This finding is supported by Khan *et al.* (2006) and Medhi *et al.* (2003) found that enzyme supplementation to fibrous diet improved the growth rate and thereby

Table 2: Effect of experimental diets on performance parameters of broilers at 6 weeks of age

	Experimental diets				
Parameters	T_C	T_1	T_2	T_3	T_4
Body weight (g/bird)	1621.50±0.027[a]	1689.14±0.054[b]	1670.81±0.074[c]	1669.19±0.014[d]	1665.11±0.025[e]
Feed intake (g/bird)	3064.63±0.516[a]	3141.80±0.254[a]	3163.16±0.226[c]	3161.38±0.258[d]	3171.40±0.577[e]
FCR	1.89±0.012	1.86±0.778	1.89±0.054	1.89±0.457	1.90±0.024
Mortality rate (%)	12.50±0.014[a]	3.13±0.025[b]	3.13±0.098[b]	3.13±0.077[b]	6.25±0.057[c]
PER	2.57±0.236	2.62±0.264	2.60±0.275	2.59±0.259	2.58±0.263

[a-d] Values within columns with no common superscripts are significantly different ($p<0.05$)

Table 3: Carcass characteristics of broilers fed on experimental diets

	Experimental diets				
Parameters	T_C	T_1	T_2	T_3	T_4
Dressed wt. (%)	76.43±0.258	77.14±0.358	77.03±0.454	77.10±0.516	76.91±0.635
Bleeding (%)	3.46±0.045[a]	3.59±0.044[b]	3.51±0.056[d]	3.40±0.036[ac]	3.48±0.074[ad]
Eviscerated wt. (%)	68.27±0.775	69.24±0.259	69.27±0.253	69.01±0.248	68.89±0.253
Abdominal					
Fat pad (%)	1.54±0.015[a]	1.50±0.054[a]	1.45±0.067[b]	1.48±0.088[ab]	1.53±0.058[a]
Breast muscle (%)	15.62±0.014[a]	16.20±0.065[ab]	16.10±0.086[ab]	15.96±0.084[b]	15.94±0.058[ab]
Thigh muscle (%)	9.44±0.031[a]	9.98±0.025[b]	9.86±0.045[c]	9.81±0.016[c]	9.60±0.874[d]
Giblet wt. (%)	5.62±0.022[a]	5.87±0.352[b]	5.84±0.346[bc]	5.71±0.247[cd]	5.64±0.258[da]

[a-d] Values within columns with no common superscripts are significantly different ($p<0.05$)

Table 4: Cost benefit analysis of broiler production

	Experimental diets				
Parameters	T_C	T_1	T_2	T_3	T_4
Cost of feed consumed including enzyme (Rs/bird)	48.68[a]	49.75[b]	49.20[c]	48.74[acd]	48.61[ad]
Fixed cost* (Rs)	35	35	35	35	35
Total cost (Rs)	83.68[a]	84.75[b]	85.04[c]	83.75[acd]	83.61[ad]
Final body weight (kg)	1.62±0.041[a]	1.67±0.245[b]	1.67±0.041[b]	1.67±0.252[b]	1.67±0.014[b]
Return on sale at Rs 70 per kg	113.4±0.266[a]	118.3±0.263[b]	116.9±0.519[b]	116.9±0.526[b]	116.9±1.07[b]
Net profit per bird (Rs)	29.72±0.492[a]	33.55±0.517[b]	31.86±0.560[c]	33.15±0.253[bc]	33.29±0.517[bc]
Net profit (Rs/kg) BW	18.34±0.256[a]	19.85±0.287[b]	19.07±0.574[ab]	19.85±0.256[b]	19.93±0.111[b]

[a-d]Values within columns with no common superscripts are significantly different ($p<0.05$), Fixed cost*: Cost of chick+transportation cost+medicine and vaccination cost+labour charges

increased the dressing percentage. Similarly Rahman *et al*. (2005) showed that broiler fed on parboiled rice polish based diet supplemented with multi enzyme improved the dressing percentage. No significant ($p>0.05$) difference was noticed in breast muscle yield and abdominal fat pad percentage in all treatment groups compared to that of control group. Whereas, thigh muscle percentage and giblet weight were significantly higher ($p<0.05$) in treatment groups than that of control group (Tc). Similarly Wu and Ravindran (2004) found that enzyme supplementation had no effect on abdominal fat pad in broilers. The data on carcass yield of different dietary treatment groups are shown in Table 3.

Margin of profit was calculated with the help of cost benefit analysis. The economics of feeding higher fibre rations supplemented with xylanase enzymes are presented in Table 4. The results

revealed that per bird total return on sale for T_c, T_1, T_2, T_3 and T_4 was Rs. 113.4, 118.3, 116.9, 116.9 and 116.9 at total expenditure of Rs. 83.68, 84.75, 85.04, 83.75 and 83.61, respectively. Net expenditure was varied slightly among experimental groups. This variation occurred mainly due to variation in feed intake, variation in feed cost (per kg) and variation in mortality in different groups. Among the treatment groups, net profit (Rs/kg body weight gain) was highest on T_4 (Rs. 19.93) followed by those of T_3 (Rs. 19.85), T_1 (Rs. 19.85), T_2 (Rs. 19.07) and T_c (18.34). Enzyme supplementation to high fiber diet (T_4) saved 1.59 paise per kg live weight production of broilers. It was concluded that supplementation of xylanase in high fiber diet may have better cost benefit ratio than that of low fiber diet without xylanase. The result obtained in the current experiment are in agreement with the findings of Srivastava *et al*. (2005) and Jawale *et al*. (2006) reported reduced feed cost for improved feed utilization and faster growth rate of broilers fed with enzyme supplemented high fiber diet. Similarly Oladunjoye and Ojebiyi (2010) found that supplementation of Roxazyme G2G enzyme to the rice bran diet at 20% inclusion level reduced the feed cost per kg live weight gain.

CONCLUSION

It was concluded that maintaining the maximum fibre level of Bureau of Indian Standards along with incorporation of xylanase as fibre degradable enzyme in broiler feed resulted in positive effect on growth performance of broilers and better cost benefit ratio when compared to that of low fibre diet without xylanase.

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