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Effect of Supplemental Enzyme on Nutrient Digestibility and Performance of Broiler Chicks Fed on Diets Containing Triticale

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Abstract: The influence of enzyme supplementation on performance and digestibility of dry matter and protein in young broiler chicks was examined for a diet based on triticale supplemented with different levels of enzyme. In a completely randomized design, two hundred d-old chicks (Ross strain) were divided into 20 groups, ten chicks per group. A basal diet containing 65% triticale was supplemented with zero, 100, 200, 400 and 800 g/kg enzyme and given to four replicates for 21 days. Added enzyme (xylanase) improved ($P<0.05$) body weight, body weight gain, feed intake and feed conversion ratio. Apparent digestibilities of energy and protein were increased ($P<0.05$) due to supplemental enzyme. Non-significant improvement was observed in protein and energy efficiencies by the addition of enzyme. All improvements had a similar trend and were the highest at 200 g/kg enzyme supplementation. Higher levels of enzyme had no beneficial effect on measured criteria. The results indicated that the nutritional value of cereal grains such as triticale can be improved by supplemental enzyme containing mainly xylanase to the diet of young broiler chicks.

Key words: Broilers, xylanase, protein and energy digestibility

Introduction

The use of triticale in broiler feeds is limited by the presence of soluble non-starch polysaccharids, specially xylans and arabinoxylans (Antoniou and Marquardt, 1981).

These compounds reduce the nutritive value of triticale by increasing gut viscosity and thus reducing the availability of nutrients for digestion and absorption (Choct and Annison, 1992). Triticale cultivars are the result of interspecific crosses between rye and wheat which tend to resemble wheat more than rye in terms of nutritional value (Classen, 1996). The metabolizable energy, fat, crude fiber and crude protein contents of triticale have been determined as 3163 Kcal/kg, 1.5, 4.0 and 15.8 % respectively (Al-Athari and Guenter, 1988; Fernandes *et al*., 1973). Pettersson and Aman (1988) reported significant improvement in growth and feed conversion for broilers when diets containing triticale were supplemented with an enzyme source containing a high level of β- glucanase and pentosanase activity. Improvement in nutritional value of grains containing non-starch polysaccharids has been reported. Hydrolysis of endo-1, 4 β- xylan due to supplemental 1,4-β- xylanase and also B-glucan destruction by added β-glucanase have been reported by several researchers (Classen and Bedford, 1991; Bedford and Classen, 1992; Pourreza *et al*., 2004). Information about the use of triticale in poultry diets and the effect of supplemental enzymes on its nutritional value is limited as compared to other cereal grains including wheat, barley and oats. The aim of the current experiment was to evaluate the effect of different levels of supplemental enzyme (Xylanase) on performance and the apparent dry matter, protein and energy of a triticale-soybean meal based diet.

Materials and Methods

A Triticale-soybean meal basal diet containing 65% triticale was formulated (Table 1). Microbial enzyme (Endo feed Produced by GNC, Canada) at levels of zero, 100, 200, 400 and 800 g/kg were added to the basal diet. The basal diet was formulated to meet National Research Council (1994) nutrient requirements of broiler chicks.

Xylanase activity of the enzyme used was 800 XTU/g of enzyme according to manufacturer recommendation. Therefore, the experimental diets contained zero, 800, 1600, 3200 and 6400 XTU/kg xylanase . Two hundred d-old broiler chicks (Ross strain) were divided into twenty groups (Pen), ten chicks per pen. Each experimental diet was fed to four pens from 1 to 21 days. The birds were housed in a windowless, central heating building and chicks had 24h access to light, feed and water throughout the entire experiment. Triticale sample was subjected to proximate analysis prior to the commencement of the experiment. It contained 93.4, 11.7, 1.45, 3.6 and 2.7 % dry matter, crude protein, crude fat, crude fiber and ash respectively. The metabolizable energy (AME and AMEn) of the triticale sample used was determined by the method of Sibbald (1986) (Pourreza, J. unpublished data). Pen weights were recorded on day 21. Prior to weighing, the birds were fasted for 4h to ensure a consistent gut full among all birds. After weighing, the birds were fed for 24h with related diets in

Table 1: Composition of basal diet.

Ingredients	(%)
Triticale	65.0
Soybean meal (44%)	25.4
Fish meal (60%)	3.0
Corn oil	2.6
Dicalcium phosphate	1.3
Oyster shell	1.4
Salt	0.35
Vitamin perimix[1]	0.35
Mineral primix[2]	0.35
DL-methionine	0.25
Total	100
Calculated analysis	
ME (Kcal/kg)	2850
Protein	20.5
Calcium	0.95
Non-phytate phosphorus	0.42
TSAA	0.82
Lysine	1.081

-Vitamin premix provided per kilogram of diet: Vitamin A, 10000; Vitamin D_3, 2500 IU; Vitamin E, 10 IU; Vitamin B_1, 2.2 mg; Vitamin B_2, 4 mg; Pantothenic acid, 8 mg; Vitamin B_6, 2 mg; Niacin, 30 mg; Vitamin B_{12}, 0.015 mg; Folic acid, 0.5 mg; Biotin, 0.15 mg Choline chloride, 200 mg;. 2- Mineral premix provided per kilogram of diet: Manganese, 80 mg; Copper, 10 mg; Iodine, 0.8 mg; Cobalt, 0.25 mg; Selenium, 0.3 mg; Zinc, 80 mg; Iron, 80 mg.

which chromic oxide was added at a level of 0.4% as an exogenous marker. After 24h feeding, from each pen, 8 chicks were killed by cervical dislocation. The ileal contents (from Meckl's diverticulum to 4 cm above the ileocecal junction) of chicks were gently squeezed, pooled and kept in ice before freezing. Chromic oxide of diets and ileal samples were measured by the method of Fenton and Fenton (1979). Dry matter, protein and energy contents of diets and ileal samples were determined by the methods of AOAC (1995). Nutrient digestibility was calculated as follows;

Digestibility = 100 - (100 % indicator in feed * % nutrient in feces) / % indicator in feces* % nutrient in feed

Body weight, feed intake and feed conversion ratio were calculated for each pen. Efficiency of energy and protein utilization also was calculated. Experiment was performed using a completely randomized design. Analysis of variance was performed on the data using the General Linear Model of SAS software (SAS Institute, 1995).

Results and Discussion

Effect of enzyme supplementation on performance of broiler chicks at 21 days of age is presented in Table 2. Supplemental enzyme significantly ($P<0.05$) improved body weight (BW) body weight gain (BWG), feed intake (FI) and feed conversion ratio (FCR). The highest BW,

Table 2: Effect of different levels of enzyme on performance parameters of chicks fed on triticale based diet at 21 d

Enzyme (g/kg)	Body wt. (g)	Body wt. gain (g/h/d)	Feed intake (g/h/d)	FCR (g/g)
0.0	477.4^{b}	20.8^{b}	34.0^{b}	1.60^{b}
100	481.0^{b}	20.9^{b}	32.2^{ab}	1.58^{b}
200	529.7^{a}	23.3^{a}	30.8^{a}	1.32^{a}
400	529.5^{a}	23.3^{a}	32.0^{ab}	1.37^{a}
800	485.3^{ab}	21.2^{ab}	32.0^{ab}	1.50^{ab}
SE	14.5	1.2	1.6	0.73

ab-Means with in columns with no common superscript differ ($P<0.05$). FCR : Feed Conversion Ratio

Table 3: Effect of different levels of enzyme on dry matter, energy and protein digestibilities and efficiencies of chicks fed on triticale based diet at 21 d

Enzyme (g/kg)	Digestibility coefficient			Efficiencies	
	Dry matter	Energy	Protein	Energy (g/Kcal)	Protein (g/g)
0.00	66.1	67.0^{ab}	72.7^{ab}	0.22	3.0
100	61.4	66.1^{a}	73.0^{ab}	0.23	3.1
200	67.7	68.5^{a}	76.4^{a}	0.26	3.7
400	65.6	67.7^{ab}	71.9^{b}	0.25	3.6
800	61.6	63.6^{b}	71.2^{b}	0.23	3.3
SE	1.8	1.6	2.6	0.007	0.095

ab-Means with in columns with no common superscript differ ($P<0.05$).

BWG and FI were obtained at 200 g/kg enzyme supplementation. FCR was the lowest at this level of added enzyme. The results obtained in the current experiment are in agreement with the findings of Al-Athari and Guenter, 1988 and Pettersson and Aman, 1988. Triticale contains pentosans which at high levels of inclusion impair the performance of chicks due to increasing gut viscosity and reducing nutrient digestibility. Response to microbial enzymes probably is due to hydrolysis of NSP's and consequently elimination of the negative effects of these polysaccharides on chicks. Reduction of viscosity by supplemental enzymes has been reported for cereal grains including barley (White *et al.*, 1983), barley, oats, rye and wheat (Edney *et al.*, 1989; Friesen *et al.*, 1992).

Significant ($P<0.05$) improvement in energy and protein digestibilities were observed due to supplemental enzyme. Enzyme had no significant effect on dry matter digestibility. Better performance of chicks could be justified by the better energy and protein digestibilities. Performance improvement had a similar trend as energy and protein digestibility improvement. The highest digestibility of energy and protein was observed with 200 g/kg added enzyme. Inhibition of nutrient digestibility due to cereal grains containing NSP's has been reported (Choct and Annison, 1992; Classen, 1996). The results of this experiment are in agreement with the reports of Classen and Bedford (1991), Edney *et al.* (1989), Friesen *et al.* (1992) and Hesselman and Aman (1986)

regarding the positive effects of enzyme supplementation on NSP's containing cereals on utilization of energy and protein for broilers. Non significant improvement in efficiencies of protein and energy utilization was observed due to added enzyme. These improvements had the same trend as digestibilities and performance. All criteria measured support the beneficial effects of enzyme in reducing the negative effects of NSP's present in triticale. Overall, the results obtained in the present experiment showed that triticale can be included in diet of broilers if an exogenous enzyme containing xylanase is used. Optimum enzyme needed for elimination of the negative effects of NSP's in triticale indicated to be 1600 XTU/kg of diet for young broilers. Further amounts of enzyme are not economically recommended.

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