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Effect of Olibanum (*Boswellia thurifera*) as a feed additive on performance, some blood biochemical and intestinal morphology in broiler chicks

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Abstract

To determine the effect of Olibanum on performance, some blood biochemical and intestinal morphology of broiler chicks, a total 360 one day Ross 308 broiler chicks were divided into 6 dietary treatments. The chicks were fed a basal diet as control; basal diet with 0.01% (T1), 0.015% (T2), 0.02% (T3), 0.03% (T4) and 0.05% (T5) of Olibanum. No significant difference was found in feed intake, weight gain and feed conversion ratio between the control and treated groups. Serum triglyceride level decreased significantly ($P<0.05$) in T1, T2 and T3 compared to the control. Villus length of ilium increased significantly ($P<0.05$) in T2. In conclusion, it seems that inclusion of Olibanum as feed additive may have significantly enhanced effects on performance and some blood biochemical in broiler chicks.

Keywords: Performance; broilers; blood parameters; Olibanum; intestinal morphology

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Introduction

Herbal, spices, as feed additives are possible natural alternatives to the use of antibiotics and probiotics as growth promoters in broiler diets. The effect of a phytogenic feed additive on nutrient digestibility has been well illustrated in many studies (Demir et al., 2003; Ghaedi et al., 2014). Herbal feed additives are plant derived products used in poultry feeding to improve the consumption and conversion of food, and the digestibility and weight gain of broiler chickens (Moorthy et al., 2009). Boswellia is a genus of trees in the order Sapindales, known for their fragrant resin which has many pharmacological uses, particularly as anti inflammatory (Etuk et al., 2006). Also, the aqueous stem bark extract of Boswellia was reported to show anti ulcer activity and reduced gastrointestinal motility (Nwinyi et al., 2004) and to possess anti diarrheal effect, which may be related to anti cholinergic mechanisms (Etuk et al., 2006). Crude extracts of the stem bark of Boswellia have been found to antibacterial activity against both Gram-positive and Gram-negative bacteria (Olukemi et al., 2005). *Boswellia serrata* resin is included in the group of feed additives approved for use in poultry production according to the European Union register of feed additives pursuant to regulation (EC) No 1831.2003. The resin of Boswellia species originates from India, Pakistan, Africa, and the Arabian Peninsula, where it is obtained from trees of the Burseraceae family. It is also known as “frankincense”, “olibanum”, “salai guggal”, “loban” or “kundur” (Afsharypuor and Rahmany, 2005) and is famous as a traditional medicine of the East. It contains mono (13%) and diterpenes (40%) as well as ethyl acetate (21.4%), octyl acetate (13.4%), and methylanisole (7.6%). The main biological activity

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among terpenes is attributed to 11-keto-ß-acetyl-beta-boswellic acid, acetyl-11-keto-ß-boswellic acid and acetyl-α-boswellic acid (Camarda et al., 2007). Singh et al. (2007) found that a dose of the pure Boswellia serrata at the level of 500 mg/kg of body weight was sufficient to inhibit their growth. In another study, a positive correlation was found between the antioxidant activity and sustenance of the integrity and activity of intestinal epithelium (Catanzaro et al., 2015). Herbs have been used as a feed additive in poultry diet for a long time to improve the growth and performance (Great head, 2003; Gill, 2009). The objective of this study was to explore the potential uses of different levels of Olibanum on performance, some blood biochemical and intestinal morphology in broiler chicks.

Materials and Methods

Birds and management

This experiment was carried out at the aviculture farm belong to the Islamic Azad University, Isfahan (Khorasgan) branch, Isfahan, Iran. All the experimental procedures were in accordance with established standards for the care and use of animal's rights for research purposes. For evaluating the effect of Olibanum powder on performance of broiler chicks, a total 360 one day broilers chicks (Ross 308) was divided into 6 groups of 10 birds each and assigned to 4 treatment diets. The experiment was carried out in 6 weeks. Feed and fresh water were provided *ad libitum* during this experiment. A lighting programmed of 23L: 1D was used for the trial period. The chicks were fed a basal diet as control; basal diet with 0.01 % (T1), 0.015 % (T2), 0.02 % (T3), 0.03 % (T4) and 0.05 % (T5) of Olibanum. Their diets were balanced according to the NRC (1994) as shown in Table 1. The body weight gain; feed consumption and feed conversion efficiency were measured weekly.

Blood biochemical evaluation

At the end of the trial, 2 male chicks from each treatment were slaughtered. Blood samples from each bird were collected and stored in refrigerator at 4°C for 24h and then they were subjected to biochemical determination (Pars Azmoon commercial kits).

Histomorphometric examination of small intestine

Samples of the intestines after the separation were fixed in Bouin's solution (Gabe, 1976), dehydrated, and paraffin-embedded. Longitudinal, 6-7 µm thick, consecutive paraffin sections were prepared and stained with hematoxylin eosin (HE) (Zawistowski, 1986). Morphometric analyses were performed on the duodenum and jejunum of 2 broilers per each treatment. The preparations were analyzed under a light microscope Axio Imager (Carl Zeiss MicroImaging GmbH, Göttingen, Germany). Patches with a correct structure were scanned with a Mirax Desk scanner (Carl Zeiss Microscopy GmbH, Jena, Germany). The measurements of the intestinal structures were performed using the Zeiss Axiovision LE image analysis program, ver. 4.1. (Zeiss MicroImaging GmBH, Jena, Germany).

Data analysis

Data were collected and analyzed using the General linear model procedure of SAS (2001). Differences between means were analyzed by Duncan's multiple range test (1995) and P value less than 0.05 was considered as significant**.** The data were analyzed according to the following model:

$$Y_{ij} = \mu + T_i + e_{ij}.$$

Whereas: Y_{ij} = Average effect observed, μ = Total average, T_i = Effect of treatments, e_{ij} = Effect of errors.

Results and Discussion

Data in Table 2 showed a non-significant difference in FI in trial groups. The lowest feed intake was found in the treated groups compared to the control. Also the highest BW belonged to the control group, but the enhanced FCR was recorded in T2 and T3.

Table 1: Composition of the experimental diets for experimental chicks

Ingredients %	0-14 (days)	14-21 (days)	21-42 (days)
Corn grain	54	54.7	60.1
Soybean meal	40	38.7	33.15
Vegetable oil	1.5	3	3
Dicalcium phosphate	2	1.7	1.6
Oyster shells	1.0	0.9	1.2
Methionine DL	0.3	0.2	0.1
Lysine L	0.17	0	0.10
NaCl	0.25	0.30	0.25
Vitamin Premix*	0.25	0.25	0.25
Mineral Premix*	0.25	0.25	0.25
Calculated nutrient content			
ME(kcal.kg)	2810	2980	3050
CP (%)	21.5	21	20
Ca (%)	0.97	0.86	0.81
Available Phosphorus (%)	0.46	0.43	0.40
Lysine (%)	1.32	1.19	1.17
Methionine + Cystine (%)	1.00	0.90	0.82

Supplied per kilogram of feed: 7.500 IU of vitamin A, 2000 IU vitamin D3, 30 Mg vitamin E, 1.5 µg vitamin B12, 2 mg B6, 5 mg vitamin K, 5 mg vitamin B2, 1 mg vitamin B1, 40 mg nicotinic acide, 160 µg vitamin Biothine, 12 mg calcium pantothenate, 1 mg folic acid, 20 mg Fe, 71 mg Mn, 100 µg Se, 37 mg Zn, 6 mg Cu, 1.14 mg I, 400 µg Cu

Table 2: The effect of added experimental diets on broilers performance (0-42 days)

Treatments	FI (g/day)	BW (g/day)	FCR
Control	89.07	45.70	1.95
T_1	87.76	45.21	1.94
T_2	86.43	44.74	1.93
T_3	86.20	42.57	2.02
T_4	85.54	42.69	2.01
T_5	85.64	43.30	1.99
SEM	2.90	1.43	0.11

The improved feed efficiency in treated groups may be due to the digestive characteristics of Oilbanum included in the broiler diet in spite of the low consumption compared with other may be due to the fact that it contains some compounds that enhance digestion and absorption of some nutrients in the diet. Gupta et al. (2001) confirmed that the dietary supplementation with the *Boswellia serrata* resin increases the absorption of iron, calcium, and phosphorus, which can also contribute to improved digestibility of dry matter and organic matter in the feed. Krieglstein et al. (2002) further confirmed that Boswellia resins appear to stimulate digestive functions, reduce gases, and enhance the flow of digestive juices. Other researchers proved that there is an increase in BW, FCR with decreasing haematological values of some important blood parameters using herbs in broiler diet (Ghaedi et al., 2014; Kheiri et al., 2014: Rafiee et al., 2014). The results of the present study are in agreement with the above findings.

Data from this study showed that the serum cholesterol, high density lipoprotein (HDL), low density lipoprotein (LDL) did not change significantly by the experimental diets (Table 3). Triglyceride level was at the lowest when chicks were fed T_2 where Olibanum caused a significant decrease in blood triglyceride. As results revealed from this study, although alanine transaminase (ALT), aspartate transaminase (AST) and alkaline phosphatase (ALK) enzymes tended to decrease by using Olibanum, but there were no significant differences between treatments and compared to the control. Qurishi et al. (2010) observed that boswellic acid stimulates secretion of pancreatic enzymes leading to an improvement of protein and energy digestibility, a reduction of endogenous losses of nitrogen and ammonia, and production of other microbial metabolites. Result of Roseline et al. (2007) reported that the *Boswellia dalzielii* bark extract did not have any significant (P>0.05) effect on alkaline phosphatase (ALP) activity in general. However, at 150 mg/kg, ALP activity showed a decrease, which still was not statistically significant. They also demonstrated that there was a significant dose dependent decrease in the activities of AST and ALT in the treated groups as compared to the control. In fact, natural flavonoids and polyphenolic compounds in Boswellia have been reported to exhibit protective and strengthening activities on liver cells (Akamatsu et al., 2004). The positive effect of supplements such as herbs, spices, plant extracts, or essential oils on the gastrointestinal tract and the production performance of animals is widely described in the literature (Jamroz et al., 2006; Abdel-Rahman et al., 2014).

The effect of Olibanum supplementation on intestinal morphology is given in Table 4. Data showed that in duodenum and jejunum villus length and crypt depth increased none significantly. There was a significant increase in villus length only in the ileum. It can be hypothesized that, in the current experiment, increased integrity of the intestinal tract associated with a greater villus length, height and surface area after Olibanum supplementation resulted in improved performance and other blood biochemical in broiler chickens. An increase in the height of the intestinal villi and the villus crypt ratio is directly correlated with an increase in the cellular turnover in the epithelium. A reduction of intestinal crypts indicates a decrease in the exchange of enterocytes and a lower requirement of tissue development (Pluske et al., 1996; Samanya and Yamauchi, 2002). Hartmann et al. (2014) observed a reduction of the inflammatory condition and swelling in the intestinal submucosa of rats and reduced damage of the epithelium lining the crypts after the use of Boswellia serrata.

Table 3: The effect of added experimental diets on some blood biochemical

Treatments	Cholesterol (mg/dl)	Triglyceride (mg/dl)	LDL (mg/dl)	HDL (mg/dl)	ALT (u/l)	AST (u/l)`	ALK (u/l)
Control	143	128^{a}	58	59	5.4	291	12.8
T_1	133	95^{b}	48	67	3.2	256	9.6
T_2	135	81^{b}	55	63	2.9	242	5.6
T_3	131	94^{b}	49	63	3.3	220	6.8
T_4	139	112^{ab}	55	61	2.6	249	7.1
T_5	122	101^{ab}	43	59	5.1	250	12.2
SEM	10.23	8.34	2.11	4.65	0.23	23.61	0.43

Means within column with no common on letter are significantly different (P<0.05); LDL: low density lipoprotein; HDL: high density lipoprotein; ALT: alanine transaminase; AST: aspartate transaminase; ALK: alkaline phosphatase

Table 4: The effect of added experimental diets on broilers intestinal morphology

Treatments	Duodenum (µm)		Jejunum (µm)		Ileum (µm)	
	Villus Length	Crypt depth	Villus Length	Crypt depth	Villus Length	Crypt depth
Control	1421	163	870	129	578^{b}	102
T_1	1669	195	1006	155	646^{ab}	133
T_2	1595	171	1064	166	792^{a}	134
T_3	1503	185	944	156	650^{ab}	109
T_4	1602	177	1104	146	692^{ab}	101
T_5	1564	180	1001	154	723^{ab}	113
SEM	34.87	23.41	78.54	12.1	19.32	11.12

Means within a column with no common on letter are significantly different (P<0.05).

Conclusion

We reported some beneficial effects of Olibanum on growth and some blood biochemical in broiler chicks. This improvement may be due to the biological functions to improve growth, digestibility and other activities.

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