

Effects of thyme volatile oils on performance of broiler chickens

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ABSTRACT

Thymus vulgaris has been known as a strong growth stimulant and as a good alternative for chemical materials in poultry industry across the world. The purpose of this study was to investigate thymus vulgaris extract on growth performance parameters of broiler chickens. Three hundred day-old male Ross 308 chicks were randomly distributed in two A (treatment) and B (control) groups with 3 replicates (50 birds per pen) and reared for 7 weeks. Diets and water offered ad libitum in each of two groups. Twenty percent extract of *Thymus vulgaris* by dose of 200cc/1000 liter, 12 hours a day, administrated a drinking water since 10 days old till slaughter. Chickens of two groups weighted weekly and feed consumption and Feed Conversion Ratio calculated. At the end of experiment total mortalities, total consumed feed and feed conversion ratio in treatment group (A) were significantly ($p < 0.05$) lower than control group (B) while mean body weight in chickens of group A was significantly ($p < 0.05$) higher than control (B) group. Comparison of feed consumption and Feed Conversion Ratio in two groups showed significant differences ($p < 0.05$) and in treatment group was lower than control group. Results of this study showed usefulness of *thymus vulgaris* in improving of growth performance parameters and reducing mortalities.

Keywords: Essential oils, Thyme extract, Growth performance parameters, Broilers

INTRODUCTION

Adding antibiotics to diet, undoubtedly, has a fundamental role in animal-keeping as a growth and healthy stimulant [22]. In spite of that the use of growth stimulant antibiotics in poultry industry has recently confronted some problems by governmental politicians and users. This event has led to prohibition of antibiotics administration as a growth stimulant in livestock feeding in EU. In another hand, there is increasing pressure from society and government in several European and non-European countries about researches for replacing antibiotics [3]. Dietary antibiotics cause to improve the animal's performance by effecting on intestinal microflora. Most of supplements which claimed are replaced by antibiotics have some direct or indirect effects on microflora [26, 27]. So, intestinal microflora must not be neglected in evaluating the birds performance. In spite of this fact, birds don't enjoy microflora contrary to herbivores. If microfloras don't be controlled suitably, they can affect adversely on hosts body. Also, it has been cleared that non-starch poly-saccharides available in grains cause to stimulate the microfloras growth; so, lead to decrease the growth performance. Intestine microfloras can hydrolyze conjugated biliary salts which limits fat digestion. It is evident that the control of microfloras can affect positively on bird's performance; also, it is clear that food supplementary can be suitable substitute for antibiotics due to their anti bacterial activity [5, 13, 22].

Today, it has been known that enzymes, probiotics, and organic acids are immune edible additives. In studies on broiler chicks for identifying probable substitute supplement for antibiotics, the attentions have been focused on herbal volatile oils and their pure constituents. Chemical constituents of most herbal volatile oils are usually considered immune as well and are used in food industry [28]. Volatile oils are complicated compounds that their chemical compounds and their concentration are variable [22]. Volatile oils consist of two compounds depending on the numbers of 5-carbone blocks: trepens and fenyl propens [2]. The main functions of volatile oils is to control the pathogens which consist of antimicrobial activity, antioxidant activity, assisting in digestion tasks like stimulation of endogen enzymes activity, absorbing nitrogen, controlling the odor and ammonia [4, 28]. Its antimicrobial action consists of interference with cell membrane which changes permeability of cations like K⁺ and H⁺ [3]. Many studies have been conducted on antimicrobial effects of herbal extracts especially volatile oils [6, 12, 15, 23]. Most of laboratory and there are few studies on poultry herds in the farm [2].

Furthermore, adding volatile oils to diet or drinking water of broilers causes to weight gain and FCR improvement. Because of containing volatile oils such as thymol, carvacrole, and linaloel, as well as important digestive effect, thymus vulgaris has been known as a strong growth stimulant and as a good alternative for chemical materials in poultry industry across the world [3]. Thyme oil is herbal oil so; it has not disadvantages of chemical growth stimulants such as deposition in animal meat, drug resistance, the risk of diseases occurring following its use and high expenses [14]. Thymol is the main constituent of thyme's volatile oils which form 20-55% of its extract. The main properties of thyme are associated to these oils which have been studied considering antimicrobial properties [7]. Carvacrol demonstrates antimicrobial activity, like thymol. Based on antimicrobial studies in lab conditions, controlling concentrations of thymol and carvacrol are 100-1000 ppm. Yeasts are the most sensitive gram positive bacteria which show high resistant against these compounds [21]. Also, antibacterial effects of thyme has been proved against *Streptococcus pneumonia* [18], *Mycoplasma gallisepticum* [6, 18], *Escherichia coli* [12], *clostridium perfringes A* [18, 23], *Salmonella interitidis*, *Staphylococcus aureous*, *Bacillus sereous* [15], and *Salmonella morium* [2]. In the present study the effect of volatile oils of thymus vulgaris on growth performance criteria was evaluated.

MATERIALS AND METHODS

300 Ross 308 mixed male broilers were distributed to two, A and B groups in three repetitions of 50. Groups A and B were considered as treatment and control groups, respectively. A penned corridor was used for breeding the broilers. The present study was conducted in broiler hennery of Azar-Behmorgh Company. The considered crowd per square meter was 10 broiler chicks. The temperature was 32°C on two first days. After 5 wards, the temperature decreased 1 degree every three days and it was remained constant at 20-22°C, finally. The humidity was kept at 40-50% at first week by water-spraying and then at 30-35%. Corridor ventilation was administrated identical for both groups. Lightening program was conducted at 24 hours with luminous intensity of 20 lux. Afterwards, this condition was kept at 23 hours lightening and one hour darkness. The feeding of both groups was equal; such that crumble grain at two first weeks and pallet grain afterwards until slaughtering. A cylindrical grain dish and a bell-form watering dish were used. Three times grain distribution was conducted after weighing. The chicks are accessed to water and grain freely. Diet formula is given in table 1 which is equal for both groups [24].

In order to immunity the following vaccination program was administered on chicks: 1) infectious bronchitis vaccine on the first day, 2) Newcastle disease vaccine on the 10th, 21st, and 31st day, and 3) IBD vaccine on the 15th day.

Evaluating growth parameters: All chicks of both groups were weighted weekly and the average weight for each week was determined. Remained grain from each repetition was weighted at the end of each week; by this way the used grain was calculated every week. Weekly and whole-period FCR were calculated by means of used grains to weight gain [24].

Administrating 20% thyme extract: 200 cc of 20% thyme extract per 1000 lit was administered 12 hours daily from their 10th day-old. It was administered in drinking water for group A. the chicks of group B (control group) didn't received thyme extract.

Statistical calculations: In the present study, calculations were conducted using SPSS software in reliability level of 95%.

Table 1: the constituents of administrated diet

Age (day) \ Diet type	0-14	15-35	36-slaughtering day
Maize	537.5	633.5	674
Soy bean meal	380	320	280
*supplement	6	6	6
Metionin	2	2	1.5
Lysine	1	1	1
Di-calcium phosphate	15	15	15
oyster	15	15	15
Salt	2	2	2
Soya oil	5	5	5
Salinomycine	0.5	0.5	0.5
Total	1000	1000	1000
Metabismable energy (kcal/kg)	2826	3299	3346
Raw protein	21.6	19.5	18.1
Calcium	1	1	1
Available phosphorous	0.41	0.42	0.43

*the used supplement obtained from Sians co. and consisted of 3 kg mineral supplement and 3 kg vitamin supplement.

Table 2: the effect of adding 20% thyme on weight gain, grain use, FCR, and loss rate

Age (week)	Loss rate		Live weight average		Used grain(g)		FCR	
	treatment	control	treatment	control	treatment	control	treatment	control
1	1	1	94±2.88	94±2.08	124±4.72	121±3.60	1.29±0.02	1.28±0.02
2	-	-	235±2.64	235±3.60	321±4.04	324±5.77	1.36±0.01	1.37±0.01
3	1	-	405±5.85	393±5.53	646±7.50	661±10.96	1.59±0.05	1.68±0.04
4	1	2	420±6.35	407±6.92	864±9.07	867±11.84	2.05±0.06	2.13±0.04
5	2	2	470±10.69	450±8.67	997±9.64	988±13.45	2.12±0.03	2.19±0.07
6	4	1	550±11.54	547±10.44	1211±14.43	1276±15.27	2.20±0.05	2.33±0.07
7	3	2	560±14.43	531±12.71	1564±16.76	1568±18.51	2.79±0.05	2.95±0.08
Total	8	12	2780±21.49 ^a	2700±28.86 ^b	5727±118.69	5805±130.76	2.06±0.03 ^a	2.015±0.05 ^b
percent	5.3%	8%						

a, b: these letters show the meaningful statistical difference on probability level of 95% ($p < 0.05$).

RESULTS AND DISCUSSION

The results obtained from measurement of growth performance parameters such as the average of weekly weighing, FCR, received diet, also weekly losses rate and total loss are given in table 2. Considering total losses, there was a meaningful difference between two groups but the rate of end-period losses of treatment group was less than control group. With regard to weight average, there was a meaningful difference between two groups at the end of breeding period and final weight gain of the group administrated 20% thyme extract was higher compared with the other ($p < 0.05$). There was a meaningful difference between two groups FCR at the end of breeding period and it decrease was observed in treatment group ($p < 0.05$).

Thyme oils extract affect broiler's digestive tract especially intestine and causes to secret digestive enzymes and endogen. Some of the enzymes are amylase and chemotripsin; thyme extract increases their production. As a result, the absorption rate of intestinal increases and consequently the chicks feeding increase as well. So, their weight loss increase and the rate of FCR will be lower. By this way, the body weight after slaughtering will be higher and economical. Furthermore, thyme volatile oils cause to increase viscera weight, like liver and gizzard [2, 3, 10, 17]. Using the oil can be economical due to its use by the mentioned viscera [17]. Thymol and carvacrol of thyme extract have antibacterial properties so they cause to remove pathogenic agents in broilers intestine; by this way lead to better and faster growth and consequently more flock yield. Based on conducted studies, thyme oil can be used for treatment of digestive and intestinal problems [8, 12, 15, 23]. The rate of positive response of broilers digestive tract is variable depending on their age; such that it causes better response and better weight gaining in younger ages [14]. Simultaneous administration of soy bean meal and thyme will increase advantages of thyme for digestive tract [17]. Based on studies the effects of thyme volatile oils on chicks growth performance are positive or without negative effect. In various studies, the rates of thyme added to diet were variable from 20 to 200 ppm. When the volatile oils have a positive effect on performance, weight gaining and grain consumption has been increased but the ratio of grain consumption to weight gain was lower compared with control group [22]. Furthermore, Botsoglou et al. in 2002 showed that adding pennyroyal extract oil to broilers diet with concentrations of 50 and 100 ppm for 38 days has a positive effect on weight and FCR [11]. The study conducted by Vogt and Rauch in 1991 also suggests that adding 0, 20, 40, 80 ppm of thyme volatile oils to broilers' diet have no positive effect on growth performance [29]. Furthermore, the positive effects of volatile oils have been demonstrated in studies conducted by Basset in 2000, Kamel in 2001, and Langhout in 2000 [9, 19, 20]. The event shows that when experimental conditions and birds diet

are in their minimum rate, the growth promoting effects of volatile oils will be observed better. Also, the studies have demonstrated that adding 200 ppm carvacrol to broilers' diet has decreased weight gain and grain consumption but the ratio of grain to weight was promoted by thyme when the birds have received the diet for 2 weeks [21]. It has been suggested that the effect of carvacrol on the ratio of grain to weight can be related to increasing in the yield of grain consumption and the changes in carcass [21]. The results of the study conducted by Ocak *et al.* in 2008 on the effect of thyme and mint extract on broilers characterized that these compounds cause to weight increase compared with control group; of course, weight gaining was not meaningful about thymol but the average of weight gain in thyme group was 1.24% higher than control group [25]. Also, Griggs and Jacob in 2005 suggested that thyme is a strong material against poultries bacterial diseases [16]. The studies of Abd El-Hakim *et al.* in 2009 showed that thyme has an important role in weight gaining until 21st day-old compared with control, citric acid and lactic acid groups [1].

CONCLUSION

The results of the studies demonstrated that the effects of volatile oil on growth performance would appear when the chickens are exposed to sub-optimized conditions such as low digestible diet and dirty environment [22]. The results of the present study showed that adding thyme extract to broiler's drinking water would promote weight gaining, grain consumption and FCR as well as decrease periodical losses. Therefore, adding 200 ppm thyme extract during breeding period is recommended for increasing production efficiency and decreasing losses.

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