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SHORT COMMUNICATION

Effect of Oral Application of Xylanase on Some Hematological and Serum Biochemical Parameters in Broilers

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ABSTRACT

The present study was conducted to evaluate the possible toxic effects of xylanase enzyme on various hematological and some serum biochemical parameters in broiler chicks. For this purpose seventy five broiler birds were randomly divided into five equal groups (A-E) each having 15 birds. Xylanase was given orally @ 0, 250, 500, 750 and 1000 IU/bird/day for 28 days. The blood samples with and without anticoagulant (EDTA; 1mg/ml) were collected from all the birds for hematological and serum biochemical analysis. Non-significant results were recorded for erythrocyte, leukocyte and platelets count as well as total protein, hemoglobin concentration and hematocrit values. Similarly, the liver, kidneys and cardiac enzymes, serum minerals and lipid profiles were not significantly different in all treated groups as compared to control. The results of present study revealed that xylanase treatments had non-significant effects on kidneys, heart and blood forming tissues exhibiting its safety for food applications.

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INTRODUCTION

Xylanase is an extracellular enzyme which hydrolyses β 1-4, D-xylosidic linkage of highly polymerized and substituted β 1-4 linked D-xylobiose, xylotriose and glucuronosyl residues. This enzyme holds potentials for the degradation of plant cell wall material (Omar *et al.,* 2008). Microbial xylanase (β-1, 4 D-xylan xylanohydrolase, EC 3.2.1.8) is extensively used in poultry diets for feed utilization and in various food industries for food processing (Walk *et al.,* 2011). The endoxylanases (EC 3.2.1.8) cleave the xylan backbone into smaller parts like oligosaccharides which are further degraded to xylose by xylosidases (EC 3.2.1.37). Xylanase is synthesized by different microbial species including bacteria and fungi. However, *Aspergillus niger* is a potential source to synthesize this enzyme (Kalogeris *et al.,* 2003). Xylanase supplementation improved live weight in chicken and had no effect on survivability. The chicks fed on enzyme supplemented diets gained more weight, improvement in carcass, organic matter and crude protein metabolism. The improved apparent nitrogen and fiber absorption as well as feed transit time was observed by the application of xylanase in poultry feed. Moreover, the enzyme addition in boiled castor seed meal (up to 150g/kg) was found to be acceptable and showed no adverse effect on growth performance or blood constituents (Babalola *et al.,* 2006). The overall effects of these feed additives (enzymes) improve live weight and feed conversion ratio (Bedford, 1995) and increase the levels of metabolizable energy of the cereal or the ration as a whole. The xylanase synthesized by *Aspergillus niger* is important due to its beneficial role in food products and in baking industry; therefore, the present study was conducted to assess its safety evaluation and possible toxic aspects.

MATERIALS AND METHODS

A total of seventy five native broiler chicks (Ross line) were obtained from local hatchery and randomly divided into five equal groups (A-E). All the birds were vaccinated against various diseases (ND, IBD, IB and HPS). No mortality was recorded throughout the entire

experiment. Initially the birds were fed on basal diet having 20% crude protein. Indigenous carbon source (wheat bran) was utilized for xylanase biosynthesis from *Aspergillus niger* in biotechnology laboratory, National Institute of Food Science and Technology, University of Agriculture, Faisalabad. The activity of xylanase produced from *Aspergillus niger* was 79 IU/ml. Different doses (0, 250, 500, 750 and 1000 IU/bird/day) of xylanase were given orally using crop tube on daily basis. The duration of this experiment was 28 days. Blood samples were collected with and without anticoagulant (EDTA; 1mg/ml) and various hematological parameters were studied (Jalees *et al*., 2011). The serum was separated and stored at -20°C for liver function tests, total bilirubin, kidney function tests, cardiac enzymes, electrolytes, lipid profile and high density lipoprotein. In addition, total protein and albumin concentration were also determined (Ahmad *et al*., 2011). The data collected in present experiment was subjected to statistical analysis.

RESULTS AND DISCUSSION

Results on hematological parameters revealed that xylanase supplementation in all groups had no significant effects as compared to control treated birds (Table 1). Previously non-significant results for erythrocyte and white blood cell counts while decreased levels of pack cell volume and hemoglobin concentrations have been reported (Apata, 2010). Moreover, Ademola *et al.* (2012) reported that Roxazyme G® (a xylanase based enzyme preparation) and Maxigrain® (a cellulase and xylanase based enzyme preparation) feed supplementations in laying hens indicated significantly higher leukocyte count. In present experiment serum total protein and serum albumin contents were statistically non-significantly different among all the groups. The non significant difference in serum protein in present study is suggestive of normal metabolic process of liver parenchyma as the proteins are synthesized in liver tissue. In contrast to our results, decreased total protein concentrations in birds given xylanase supplemented diets have been reported (Apata, 2010).

In the present study, non-significant results were observed for AST, ALP and ALT in all experimental groups (Table 1). Different enzymes are considered as biomarkers and can be used to asses liver and kidney functions. The higher serum AST and ALT concentrations indicate the release of aminotransferase from cytoplasm to blood stream probably due to damaged liver or different other tissues. In present study statistical analysis revealed that supplementations of xylanase had no toxic effect on different liver enzymes including ALP, AST and ALT and total bilirubin concentrations. Similar results have also been reported that xylanase supplementation in broiler birds had no adverse effects on liver, kidneys and various internal organs (Luo *et al.,* 2009). In contrast to these results, lower values for hemoglobin and packed cell volume while increased activities of serum AST and ALT (Kongbuntad *et al.,* 2006) have been reported in chickens. The increased activities of liver enzymes and lower concentrations of hemoglobin could be due to the toxic effect of diets supplemented with different enzymes including protease, pectinase, cellulase, phytase, amylase, beta-glucanase and xylanase to liver or other tissues (Apata, 2010; Hussain *et al*., 2011). Further studies should be conducted to explore link of this enzyme to liver injury. In present study the indices of kidney varied non-significantly in response to xylanase treatments. Urea and creatinine are commonly used as biomarkers for kidneys function. Previously non-significant results have been recorded (Kongbuntad *et al.,* 2006). In contrast to our findings decrease in blood urea nitrogen levels in xylanase treated broiler birds have been reported (Kongbuntad *et al.,* 2006).

Cardiac enzymes including LDH, CPK and isoenzyme CK-MB were non-significantly different from each other and control group as well (Table 1). In

Table 1: Various hematological and serum biochemical values (Means ± SD) in broiler given different levels of xylanase

Parameters	Units	Groups				
		A	B	C	D	E
RBC (M/µL)		2.4±0.1	2.4±0.1	2.3±0.1	2.6±0.1	2.4±0.1
WBC (K/µL)		8.3±0.4	8.6±0.4	8.0±0.4	8.3±0.3	8.3±0.4
Platelets (K/µL)		13.3±0.6	13.7±0.5	14.0±0.7	14.0±0.5	13.3±0.6
HCV (%)		34.5±1.6	35.8±1.6	35.1±1.7	35.2±1.4	34.5±1.7
Total Protein (g/dL)		2.9±0.1	3.0±0.1	2.9±0.1	3.1±0.1	2.5±0.1
Hb (g/dL)		11.2±0.5	11.2±0.4	11.3±0.5	11.2±0.4	11.2±0.5
Albumin (g/dL)		1.5±0.1	1.4±0.1	1.5±0.1	1.6±0.1	1.3±0.1
Bilirubin (mg/dL)		0.51±0.02	0.44±0.02	0.46±0.02	0.48±0.02	0.50±0.02
ALP (IU/l)		2965.6±143.1	3108.6±135.2	3035.0±149.3	3136.3±121.2	3271.3±162.1
AST (IU/l)		304.00±14.7	323.00±14.1	331.7±16.3	314.3±12.2	328.3±16.3
ALT (IU/l)		9.6±0.5	10.2±0.4	9.8±0.5	10.1±0.4	9.7±0.5
Urea (mg/dl)		8.3±0.4	9.3±0.4	9.1±0.5	8.2±0.3	9.5±0.5
Creatinine (mg/dl)		0.30±0.01	0.25±0.01	0.27±0.01	0.32±0.01	0.26±0.01
LDH (IU/l)		3103.3±149.7	3142.7±136.6	2992.7±147.3	3010.7±116.3	2550.0±126.5
CPK (IU/l)		2898.0±139.8	2763.7±120.2	2654.7±130.6	3005.7±116.1	2469.3±122.6
CK-MB (IU/l)		10.2±0.5	10.9±0.4	10.3±0.5	10.70±0.4	11.73±0.6
Sodium (mEq/L)		150.7±7.3	160.3±6.9	145.7±7.2	154.0±5.9	146.0±7.2
Potassium (mEq/L)		7.8±0.4	8.2±0.4	7.2±0.4	7.4±0.3	8.3±0.4
Chloride (mEq/L)		112.3±4.4	106.5±4.6	106.1±5.2	103.9±5.1	101.7±5.1
Bicarbonate (mEq/L)		24.6±1.2	24.3±1.1	24.2±1.2	25.3±0.9	24.8±1.2
Cholesterol (mg/dL)		112.3±5.4	122.0±5.3	120.3±5.9	130.0±5.0	122.7±6.1
Triglycerides (mg/dL)		95.8±4.6	88.2±3.8	91.3±4.5	86.7±3.4	78.7±3.9
LDL (mg/dL)		46.9±2.3	51.5±2.7	53.4±2.6	52.6±2.4	56.6±2.8
HDL (mg/dL)		46.2±2.2	42.8±1.8	48.7±2.4	50.0±1.9	50.3±2.5

Xylanase was given orally @ 0 (A), 250 (B), 500 (C), 750 (D) and 1000 (E) IU/bird/day for 28 days.

published literature, effects of xylanase on various cardiac enzymes have not been reported. In present study, statistical analysis indicated that various xylanase applications showed non-significant results for sodium, potassium, chloride and bicarbonates levels in serum of experimental birds (Table 1). Previously no studies have been conducted to determine the effects of xylanase supplementation on minerals profile. However, Alu (2010) investigated no significant influence of different combination of enzymes including xylanase on triglycerides in birds. Various lipid profiles (Table 1) including cholesterol, triglycerides, LDL and HDL indicated non-significant results. Previously no reports have been found about lipid profile in accessible literature. The findings of present experiment showed that xylanase had no deleterious impacts in poultry.

Conclusion: From the results of present experiment in response to different levels of xylanase, the various parameters related to liver, kidneys, heart and blood electrolytes were within normal ranges showing the safety of enzyme.

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REFERENCES

Ademola SG, OO Egbewande, TE Lawal, AT Isah and SM Kuranga, 2012. Effects of Roxazyme G® and Maxigrain® on performance, egg quality, cost-benefit and haematological parameters of laying hens fed wheat offal, corn bran and brewery dry grain diets. Int J Poult Sci, 11: 33-38.

Ahmad L, A Khan and MZ Khan, 2011. Cypermethrin induced biochemical and hepato-renal pathological changes in rabbits. Int J Agric Biol, 13: 865–872.

Alu SE, 2010. Nutrient digestibility and serum biochemistry of laying quails (*Cortunix cortunix japonica*) fed sugarcane scrapping meal-based diets supplemented with exogenous enzyme. IOSR J Agric Vet Sci, 1: 29-35.

Apata DF, 2010. Effects of treatment methods on the nutritional value of cotton seed cake for laying hens. J Anim Vet Adv, 9: 2401-2404.

Babalola TOO, DF Apata and JO Atteh, 2006. Effect of β-xylanase supplementation of boiled castor seed meal-based diets on the performance, nutrient absorbability and some blood constituents of pullet chicks. Trop Sci, 46: 216-223.

Bedford MR, 1995. Mechanism of action and potential environmental benefits from the use of feed enzymes. Anim Feed Sci Technol, 53: 145-155.

Hussain SM, SA Rana, M Afzal and M Shahid, 2011. Efficacy of phytase supplementation on mineral digestibility in *Labeo rohita* fingerlings fed on corn gluten meal (30%) based diets. Pak J Agric Sci, 48: 237-241.

Kalogeris E, P Christakopoulos, P Katapodis, A Alexiou, S Vlachou, D Kekos and BJ Macris, 2003. Production and characterization of cellulolytic enzymes from the thermorhilic fungus *Thermoascus aurantiacus* under solid-state cultivation of agricultural wastes. Process Biochem, 38: 1099-1104.

Jalees MM, MZ Khan, MK Saleemi and A Khan, 2011. Effects of cottonseed meal on hematological, biochemical and behavioral alterations in male Japanese quail (*Coturnix japonica*). Pak Vet J, 31: 211-214.

Kongbuntad W, C Khanongnuch and S Lumyong, 2006. Efficacy of xylanase supplementation produced from *Thermoascus aurantiacus* SL16W in diet on Thai native chicken performance. Int J Poult Sci, 5: 463-469.

Omar AW, MH Khataibeh and K Abu-Alruz, 2008. The use of xylanases from different microbial origin in bread making and their effects on bread quality. J Appl Sci, 8: 672-676.

Walk CL, AJ Cowieson, JC Remus, CL Novak and AP McElroy, 2011. Effects of dietary enzymes on performance and intestinal goblet cell number of broilers exposed to a live coccidia oocyst vaccine. Poult Sci, 90: 91-98.

Luo D, F Yang, X Yang, J Yao, B Shi and Z Zhou, 2009. Effects of xylanase on performance, blood parameters, intestinal morphology, microflora and digestive enzyme activities of broilers fed wheat-based diets. Asian-Aust J Anim Sci, 22: 1288-1295.