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Effects of the Commercial Enzyme Supplementation to the Rations on Broiler Performance

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Abstract: This study was conducted to determine the effects of using 2 different multi enzyme preparations on broiler performances. In the study, 270 7-day-old (Ross-308) broiler chicks were used. This study was conducted in 3 groups (Control, Multi enzyme A and Multi enzyme B) with 3 replicates of 30 chicks. During the study, commercial starter (7-21 days; 23% CP, 3100 kcal kg^{-1} ME), grower (21-35 days; 21% CP, 3200 kcal kg^{-1} ME) and finisher (35-42 days; 19% CP, 3200 kcal kg^{-1} ME) broiler diets were used and 1 kg/t enzyme (A and B) were added to the enzyme-containing groups. Enzyme supplementation did not affect the LWG, FI and FCR on 42nd day. Similarly, abdominal fat weight, digestive tract length, intestinal pH and dressing percentage were not affected by enzyme supplementation in females. In males, Multi enzyme B supplementation did not affect the parameters except dressing percentage. In mixed-sex group, Multi enzyme B supplementation had significant effect on edible organs weight, digestive tract weight and dressing percentage ($p<0.05$), but not on other traits.

Key words: Compound feed, multi enzyme, broiler, performance

Introduction

The most important factor affecting high-qualified compound feed production is ingredients. Feeding costs compose 80-85% of the production costs in broiler production .

Endogen enzymes degrading complex compounds such as celluloses and other non starch polysaccharides (NSPs) are not secreted in digestive systems of poultry. For this reason, broilers can not make use of NSPs found in feeds in high amounts efficiently (Annison, 1995). NSP contents can be reached to 50 % in some feeds (Anonymous, 1988). Some grains with high cellulose content such as barley and oat can not be digested by poultry efficiently (Annison, 1995). Furthermore, digestibilities of the other components found in feeds decrease due to the presence of higher levels of cellulose and other NSPs (hemicelluloses, β-glucans and pectins). This, in turn, decreases the energy values of feeds and consequently the live weight gains and feed conversion rates.

Enzyme supplementation is recommended with the aim of enhancing the feeding values of feeds such as barley, wheat and sunflower meal which are high in cellulose and other NSPs (Steenfeldt, 1995; Almirall and Esteve-Garcia, 1994). Similarly, Meng and Slominski (2005) found that the nutrient utilization of corn-SBM diet by broilers could be enhanced by using an appropriate multicarbohydrase enzyme supplement.

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Chesson (1992) reported that addition of enzyme preparations containing β-glucanases to the barley-based rations increased the ME content of the feed and feed intakes and performances of the broilers. In the study of Wang *et al*. (2005) enzyme supplementation (primarily xylanase and beta-glucanase) improved performance of the broilers; daily gain and feed conversion increased linearly with increasing levels of enzyme supplementation. In this study, it was also reported that enzyme inclusion decreased the size of the digestive organs and the gastrointestinal tract to some extent. Similarly, evidences presented by Meng *et al*. (2004) suggested that carbohydrase enzyme supplementation (xylanase, glucanase, cellulase and other enzyme activities) improved daily gain and feed conversion ratio. On the contrary, Vahjen *et al*. (2005) found that multi enzyme addition did not affect the performances of broilers.

Live weight gain in broiler production was reported to increase due to the pentosanase addition to the rye-based rations (Peterson and Aman, 1989; Friesen *et al*., 1991). Furthermore, Barrier-Guillot *et al*. (1995), reported that xylanase addition was very effective in cell wall degradation in rye-based rations.

The objective of the present study was to determine the effects of 2 different commercial multi enzyme preparations composed of various enzymes added to the diet on broiler performance.

Materials and Methods

In the study, 270 7-days-old broiler (Ross-308) chicks were used. The composition of the rations and enzymes (Farmazym 3000 Proenx; 3000 IU kg^{-1} and Farmazym 2010; 2000 IU kg^{-1}) were given in Table 1 and 2, respectively. This study was conducted at Research and Application Farm of Agricultural Faculty of Ondokuz Mayis University in 2004.

The study was conducted in 3 groups (Control, Multi enzyme A; 1 kg/t and Multi enzyme B; 1 kg/t) with 3 replicates of 30 chicks. During the first week starter feed was fed to the chicks and then chicks were allocated to the groups according to their live weights. In the study, commercial starter (7-21 days; 23% CP, 3100 kcal kg^{-1} ME), grower (21-35 days; 21% CP, 3200 kcal kg^{-1} ME) and finisher (35-42 days; 19% CP, 3200 kcal kg^{-1} ME) broiler diets were used and 1 kg/t enzyme (A and B) were added to the enzyme-containing groups. Feed and water were provided ad libitum for the duration of the trial. The sawdust was used as litter material. Feed intake (FI)s and live weight gain (LWG)s were determined weekly. At the 42nd day, 2 male and 2 female birds from each replicate (totally 12 birds from a group) were killed by cervical dislocation and carcass weights, dressing percentages, abdominal fat weights, edible organs' weights, digestive tract lengths, digestive tract weights, digestive tract thicknesses, intestinal pHs and mortality rates were determined. Proximate analyses of feeds were carried according to the AOAC (1990).

Data obtained throughout the trial were analysed using SPSS (12.0) pocket programme and differences between the averages were examined by Duncan' multiple-range test.

Results

Control group was superior in LWG to the multi enzyme A and multi enzyme B groups during 7-21 days ($p<0.01$). There were no differences in terms of LWG among the groups on 35th and 42nd days (Table 3) .

While the 21st and 42nd day FIs were not different among the groups, Multi enzyme B group consumed less feed compared to the control group and Multi enzyme A group on 35th day ($p<0.01$).

FCRs of the all groups on 21st, 35th and 42nd days were similar (Table 3).

Table 1: Composition of the starter, grower and finisher diets

Ingredients	Starter	Grower	Finisher
Maize, yellow	355.5	330.4	256.8
Soybean meal (480 g CP/kg)	275.3	204.5	171.5
Sunflower meal (350 g CP/kg)	110.0	150.0	111.5
Wheat	99.0	130.0	330.0
Wheat bran	-	38.0	-
Meat-bone meal	64.4	56.0	49.2
Vegetable oil	73.7	85.0	73.6
Limestone	13.6	-	-
Premix[1]	3.5	3.5	3.1
Sodiumchloride	3.0	2.5	2.5
L-Lysine	0.4	-	0.1
DL-Methionine	1.6	0.1	1.7
Total	1000.0	1000.0	1000.0
Analyzed composition			
Dry matter (%)	91.04	90.18	89.77
Crude Protein (%)	23.07	20.99	18.87
Crude fiber (%)	4.15	6.35	5.59
Ether extract (%)	9.68	10.48	10.01
NFE (%)	44.29	44.59	48.59
Ash (%)	9.85	7.77	6.71
Calculated chemical composition (per kg of diet)*			
ME (kcal/KM)	3100.0	3200.0	3200.0
Calcium (g)	15.0	9.0	8.0
Available phosphorus (g)	5.0	4.7	3.9
Lysine (g)	12.0	10.0	8.5
Methionine (g)	5.6	4.0	5.2
Methionine+cystine (g)	9.3	7.6	8.4
Sodium chloride (g)	3.4	2.9	2.9

[1]Provides per kg of diet: Mn, 80 mg; Zn, 60 mg; Fe, 60 mg; Cu, 5 mg; Co, 0.2 mg; I, 1 mg; Se, 0.15 mg; choline chloride, 200 mg; vitamin A, 12000 IU; vitamin D3, 2400 IU; vitamin E, 50 mg; vitamin K3, 4 mg; vitamin B1, 3 mg; vitamin B2, 6 mg; niacin, 25 mg; calcium-D pantotenate, 10 mg; vitamin B6, 5 mg; vitamin B12, 0.3 mg; D- biotine, 0.05 mg; folic acid, 1 mg.

*: Calculated to meet or exceed the requirements of broiler starter, grower and finisher diets (NRC,1984)

Table 2: Composition of enzyme preparations

Enzyme	Multi A (3000 Proenx)	Multi B (2010)
Protease	+*	-
Fungal xylanase	+	+
Fungal β-glucanase	+	+
Endo β-glucanase	+	+
α-amylase	+	+
β-glucanase (pH = 5⁻°C30)	+	+
β-glucanase (pH = 7⁻°C30)	+	+
Hemicellulase	+	+
Pentosanase	+	+
Pectinase	+	+

*: The signs indicate the presence (+) or absence (-) of the ingredients in enzyme preparations

While addition of B enzyme to the rations decreased carcass weight compared to the control group ($p<0.05$) in males and mixed-sex group, no difference in carcass weight was not observed due to enzyme supplementation in females.

In females abdominal fat weight, digestive tract length, intestinal pH and dressing percentage were not affected by the addition of A and B enzyme.

There were significant differences ($p<0.05$) between Multi enzim B and control group in terms of edible organ weights, digestive tract weight and digestive tract thickness in females (Table 4).

Table 3: Effect of enzyme supplementation on the performances of broiler chicks

	Initial weight	Weight gain (g)			Feed intake (g)			Feed conversion ratio		
Groups	7d	21d	35d	42d	21d	35d	42d	21d	35d	42d
Control	98.93	388.13a	1246.24	1778.43	586.44	2304.94a	3547.43	1.51	1.85	2.00
Multi A	98.92	363.97b	1067.57	1606.22	574.61	2279.71a	3565.21	1.58	2.24	2.26
Multi B	98.96	359.19b	1168.37	1822.15	595.23	2184.77b	3514.63	1.66	1.87	1.93
SEM	0.013	2.26	50.59	57.75	9.65	10.80	24.66	0.028	0.122	0.073

Means within each column with no common superscript differ a,b,c.... ($p<0.01$)

Table 4: Effect of enzyme supplementation on carcass composition of broilers

Groups	CW (g)	AFW (g)	EIOW (g)	CY (%)	DSL (cm)	DSW (g^{1})	DST (g/ 100 cm)	pH	M (%)
Mixed sex									
Control	1377.33a	1.13	4.12b	70.26a	199.38ab	8.42b	0.84	5.94	1.11
Multi A	1299.67ab	1.13	4.33ab	70.47a	196.58b	9.23ab	0.87	5.85	1.11
Multi B	1269.67b	0.91	4.40a	67.91b	207.13a	9.79a	0.89	5.87	2.22
SEM	17.55	0.70	0.05	0.39	1.95	0.168	1.18	0.03	0.52
Female									
Control	1274.67	1.23	4.12b	70.82	195.58	8.16b	0.75b	5.93	
Multi A	1229.83	1.28	4.38ab	70.68	191.33	9.19ab	0.84ab	5.92	
Multi B	1217.67	0.95	4.70a	69.56	203.09	10.23a	0.88a	5.98	
SEM	12.69	0.09	0.06	0.36	2.58	0.26	1.69	0.06	
Male									
Control	1480.00a	1.04	4.11	69.71a	203.17	8.68	0.90	5.95	
Multi A	1369.50ab	0.98	4.28	70.27a	201.83	9.27	0.90	5.78	
Multi B	1321.67b	0.86	4.09	66.25b	211.03	9.36	0.87	5.76	
SEM	19.72	0.08	0.07	0.71	3.02	0.21	1.50	0.05	

Means within each column with no common superscript differ a,b,c,d. ($p<0.05$), CW: Carcass weight, AFW: Abdominal fat weight, EIOW: Edible inner organ weight, CY: Carcass yield, DSL: Digestive system length, DSW: Digestive system weight, DST: Digestive system thickness, M: Mortality, [1]: Calculated as per cent (%) of live weight

Multi enzyme A and B supplementation increased the edible organ weights and digestive tract weights and thicknesses in females ($p<0.05$).

In males, abdominal fat weight, edible organ weight, digestive tract weight, digestive tract length, digestive tract thickness and intestinal pH were not affected by Multi enzyme A and Multi enzyme B supplementation, but dressing percentage was found lower for Multi enzyme B group than Multi enzyme A and control groups ($p<0.05$).

In mixed-sex group, while the enzyme (A and B) supplementation had no effect on abdominal fat weight, digestive tract thickness, intestinal pH and mortality, Multi enzyme B group had higher ($p<0.05$) digestive tract lengths and thicknesses compared to control group. Dressing percentage was found lower ($p<0.05$) for Multi enzyme B group compared to Multi enzyme A and control groups.

Discussion

In the study, Multi enzyme B addition had no effect on LWG on 42nd day. As a matter of fact, Fisher *et al*. (2002) reported that multi enzyme (protease, amylase and cellulase) supplementation to the corn-soy based broiler rations did not affect the LWG. Similarly, Vahjen *et al*. (2005) found no effect of multi enzyme supplementation on performance of broilers. Conversely, many researchers (Friesen *et al*., 1991; Mathlouthi *et al*., 2002; Torresi *et al*., 2003; Cowiesen *et al*., 2003; Odetallah *et al*., 2003; Kocher *et al*., 2003; Yobo *et al*. 2005) reported that multi enzyme supplementation improved the LWG. The lack of effect of multi enzyme addition

on LWG in this study can be attributed to the insufficiency of enzyme activity and dosage as well as impropriety of enzyme preparations.

Enzyme supplementation affected FI on 35th day but not on 21st and 42nd day. This finding is in consistence with that of Fisher *et al*. (2002) but is not consistent with findings of Friesen *et al*. (1991) and Mathlouthi *et al*. (2002), who reported that xylanase and β-glucasanase supplementation improved FI and Samarasinghe *et al*. (2000) who reported that multi enzyme supplementation decreased FI in broilers.

The effect of enzyme supplementation on FCR was found insignificant in present study. This finding is in consistence with the findings of Saricicek *et al*. (2005). However, Alam *et al*. (2003) found that multi enzyme supplementation to the broiler rations improved FCR. Multi enzymes are more effective especially in rations which contain high amounts of barley and sunflower with high cellulose. Effect of the enzyme addition may not be observed due to the fact that the rations used in this study contain no barley and small amounts of sunflower.

The lower dressing percentage observed in Multi enzyme B group may be attributed to the fact that Multi B enzyme preparation was not effective on NSP digestion and therefore could not improve LWG and FCR adequately.

Abdominal fat weight was not affected by enzyme supplementation in males, females and mixed-sex group. Similarly, Torresi *et al*. (2003) reported that amylase, protease and xylanase addition to the corn-soy based broiler rations did not affect abdominal fat weight. On the contrary, Garcia *et al*. (1997), found that β-glucasanase and xylanase addition to the barley-wheat based rations increased the abdominal fat weight in broilers. The lower abdominal fat weight observed in multi enzyme B group composed to the other groups may be attributed to the fact that multi enzyme B addition lowers fattening due to its lowering effect on FI and FCR.

While Multi enzyme B supplementation increased the edible organ weights compared to control group in females and mixed-sex group, there was no effect of enzyme addition on edible organ weights in males. Rahman *et al*. (2005) reported that enzyme supplementation had no effect on edible organ weights.

In this study, consistent effects of enzyme supplementation on digestive tract weight, digestive tract thickness and intestinal pH were not found in males, females and mixed-sex group. This finding is inconsistent with the findings of Wang *et al*. (2005) who reported that enzyme inclusion decreased the size of the digestive organs and the gastrointestinal tract to some extent. Multi enzyme B preparation's composition probably is not appropriate for degradation of NSPs found in feeds and digestive tract muscle should work harder to decrease these NSPs and, therefore length, weight and thickness of digestive tract increase.

In males and mixed-sex group, Multi enzyme B group had lower dressing percentage than Multi enzyme A and control groups, but no difference was observed between the groups in females. These findings is in agreement with findings of Biswas *et al*. (1999) but not with those of Leeson *et al*. (1996) who reported that enzyme supplementation improved dressing percentage.

In conclusion, enzyme supplementation to the broiler rations did not lead to significant improvements in broiler performance. It can be more appropriate to use these enzymes in rations composed of feed ingredients high in cellulose or other NSPs. Among the factors affecting success in enzyme supplementation are origin of grain used in ration, composition of the ration, storage conditions of enzyme, feed production technology, composition of the enzyme preparation and homogeneity of feed mixing.

In this study, beneficial effects from enzyme supplementation could not be obtained. In theory, enzyme supplementation should be beneficial in rations containing barley, wheat and rye with high amounts.

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