The effects of dietary antibiotic and anise oil supplementation on body weight, carcass characteristics and organoleptic analysis of meat in broilers

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SUMMARY

In this study, the effects of dietary antibiotic (avilamycin) and anise oil supplementation on broilers body weight, including carcass characteristics and organoleptic analysis of meat were investigated. Two hundred, five days old broiler chicks (Ross-308) were divided into five groups of 40. These five groups were fed the basal diet (Control) or the basal diet supplemented with 100 ppm of anise oil (A100), 200 ppm of anise oil (A200), 400 ppm of anise oil (A400) and 0.1 % of avilamycin (Antibiotic). The mean body weight of A400 (2572.25 g) group was higher than Antibiotic group (2414.40 g) at the end of the treatment (40th day) (P<0.05). Besides, mean bodyweight of Antibiotic group was different from those of A100 (2299.95 g), A200 (2296.4 g) and Control group (2255.50 g) (P<0.05). Carcass characteristics showed differences among groups at gizzard ratio (P<0.01), liver, wings ratio, hot and cold carcass yield (P<0.05). The meat belong to A400 group was the better than the others according to results of the organoleptic analysis (P<0.05). In conclusion, the results of this study showed that anise oil, at a dose of 400 ppm, can be used as an alternative to antibiotic for growth promotion in broiler diets.

Keywords: Anise oil, carcass characteristics, body weight, broilers.

RÉSUMÉ

Effets d'une supplémentation en antibiotiques et en huile d'anis sur le poids vif, les caractéristiques de carcasse et les propriétés organoleptiques de la viande de poulet

L'objectif de cette étude était d'étudier les effets de la supplémentation en antibiotiques (Avilamisin) et en huile d'anis sur le poids vif, les caractéristiques de carcasse, et les propriétés organoleptiques de la viande de poulet. Deux cents poulets âgés de 5 jours (Ross-308) ont été divisés en 5 groupes de 40 animaux : le groupe control, le groupe A100 (supplémentation en huile d'anis de 100 ppm), le groupe A200 (supplémentation en huile d'anis de 200 ppm), le groupe A400 (supplémentation en huile d'anis de 400 ppm) et le groupe antibiotique (supplémentation en avamycine à 0.1%). A la fin de l'étude (40 jours), le poids vif moyen du groupe A400 était plus élevé (2572.25 g) que celui du groupe antibiotique (2414.40 g) (p<0.05). En outre le poids vif moyen du groupe antibiotique était différent de celui des groupes A100 (2299.95 g), A200 (2296.4 g) et contrôl (2255.50 g) (p<0.05). Les caractéristiques de carcasse étaient différentes en fonction du groupe au niveau du gésier (p<0.04), du foie, des ailes, de la carcasse chaude et de la carcasse froide (p<0.05). Les propriétés organoleptiques de la viande étaient meilleures dans le groupe A400 (p<0.05). En conclusion, les résultats de cette étude ont montré que l'huile d'anis à 400 ppm peut être utilisée comme alternative aux antibiotiques pour améliorer la croissance des poulets de chair.

Mots-clés : Huile d'anis, poids vif, qualité de la carcasse, poulets.

Introduction

The World Health Organization estimates that approximately 80 % of the people rely on traditional medicine for their primary health care. Most of these therapies are based on the use of plant extracts or their active components [14].

Antibiotics used as growth promoters have been forbidden in the European Union, because they could lead to resistance against pathogens and residues in tissues. In this view, aromatic plants and essential oils extracted from these plants became interesting due to their antimicrobial effects and the stimulating effects on animal digestive systems [10].

CRAIG [14] noticed that various herbs that have hypolipidemic, antiplatelet, antitumor or immune-stimulating properties may be useful for the reducing of the cardiovascular disease and cancer risk in human. Additionally, herbs have antimicrobial activity [17,31,35] and other biological activities such as antioxidant [9,13,27,28], hypocholesterolemic [14] and stimulating effects on animal digestive systems [21,30].

Anise (*Pimpinella anisum L.*), which is an aromatic plant, was used for its stimulating effects on digestion and its antiparasitic [10], antibacterial [31,33], antifungal [32], antipyretic [2] and laxative [12] properties. Additionally, the plant was used in the treatment of some disease like seizures and epilepsy [1,7]. Furthermore, it has been shown to have anticonvulsant [16,29] and muscle relaxant effects [3].

Few studies reported that the addition of some aromatic plants and their components in the feeds or water ingested by animals, improved live weight gain, feed intake, feed conversion ratio and carcass yield [4,8,20,34].

The aim of this study was to evaluate the use of anise oil in animal nutrition as a natural growth promoting substance instead of antibiotics. For this purpose, different levels of anise oil were added in a standard diet and effects on the broilers performance were investigated and were compared to control and antibiotic groups.

Materials and Methods

EXPERIMENTAL DESIGN AND DIET

Two hundred, five days old broiler chicks (Ross-308) were obtained from a local hatchery and divided into five groups of 40. Each treatment group was further sub-divided into four regular replicates. In the control group the birds were fed only the standard diet (Control). Three different levels of anise oil (87.5-90 % purity; Özdrog Co., Hatay, TURKEY) or a level of antibiotic (Avilamycin, Kartal chem., TURKEY) were added to the standard diets to generate the four other treatment groups. For the anise oil treatments, 100 mg/kg (A100), 200 mg/kg (A200), and 400 mg/kg (A400) of anise oil were added to the standard diets. The feed contained 0.1 % (10 mg/kg) of antibiotic in the Antibiotic treatment. Vegetable oil was used as fat source. Anise oil was dissolved in vegetable oil and then gently added to the standard diets and antibiotic were mixed carefully with the standard diet. The diets were prepared freshly each day. The ingredients and chemical composition of the diets are presented in Table 1. The diets were isocaloric and isonitrogenous. Diets and water were given ad libitum. The feeding procedure was performed according to description of the local hatchery.

Chickens were kept in 20 pens (1.5 x 1.5 m) ventilated broiler house containing straw as litter material.

CHEMICAL ANALYSIS

Chemical composition of feed ingredients (dry matter, crude protein, ash and ether extract) were analyzed according to the AOAC procedures, and crude fiber was determined by the methods of CRAMPTON and MAYNARD [15]. Plant materials were subjected to hydrodistillation using a Clevenger-type apparatus for 3 h to yield [5].

Chickens were weighted at 5, 20 and 40 days. At the end of study (40th day), six male chicken presented a body weight near the group average, were selected in each group and were slaughtered for carcass characteristics. From these chickens were removed feathers, head, legs and inner organs (except kidneys and lungs). Carcasses were kept at +4 ºC for 24 h, before remove legs (from articulatio coxe), breast (from articulatio sternocostalis), wings (from articulatio humeri), neck and back, according to Institute of Turkish Standarts rules [6]. These pieces were weighted together with skin.

Chicken breast were salted and covered with aluminum foil and cooked for organoleptic analysis of meat. Cooking was done at 200 °C for 45 min in oven. After then these were cut into pieces (1x1x1 cm) and presented for taste to the panelists. All panelists were selected from trained hygienists. Each panelist scored smell, tenderness, flavor, appearance and general evaluation of chicken meats by using 10 point scale. Procedures were carried out according to KUTCAN and GONUL [24].

STATISTICAL ANALYSIS

After tests of normality, the data collected from body weight characteristics were analyzed with ANOVA. Significant differences ($P<0.05$) among the treatment means were determined Duncan's multiple range tests. The data collected from carcass and organoleptic characteristics were analyzed with Kruskal Wallis-H. Significant differences ($P<0.05$) among the treatment means were determined Mann-Whitney U tests by using SPSS 11.5 for Windows. Procedures were carried out according to KOKSAL [23].

Results and discussion

There were no statistical differences in body weight in all treatment groups at the middle of the study (20th day). At the end of the treatment (40th day), the highest body weight was determined for the A400 group (2572.25 g) ($P<0.05$). Antibiotic (2414.40 g), A100 (2299.95 g), A200 (2296.45 g) and Control (2255.50 g) groups followed the A400 group (Table 2). Besides, Antibiotic groups were statistically different from the other three groups ($P<0.05$). This may be related to anise oil that has been added in the ration, and its content of some active items such as *anathol* (%85), *eugenol, methyl-chavicol* and *anisaldehyde*. Especially, *anathol* and *eugenol* increase the body weight gain and feed conversion by destroying of the pathogen microorganism in digestive system, increasing production of digestive enzymes, improving utilization of digestive products and enhancing liver functions [10,19,25,35]. In this study, the improved body weight in the A400 group could be due to these positive effects of anise oil on digestive system. In agreement with these results, HERNANDEZ *et al.* [19] reported that a supplementation of essential oil extract (EOE) from oregano, cinnamon and pepper improved apparent whole tract and ileac digestibility of the nutriments in broilers. Also, JANG *et al.* [22] showed that a supplementation of a blend of commercial essential oils combined with lactic acid increased trypsine and pancreatic amylase activity in broilers. Similar positive effects were noticed in rats by RAMAKRISHNA *et al.* [30]. Additionally, ERTAS *et al.* [18] reported that the addition of essential oils mix (oregano, clove and anise) in the diet improved body weight gain, feed intake and feed conversion ratio in broilers. Similarly, JAMROZ and KAMEL [21] who observed improvements of 8.1 % in daily gain and 7.7 % in feed conversation ratios fed a diet supplemented with a plant extract containing capsaicin, cinnamaldehyde and carvacrol in broilers. The cause of low body weight in A100 and A200 groups may result from the low intake of essential oil.

At the inspection of the carcass characteristics (Table 3), there were improvement in hot and cold carcass yield (g/100g of body weight) at A400 group ($P<0.05$). The reason of this improvement may result from positive effects of the anise

	0 to 7	7 to 14	14 to 21	21 to 28	>28
Feeds Ingredients (% of the diet)					
Corn	49.31	55.08	42.41	47.24	45.49
Wheat	-	-	20.00	20.00	20.00
Soybean meal (44 CP)	25.00	25.00	25.00	1.54	12.20
Full fat Soybean	12.05	10.57	1.55	17.50	10.00
Vegetable oil	0.90	0.63	1.12	1.25	2.47
Fish meal	10.00	5.62	7.00	10.00	7.40
Dicalcium Phosphate	0.46	1.08	0.93	0.58	0.44
Ground Limestone	1.13	0.89	0.90	0.80	0.92
NaHCO3	0.20	0.20	0.20	0.20	0.20
Salt	0.20	0.11	0.06	0.06	0.06
DL-Methionine	0.15	0.22	0.23	0.23	0.25
L-Lysine	0.05	0.05	0.05	0.05	0.02
Choline	0.05	0.05	0.05	0.05	0.05
Vitamin Premix *	0.25	0.25	0.25	0.25	0.25
Mineral Premix**	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100
Nutritional composition (% of the diet)					
Dry matter	88.25	88.32	88.41	88.31	88.50
Crude protein	27.0	24.5	22.50	20.50	20.0
Crude fiber	3.46	3.48	3.27	2.83	3.01
Ash	6.61	6.54	6.35	5.69	6.08
Ether Extract	4.84	4.56	4.01	6.57	6.41
Ca	1.09	1.00	1.00	0.96	1.00
P	0.5	0.50	0.50	0.50	0.50
Methionine	0.64	0.65	0.66	0.65	0.65
Lysine	1.57	1.34	1.25	1.05	1.08
ME, MCal/kg	3.0	3.0	3.1	3.25	3.25

*Vitamin Premix (Rovimix 124/V) supplied per 1 kg: vitamin A, 7 500 IU;cholecalciferol, 1 500 IU; vitamin E, 7 500 IU; menadione, 1.25 mg; vitamin B1, 0.5 mg; vitamin B2, 5 mg; niacin, 35 mg; d-pantothenic acid, 10 mg; vitaminB12, 0.1 mg; folic acid, 1 mg; biotin, 50 mg.
** Mineral Premix (Remineral CH) supplied per 1 kg: Mn, 40 mg; Fe, 12.5 mg; Zn, 25 mg; Cu, 3.5 mg; iodine, 0.15 mg; Se, 0.75 mg; cholinchloride, 175 mg.

TABLE 1: Composition of the standard diets.

Supplementation	Body weight (g)	
	20th day	40th day
Control	732.86±18.03	2255.50±50.02^{c}
Antibiotic	731.79±17.84	2414.40±55.96^{b}
Anise 100	748.20±15.43	2299.95±53.17^{c}
Anise 200	721.02±22.90	2296.45±65.74^{c}
Anise 400	759.36±20.68	2572.25±59.41^{a}
P	NS	*

NS: Non significant, *: P<0.05.
^{a,b,c}: Mean values with different superscripts within a column differ significantly.

TABLE 2: Effect of anise oil and antibiotic supplementation on body weight in broilers (n=40) (mean ± SEM).

Ratio (%)	Control	Antibiotic	Anise 100	Anise 200	Anise 400	P
Hot carcass	73.68±0.27^{ab}	72.88±0.57^{b}	74.53±0.56^{ab}	73.12±0.27^{ab}	74.63±0.32^{a}	*
Cold carcass	71.89±0.15^{b}	71.36±0.77^{b}	72.74±0.61^{ab}	71.47±0.40^{b}	73.06±0.31^{a}	*
Gizzard	2.06±0.07^{b}	2.12±0.05^{bc}	2.48±0.04^{ac}	2.36±0.14^{abc}	2.53±0.09^{a}	**
Heard	0.51±0.01	0.51±0.04	0.49±0.02	0.47±0.15	0.41±0.02	NS
Liver	2.40±0.07^{ab}	2.27±0.08^{b}	2.43±0.11^{ab}	2.42±0.12^{ab}	2.67±0.12^{a}	*
Spleen	0.13±0.02	0.14±0.02	0.14±0.01	0.13±0.01	0.12±0.00	NS
Legs	44.39±1.10	42.62±0.61	42.72±0.43	42.22±0.32	42.92±061	NS
Breast	28.49±0.93	28.96±0.56	28.77±0.59	28.73±0.40	29.53±0.40	NS
Wings	10.78±0.39^{ab}	10.74±0.46^{ab}	11.26±0.46^{a}	10.57±0.40^{ab}	9.8±0.13^{b}	*
Back, neck	15.03±0.58	14.77±0.22	14.73±0.35	15.93±0.45	15.16±0.23	NS
Abdominal fat	2.34±0.17	2.45±0.18	2.44±0.10	2.62±0.16	2.75±0.14	NS

NS: Non significant, *: P<0.05, **: P<0.01.
^{a,b,c}: Mean values with different superscripts within a column differ significantly.

TABLE 3: Effect of anise oil and antibiotic in ration on carcass characteristics in broiler (n=6) (mean ± SEM).

Properties	Control	Antibiotic	Anise 100	Anise 200	Anise 400	P
Smell	7.10±0.31^{a}	5.60±0.37^{b}	7.00±0.44^{a}	6.90±0.40^{ab}	6.70±0.49^{ab}	*
Tenderness	6.10±0.45^{ab}	5.50±0.42^{b}	6.80±0.35^{ab}	6.80±0.24^{ab}	7.20±0.27^{a}	*
Flavor	6.50±0.42	6.10±0.52	7.30±0.30	7.20±0.44	7.70±0.47	NS
Appearance	6.70±0.47	6.50±0.34	6.50±0.45	6.70±0.36	7.00±0.33	NS
General evaluation	6.60±0.31^{ab}	5.92±0.35^{b}	6.90±0.25^{ab}	6.90±0.33^{ab}	7.15±0.24^{a}	*

NS: Non significant, *: P<0.05.
^{a,b,c}: Mean values with different superscripts within a column differ significantly.

TABLE 4: Effect of anise oil and antibiotic in ration on sensory properties in broiler (n=10) (mean ± SEM).

oil on the carcass performance. Similarly, ALCICEK *et al.* [4] reported that adding essential oil (Herbomix™) in the ration had positive effects on the carcass yield in broilers. At the same time, gizzard (P<0.01) and liver (P<0.05) ratios (g/100g of body weight) were different among the groups, statistically. This may be related to the effects of *anathol* on the digestive system and liver metabolism. In the study that has been performed by adding antibiotic and different essential oils in a standard ration, it was shown that there were no statistical differences among groups for liver, pancreas, provetriculus, gizzard, small and large intestine ratios in broiler [19]. LEE *et al.* [26] reported that relative liver weight (g/100g of body weight) was highest in birds given thymol, but this was seen only at the age of 21 d and not at 40 d. Besides, DEBERSAC *et al.* [16] noticed that rosemary, containing rosmarinic acid, flavones and monoterpenes, enhanced hepatic metabolism and increased relative liver weight in rats.

The effects of anise oil on organoleptic characteristics of chicken meat were also investigated in the present study (Table 4). We observed that the broilers meat fed anise oil supplemented diets exhibit impaired tenderness. This positive effect was apparent particularly in A400 group compare to antibiotic group (P<0.05). These differences were determined for smell and the general evaluation of meats (P<0.05). We believed that these differences could be explained by the sedative and aromatic characteristics of the active items of anise oil [11]. One of the most active item *anathol* has sedative effects which reduces the movements of animals. Thus, more body weight gain and tenderness of meat in A400 group may result from the limited activity of broilers.

The results of this study indicated that anise oil supplementation to broiler diets had positive effects on their body weight, carcass performance and organoleptic characteristics of meat. Therefore, we suggested that this material can be use as an alternative to antibiotic.

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