Response of Broiler Chickens to Diets Based on Triticale and Supplemented with Microbial Enzymes

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Response of Broiler Chickens to Diets Based on Triticale and Supplemented with Microbial Enzymes

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ABSTRACT

A total of 384 day-old male Ross 308 broiler chicks were allocated to 8 dietary treatments to examine the influence of supplementation xylanase and phytase, individually or in combination, in diets based on two cultivars of triticale (Bogong and Canobolas) on the growth response, visceral organ development as well as some physiological responses. The inclusion of phytase alone in either Bogong or Canobolas diets increased ($p<0.01$) feed intake and body weight while the inclusion of xylanase tended to increase ($p=0.063$) the feed intake to day 21. The ileal digestibility of crude protein, gross energy, starch, calcium and phosphorus was increased by the inclusion of phytase ($p<0.01$) and xylanase ($p<0.05$). There was an interaction ($p<0.01$) between xylanase and phytase on the the digestibility of crude protein, gross energy, calcium and phosphorus. Ileal viscosity was significantly decreased ($p<0.05$) by the inclusion of xylanase and phytase individually or in combination. The relative weight of various visceral organs was affected to different degrees by grain type and enzyme supplementation. Enzyme supplementation of the diets proved to be beneficial, and such response was due to an improvement in digestibility.

KeyWords: Triticale, Xylanase, Phytase, Intestine, Broiler chickens

INTRODUCTION

The nutritive value of older cultivars of triticale as the sole cereal grain in diets for poultry is generally reported poor (Smith et al., 1989). This is due to the presence of non-starch polysaccharides (NSP), which are mainly arabinoxylans and β-glucans (Pourreza et al., 2007) and also phytic acid (Jondreville et al., 2007). Nevertheless, supplementation with exogenous carbohydrase enzymes, such as xylanase, can reduce the viscosity of the intestinal contents and improve the digestibility of starch, protein and energy in broiler diets (Annison and Choct, 1991 and Bedford, 1995). Likewise, the inclusion of phytase in the broiler diet can increase feed utilisation and body weight (Huff et al., 1998 and Levic et al., 2006).Newer cultivars are being developed around Australia, with higher grain yield and protein content than the older cultivars. However, their nutritive value for poultry has not been extensively tested. The objective of this trial was to examine the influence of supplementation with xylanase and phytase, individually or in combination, in diets based on twonew cultivars of triticale (Bogong and Canobolas) on the gross response, ileal digestibility as well as visceral organ weight of broiler chickens.

MATERIALS AND METHODS

This was a 2 x 2 x 2 factorial experiment with 2 cultivars of high-yielding triticale (Bogong and Canobolas), with or without xylanase and with or without phytase. Each diet was formulated to contain triticale (650 g/kg) as the sole cereal grain. The dietary treatments were as follows: a diet based on Bogong without any enzymes (B); Bogong supplemented with xylanase (BX); Bogong with phytase (BP); Bogong with xylanase and phytase (BXP); Canobolas without enzymes (C); Canobolas supplemented with xylanase (CX); Canobolas with phytase (CP) and Canobolas with xylanase and phytase (CXP).

A total of 384 day-old male Ross 308 broiler chicks (initial weight 41.30±0.35 g), were randomly allocated to 48 cages. Each of the 8 treatments was randomly assigned to 6 cages with 8 birds per cage. On days 7 and 21, one bird and three birds, respectively, from each cage, were randomly selected, weighed and killed by cervical dislocation. Nutrient digestibility was also measured, using TiO2 as a marker. All data were subjected to the analysis of variance using General Linear Model (GLM) of Minitab 16.0 software. Differences were considered significant at $p<0.05$.

Table 1. Feed intake (FI), body weight (BW) and feed conversion ratio (FCR) of chickens on triticale-based diet with or without enzymes between hatch and 7 or 21 d of age[1]

Treatments			1-7 days			1-21 days		
Grain	Xyl[2]	Phy[3]	`FI (g/bird)	BW (g/bird)	FCR (g/g)	FI (g/bird)	BW (g/bird)	FCR (g/g)
Bogong	-	-	146.3^{c}	180.8^{cd}	1.05	1008.7^{de}	813.7^{b}	1.31
Bogong	+	-	147.2^{c}	182.8^{cd}	1.04	1043.0^{d}	826.6^{b}	1.33
Bogong	-	+	167.5^{a}	201.7^{a}	1.04	1385.5^{a}	1071.9^{a}	1.35
Bogong	+	+	164.6^{ab}	198.3^{ab}	1.05	1275.6^{c}	1045.4^{a}	1.27
Canobolas	-	-	147.4^{c}	178.1^{d}	1.08	954.9^{e}	775.2^{b}	1.31
Canobolas	+	-	154.1^{bc}	189.1^{bc}	1.04	961.1^{e}	788.0^{b}	1.29
Canobolas	-	+	168.3^{a}	201.2^{a}	1.05	1373.6^{ab}	1066.0^{a}	1.34
Canobolas	+	+	170.8^{a}	199.4^{a}	1.08	1305.1^{bc}	1048.4^{a}	1.30
Pooled SEM[4]			1.94	1.79	0.005	27.00	20.20	0.010
Source of variation			Significance of treatment effect					
Grain			ns	ns	0.056	ns	ns	ns
Xylanase			ns	ns	ns	0.063	ns	ns
Phytase			**	**	ns	**	**	ns
Grain x Xylanase			ns	ns	ns	ns	ns	ns
Grain x Phytase			ns	ns	ns	*	ns	ns
Xylanase x Phytase			ns	0.081	0.067	**	ns	ns
Grain x Xylanase x Phytase			ns	ns	ns	ns	ns	ns

[1]Each value represents the mean of 6 replicates. [2]Xylanase. [3]Phytase. [4]SEM = Standard error of mean.
[a-d]Values with unlike superscripts within each column are significantly different at *$p<0.05$; **$p<0.01$.
ns = not significant.

RESULTS DISCUSSION

Feed intake to day 7 was increased ($p<0.01$) by the inclusion of phytase to both diets. Body weight of birds at 7 and 21d was also increased ($p<0.01$) by the inclusion of phytase. There was no significant interaction between grain and xylanase for all parameters measured, except for a significant interaction ($p<0.05$) between grain and phytase as well as between xylanase and phytase ($p<0.01$) on the feed intake to 21d (Table 1.).

The digestibility of crude protein increased by 9.4% with the inclusion of phytase in the Bogong diet, while the inclusion of the combination of supplemental xylanase and phytase increased by 11.5% in the Canobolas diet.The digestibility of gross energy was increased ($p<0.05$) by the inclusion of xylanase and the inclusion of phytase ($p<0.01$) and the interaction between the inclusion of xylanase and phytase ($p<0.01$). Likewise, the digestibility of starch was increased ($p<0.05$) by the inclusion of xylanase and phytase ($p<0.01$).

The ileal digestibility of Ca was increased ($p<0.05$) by the inclusion of xylanase and the interaction ($p<0.01$) between xylanase and phytase. Similarly, the ileal digestibility of P was

significantly increased ($p<0.05$) by the inclusion of xylanase and phytase ($p<0.001$), as well as the interaction ($p<0.01$) between xylanase and phytase. The inclusion of enzymes increased P digestibility by about 13.4 to 29.0% and 30.0 to 35.0%, in the Bogong and Canobolas diets, respectively.

There was no statistically significant effect of xylanase and phytase inclusion on the relative weight of any of the visceral organs examined; however, the relative weight of the proventriculus plus gizzard of birds on the Bogong diets was less ($p<0.01$) than that on the Canobolas diets.

On day 21 the only significant effect of the inclusion of enzymes in the diets was on the relative weight of liver, which was decreased ($p<0.001$) by the inclusion of phytase in the diets.

The highest FI and BW were found in the diets with only phytase inclusion. These diets also exhibited the highest CP, GE, starch and P digestibility. This finding, however, was unexpected, because the ileal viscosity of birds on the diet with only phytase supplementation was significantly higher than that of birds on the diets containing only xylanase or those containing a combination of supplemental xylanase and phytase. This phenomenon may be the result that the microbial phytase used in the present study was produced by solid state fermentation and contains significant activities of beta-glucanase and xylanase (Wu et al., 2004).

IMPLICATIONS

Supplementation with phytase alone or combination of phytase and xylanase further improved productivity. The beneficial effect of exogenous enzymes may be due to improvement in the digestibility of CP, gross energy, starch, Ca and P.

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