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Supplementation of Protease and Xylanase Enzymes in Broiler Diet with Varying Energy and Protein Levels

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A B S T R A C T

An experiment was conducted on three hundred broiler chicks divided into five groups of three replications each and reared upto six weeks of age on deep litter system. The control group (T_1) was fed on corn soya based diet. Whereas T_2, T_3, with five percent reduction of energy and protein level than that of standard diet with supplementation of protease and xylanase enzymes, each at the rate of 100 g/ton of feed in T_2 and 200 g/ton of feed in T_3, however T_4, T_5 were fed on ten percent reduction of energy and protein level than that of standard diet with supplementation of protease and xylanase enzymes, each at the rate of 100 g/ton of feed in T_4 and 200 g/ton of feed in T_5. The body weights gain were significantly ($P<0.01$) higher on supplementation of protease and xylanase each @ 200 g/ton feed with reduced energy and protein levels by 5 percent in the diet than that of control. The feed consumption and FCR did not vary significantly amongst the groups. The DM and CP metabolizability was significantly better on supplementation on enzyme even on reduction in energy and protein in the diet either at 5 or 10 percent. The dressing percentage was more when enzymes were supplemented in 5 percent energy, protein deficient diet. The intestinal length was also reduced significantly due to enzyme supplementation on energy protein deficient. The *E coli* count was significantly ($P<0.01$) higher in control group and were lower in energy protein deficient diet with enzyme supplementation. Significantly lower serum total protein, albumin and globulin were observed due to reduction in energy and protein in the diet even after supplementation of enzymes xylanase and protease. The highest net profit per kg was obtained in T_3 group. It was concluded that the supplementation of protease and xylanase @ 200g/ton each with reduction in energy and protein levels by 5 percent in broiler diet could be economical.

Introduction

Ensuring feed availability at affordable prices which remain the key concern for the poultry industry with more than 70% of production costs being in the form of feed. Maize and soy meal forms the major proportion of poultry feed, maize contributing 55-65% and out of the total feed volume soy meal forming 30-35%. Hence, the industry has been experimenting with varying feed mixes by using alternative ingredients like jowar, bajra, rice bran, and rape seed etc. The industry also uses feed additives such as vitamin pre-mixes, amino acids and enzymes which are largely procured from indigenous sources. Feedstuffs are consistently increasing in their cost and the trend that has exacerbated in recent years. Parallelly increased public concern regarding the environment impact of animal and

agriculture has increased the need to reduce nutrient in waste by food animals. Research on the use of exogenous enzymes is going on and many commercial enzymes are presently available to the poultry industry.

The supplementation of NSP degrading enzymes like xylanase break down the NSP's, decreases intestinal viscosity and eventually improve the digestibility of nutrients by improving gut performance and may also remove the anti-nutritive effects of NSPs and release some nutrients (starch, protein) from these elements. Numerous studies have reported the beneficial impact of exogenous enzymes on chick performance and nutrient digestibility (Hajati, 2010). Hong *et al.*, (2002) found that the use of an enzyme cocktail that has xylanase and protease activities improved the digestibility of a corn–soya- based diet for ducks. The positive effects of the enzymes are suggested to be due to enhancement of nutrient digestibility in young chicks as well as digestion of soluble and insoluble NSP in corn and SBM. Hence considering the two different experiments on protease and xylanase individually in the Department, the present study was undertaken to utilize xylanase and protease in broilers.

Materials and Methods

Three hundred commercial, unsexed, straight run, day old Vencobb broiler chicks were divided into five groups of three replications each and reared upto six weeks of age on deep litter system. The birds were vaccinated against Marek's disease, New Castle Disease and Infectious Bursal Disease on 0^{th}, 7^{th} and 21^{st} day, respectively. The T_1 group was fed on corn soya based diet as per BIS (2007). The T_2 was fed on diet with 5 percent reduction of energy and protein than that of standard diet with supplementation of protease and xylanase enzymes, each at the rate of 100g/ton of feed. (1 gm of protease equals 6,00,000 IU; 1 gm of xylanase equals 1,60,000 IU), whereas T_3 having each enzyme @ 200 g/ton of feed. The T_4 fed on diet with 10 percent reduction of energy and protein than that of standard diet with supplementation of protease and xylanase enzymes, each at the rate of 100g/ton of feed. (1 gm of protease equals 6,00,000 IU; 1 gm of xylanase equals 1,60,000 IU), and T_5 with 10 percent reduction in energy, protein and supplementation of xylanase and protease each @ 200 g/ton of feed. The feed ingredients were analyzed in the laboratory as per AOAC (1995) and ration was formulated accordingly (Table 1). The body weight of each bird was recorded weekly. The blood samples were collected at the end of experiment and were analyzed for total serum protein, albumin and globulin (Doumas, 1978). The intestinal content (jejunum) was collected aseptically from sacrificed birds. The digested content were emptied in sterile bag and kept in ice until time of analysis. One gram of sample was diluted upto 1:9 sequentially and 0.1 ml of each sample was plated in duplicates by using EMB agar (Himedia Lab. India). The plates were then incubated at 37^{o}C for 48 hrs. *E coli* count per gram was adjudged for *E. coli* and results expressed as log10 colony forming unit per gram of intestinal content (log CFU/g). The carcass traits were studied at the end of experiments for dressing percentage, edible meat percentage, abdominal fat pad and intestinal length. The metabolic trial was conducted at the end of experiment for metabolizability of crude protein, ether extract, crude fibre and dry matter. The data collected during the experiment were analyzed statistically as per Snedecor and Cochran (1994).

Results and Discussion

The body weights gain were significantly ($P<0.01$) higher on supplementation of

protease and xylanase each @ 200 g/ton feed with reduced energy and protein levels by 5 percent in the diet than that of control. Further the body weights gain were significantly lower on 10 percent reduction in energy and protein either at 100 or 200 g/ton of protease and xylanase supplementation. The findings of the present study are in accordance with the findings of Panda *et al.,* (2012) where they observed that supplementation of enzymes at the lowest concentration to the low energy diet resulted in improved weight gain at 3 and 6 weeks of age in broiler chickens. Nian *et al.,* (2011) recorded the improvement in growth performance of broiler chickens irrespective of dietary grain source, as expected in light that xylanase supplementation could hydrolyse polysaccharides which are involved in encapsulation of starch or protein in cereal grains, reducing the barriers to nutrient digestion and utilization. The feed consumption did not vary significantly, however comparatively feed consumption was more on 5 percent reduction in energy and protein with enzyme supplementation than that of control (Table 2).

The feed consumption on 10 percent reduction of energy, protein was lower than the control group. The findings are consistent with Suresh *et al.,* (2010) who revealed non-significant difference in feed consumption among different groups in case of broiler chickens. The comparatively more feed intake on enzyme supplementation are supported by Alam *et al.,* (2003) who reported increased feed intake on diet with exogenous enzymes for broilers. Since use of enzyme, decreases mean retention time of digesta in the gizzard and large intestine and increases gut motility. Digesta viscosity and microbial fermentation decrease nutrient digestibility and the rate of absorption are increased so that more feed can be consumed. The feed conversion ratio was unaltered due to low energy, protein diet and also enzyme supplementation. The findings corroborates with Nian *et al.,* (2011) who observed that xylanase supplementation resulted in a numerical improvement of FCR in broiler chicken. The dry matter and crude protein metabolizability was significantly better on supplementation on enzyme even on reduction in energy and protein in the diet either at 5 or 10 percent. The results are in accordance with Zanella *et al.,* (1999), who reported that supplementation of broiler diet with exogenous enzyme improved starch digestibility and consequently DM and CP digestibilities. They explained that the solubilization and disruption of grains endosperm cell walls by enzyme supplementation was primarily responsible for the improvement in digestibility. He also observed that enzyme supplementation improved overall CP digestibility by 2.9 % in broiler chickens. Dourado *et al.,* (2009) reported that all the enzymes improved ($p<0.05$) dry matter metabolizability coefficient, indicating better nutrient utilization by the broiler birds. Viveros *et al.,* (1993) reported that the improvement in digestibility by using an enzyme might get a little better, as without the enzyme, indigestible fibre promotes the growth of 'harmful' bacteria but with the enzyme, the fibre is broken down and promotes the growth of 'useful' bacteria.

The crude fibre metabolizability was improved significantly on supplementation of enzyme than that of control and even on reduction in energy and protein in diet. However the metabolizability was even better on 10 percent reduction in energy and protein as compared to 5 percent reduction. Cowieson (2005) suggested that although viscosity per se is unlikely to be a major problem, the use of xylanase may have beneficial effects in corn soybean diets for poultry, perhaps by an improvement in nutrient digestibility coefficients.

Table.1 Composition of treatment diet

Ingredients	Pre starter	Starter			Finisher		
		T_1	T_2, T_3	T_4, T_5	T_1	T_2, T_3	T_4, T_5
Maize	55.00	56.50	63.00	55.50	61.00	67.00	62.00
Soya DOC	39.80	37.20	33.70	29.50	31.80	28.80	24.00
DORB	-	-	-	11.60	-	-	10.60
Oil	2.00	3.00	-	-	3.80	0.80	-
DCP	1.30	1.30	1.30	1.30	1.30	1.30	1.30
LSP	1.30	1.30	1.30	1.40	1.40	1.40	1.40
Salt	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Lysine	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Vit, Min Mix	0.20	0.20	0.20	0.20	0.20	0.20	0.20

Table.2 Performance of broilers

Parameters	Treatments					SEM
	T_1	T_2	T_3	T_4	T_5	
Avg. wkly BW gain*, g	157.94^{c}	160.70^{c}	166.49^{d}	143.91^{a}	149.09^{b}	11.26
Avg. wkly feed cons., g	280.84	282.23	289.38	264.86	270.41	12.72
FCR	1.74	1.72	1.70	1.80	1.77	0.04
DM metabolizability**, %	78.94^{a}	79.69^{b}	79.69^{b}	79.85^{b}	80.18^{b}	0.11
CP metabolizability**, %	65.06^{a}	74.08^{b}	76.18^{bc}	77.17^{cd}	78.99^{d}	0.26
CF metabolizability**, %	34.55^{a}	40.50^{b}	41.33^{b}	42.52^{c}	44.14^{d}	0.39
EE metabolizability, %	81.34	81.64	81.26	81.16	81.07	0.52
Dressing**, %	71.16^{bc}	72.43^{cd}	73.50^{d}	69.69^{a}	69.86^{a}	0.26
Edible meat**, %	64.94^{b}	66.53^{bc}	67.35^{c}	63.25^{a}	63.53^{a}	0.37
Abdominal fat pad**, %	2.17^{d}	1.83^{c}	1.81^{c}	1.72^{b}	1.58^{a}	0.05
Intestinal length*, cm	117.60^{b}	108.84^{a}	107.34^{a}	109.34^{a}	108.94^{a}	0.56
Serum protein**, g/dl	4.51^{e}	4.06^{c}	4.20^{d}	3.67^{a}	3.85^{b}	0.04
Serum albumin**, g/dl	2.66^{c}	2.27^{b}	2.26^{b}	2.08^{a}	2.16^{a}	0.04
Serum globulin**, g/dl	1.84^{cd}	1.77^{bc}	1.93^{d}	1.58^{a}	1.69^{b}	0.04
E-coli count*, 10^{7}CFU/g	3.66^{d}	1.33^{c}	1.00^{b}	0.66^{a}	0.66^{a}	0.31
Net profit, Rs/bird	11.60	19.20	20.92	12.91	14.76	

*Means bearing abc in a row differ significantly *(P<0.05), ** (P<0.01)*

This is presumably mediated through changes in cell wall architecture achieved by hydrolysis of structurally important arabinoxylans, which may release encapsulated nutrients. The ether extract metabolizability did not reveal significant variation and consistent with Esmaeilipour *et al.,* (2011) who reported that xylanase did not have a significant effect on the retention of fat. The dressing percentage yielded more when enzymes were supplemented in 5 percent energy, protein deficient diet than that of control and in agreement with those observed by Khan *et al.,* (2006) and Chouhan *et al.,* (2012) who observed significant effect on dressing percentage due to the inclusion of

enzyme in the diet of broilers. The abdominal fat pad was reduced significantly (P<0.01) on reduction in energy and protein in diet with enzyme supplementation. The abdominal fat pad was lowest when energy and protein was reduced by 10 percent. Panda *et al.,* (2012) found that the abdominal fat percentage was significantly lower in the broiler birds fed the low energy diet compared to either control or enzyme supplemented diets and attributed lowest abdominal fat content due to lower ME content of the diet as compared to other dietary groups. The intestinal length was also reduced significantly due to enzyme supplementation on energy protein deficient diet than control. Khan *et al.,* (2006) observed that the enzyme supplementation reduced (P < 0.05) relative length of total GIT, duodenum, jejunum and ileum of broiler chickens. The jejunal contents of the sacrificed birds were collected on 42nd day analysed for *E coli* count revealed that the mean *E coli* count was significantly (P<0.01) high in control group and were lowest in energy protein deficient diet by 10 percent with enzyme supplementation. The results are in agreement with Narasimha *et al.,* (2013) who found NSP degrading enzymes and protease decreases CFU count in broiler birds. The haemobiochemical studies revealed significantly lower serum total protein, albumin and globulin due to reduction in energy and protein in the diet even after supplementation of enzymes xylanase and protease. These findings are in agreement with Hernandez *et al.*, (2012) who found that the reduction in dietary protein content by 3% reduced plasma albumin levels (P < 0.05) during the pre-starter, starter, and finisher phases. The reduction in blood biochemicals on the supplementation of enzymes may be attributed to low energy protein diet in the present study. In terms of economics, the highest net profit per kg was obtained in T_3 group where energy and protein was reduced at 5 percent level and protease and xylanase was added @ 200g/ton of feed and corroborates with Alam *et al.,* (2003) who observed reduced feed cost per kg live weight by addition of exogenous enzymes in broiler diet. It was concluded that the supplementation of protease and xylanase @ 200g/ton each with reduction in energy and protein levels by 5 percent in broiler diet could be economical.

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