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RESEARCH ARTICLE

Effect of Glucanase Supplementation in Nutritionally Marginal Diet on Turkey Poult Performance

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ABSTRACT

A biological trial was conducted to study the effect of exogenous supplementation of glucanase on turkey poult performance. Forty straight run day old Beltsville small white turkey poults were randomly distributed into two treatments having two replicates per treatment and 10 poults per replicate. High fibre (8.91%), low energy (2606 K cal/Kg of metabolizable energy) nutritionally marginal diet having crude protein content of 25.91%, and with or without glucanase supplementation (500 BG units/g activity, @ 10 g/100Kg of feed), was fed *ad libitum* upto 8 weeks of age. Glucanase significantly ($p<0.05$) increased the biweekly body weight at fourth, sixth and eighth week body weight of male and female. Improvement in pooled eighth week body weight was also highly significant ($p<0.01$). However, feed efficiency and livability were only numerically better but did not show significant difference statistically. It may be concluded that it is possible to formulate cheaper enzyme-supplemented high fibre diets for turkey poults to maximize performance.

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INTRODUCTION

Shortage of conventional feed ingredients and so rising high cost act as the major constraints in future expansion of the poultry industry. In cereal grains, the tough pericarp protects the intact grain. To avail energy rich starch from grains, the seed pericarp, aleurone layer and finally cell wall have to be penetrated by digestive enzymes. All these layers are having cellulose, non-starch polysaccharides (cellulose, glucans, arabinoxylans, pectins and their derivatives), phenolic compounds, pectins and proteins which are not effectively digested by poultry species. The non-starch polysaccharides (NSP) in digestive system act as barrier to the release of nutrients from the cell or increase the viscosity of the digesta and restrict their absorption (Bach Knudsen, 2001). Birds do not secrete enzymes to degrade the non-starch polysaccharides and hence supplementation of non-starch polysaccharide degrading enzymes will be the novel solution to overcome these adverse effects (Devegowda, 1991). Microbial enzyme preparations such as xylanase, β-glucanase, cellulase, α-amylase, protease and phytase are found to circumvent the adverse effects of NSP in the diet and increase the performance of animals (Mathlouthi *et al.*, 2003). In most of the countries, poultry feed is based primarily on corn and soyabean meal, which supplies major part of energy and protein in the diet. It has been studied that the glucanase improved the energy value of both corn and soyabean meal at all ages in broilers (Leslie *et al.*, 2007). Glucanase cannot be synthesized by the birds and it digests high molecular weight β-glucans in grain- and cereal-based feeds. Hence it can be used to digest endosperm cell walls which contain about 70% β-glucans (Thyagarajan *et al*., 2010).

Hesselman and Aman (1986) reported that feeding of broilers with high or low viscous barley at 65 per cent inclusion level with beta glucanase (10000 U/kg) at 0.5 g/kg diet inclusion, increased live weight by 25 and 27 per cent respectively. Similar findings were also observed by Rotter *et al.* (1989) and Almirall *et al.* (1995). Feed conversion was reported to be markedly improved by the β- glucanase addition to barley diets for broilers (Almirall and Esteve-Garcia, 1994; Almirall *et al.* 1995). Esteve-Garcia *et al.* (1997) reported that β-glucanase supplementation in broiler chicken diet improved the feed consumption, weight gain and feed efficiency and dry

matter content of excreta. Mathlouthi *et al*. (2002) observed that the addition of xylanase and *β*-glucanase to the rye-based diet improved weight gain, feed intake, and feed efficiency in broiler chickens. Similarly, Wang (2003) used xylanase at the rate of 3450 units/g and β glucanase at the rate of 900units/g in rice bran diets of Leghorn chicks. He recorded better body weight and feed efficiency than corn-soyabean meal fed birds due to the influence of these enzymes on the hemi-cellulose fraction of rice bran. The supplementation of glucanase enzyme to turkey poults from 0 to 8 weeks of age would improve their growth performance. It is beneficial to use glucanase enzyme in poult feed (Thyagarajan *et al*., 2010). Research on influence of exogenous enzymes on the performance of turkey appears to be scanty. Therefore, the objective of this study is to find out the effect of glucanase supplementation in diet on 0-8 weeks brooder performance of Beltsville Small White turkey poults.

MATERIALS AND METHODS

Experimental design

Fourty day old straight run Beltsville small white turkey poults were randomly divided into two treatments of two replications in each with 10 poults per replicate and were reared upto 8 weeks period. Colony cages were utilized for conducting the biological experiment. Each colony cage was identified as one replicate. Feeder space, waterer space, lighting and other management conditions were identical in all treatment groups

Supplemental enzyme

Patent glucanase enzyme from leading enzyme manufacturer was used for this research work. Freshly indented enzyme was mixed in the experimental diet at recommended level of 0.5 lakh BG units per tonne of feed (Table 1). Experimental feeds both control and treatment, were mixed once in fifteen days so as to retain enzyme activity in treatment feed. Enzyme was stored in tight packed container to avoid any oxidative changes.

Experimental diet

The experimental diets were prepared based on analysed values of feed ingredients at the Central Feed Technology Unit, Poultry Research Station, Chennai. Experimental diets of the biological trial were iso-caloric and iso-nitrogenous.

Glucanase enzyme was procured from Biocon Limited, Bangalore. This enzyme is a thermostable fungal β-glucanase enzyme, which has both β-1-3 and β-1-4 endo-glucanase activities. Glucanase (0.5 lakh BG units per tonne of feed) was incorporated in a low energy diet (2606 KCal / Kg of ME), in poults between 0 and 8 weeks of age, along with a control group. The diet (Table 1) was formulated using deoiled rice bran at moderately high level. The crude protein level was maintained at 25.91%. The experimental poults were fed with measured quantity of feed but adlibitum.

Performance assessment

Brooder performance of poults (0-8 weeks of age) was assessed based on the biweekly body weight, feed consumption and livability percentage. Feed efficiency was calculated based on the total feed consumption and total body weight gain in respective treatments. Biweekly body weight was taken at 2nd, 4th, 6th and 8th week of age. At 8th week, sex of the bird was identified and noted for sex correction. Dead birds are subjected to necropsy examination to find out the etiology.

Table 1: Percent Ingredient and Nutrient Composition of Experimental Diet

Ingredients	% Composition
Maize	32
De-oiled rice bran	15
Soyabean meal	33
Sunflower oil cake	10.4
Fish meal	8
Mineral Mixture	0.5
Di-calcium phosphate	1.1
Total	100
Nutrients	
Crude Protein (%)	25.91
M.E. K Cal / kg	2606
Calcium (%)	1.24
Available phosphorous (%)	0.57
Lysine (%)	1.51
Methionine (%)	0.47
Glucanase Enzyme	Inclusion level (g)
(Activity 500 BG units per gram)	
Control	0
Treatment	10

Statistical analysis

All the data were subjected to statistical analysis as recommended by Snedecor and Cochran (1994) to arrive at inferences. The analysis was carried out by utilizing MS-Excel, Statpak-3 and SPSS (14.0, SPSS Inc., Chicago, USA) software.

RESULTS

The mean eight weeks performance of the Beltsville small white poults fed with glucanase in low energy diet is presented in Table 2. The analysis of variance of the data is presented in Table 3. Glucanase significantly ($P<0.05$) increased the biweekly body weight at fourth, sixth and eighth week body weight of male and female. Improvement in pooled eighth week body weight was also highly significant ($P<0.01$). However, feed efficiency and livability were only numerically better but did not show significant difference statistically.

Table 2: Effect of glucanase supplementation on turkey poults performance

Treatments	Body weight (g) Mean ± SE						Feed efficiency	Livability (%)
	2nd week	4th week	6th week	8th week				
				Male	Female	Pooled		
Control	154.15± 2.72	333.37^{b}± 5.88	559.78^{b}±10.33	972.60^{b}±15.08	757.50^{b}±19.93	865.89^{b}± 11.84	3.26±0.01	90
Glucanase	158.8± 2.74	356.35^{a}± 7.00	604.15^{a}±14.26	1057.00^{a}±28.95	867.27^{a}±28.75	963.60^{a}± 20.07	2.94±0.13	100

Means within column bearing different superscripts differ significantly

Table 3: ANOVA for the effect of glucanase supplementation on turkey poults performance

Parameters	Treatment		Error		F
	df	MSS	df	MSS	Value
2nd week body weight	1	216.22	38	149.41	1.447 ^{NS}
4th week body weight	1	5146.11	37	822.84	6.254 *
6th week body weight	1	18652.68	36	3051.44	6.113 *
8th week body weight					
Male	1	33742.23	17	4753.91	7.098 *
Female	1	55810.77	17	6657.30	8.383 *
Pooled	1	90449.63	36	5444.29	16.614 **
Feed Efficiency	1	0.1024	2	0.017	6.024 ^{NS}
Livability (by arcsine transformation)	1	176.49	2	176.49	1.000 ^{NS}

** - Highly significant (P<0.01); * - Significant (P<0.05); ^{NS}- Non-significant

DISCUSSION

Exogenous supplementation of glucanase enzyme at the level of 0.5 lakhs BG units/tonne in deoiled rice bran mixed low energy diet resulted in significant (P<0.05) improvement in 4th, 6th and 8th week male and female and highly significant (P<0.01) improvement in 8th week pooled body weights of poults. Simultaneously there was non-significant improvement in feed efficiency and livability. It could be inferred that the energy sources such as maize and deoiled rice bran along with protein source of soyabean meal and sunflower oil cake included in the diet might have provided the required substrate for glucanase resulting in positive improvement in the performance of poults. Total non-starch polysaccharides available in deoiled rice bran and soyabean meal are 59.9 and 29.9 per cent respectively (Devegowda, 2005).This high level of NSP available in the diet might have provided the substrate for glucanase resulting in positive action on the performance of poults. It was already established that the β-glucanase enhanced the digestion and utilization of nutrients in barley (Almirall and Esteve-Garcia, 1994; Almirall *et al*. 1995) and rye (Lazaro *et al*., 2004) due to reduction in the digesta viscosity in broilers. Earlier report indicated that the combination of xylanase and β-glucanase improved the performance of broilers (Mathlouthi *et al*., 2002) and leghorn chicks (Wang, 2003). It was also reported that feeding of broilers with high or low viscous barley with beta glucanase, increased live weight by 25 and 27 per cent respectively and feed conversion (Hesselman and Aman, 1986; Rotter *et al*., 1989; Almirall *et al*., 1995). Confirming the results in the present study, Esteve-Garcia *et al*., (1997) reported that β-glucanase supplementation in broiler chicken diet improved the feed consumption, weight gain, feed efficiency and dry matter content of excreta. Enzyme supplementation significantly improved the body weight with simultaneous decrease in feed intake and improvement in feed efficiency in the high fibre broiler diets has also been reported. Results in the present study coincides with the report of Senthilkumar (2003) who recorded that addition of rice bran in the enzyme mixture supplemented group increased the NSP content and relatively better protein digestibility in broiler diet. In a study by Thyagarajan *et al*. (2010), out of 12.5 BG U/Kg, 25 BG U/Kg and 50 BG U/Kg of feed tried in Beltsville Small White turkey poults, the influence of glucanase inclusion was highly significant (P≤0.01) on eighth week performance with eighth week body weight being better at 50 BG U/Kg feed followed by other groups according to the decreasing concentrations of enzyme in feed.

Conclusion

Highly significant improvement observed in 8th week pooled body weights of poults and significant improvement of eighth week male and female body weights with simultaneous non-significant improvement in feed efficiency and livability in glucanase supplemented poults**.** It may be concluded that it is possible to formulate cheaper enzyme-supplemented high fibre diets for turkey poults to maximize performance.

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