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Effect of Enzyme Supplementation to the Rations in Which Soybean Meal Replaced by Canola Meal on Performances of Broilers

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Abstract: This study was carried out to determine the effects of multi and protease enzyme supplementation to the rations in which soybean meal (SBM) replaced by Canola Meal (CM) on performances of broilers. With this aim, SBM (44% CP), CM (37% CP), multi enzyme (Farmazyme 2010) and protease enzyme (Farmazyme 3000 Proenxs) were used. This study was conducted with 270 seven-days-old Ross-308 broilers in 3 groups with 3 replicates including 30 birds. The groups were control (without enzyme addition), protease enzyme group and multi enzyme group. Liveweight gains (LWG), feed consumptions and feed conversion rates on 21st, 35th and 42nd days were not different between enzyme-containing and without enzyme groups ($p>0.05$). Abdominal fat content was found low for mixed-sex group and male group ($p<0.05$), but not for female group ($p>0.05$) in enzyme-containing groups. There were no differences between enzyme-containing and without enzyme groups as well as sexes in terms of edible organ weights, digestive tract lengths, digestive tract weights, digestive tract thicknesses, intestinal pH, dressing percentages and mortalities ($p>0.05$).

Key words: Soybean meal (SBM), canola meal (CM), protease enzyme, multi enzyme and performance

Introduction

Broiler diet is predominantly composed of plant materials mainly cereals and vegetable proteins plus little amount of animal protein. Although soybean meal (SBM) has been used for a long time in broiler diets as a vegetable protein source, in recent years canola meal (CM) which has a suitable amino acid composition for nutrition of broilers was begun to use as an alternative vegetable protein source in broiler rations (Alloui *et al*., 1994).

Most of the vegetable protein sources contain simple sugars as well as nondigestible polysaccharides (cellulose, hemicellulose, ksilose, arabinose, galactonic acid and pectins) and antinutritional factors (tannins, glicosides etc.) (Huyghebaert and DeGrote, 1995).

Monosaccharides and nonstarch polysaccharides (NSP) total 70-95% of the cell walls in vegetable feed sources (Adams, 1993). CM (35-46.1%) and SBM (19.2%) are rich in NSP (Choct, 2002). Most of the nutrients including proteins could not be fully utilized in poultry nutrition due to lacking of NSP degrading enzymes in digestive tracts of poultry (Alloui *et al*., 1994).

Several studies reported that nondigestible components in vegetable protein sources could be degraded by using exogen enzymes of microbial or fungal origin (Silominski *et al*., 1997;

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Guenter *et al*., 1998). Supplementation of the diets with carbohydrases (Rassmussen and Petterson, 1997; Campbell *et al*., 2001) and proteases (Kocher *et al*., 2001) gave rise to positive effects in broiler nutrition.

Results from our previous study, in which 0, 25, 50, 75 and 100% (replacement) levels were investigated, (Sarıcicek and Serdar, 2005) have shown that CM could replace 25% of the dietary protein provided by SBM.

The objective of this study was to determine the effects of the multi enzyme and protease enzyme supplementation to the broiler rations in which CM replaced 25% of the dietary protein provided by SBM on the performances of the broilers.

Materials and Methods

A total of 270 seven-day-old Ross-308 broiler chickens were used in this study. SBM (44% CP) and CM (37% CP) were used as vegetable protein sources. The enzymes used in this study were protease (Farmazym 3000 proenx: protease, fungal xylanase, fungal β-glucanase, endo β-glucanase, α-amylase, β-glucanase (pH = 7.5), β-glucanase (pH = 5), hemicellulase, pentosanase, pectinase) and multi enzyme (Farmazym 2010, fungal xylanase, fungal β-glucanase, β-glucanase (pH = 7.5), β-glucanase (pH = 5), cellulase, α-amylase, pentosanase, cellobiase, hemicellulase, endo β-glucanase). This study was conducted at Research and Application Farm of Agricultural Faculty of Ondokuz Mayis University in 2004.

This study was conducted in 3 groups with 3 replicates including 30 birds. The birds were fed commercial starter diet from day 1 to day 7. On day 7, birds were allocated to the groups such that all groups had a similar initial weight.

The groups were control (CM replaced 25% of the dietary protein provided by SBM without enzyme addition), protease enzyme group (CM replaced 25% of the dietary protein provided by SBM with protease enzyme addition), multi enzyme group (CM replaced 25% of the dietary protein provided by SBM with multi enzyme addition).

The birds were fed starter diet (23% CP and 3100 kcal/kg ME) during 7-21st days, grower diet (21% CP and 3200 kcal/kg ME) during 21-35th days and finisher diet (19% CP and 3200 kcal/kg ME) during 35-42nd days. Multi enzyme (1 kg/ton) and protease enzyme (1 kg/ton) were added to the each of the diets (Table 1). The birds had free access to water and feed for the duration of the study. The birds were housed in floor pens with sawdust as litter.

Liveweight Gains (LWG), Feed Consumptions (FC) and Feed Conversion Ratios (FCR) were determined weekly.

At 42 day of age 2 male and 2 female birds per replicate (12 birds per group) were slaughtered and carcass weights, abdominal fat weights, edible organ weights, digestive tract lengths, digestive tract weights, digestive tract thicknesses, dressing percentages, intestinal pH and mortalities were determined.

Dry Matter (DM), Crude Protein (CP), Ether Extract (EE), Ash (A) and Crude Fiber (CF) contents were determined according to the AOAC (1990).

The data were analyzed by using SPSS pocket programme and Duncan's multiple-range test was used to separate means when significant effects were detected by analysis of variance.

Table 1: Composition and calculated analyses of broiler diets used in the experiment

	Starter diets			Grower diets			Finisher diets		
Ingredients (kg)	Control	Multi	Protease	Control	Multi	Protease	Control	Multi	Protease
Corn	52.00	52.00	52.00	53.10	53.10	53.10	56.50	56.50	56.50
SBM	21.00	21.00	21.00	24.00	24.00	24.00	23.00	23.00	23.00
CM	9.24	9.24	9.24	7.91	7.91	7.91	7.59	7.59	7.59
Fish meal	7.23	7.23	7.23	2.60	2.60	2.60	0	0	0
Vegetable oil	5.06	5.06	5.06	6.80	6.80	6.80	6.65	6.65	6.65
Lime stone	2.82	2.82	2.82	2.10	2.10	2.10	2.71	2.71	2.71
DCP	2.00	2.00	2.00	2.84	2.84	2.84	2.90	2.90	2.90
L.Lysine	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Methionine	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Vits.[1]	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Mins.[2]	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Enzyme	-	+	+	-	+	+	-	+	+
Calculated composition									
ME (kcal/kg DM)	3100.4	3100.4	3100.4	3199.5	3199.5	3199.5	3200.4	3200.4	3200.4
CP (g)	23.0	23.0	23.0	21.0	21.0	21.0	19.0	19.0	19.0
Ca (g)	2.0	2.0	2.0	1.7	1.7	1.7	1.8	1.8	1.8
Available P (g)	0.95	0.95	0.95	0.97	0.97	0.97	0.9	0.9	0.9
Lysine (g)	1.40	1.40	1.40	1.19	1.19	1.19	1.0	1.0	1.0
Methionine (g)	0.54	0.54	0.54	0.45	0.45	0.45	0.40	0.40	0.40
Analysed composition									
DM (%)	90.17	90.17	90.17	89.85	89.85	89.85	89.03	89.03	89.03
CP (%)	24.42	24.42	24.42	20.78	20.78	20.78	18.93	18.93	18.93
EE (%)	6.74	6.74	6.74	8.88	8.88	8.88	7.89	7.89	7.89
CF (%)	4.01	4.01	4.01	3.59	3.59	3.59	3.03	3.03	3.03
Ash (%)	7.65	7.65	7.65	9.53	9.53	9.53	7.52	7.52	7.52
N-free ext. (%)	47.35	47.35	47.35	47.07	47.07	47.07	51.66	51.66	51.66

[1]:Provides per kg of diet: 6000 000IU vitamin A, 2000000 IU Vitamin D_3, 35 000 mg Vitamin E, 2000 mg Vitamin K_3, 1000 mg Vitamin B_1, 3000 mg Vitamin B_2, 30 000 mg Niasin, 7500 mg Calcium D-Pantotenat, 2000 mg Vitamin B_6, 10 mg Vitamin B_{12}, 750 mg Folic acid, 75 mg D-Biotin, 62500 mg Endox D dry. [2]:Provides per kg of diet: 100000 mg Mn, 80000 mg Fe, 80000 mgZn, 8000mg Cu, 200 mg Co, 150 mg Se, 300000mg Choline cloride, 1000 mg I. *:Calculated to meet or exceed the requirements of broiler starter, grower diet (NRC,1984)

Results

Multi enzyme and protease enzyme addition did not affect the liveweight gains on 21st, 35th and 42nd days and feed consumptions and feed conversion ratios ($p>0.05$) (Table 2).

In Table 3, it can be seen the effects of the multi enzyme and protease enzyme addition to the rations on some carcass characteristics.

While multi and protease enzyme addition did not affect carcass weight in females and mixed-sex groups, multi enzyme addition increased the carcass weight compared to the protease enzyme addition in males ($p<0.05$).

Multi enzyme addition decreased abdominal fat contents in mixed-sex group compared to the other groups ($p<0.05$). Abdominal fat contents were not different between the groups given multi enzyme or protease enzyme ($p>0.05$). Multi enzyme addition decreased the abdominal fat content compared to the control group in males ($p<0.05$), but it did not affect it in females ($p>0.05$).

Enzyme addition did not affect edible organ weights, digestive tract lengths, digestive tract weights, digestive tract thicknesses, digestive tract pH, dressing percentages and mortalities in males, females and mixed-sex group ($p>0.05$).

Table 2: Growth performance of broilers fed on diets with multi and protease enzyme addition

	Diets				
Variable	Age (day)	Control	Multi enzyme	Protease enzyme	Interaction	SEM
Initial weight	7	98.89	98.93	98.92	NS	2.42
Live weight (g/bird)	21	476.60	453.69	439.54	NS	1.63
	35	1436.04	1374.18	1382.78	NS	0.82
	42	1840.09	1779.34	1761.06	NS	1.17
Feed intake (g/bird)	21	766.79	771.44	754.24	NS	0.41
	35	2689.73	2731.33	2725.63	NS	0.76
	42	3985.03	3966.28	3993.65	NS	0.17
FCR (feed: weight gain)	21	1.61	1.70	1.73	NS	0.96
	35	1.87	1.99	1.98	NS	1.52
	42	2.17	2.23	2.27	NS	2.24

NS: Non significant

Table 3: The effect of multi and protease enzyme addition to broiler diets on carcass composition

	Diets					
Characteristics	Sex	Control (without enzyme)	Multi enzyme	Protease enzyme	Interaction	SEM
Carcass weight	Mixed	1390.33	1385.25	1346.17	NS	1.86
	M	1478.33ab	1499.00b	1406.00a	p<0.05	3.24
	F	1302.33	1271.50	1286.33	NS	0.454
Abdominal fat pad	Mixed	1.53b	1.18a	1.44b	NS	3.53
	M	1.48b	1.05a	1.30ab	NS	3.04
	F	1.59	1.32	1.58	NS	0.89
Edible organs'	Mixed	3.62	3.58	3.60	NS	0.90
weights	M	3.69	3.52	3.55	NS	0.82
	F	3.54	3.65	3.64	NS	0.22
Digestive system	Mixed	203.33	203.08	206.33	p<0.05	0.55
length	M	208.33	215.17	211.83	NS	0.16
	F	198.33	191.00	200.83	NS	0.68
Digestive system	Mixed	8.82	8.38	9.06	NS	1.06
weight	M	9.07	8.17	9.04	NS	1.62
	F	8.57	8.59	9.08	NS	0.29
Digestive system	Mixed	84.26	80.02	83.58	NS	2.54
thickness	M	88.79	79.55	83.59	NS	2.17
	F	79.74	80.40	83.57	NS	2.02
Intestine pH	Mixed	5.63	5.92	5.67	p<0.05	0.49
	M	5.73	6.15	5.75	NS	1.30
	F	5.53	5.68	5.58	NS	0.48
Dressing percentage	Mixed	71.04	72.05	70.71	NS	0.16
	M	71.40	72.59	70.81	NS	2.04
	F	70.68	71.51	70.61	NS	0.31
Mortality		1.11	0.00	1.11	NS	0.50

a,b,c,...means within a row with no common superscript are significantly different. (p<0.05), NS: Non significant

Discussion

Enzyme addition to the SBM-based or CM-based rations did not affect LWGs (p>0.05). This finding are in agreement with the studies of Kocher *et al.* (2001) and Alloui *et al.* (1994) in which multicarbohydrase and protease enzymes were added to the rations. However, Simbaya *et al.* (1996) demonstrated that while protease and carbohydrase enzymes did not affect the LWGs if they are used separately, they increased LWGs when they are used collectively. The results of this study are in contradiction with those of some previous studies which reported that protease and carbohydrase addition to the SBM-based or CM-based rations affected LWGs positively (Rasmusen and Pettersen, 1997; Slominski *et al.*, 1997; Guenter *et al.*, 1998; Kocher *et al.*, 2003; Alam *et al.*, 2003).

The FC and FCR were not affected by the addition of multi enzyme and protease enzyme. This finding is in consistent with reports from Bedford and Morgan, (1995), Simbaya *et al*. (1996), Kocher *et al*. (2001) and Alam *et al*. (2003) but not inconsistent with those from Kocher *et al*. (2003), Torres *et al*. (2003), Kapacius *et al*. (2003), Odetallah *et al*. (2003) and Mathlouth *et al*. (2002).

The multi enzyme and protease enzyme addition to the rations decreased the abdominal fat contents in mixed-sex group and males ($p<0.05$). The decrease in abdominal fat content due to enzyme addition is not surprising because of the fact that enzyme addition did not affect FC and FCR. In contrast to the current study, Torres *et al*. (2003) reported that amylase, protease and ksilanase enzymes added to the rations did not affect abdominal fat contents in broilers.

The edible organ weights, digestive tract weights, digestive tract lengths, digestive tract thicknesses, digestive tract pH, dressing percentages and mortalities were not affected by enzyme addition in this study. The results of this study confirmed findings by Johri (2004) and Torres *et al*. (2003) who showed that protease enzyme and multienzyme addition did not affect the carcass characteristics. However, this study is inconsistent with that of Kocher *et al*. (2001) who showed that multienzyme addition improved the carcass quality and with that of Shires *et al*. (1987) who showed that enzyme addition increased the digestive tract weight.

In this study, multienzyme and protease enzyme were added to the rations in which CM replaced 25% of the dietary protein provided by SBM on the broiler performances. Enzyme addition had no influence on broiler performance and carcass characteristics except for abdominal fat content which decreased due to enzyme addition. Alternative enzymes or enzyme mixtures must be evaluated to accomplish desirable changes in broiler performance and carcass characteristics.

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