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Effects of Mannanoligosaccharide (MOS) from Saccharomyces Cerevisiae on Some Internal, Gastrointestinal and Carcass Parameters in Broilers

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Abstract: The study was conducted to investigate the effects of MannanOligoSaccharide (MOS) on internal organ weights, pHs of GastroIntestinal Tract (GIT) and carcass characteristics in broilers. A total of 120, 1-day-old Ross 308® chicks were used in this study. Birds were assigned into four groups, each consisting three subgroups which are having 10 animals in them. The control group was fed a basal diet without supplemented MOS and the treatment groups were fed 0.05, 0.10 and 0.15% MOS in basal diet. MOS addition to the diet did not have any effect on carcass characteristics in broilers. Pancreas weight was significantly ($p<0.05$) lower in 0.10% MOS supplemented group than those in control group. The weight of bursa of fabricius in 0.05% MOS supplemented group was significantly ($p<0.05$) higher than those in control group. PHs in crops of animals in MOS supplemented groups was higher than ($p<0.05$) those in control group. MOS addition to the broiler diet did not alter carcass parameters although, supplementation increased pancreas weight and decreased the weight of bursa fabricius. Additionally MOS in diet altered the pH of the crop.

Key words: Broiler, MOS, pH, carcass, GIT, crop

INTRODUCTION

Antibiotics have been widely used extensively in poultry feeds for more than 50 years but the ban on antibiotic growth promoters in some parts of the world legislations has prompted to the search for alternatives. Therefore, prebiotics and probiotics which are considered to be the alternatives as non-antibiotic growth promoters are becoming more popular in poultry industry. Outer cell wall component of Saccharomyces cerevisiae, Mannan OligoSaccharide (MOS), was first introduced as a feed additive commercially for broiler chickens (Bio-Mos®, Alltech, Nicholasville, Kentucky USA). Since then, Many studies have been conducted on MOS effects on various parameters in vide range of animal species and they have postulated that MOS improved body weight, feed conversion ratio (Spring *et al*., 2000; Raju and Dewegowda, 2000; Ferket *et al*., 2002) and disease resistance in various animal groups (Oyofo *et al*., 1989; Loddi *et al*., 2002; Hooge, 2004) without giving much attention to the digestion and carcass parameters.

Prebiotics can be defined as feed ingredients, which are non-digestible growth promoting substrates, the beneficial bacteria natural resident of caecum and colon. Several studies have shown that addition of prebiotics in various amounts to diet of broilers, layers and pigs lead to improve performance through improving gastrointestinal microflora (Raju and Dewegowda, 2000; Parks *et al*., 2001; Xu *et al*., 2003).

Although, results on the improvement of performance by MOS addition were well investigated and postulated clearly, results on carcass characteristics were contradictory (Ceylan *et al*., 2003). One of the possible explanation for the improvement of performance by MOS was to improve immune system and GI tract health (Hooge and Sefton, 2004). Therefore, mostly immune organs and those related to gut were investigated and found that the weights of bursa and pancreas were decreased (Ao *et al*., 2004).

Relative weights of intestinal parts, both pathogen and resident microbial populations and pHs of various segments of GI tract were affected in various degree by different levels of MOS addition in so many environmental and management conditions (Loddi *et al*., 2002; Ao *et al*., 2004). Therefore the aim of this study was to investigate the effects of various levels of MOS in broiler diet on internal organs gastrointestinal pHs and carcass characteristics in broilers.

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MATERIALS AND METHODS

A total of 120 1 day old Ross 308® broiler male chicks were divided randomly into 4 groups, in which there were 3 replicates of 10 broiler chicks. The chicks were housed under fluorescent lighting and fed a starter diet from 1-15 days of age and a grower diet for the period of 15-42 days. Experimental diets were formulated as recommended by NRC (1994) (Table 1). The chicks were allowed *ad libitum* access to feed and water.

At the end of the study (day 42), birds were weighed individually and 9 birds from each treatment group were randomly slaughtered for carcass data. The birds were not fasted before slaughter and carcasses were cleaned thoroughly, feathers (wet), feed and visceral organs being removed. Hot carcass weights and yields were calculated after carcasses were slaughtered. Cold carcass weights were calculated after carcasses were kept at + 4°C for 18 h. Cold carcass yields were calculated as dividing cold carcass weights by body weights at slaughter.

The liver, pancreas, gizzard, spleen, bursa of fabricius and heart were removed and weighed and expressed as relative organ weights (gram of per 100 of live weights). Crop and duodenal pH was measured using a microelectrode pH/ION meter (WTW GmbH, Germany).

Statistical analysis: The experiment was designed as Completely Randomized Blocks. The data were statistically analyzed by one-way Analysis of Variance (ANOVA). When the main effect was significant then the means were separated by Duncan's multiple range test. To investigate the MOS effect on investigated parameters, orthogonal contrasts were utilized. $p<0.05$ was considered to be significant, unless noted otherwise.

Table 1: Compositions of the starter and grower diets

Ingredients	Starter diet[2] (%)	Grower diet[3] (%)
Corn	36.00	49.00
Wheat	15.35	8.00
Soybean Meal	25.00	20.00
Full Fat Soybean	14.15	15.00
Fish Meal	3.15	1.65
Oil	3.00	3.00
Limestone	1.50	1.50
Dicalcium phosphate	1.00	1.00
Salt	0.25	0.25
DL-Methionine	0.25	0.25
Vitamin Premix[4]	0.15	0.15
Mineral Premix[5]	0.20	0.20

[1]: Batches of diet were prepared weekly stored in dry and cool place; [2]: Crude Protein 23.00%; ether extract 8.66%; Ash 5.67%; ME (calculated) 3.100 kcal kg^{-1}; [3]: Crude Protein 20.00%; ether extract 10.17%; Ash 5.24%; ME (calculated) 3.200 kcal kg^{-1}; [4]:Each kg of premix contain; 15.000.000 IU Vitamin A, 1.500.000 IU Vitamin D_3, 50.000 IU Vitamin E, 5.000 mg Vitamin K_3, 3.000 mg Vitamin B_1, 6.000 mg Vitamin B_2, 25.000 mg Niacin, 12.000 mg Calcium-D Pantothenate, 5.000 mg Vitamin B_6, 30.000 mg Vitamin B_{12}, 1.000 mg Folic acid, 125 mg D-Biotin, 300.000 mg L-Lysin; [5]: Each kg of premix contain; 80.000 mg Manganese, 30.000 mg Iron, 60.000 mg Zinc, 5.000 mg Copper, 500 mg Cobalt, 2.000 mg Iodine, 235.680 mg Calcium Carbonate

RESULTS AND DISCUSSION

Carcass weights and carcass percentages of the treatment groups are presented in Table 2. Cold carcass percentages were found as 75.13, 74.97, 76.16 and 76.24%, in control, 0.05, 0.10 and 0.15% MOS supplemented groups, respectively. Adding MOS to the diet had no effect on carcass parameters of broilers. However, the hot and cold carcass percentages were higher in 0.10 and 0.15% MOS added groups than other groups, although, they were not significant. Namely, carcass percentages were slightly improved by MOS addition to the broiler rations. Carcass percentages were slightly improved by the addition of MOS to the broiler rations in present study (Table 2). The results from some researches (Ceylan *et al*., 2003; Waldroup *et al*., 2003; Jamroz *et al*., 2004) indicated that the usage of MOS in broiler rations has no statistical effect on carcass percentages although, edible giblets in MOS added groups were significantly higher than those in control group (Jamroz *et al*., 2004). Contradictory to the possible mechanism of action of MOS in gastrointestinal environment (Raju and Dewegowda, 2000) and immune system (Ferket *et al*., 2002), improvement in carcass parameters was not observed in neither present nor previous studies.

Internal organ weights and gastrointestinal pHs, presented in Table 3. No significant difference was observed in weights of the liver, heart gizzard and spleens in treatment groups, however pancreas weight as relative to the body weight significantly reduced by dietary supplementation of MOS ($p<0.05$). Mean edible giblets and bursa of fabricious weights was significantly higher in broiler fed 0.05% MOS than those in other groups ($p<0.05$).

Some researchers in previous experiments observed differences in internal organ weights (Pelicano *et al*., 2004; Ozturk and Yidirim, 2005).

In this study, pancreas weight as relative to the body weight significantly reduced by dietary supplementation of MOS ($p<0.05$). Similar observations have been reported by Ao *et al*. (2004). Edible giblets weights were significantly higher in broiler fed with 0.05% MOS than those other groups ($p<0.05$). The weight of bursa of fabricius was significantly higher in animals fed with 0.05% MOS compared to those in other groups ($p<0.05$). The results obtained here are in agreement with the findings of Ao *et al*. (2004).

Although, no significance was observed in the pHs of duodenum of treatment groups, pHs in crops of animals in 0.10% MOS fed groups were significantly higher than those of other treatment groups ($p<0.05$).

Table 2: Effects of mannanoligosaccharide supplementation on carcass parameters of male broiler chicks

Variable parameter	Control	0.05% MOS	0.10% MOS	0.15% MOS
42 d Body weight (g)	2621.00±41.73	2520.22±51.16	2588.89±69.10	2569.56±45.81
Hot carcass weight (g)	2010.11±43.35	1918.67±44.40	1996.67±52.30	1980.00±34.20
Hot carcass percentage (%)	76.67±0.88	76.10±0.53	77.20±1.15	77.06±0.33
Cold carcass weight (g)	1969.44±39.93	1890.00±44.11	1969.67±52.30	1958.89±33.58
Cold carcass percentage (%)	75.13±0.84	74.97±0.56	76.16±1.23	76.24±0.31

Table 3: The effects of MOS on relative organ weights (g/100g BW) and GIT pHs

Parameters	Control	0.05% MOS	0.10% MOS	0.15% MOS	MOS VS Control
Liver	1.73	1.90	1.78	1.74	NS
Heart	0.51	0.55	0.49	0.50	NS
Gizzard	1.21	1.36	1.15	1.25	NS
Spleen	0.12	0.12	0.12	0.14	NS
Pancreas	0.21^{a}	0.19^{ab}	0.16^{b}	0.19^{ab}	0.024*
Bursa fabricius	0.23^{b}	0.29^{a}	0.26^{ab}	0.22^{b}	0.026*
Edible giblets	3.57^{b}	3.94^{a}	3.55^{b}	3.63^{b}	NS
Crop pH	5.14^{b}	5.21^{b}	5.94^{a}	5.47^{ab}	0.038*
Duodenal pH	6.28	6.16	6.23	6.18	NS

a, b: Means within row with different superscripts are significantly different ($p<0.05$)

Mannanoligosaccharide supplemented diets increase the lactic acid content and decrease pH of digesta in broiler chickens (Iji and Tivey, 1999). Zdunczyk *et al.* (2005) reported that caecal pH was highest in dietary MOS (0.25%). But that level of MOS in the diet had no significant influence on pH level of caeca in broilers (Derebasg and Demir, 2004; Ozturk and Yildirim, 2005; Raju and Dewegowda, 2000) and turkeys (Juskiewicz *et al.*, 2003). Although, it was postulated that MOS addition to diet modify lower parts of the intestine (Ferket *et al.*, 2002), present study showed that MOS starts its action of changing the environment by sugar coating (Oyofo *et al.*, 1989) even in the upper parts of the GI tract.

CONCLUSION

In conclusion, MOS addition to broilers diet did not alter carcass percentages. Additionally, internal organs such as pancreas and those related with immune system such as bursa of fabricius were significantly affected by MOS addition to diet of broilers. Although, no pH difference was detected in duodenum, MOS addition elevated the pH in the content of crop.

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