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EFFECT OF THYME (*THYMUS VULGARIS*) ON PRODUCTIVE PERFORMANCE, CARCASS CHARACTERISTICS, BLOOD HEMATOLOGY AND LIPID PROFILE OF BROILER CHICKS OF BROILER CHICKS

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ABSTRACT: The aim of the present study is to evaluate the effect of thyme powder or oil extract addition to the broiler diets on productive performance, carcass characteristics and blood constituents. A total number of 180 seven day old of broiler chicks (Arbor Acres) were randomly divided into five equal experimental groups with 6 replicates of 6 birds in each for 35 day of age. The first group was served as control group without any supplementation while birds of the 2nd and 3rd groups were fed diets contained 2.5 and 5 g thyme powder/ kg diet, respectively, the 4th and 5th groups were fed diets contained 100 and 200 mg thyme oil/ kg diet, respectively. Final body weight, body weight gain and feed conversion at 35 days of age were significantly improved by thyme treatments. Results showed that birds fed 200 mg thyme oil/ kg diet had significantly better productive performance, while feed consumption was reduced compared with control group. However, percentage of dressing and other organs were increased but not significant in thyme supplemented broiler chickens. While, abdominal fat was significantly decreased by thyme groups. Supplementation of dietary thyme from different sources significantly increased hematology parameters and improved white blood cell, lymphocyte, heterophils and lymphocyte per heterophils ratio. Additionally, serum triglycerides, total cholesterol and very low density lipoprotein were significantly decreased with thyme groups compared to control group. While, supplementation of dietary thyme from different sources significantly increased the concentration of high density lipoprotein compared with the control group. In conclusion, thyme oil extract supplementation with 200 mg/ kg diet was improved the productive performance and physiological parameters of broiler chickens.

Key words: Thyme; Productive performance; Hematology; Lipid profile; Broilers

INTRODUCTION

The use of many antibiotics and anti-coccidiosis as growth promoters in poultry feed or to treat diseases have now become prohibited in use due to its effect on the low level of the body's natural immunity and thus resistance to many types of pathogenic bacteria. However, the routine use of antibiotics in the broiler chicken diet now causes an increase in the resistance of human and animal bacteria to antimicrobials.

As a result of this concern, the researchers were interested in studying the effect of alternate growth enhancers such as prebiotics and probiotics, and evaluating their role on the activity of the digestive system and its habitants (Patterson & Burkholder, 2003). Some researchers assessed the role of medical herbs and their essential oils on the physiological state of broiler chicks. The profitable effects of thyme on poultry nutrition and the metabolism cycle within the body have been notified in several studies (Al-Kassie, 2009; El-Ghousein & Al-Beitawi, 2009 and Najafi & Torki, 2010). Thyme belongs to the Labiatae family and is a small perennial small shrub. It is native to the Mediterranean coast. Scientific studies and international researches are currently focusing on studying the pharmacology of thyme, its effectiveness and superior ability to conserve food, its microbial antagonists *in vitro*, and its natural antioxidant substance and anti-aging effect on mammals, etc. But, research and studying its application in animals and birds *in vivo* and the mechanisms of its action are still unclear.

The primary pharmacological actions of thyme may be due to the presence of thymol and carvacrol, which are the most substantial bioactive compounds contained in this plant (Aeschbach *et al*., 1994 and Grigore *et al*., 2010). Bölükbaşi & Erhan (2007) reported that supplementation of the diet of laying hens with 0.1 and 0.5% thyme enhanced feed conversion ratio and egg production rate as well as a lower account of *E. coli fecal* content. Feed supplementation with thyme, according to research studies, improves the productive performance of chickens (Abd El-Latif *et al*., 2002 and Tolba & Hassan, 2003). Cross *et al*. (2007) indicated that body weight gain of broiler chickens was positively affected by the implication of thyme oil in the diet. Essential thyme oil can increase growth rate and feed efficiency, as well as the antibody response to sheep RBCs (Abdulkarimi *et al*., 2011). Ocak *et al*. (2008) noticed that the inclusion of 0.2% dry powder thyme leaves in broiler chickens diets from 7 to 42 days of age had no significant effects on feed conversion ratio and productive performance, but, the relative weight of abdominal fat was reduced. Thymus vulgaris (Thymol) essential oil increases the production of digestive enzymes (Khan *et al*., 2012 and Feizi *et al*., 2013).

Moreover, thyme essential oil leads to a significant decrease in the levels of triglycerides, total cholesterol and glucose levels (Khaksar *et al*., 2012). Thymol can also stimulate the immune system by increasing the activity of lymphocytes, stimulating macrophages and NK cells, as well as increasing phagocytosis and interferon synthesis (Lavinia *et al*., 2009). The target of the present study was to investigate the influences of dietary modulation of thyme powder and thyme oil on productive traits, carcass characteristics and blood parameters of broiler chickens.

MATERIALS AND METHODS

The study was carried at the Poultry Research Unit at Al-Bostan, Department of Animal and Poultry production, Faculty of Agriculture, Damanhour University from June-July 2017. The scientific committee of Animal and Poultry production Department, Faculty of Agriculture, Damanhour University approved the experiment.

All treatments and birds care procedures were approved by the Institutional Animal Care and Use Committee in AU-IACUC, Damanhour University, Egypt.

Broiler and experimental design

A total of 180 unsexed seven day old of broiler chickens (Arbor Acres) were acquired from a commercial hatchery (Cairo Poultry

Company), wing banded and randomly divided keeping similar initial body weight with an mean body weight of 152±0.64g, were used in the current study. Broiler chicks were divided into 5 experimental groups (treatments) in a straight run experimental design in 30 cages with 6 replicates of 6 birds in each for a 28-day feeding trial (from 7 to 35 day of age). Birds of the first group was served as control group (T0) and was fed the basal diet without any addition, while the 2nd (T1) and 3rd (T2) groups were fed diet containing 2.5 and 5 g thyme powder/ kg diet, respectively, the 4th (T3) and 5th (T4) groups were fed diet containing 100 and 200 mg thyme oil/ kg diet, respectively, and the first group was served as control group (T0) basal fed without any addition. All diets were formed to meet or exceed NRC (1994) nutrient recommendations of chickens for starter (7-21 days), finisher (21-35 days) periods.

The thyme (*Thymus vulgaris* L.) powder was purchased commercially as dry powder and thyme oil was obtained from the local commercial market at Damanhour city, Egypt. The thyme powder is consisted of the thyme leaves and stems. The thyme oil is a steam distilled product was softly mixed with the control diet. This experimental diet was destined weekly and stored in airtight containers.

Flock management

All chicks were housed in battery brooders, gas heater was utilized to supply the chickens with heat needed for brooding, in semi-opened room and remained under the same managerial, hygienic and environmental conditions. Birds of all experimental groups were vaccinated against Newcastle via drinking water at 7, 18 and 28 days of age respectively. They were also vaccinated against Gumboro at 12 days of age. Ambient temperature was reached at 30-32 ^{o}C during the 1st week and weekly decreased by 3 ^{o}C for the next three weeks. During the 4th and 5th weeks, temperature was maintained at 22-24 ^{o}C. A similar light schedule to commercial condition was used; 23 h light from one-day old until 7th day, pursued by 20 h light from 8th day to the end experiment (35 days of age). All birds were fed *ad libtium* the experimental diets and given free access to water. Ingredients and chemical composition of the basal diets (% as fed basis) fed during the two phases are offered in Table (1). The average minimum, maximum temperature degree as °C and relative humidity as % during 21-35 days of age were 28.6 and 35.2°C and 53.2 and 64.5%, respectively.

Data collection for Productive performance

During the trial period chicks were weighed (g) individually at 7 and 35 d of age and body weight gain (g/chick) was calculated. The feed consumption (FC, g/chick) was recorded for each pen and calculated for the 28 days of the experimental period. The feed conversion ratio (FCR, g feed/ g gain) was calculated as the average of feed consumption per unit of body weight gain during the same periods.

Blood samples collections and analysis

At the end of the experimental period (35 days of age), five chicks from each treatment (n=5/treatment) were randomly selected at 08:00–09:00 am and about 3 ml blood was collected from the wing vein into vacationer tubes with or without containing K3-EDTA (1 mg/mL). The first part was used shortly after collection for estimating hematological parameters (blood picture) in terms of red blood cells (RBCs, 10^6/ml^3) were counted by haemocytometer using a light microscope at 1,900x magnification. Hemoglobin (Hb, g/dl) was measured by cyanomethemoglobein method (Eilers, 1967). Wintrobe hematocrite tubes (Jiangdu Sunflower Glass Instrument Factory, Jiangdu, China) were used for determination of the packed cell volume (PCV, %). The hematological indices including: mean corpuscular volume (size) of RBCs (MCV, µm^3) = [hematocrit (%)/RBCs] × 10, mean corpuscular hemoglobin in RBCs (MCH, pg) = [hemoglobin concentration (g/dl)/RBCs] × 10 and mean corpuscular hemoglobin concentration (MCHC, %) = [hemoglobin (g/dl)/ hematocrit (%)] × 100 counts were calculated. Leukocytes (WBCs, 10^3/ml) count and differential counts i.e. lymphocytes (L), heterophils (H), monocytes,

basophils and eosinophils were counted as a percentage by an Ao bright line hemocytometer using a light microscope at 100 x magnification as described by (Hepler, 1966). The H/ L ratio was rated by dividing the total count of H of the total number of L.

The second part was centrifuged at 1,500 x g for 10 min and the clear serum was separated at 4°C and stored in a deep freezer at–18 ºC until biochemical analysis for its lipid profiles including plasma triglycerides, total cholesterol, high-density lipoprotein (HDL), and low-density lipoprotein (LDL) by a colorimetric method using a commercial kit of Diamond diagnostics (Heliopolis, Cairo, Egypt). Where VLDL are very low-density lipoprotein which was calculated as concentration of plasma triglycerides divided by 5 (Raya et al., 2014).

Carcass characteristics

At d 35 of age, six broilers chickens from each treatment (1 per each replicate) with equal number of each sex, were randomly selected for slaughtering with body weight similar to each treatment mean, the assigned chicks were slaughtered to determine carcass characteristics. Birds were fasted (by feed withdrawal overnight), approximately 12 h, then individually weighed to the nearest gram and slaughtered by severing the jugular veins of the neck with a sharp knife (Islamic procedure). After bleeding, each carcass was achieved, scalded, plucked, eviscerated, and weighed to determine carcass weight and calculated as percentage from live body weight, dressing percentage included relative weights of carcass and giblets (liver, gizzard and heart) were estimated as a percentage of live body weight. Liver, gizzard, heart, spleen, panaceas, intestinal, proventriculus, thymus and bursa of Fabricius were separated, individually weighed, and expressed as absolute weight and as percentage of live body weight.

Statistical analyses

Statistical analysis was done utilizing the GLM procedure of Statistical Analysis Software of SAS Institute (SAS® 2003) using one-way analysis of variance approving to the following formula: $yij = \mu + \tau j + \varepsilon ij$, where μ=general mean, τ= treatment effect and ε= experimental random error. Before analyses, arcsine transformation was done to normalize data distribution. Mean difference at $p \leq 0.05$ was tested using Tukey's HSD test. The replicate was the experimental unit.

RESULTS AND DISCUSSION

Productive performance

Table (2) shows the effect of dietary supplementation of thyme powder (TP) and thyme essential oil (TEO) on productive performance of broiler chickens (Arbor Acres) during 7-35 days of age. The high levels of thyme powder (5 g/kg) and oil (200 mg/kg) had significant effects in enhancing final body weight (BW), body weight gain (BWG) and feed conversion ratio (FCR) by 3.67 and 4.39% ; 4.09 and 4.83% and 7.87 and 11.24%, respectively compared to control group (T0). It was found that feed consumption was lower significantly (P=0.007) in the chicks fed thyme oil (TEO) with 100 and 200 mg/kg compared to control by 6.75 and 7.00%, respectively. In addition, chicks fed thyme powder (5g/kg) and TEO with 100 and 200 mg /kg had the better FCR compared to control. These findings are in agreement with Genedy & Zeweil (2003) who used the thyme flowers as growth promoter in diets of Japanese quails. They found that the level of thyme flowers (1 g/kg of diet) improved body weight, feed conversion ratio and economic efficiency. Cross *et al.* (2007) noted a positive effect on broiler body weight gain when thyme oil was included in the diet. Essential oils of herbs play an effective role as enhancers for digestion, maintaining the balance of the microbial ecosystem of the intestine and also stimulating the secretion of internal digestive enzymes, thus improving growth performance in poultry in general (Lovkova *et al*., 2001; Williams & Losa, 2001and Cross *et al*., 2007). Abdel-Wareth *et al*. (2012) observed an increase in body weight gain as a result of the quadratic effect of thyme powder at levels of 15 and 20 g/kg diet of broiler chickens. Khaksar *et al*. (2012) explained that the increases in live body

weights of Japanese quail were significantly positive after using thyme essential oil. They noted also that the feed consumption decreased while feed conversion ratio was enhanced as a result of including this essential oil in the basic diet. Moreover, Dehghani *et al*. (2018) observed that adding 400 ppm of thyme essential oils (TEO) in quail's diet has a significant reduction in feed consumption and the same time, feed conversion ratio significantly enhanced ($P < 0.05$) in the same treatment. However, some other authors have not noticed the positive or negative impact of these essential oils on poultry production performance (Hoffman-Pennesi & Wu, 2010; Mehdipour *et al*., 2014 and Montazeri *et al*., 2014). Lee *et al.* (2003) further, indicated that the used of 200 ppm thymol in the diet did not affect the body weight gain, feed intake and feed efficiency of female broilers.

Hematological parameters

Table (3) illustrates the effect of thyme powder and oil supplementation on blood hematological parameters of broiler chicks at 35 days of age. Chicks fed basal diet with TEO (200 mg/ kg) exhibited higher RBC`s counts than the TP (2.5g /kg) and control groups. Chicks fed basal diet supplemented with high levels of thyme whether powder or oil had significantly higher haemoglobin concentration than that of TP (2.5 g/ kg) treatment and the control group. Feeding diet with high levels of thyme whether powder or oil significantly increased PCV compared to control group. Meanwhile, birds fed on TP (5g/kg) had higher MCH and MCHC than the basel diet and TP (2.5g/ kg) groups. Chickens fed the basel diet exhibited lower WBC`s counts than the TEO 200 mg group. Meanwhile, broilers fed the basel diet had a significantly lower lymphocyte percentage than those fed TP5 g /kg . Arbor Acres chicks fed the basel diet showed higher heterophil percentage and L/H ratio than high level of TP and TEO groups Table (4).

It is clear that there is a correlation between hematological parameters and health status. These parameters are used as important diagnostic indicators during the clinical evaluation of the animal health status. Blood parameters are also good indicators of the physiological, pathological, and nutritional status of the animal and poultry. Changes in blood parameters can be used to explain the effect of nutritional factors and additives available in the diet on animals or poultry (Adekunle & Omoh, 2014). Al-Kassie (2009) showed that feeding diets were supplemented with oil extracted from thyme to broiler chickens, significantly improved RBCs, Hct, Hb and WBCs counts compared with control basal diet. Unlike our observations, Toghyani *et al*. (2010) noticed that diets supplemented with thyme powder had no adverse effect on RBCs and WBCs counts, Hb concentration and Hct percentage in broiler chickens.

Serum biochemical parameters

Arbor Acres chickens fed the TEO 200 mg/kg showed lower triglyceride level than the control group, significantly lower total cholesterol was found in 200 mg/ kg of TEO over control and 2.5 g/ kg of TP groups. Meanwhile, chickens fed the basel diet showed lower HDL than those the other groups. Feeding diet with TEO 200 mg/ kg significantly decreased VLDL compared to control and TP2.5 g groups Table (5). Several scientific articles appeared which have confirmed the hypocholesterolemic and antilipidemic effects of thyme on blood parameters have been supposed to be exerted through inhibiting the activity of β-hydroxy-β-methylglutaryl-CoA reductase (the rate-limiting enzyme in cholesterol synthesis), decreasing fat absorption from the intestinal tract or *via* lipid catabolism for gluconeogenesis (El-Ghousein and Al-Beitawi (2009). Also, Toghyani *et al.* (2010) and Dahal & Farran (2011) appeared which have confirmed the hypocholesterolemic and antilipidemic effects of thyme powder or oil in poultry. The current results correspond also with the findings of Rostami *et al*. (2012) who observed that supplemental dietary thyme significantly reduced serum levels of triglycerides and cholesterol in Japanese quail. Similar data were also establish by Khaksar *et al*. (2012) who explained that Japanese quail

fed a diet supplemented with thyme essential oil showed significantly lower levels of blood glucose, triglycerides and cholesterol compared with control group. Raya *et al*. (2014) who showed that plasma levels of triglycerides, cholesterol and LDL-C, of growing Japanese quail were significantly reduced (P≤0.01) while HDL-C level was significantly increased (P≤0.01). However, Sengül *et al.* (2008) reported that blood cholesterol, triglycerides, high density lipoprotein, very low density lipoprotein levels were not affected by dietary diets containing thyme extracts compared with the control broiler chickens.

Carcass characteristics

The results of carcass characteristic of broiler chickens under effect of different dietary levels of TP and TEO are summarized in Table (6). Different treatment had statistically no significant effects on carcass characteristics and inner organs of chickens at 35 days of age except for abdominal fat. Broilers fed TP or TEO had asignificantly lower abdominal fat in Table (6), significantly lower abdominal fat was found in high levels of thyme whether powder or oil over the other treatments. The percentages of those decreases compared with the controls were (20.39 and 40.13%) and (21.71% and 41.45%) with the levels 2.5 and 5g /kg TP diet and TEO with levels 100 and 200 mg/ kg diet at 35 days of age, respectively.

In this study different levels of thyme powder or essential oils of thyme had no marked effect on the relative weight of the dressing, proventriculus, gizzard, liver, heart, pancreas and intestinal tract. In agreement with our findings, some investigators studied the effects of thyme powder extract or essential oils on broiler chickens weight of organs and observed no significant effects (Ghalamkari *et al*., 2012; Nobakht *et al*., 2011and Hernandez *et al*., 2004).

On the other hand, Khaksar *et al*. (2012) detected higher carcass percentage in Japanese quail fed diets included with thyme essential oil. Toghyani *et al*. (2010) noted that chickens receiving 5g thyme /kg diet had the highest carcass percentage, but the differences were not statistically significant, while other carcass organs estimated including liver, gizzard, heart, pancreas, proventriculus, small intestine tract and caecum weights, small intestine tract and caecum lengths were not significantly influenced by dietary thyme powder in broiler chickens. Denli *et al*. (2004) observed that carcass yield was not affected by the dietary groups but the supplementation of the diet with thyme essential oil significantly reduced abdominal fat weight and percentage in broiler chickens.

Also, the data by Ocak *et al*. (2008) observed no significant statistical in carcass weight, dressing yield, the relative weights of the edible parts and small intestine, and length of small intestine tract of broilers chickens fed diets supplemented with dry thyme powder. Dahal & Farran, (2011) noticed no effect of feeding thyme-containing diet on carcass traits of broiler chicks. The present data are also in agreement with those obtained by Amouzmehr *et al.* (2012) who demonstrated that carcass characteristics of broiler chickens were not affected by feeding diets containing thyme powder.

CONCLUSION

Data obtained from this study indicated that the inclusion of thyme powder and thyme essential oil may have beneficial effects on productive performance, hematology and enhanced blood lipid profile and carcass traits of broiler chickens.

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Table (1): Composition and calculated analyses of the experimental diets.

Ingredients	**Starter diet, 1-21 d of age**	**Grower diet, 22-35 d of age**
Yellow corn, kg	490	550
Soybean meal 48% CP, kg	420	358
Di-calcium phosphate, kg	20	15
Limestone, kg	10	12.5
NaCl, kg	3	3
Vitamin+ mineral premix[1], kg	3	3
Dl-Methionine, kg	2.5	2.5
L- Lysine, kg	1.5	2.0
Vegetable oil[2], kg	50	54
Total	1000	1000
ME	3035	3135
CP	229	208
Ca	9.5	9.1
Available P	5.2	4.2
Methionine	6.0	5.6
TSAA	9.6	9.1
Lysine	13.7	12.6
Ether extra	47	48
Crude fiber	33	38
Ash	55	52
Dry matter	901	912

[1]Vitamin+Minerals mixture provides per kg of the diet: vitamin A (retinyl acetate) 24 mg, vitamin E (dl-α-tocopheryl acetate) 20 mg, menadione 2.3 mg, Vitamin D3 (cholecalciferol) 0.05 mg, riboflavin 5.5 mg, calcium pantothenate 12 mg, nicotinic acid 50 mg, choline chloride 600 mg, vitamin B12 10 µg, vitamin B6 3 mg, thiamine 3 mg, folic acid 1 mg, d-biotin 0.50 mg. Trace mineral (mg per kg of diet): Mn 80 Zn 60, Fe 35, Cu 8, Se 0.60. [2] A mixture of soybean oil, cotton seed oil and sunflower at 33.33% of each.

Table (2): Effect of dietary supplementation of thyme powder and oil on performance of Arbor Acres broiler chickens during 7-35 days of age (Values are means ± SEM).

Traits	Control	Thyme powder		Thyme essential oil		*P* value
		2.5 g/kg	5 g/kg	100 mg/kg	200 mg/kg	
Initial BW, 7 d	152±0.58	152±0.36	153±1.88	152±0.33	152±1.97	0.978
Final BW, 35 d	1913±14.6^{b}	1943±14.4^{ab}	1985±22.9^{ab}	1941±18.1^{ab}	1997±22.3^{a}	0.028
BWG, 7-35 d	1760±14.1^{b}	1794±15.7^{ab}	1832±22.3^{ab}	1790±18.1^{ab}	1845±23.5^{a}	0.035
FI, 7-35 d	3141±17.9^{a}	3033±37.1^{ab}	2996±42.6^{ab}	2929±49.4^{b}	2921±50.6^{b}	0.007
FCR, 7-35 d	1.78±0.022^{a}	1.69±0.015^{ab}	1.64±0.019^{b}	1.64±0.039^{b}	1.58±0.038^{b}	0.001

SEM, Standard error of mean; BW, Body weight; FI, feed intake; FCR, feed conversion ratio
^{a,b} Means within the same row with different superscript letters are significantly different at ($p \leq 0.05$).

Table (3): Effect of dietary supplementation of thyme powder and oil on red blood cells indices of Arbor Acres broiler chickens at 35 days of age (Values are means ± SEM).

Traits	Control	Thyme powder		Thyme essential oil		*P* value
		2.5 g/kg	5 g/kg	100 mg/kg	200 mg/kg	
RBC's, 10^6/mm^3	3.80±0.032^{b}	3.82±0.049^{b}	3.92±0.037^{ab}	3.86±0.060^{ab}	4.02±0.037^{a}	0.015
Hemoglobin,g/dL	10.1±0.22^{b}	10.2±0.44^{b}	12.3±0.27^{a}	11.0±0.32^{ab}	12.0±0.42^{a}	0.0001
PCV, %	32.2±0.68^{c}	32.9±0.45^{bc}	34.7±0.61^{ab}	33.7±0.47^{abc}	35.2±0.53^{a}	0.006
MCV, fL	84.73±2.29	86.13±3.10	88.52±2.52	87.31±3.89	87.56±1.25	0.367
MCH, pg	26.57±0.81^{b}	26.70±2.34^{b}	31.38±0.87^{a}	28.50±1.65^{ab}	29.85±1.32^{ab}	0.011
MCHC, g/ dL	31.4±0.17^{b}	31.1±1.22^{b}	35.4±0.94^{a}	32.5±0.86^{ab}	34.0±0.94^{ab}	0.012

SEM, Standard error of mean; RBC's, Red blood cells; PCV, Packed cells volume; MCV, Mean cell volume; MCH, Mean cell hemoglobin; MCHC, Mean cell hemoglobin concentration.
^{a,b,c} Means in the same row having different letters are significantly different at ($p \leq 0.05$).

Table (4): Effect of dietary supplementation of thyme powder and oil on white blood cells of Arbor Acres broiler chickens at 35 days of age (Values are means ± SEM).

Traits	Control	Thyme powder		Thyme essential oil		*P* value
		2.5 g/kg	5 g/kg	100 mg/kg	200 mg/kg	
WBC's, 10^3/mm^3	26.6±0.32^{b}	27.6±0.65^{ab}	27.8±0.37^{ab}	28.6±0.51^{ab}	28.7±0.46^{a}	0. 037
Lymphocytes, %	42.4±0.90^{b}	44.3±0.54^{ab}	46.3±0.97^{a}	43.3±0.73^{ab}	45.1±1.08^{ab}	0.046
Monocytes, %	6.07±0.44	6.70±0.35	7.79±0.41	6.43±0.52	6.92±0.85	0.139
Basophils, %	0.640±0.019	0.644±0.032	0.654±0.023	0.646±0.039	0.660±0.025	0.984
Eosinophils, %	11.0±0.37	11.9±0.59	11.4±0.64	11.2±0.92	11.3±0.17	0.908
Heterophils, %	24.4±0.33^{a}	23.3±0.32^{ab}	23.1±0.32^{b}	23.2±0.16^{ab}	23.0±0.26^{b}	0.018
L/H ratio	0.576±0.016^{a}	0.527±0.007^{ab}	0.499±0.015^{b}	0.537±0.008^{ab}	0.510±0.015^{b}	0.006

SEM: Standard error of mean; WBC's, White blood cells; L/H ratio, Lymphocyte/ Heterophils ratio
^{a,b} Means in the same row having different letters are significantly different at ($p \leq 0.05$).

Table (5): Effect of dietary supplementation of thyme powder and oil on serum lipid profile of broiler chickens at 35 days of age. (Values are means ± SEM)

Traits	Control	Thyme powder		Thyme essential oil		*P* value
		2.5 g/kg	5 g/kg	100 mg/kg	200 mg/kg	
Triglycerides, mg/dl	80.6±6.25[a]	58.1±6.39[ab]	66.8±7.30[ab]	54.4±5.58[ab]	41.2±2.76[b]	0.003
Cholesterol, mg/dl	133.0±2.49[a]	127.9±3.06[a]	122.0±2.22[ab]	124.3±2.23[ab]	117.4±4.06[b]	0.004
HDL, mg/dl	53.3±0.44[b]	55.5±0.42[a]	55.4±0.39[a]	55.6±0.28[a]	56.0±0.51[a]	0.0001
LDL, mg/dl	63.6±2.66	60.8±3.72	53.2±2.86	57.8±1.58	53.2±4.05	0.191
VLDL, mg/dl	16.12±0.94[a]	11.62±1.05[bc]	13.36±0.97[b]	10.88±1.13[bc]	8.24±0.63[c]	0.001

SEM, Standard error of mean; HDL, high-density lipoprotein; LDL, low-density lipoprotein; VLDL, very low-density lipoprotein.

[a,b,c] Means in the same row having different letters are significantly different at ($p \leq 0.05$).

Table (6): Effect of dietary supplementation of thyme powder and oil on carcass characteristics and inner organs of broiler chickens at 35 days of age (Values are means ± SEM).

Parameters	Control	Thyme powder		Thyme essential oil		P value
		2.5 g/kg	5 g/kg	100 mg/kg	200 mg/kg	
Dressing*, %	71.5±0.55	72.9±1.05	72.9±0.68	72.3±0.51	72.8±0.89	0.649
Proventriculus, %	0.50±0.03	0.52±0.03	0.51±0.06	0.64±0.06	0.53±0.07	0.389
Gizzard, %	1.51±0.06	1.51±0.07	1.43±0.05	1.73±0.09	1.42±0.07	0.087
Liver, %	2.96±0.17	2.82±0.20	2.68±0.11	2.94±0.14	2.99±0.27	0.75
Heart, %	0.53±0.03	0.60±0.04	0.53±0.04	0.58±0.03	0.62±0.04	0.298
Pancreas, %	0.28±0.03	0.26±0.01	0.26±0.01	0.29±0.02	0.28±0.03	0.743
Intestinal tract, %	6.95±0.36	6.17±0.33	6.85±0.32	6.50±0.28	7.18±0.23	0.191
Abdominal fat, %	1.52±0.05[a]	1.21±0.39[b]	0.91±0.05[c]	1.19±0.07[b]	0.89±0.09[c]	0.001

*Percentage of live body weight; SEM, Standard error of mean.

[a,b,c] Means within the same row with different superscript letters are significantly different at ($p \leq 0.05$).

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الملخص العربي

تأثير الزعتر على الآداء الإنتاجي، وخصائص الذبيحة، صورة الدم الهيماتولوجية، وصورة الدهون لدجاج اللحم

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إستهدف دراسة تأثير إضافة مسحوق أو زيت الزعتر إلى علائق بداري التسمين على الأداء الإنتاجي وخصائص الذبيحة ومكونات الدم. تم تقسيم 180 كتكوتاً (أربور آيكرز) عمر سبعة أيام بشكل عشوائي إلى خمسة مجموعات تجريبية متساوية بكل مجموعة 6 مكررات وبكل مكررة 6 كتاكيت حتى عمر 35 يوماً. تغذت كتاكيت المجموعتين الثانية والثالثة على علف يحتوي على 2.5 و5 جم من مسحوق الزعتر/ كجم علف، على التوالي، وتم تغذية المجموعتين الرابعة والخامسة على علف يحتوي على 100 و200 ملجم من زيت الزعتر/ كجم علف، على التوالي، وكانت المجموعة الأولى مجموعة ضابطة بدون أي اضافات. تحسن وزن الجسم النهائي، وزيادة وزن الجسم ومعدل التحويل الغذائي عند عمر 35 يوماً معنوياً بإضافة الزعتر. أوضحت النتائج أن الكتاكيت التي تغذت على 200 ملجم من زيت الزعتر/ كجم علف كانت أفضل معنوياً في الأداء الإنتاجي، بينما انخفض استهلاك العلف مقارنة بالمجموعة الضابطة. ومع ذلك زادت نسبة الذبيحة والأعضاء الأخرى زيادة غير معنوية في دجاج اللحم المغذى على الزعتر. بينما انخفضت نسبة الدهون الحشوية معنوياً بإضافة الزعتر. أدت إضافة الزعتر سواء المسحوق أو الزيت إلى تحسن إيجابي فى صفات الدم الهيماتولوجية حيث تحسن عدد كرات الدم البيضاء والخلايا الليمفاوية والخلايا المتعادلة ونسبة الخلايا الليمفاوية للخلايا المتعادلة. بالإضافة إلى ذلك، انخفضت الدهون الثلاثية والكوليسترول الكلي والكوليسترول منخفض الكثافة في الدم معنوياً مع إضافة الزعتر مقارنة بالكنترول. من ناحية أخرى، أدت إضافة الزعتر إلى زيادة الكوليسترول الدهني عالي الكثافة مقارنة بالكنترول. نستنتج من ذلك أن إضافة زيت الزعتر بمعدل 200 ملجم/ كجم علف أدت إلى تحسن الأداء الإنتاجي والمعايير الفسيولوجية لبدارى اللحم.
الكلمات الدالة: الزعتر ، الكفاءة الإنتاجية ، صفات الدم الهيماتولوجية ، صورة الدهون ، دجاج اللحم.