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IMPACT OF DIETARY SUPPLEMENTATION OF DIFFERENT LEVELS OF THYME AND ITS ESSENTIAL OILS ON PERFORMANCE, BLOOD PARAMETERS, METABOLIC AND IMMUNE RESPONSE OF BROILER CHICKENS

F. S. A. Ismail , M. R. El-Gogary and M. N. El-Morsy

Dep. of Poult. Prod., Fac. of Agric.e, Mansoura Uni., Mansoura, 35516,Egypt

Correspondence: M. R. El-Gogary E-mail: melgogary@mans.edu.eg

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ABSTRACT: The aim of this study was to investigate the effects of dietary supplementation with three levels of thyme (5, 10 and 15 g/kg) and its essential oils (0.5, 1.0 and 1.5 g/kg) on growth performance, blood profiles, immune response and antioxidant status in broiler chickens. A total of one hundred-forty day-old unsexed broiler chicks were randomly allotted to 7 equal groups, each with 4 replicates, and kept in battery cages. Feed and water were offered *ad libitum* till the termination of the trial at 6 weeks of age. Growth performance and blood parameters were measured. The control group and the group fed 5 g/kg thyme were significantly better in their LBW and BWG as compared to other groups in the first three weeks of study and whole experimental period. On the other hand, feeding the diet having 5 g/kg thyme enhanced feed intake during the starter and whole experimental periods as compared to other groups. Broilers fed the diet fortified with1.0 g/kg thyme oil displayed significantly better feed conversion ratio than did other experimmintal groups during the starter and whole experimintal periods. Dietary treatments had no significant effect on the plasma levels of total lipids, triglycerides and total protein as well as activity of AST and ALT. It was observed that broiler chickens fed the diets conaining thyme and/or essential oils exhibited higher concentration of plasma HDL compared with the control group, with the highest concentration of HDL in 15 g/kg thyme-group. On the other hand, dietary supplementation with thyme or its essential oils led to a significant reduction in plasma LDL compared with control group. The humoral immune response was improved in broiler chickens fed the treated diets as evidenced by a significant increase in immunoglobulins (IgG, IgA and IgM) compared with the control group. It is of great interest to notice that thyme and its essential oils administred-groups significantly increased TAC but decreased MDA as compared to the control group. Findings from this study highlighted the beneficial effect of thyme supplementation in diets at the rate of 5.0 g/kg on cholesterol , immunity and antioxidant status of broiler chickens

Key words:broilers- thyme -lipids profile-immune response -antioxidant status

INTRODUCTION

Thyme (*Thymus vulgaris*) is one of regular restorative plants, known for their antibacterial properties, fundamentally because of their dynamic parts thymol and carvacrol, which break down the external layer of microbial cell (Helander *et al.,* 1998). Thyme is herbaceous perennial evergreen herb grown in Mediterranean regions and classified among the most important medicinal plants due to its antioxidant and antibacterial properties, which received progressive global attention. Additionally, it has been reported that thyme has an antagonistic effect against a wide range of microbial pathogens due to its antioxidant, anti-coccidial and antibacterial activities as well as its appetite inducing effects (Varel, 2002).

The fundamental dynamic substance of thyme is thymol as phenolic part which usually utilized as antibacterial agent (El-Ghousein and Al-Beitawi , 2009 and Toghyani *et al.,* 2010). Herbs that are rich in such flavonoids as thyme extends the activity of vitamin C, which acts as an antioxidant furthermore, may in this manner improve the immune function (Manach *et al.,* 1996). Thymol and carvacrol could have positive effects on performance and growth of broiler chickens. They also have antioxidant, antibacterial, antifungal and anticoccidial impacts. These active components of thyme can promote the health status and immune defense of the host animals, particularly during environmental and physiological stress and critical situations. They also can improve the intestinal absorpability of nutrients and assist the animal to develop better. Herbs and herbal products are incorporated in poultry diets to stimulate their productive performance. Plant extracts and spices as mixed or as single compound preparations can play a role in reinforce both health status and production performance of the animal (Manzanilla *et al*., 2001). It is worth noting that several free radicals including hydroxyl, superoxide and hydrogen peroxide are generated due to the typical metabolic action and are distributed through various routes. However, these radicals might cause physiological threats (e.g. tissue damage and/or lipid peroxidation of fatty acids) due to stress factors, which cause antioxidant deficiency and the generation of free radicals **(**Gumus *et al.,* 2017) Attributable to the phenolic mixes (carvacrol and thymol) it contains, thyme has antioxidant properties (Lawrence, 2005). Thymol and carvacrol are demonstrated to have a potent antioxidant activity in volatile oils of thyme. In this manner, this study was intended to assess the effect(s) of dietary thyme and its essential oils on performance, blood profile and immune responses of broiler chickens.

MATERIALS AND METHODS

This study was conducted at the Poultry Production Farm; Center of Agricultural Research and Experiments, Faculty of Agriculture, Mansoura, University from May to June 2016. The objective of the present study was to evaluate the effect of thyme and its essential oils on growth performance, carcass yield d, some blood metabolites, immunity and lipid peroxidation in broiler chickens.

Experimental Design and Management:

Cobb 500 one-day-old broiler chickens (n=140) were divided into seven treatment groups, each of them included four replicates (cages). The groups were assigned to seven dietary treatments: control group (basal diet), 0.5 g/kg thyme

essential oils group, 1.0 g/kg thyme essential oils group, 1.5 g/kg thyme essential oils, 5.0 g/kg thyme group, 10.0 g/kg thyme group and 15.0 g/kg thyme group. Broilers were reared in battery cages having 0.168 m^3 (70 cm length, 60 cm width and 40 cm height), and birds were fed with their respective experimental diets up to 42 days of age according to nutritional program. Chickens were reared using a starter diet from the first up to the day 21 of age (3153 kcal of ME/kg and 22.95% CP). Thereafter, chickens were fed using grower diet (3199 kcal of ME/kg and 19 % CP) from 21 to 42 days of age. The experimental diets were formulated to satisfy the recommended doses of broiler chickens nutrition according to NRC (1994). Feed in mash form and fresh water were given freely. The composition and chemical analysis of the experimental diets are shown in Table 1.

Performance of broiler chickens:

Based on replicate group basis feed intake (FI), live body weight (LBW) and body weight gain (BWG) were weekly measured throughout the experiment. Consequently, feed conversion ratio (FCR) was calculated as a gram feed : gram gain. Chickens were weighed (in grams) at early morning before receiving any food or water at the beginning of the experiment and at weekly intervals until the end of the experiment. Weekly records on FI and BWG of broilers were also calculated on a replicate group basis.

Carcass traits:

At the termination of the study (42 day of age), four birds per treatment were randomly chosen for slaughtering to collect their liver, gizzard, heart and lymphoid organs (spleen, bursa of Fabricius and thymus). These organs were weighed and expressed as a percentage of live body weight.

Blood sampling and biochemical analysis:

During slaughter, blood samples were collected in heparinized tubes and centrifuged at 4000 rpm for 15 min. Furthermore, the plasma acquired was stored at -20^{o}C until analysis. Plasma biochemical constituents and metabolites, including total protein(TP), albumin (ALB), total cholesterol (Chol), alanine aminotransferase (ALT), triglycerides (Trig), aspartate aminotransferase (AST), high density lipoprotein (HDL), low density lipoprotein (LDL), total antioxidant capacity (TAC) and malondialdehyde (MDA) were measured by commercial kits. Immunoglobulins (IgG, IgA and IgM) were determined by ELISA technique.

Statistical analysis:

The acquired data were subjected to statistical analysis using one-way analysis of variance (SAS, 2006). Duncan's multiple range test was utilized to separate significant differences among means (Duncan, 1955).

RESULTS AND DISCUSSION

Growth performance

The effects of dietary supplementation with thyme and its essential oils on broiler chickens' performance at 21 and 42 days of age are presented in Table 2. There were significant differences in LBW, BWG, FI and FCR of broilers fed the different experimental diets. The control group was significantly better in LBW and BWG as compared to all other groups (except the group fed 5 g/kg thyme) in the first three weeks of study and whole experimental period. Moreover, , feeding the diet supplemented with 5 g/kg thyme enhanced FI during the starter and whole

experimental periods as compared to other groups. Broilers fed the diet fortified with 1.0 g/kg thyme essential oils displayed significantly better FCR than the other experimmintal groups during the starter and whole experimintal periods. These results agree with those of Lee *et al.* (2003), who found that 200 mg/kg thyme in the diet did not influence the BWG, FI, and FCR of female broilers. Also, Toghyani *et al.* (2010) revealed that the low dosage (5.0 g/kg) of thyme had a significant positive impact on broiler BW and FCR, while the high level (10.0 g/kg) did not exert such impact. Najafi and Torki (2010) found that the broiler chicks which was fed 200 mg thyme essential oils per kg diet had significantly higher LBW and FCR. On the other hand, Tekeli *et al.* (2006) found that added dietary thyme had no beneficial effect on broilers performance. Also, dietary supplementation of thyme powder or thyme essential oils did not significantly affect the performance of broiler chickens (Demir *et al.*, 2008).Also, , dietary inclusion of thyme powder significantly increased body weight when it was added at a level of 5 g/kg and significantly improved both daily weight gain and body weight when added to the diet at levels of 0.5, 1.0, 1.5 and 2.0% (Safa and Al-Beitawi, 2009). On the contrary, Cross *et al.* (2002) observed no significant differences in weight gain of chickens fed diets fortified with garlic and thyme extract. Moreover, Thakar *et al.* (2004) showed that thyme extract powder decreased broiler chicken weight compared with the control.

Carcass yield

The data of carcass parameters are shown in Table 3. It could be detected that inclusion of thyme and its essential oils in the broiler diet did not have any significant effect on weight of giblets (heart, gizzard, liver) or immunity organs (spleen, bursa and thymus). Percentages of immunity organs as indicators of immune situation were improved in the groups fortified with thyme and its essintial oils compared with the control group. The active compounds of thyme essental oils has been reported to have promoting effects on gastrointestinal tract and immune system and can improve growth and health status of birds (Toghyani *et al.,* 2010 and Kalantar *et al.*, 2017). Ocak *et al*. (2008) reported that relative carcass weight of broilers was not affected by the inclusion of 0.2% thyme leaves in the diet. In accordance with the present results, Sarica *et al.* (2005) demonstrated that using the extractions of two natural herbs (thyme and garlic) did not show significant effect neither on carcass components nor on weights of heart, liver, gizzard and spleen of broiler chickens. Hernandez *et al.* (2004) reported that using combination of two herbal extracts had no significant effect on carcass characteristics. The results of the present study are also in agreement with the results of Mandal *et al.* (2000) who showed that essential oils had no significant effect on performance of carcass yield of broiler chickens. In contrast, Alçiçek *et al,* (2003) found that the use of herbal extract in broiler diet resulted in an improvement in carcass yield but had no significant effect on abdominal fat percentage. Similar to the results obtained in this study, Denli *et al.*, 2004 also showed that carcass percentage was not influenced by dietary treatments but the supplementation of the diet with thyme essential oils significantly decreased abdominal fat weight and percentage.

Blood lipids profile

The effects of added dietary thyme and its essential oils on plasma concentrations of total lipids, triglycerides, cholesterol, HDL and LDL of broiler chickens are shown in Table 4. Plasma levels of total lipids and triglycerides were not affected by dietary supplementation with thyme or its essential oils for broiler chickens. However, the experimental groups fed the fortified-diets achieved significantly higher concentration of HDL, particularly when the level of thyme reached 10 g/kg. On the other hand, dietary supplementation with thyme and its essential oils caused a significant decrease in plasma levels of LDL compared with the control group. These results are in accordance with those of Bölükbaş *et al.* (2006), who reported that supplemental dietary thyme oils increased plasma level of HDL-cholesterol in broilers. Similarly, Gumus *et al.* (2017) reported that plasma LDL levels were significantly lower in treatments recieved thyme essential oils at levels of 150 and 450 mg/kg compared with that of the control group. Our results disagree with the findings of Najafi and Torki (2010), who observed that plasma cholesterol and triglycerides levels were not affected by dietary supplementation of thyme essential oils in broiler chicks. Additionally, supplementation of 5.0 and 10.0 g/kg of thyme powder into broiler diets did not influnce serum levels of cholesterol and triglyceride but serum levels of HDL-cholesterol were significantly higher with birds fed the diet containg 10 g/kg of thyme powder (Toghyani *et al.*, 2010). Furthermore, Lee *et al.* (2003) reported that addition of thymol to broiler chickens diets did not significantly influnce plasma triglyceride. The significant decrease observed in the serum LDL levels of the groups that received 150 and 450 mg/kg of thyme essential oils in the study of Gumus et al. (2017) may be attributable to the possible impact of thyme on the hypolipidemic mechanism but added thyme essential oil did not alter serum levels of triglycerides, cholesterol or HDL.

Blood plasma protein and liver enzymes:

Results of plasma parameters (total protein, albumin, AST and ALT) for the different experimental groups of broiler chickens fed diets supplemented with thyme and its essential oils are presented in Table 5. Feeding the diets fortified with thyme and essential oil had no significant effect on plasma total protein or activity of transaminases (AST and ALT). However the experimental groups received the diets containing 10 and 15 g/kg thyme exhibited higher concentration of plasma total protein compared with the other groups. Theseresults are in harmony with those of Ragaa *et al.* (2016), who found that dietary thyme supplementation had no effect on liver function. The results of the study of Toghyani *et al.* (2010) stated that the effect of dietary supplementation with 5 and 10 g/kg thyme did not alter concentration of serum total protein in broiler chickens. On the other hand, Belenli *et al.* (2015) found that the serum total protein level was significantly lower in thyme essential oils-supplemented group than that of the control broiler chicks. Nevertheless, serum albumin level was significantly higher in the thyme essential oils (100 ppm)-supplemented group as compared to the other experimental groups.

Immune response and antioxidant status

The effects of dietary supplementation with thyme and its essential oils on plasma immunoglobins (IgG, IgA and IgM), total antioxidant capacity (TAC) and malondialdehyde (MDA) of broiler chickens are shown in Table 6. The results related to humoral immune response of broiler chickens showed a significant increase in immunoglobulin A and G in the groups supplemented with thyme essential oils (0.5 , 1.0 and 1.5 g/kg) and thyme (5, 10 and 15 g/kg) compared with the control group. It is of great interest to notice that groups of broiler chickens administered thyme and its essential oils displayed significantly higher level of plasma TAC as compared to the control group Similarly, MDA was significantly lower in treated groups compared with the control group. In this respect, Acamovic and Brooker (2005) reported a stimulating effect of polyphenol fraction of thymol oil of on the mononuclear phagocyte system, cellular, and humoral immunity. The current results are in agreement with those of Jameel *et al*. (2014), who found that supplementing broilers diet with blend of 1% thyme plus 1% garlic could improve the immune response and blood profile of broilers. Gumus *et al.* (2017) showed that thyme essential oils significantly improved the liver function and the serum activity of CAT and GSH-Px. They also extrapolated that, as the most significant indicator of lipid peroxidation, MDA levels may decrease in both the liver and serum in response to feeding the thyme essential oils-supplemented diets. Research has demonstrated that the active substances of thyme essential oils (thymol and carvacrol) significantly decrease the lipid peroxidation in tissues (Nieto *et al.,* 2011). These outcomes concur with the discoveries of El-Hack and Alagawany (2015) that serum SOD activity and GSH levels were significantly increased in the broilers groups fed diets supplemented with thyme. They also stated that muscle MDA levels were significantly decreased by the addition of 9.0 g thyme/kg. Alipour *et al.* (2015) found that dietary supplementation with thyme oil extract (50, 100, 200, or 400 ppm), especially the level of 100 ppm, can improve immunological responses of broiler chicks. Jameel *et al.* (2014) proposed that enriching the broilers diet with a blend of 1% thyme plus 1% garlic could improve the immune response and blood profile of broilers. Radwan *et al.* (2008) reported that supplemention of 0.1% thyme to laying hens diet gave better antibody production response as compared to the control group. Since thyme oils extract likely acts as an antioxidant, it is conceivable that high doses could prevent initial increase of reactive oxygen species that are important to stimulate lymphocytes of broiler chickens (Placha *et al*., 2014). Hashemipour *et al.* (2013) found that supplementation of the broiler diet with equivalent blend of thymol and carvacrol at 4 levels (0, 60, 100, and 200 mg/kg) linearly enhanced the activity of SOD and GSH-P_X and decreased the level of MDA in serum in broilers at 42 d of age compared with those fed the control diet.

CONCLUSION

In view of the present outcomes, it may be concluded that dietary supplementation with thyme (5.0 g/kg) can improve the effectiveness of feed usage, and immune status of broiler chickens. Furthermore, supplemental thyme can induce an advantageous impact on the lipid profile and oxidative status of broiler chickens.

Table(1): Composition and Chemical Analysis of the Basal Diets

Ingredients (%)	**Starter Diet**	**Grower Diet**
Yellow corn	65.15	74.5
Soybean meal, 44% CP	11	6.7
Corn Gluten Meal, 60.2% CP	19.5	14.9
Dicalcium Phosphate	1.8	1.34
Limestone	1.47	1.49
DL-methionine	0.05	0.0
L-Lysine HCL	0.43	0.47
Sodium chloride	0.3	0.3
Vit. + Min. Premix[1]	0.3	0.3
Total	100	100
Chemical analysis: (As-fed)		
Metabolizable energy, kcal/kg	3153	3199
Crude protein, %	22.95	19
Crude Fiber, %	2.45	3.25
Ether extract, %	3.05	2.3
Calcium, %	1.0	0.9
Nonphytate Phosphorus, %	0.45	0.35
Methionine, %	0.53	0.4
Meth. + Cys. (TSAA, %)	0.93	0.74
Lysine, %	1.1	1.0

"[1]Premix Contained per kg diet: VA 2654 µg; VD3 125 µg; VE 9.9 mg; VK3 1.7 mg; VB1 1.6 mg; VB12 16.7 µg; riboflavin, 5.3 mg; niacin 36mg; calcium pantothenate, 13mg; folic acid,0.8 mg; d-biotin,0.1mg; choline chloride,270; BHT, 5.8; Fe 50 mg; Cu 12 mg; I 0.9mg; Zn 50mg; Mn 60 mg; Se 0.2mg; Co 0.2mg.

Table (2): Effect of dietary supplementation of thyme and its essential oils on growth performance of broilers from one to 42 days of age.

Treatment	LBW 0-d-old (g)	LBW 21-old (g)	Final LBW (g)	BWG 0-21 - old (g)	BWG 0-42 old (g)	FI (0-21 - old)/ bird (g)	Feed intake / bird (g)	FCR(0-21 - old	FCR
Control (0.0 g/kg)	47.0	657.5^{a}	1873^{a}	610.5^{a}	1826^{a}	976.8^{b}	3679^{cd}	1.600^{a}	2.017^{ab}
Thyme oil (0.5 g/kg)	47.2	598.0^{bc}	1756^{b}	550.8^{bc}	1709^{b}	923.5^{b}	3523^{abc}	1.675^{ab}	2.065^{ab}
Thyme oil (1.0 g/kg)	46.7	565.7^{cd}	1780^{b}	519.0^{cd}	1733^{b}	831.3^{a}	3406^{a}	1.605^{a}	1.967^{a}
Thyme oil (1.5 g/kg)	46.5	585.5^{bcd}	1780^{b}	539.0^{bcd}	1734^{b}	904.1^{b}	3672^{cd}	1.677^{ab}	2.120^{b}
Thyme (5.0 g/kg)	45.7	612.2^{b}	1903^{a}	566.5^{b}	1857^{a}	985.3^{c}	3739d^{d}	1.740^{b}	2.015^{ab}
Thyme (10.0 g/kg)	46.2	583.7^{bcd}	1758^{b}	537.5^{bcd}	1711^{b}	901.3^{b}	3612^{bcd}	1.675^{ab}	2.110^{b}
Thyme (15.0 g/kg)	46.0	558.7^{d}	1738^{b}	512.8^{b}	1692^{b}	862.5^{a}	3448^{ab}	1.685^{ab}	2.040^{ab}
Pooled SEM	0.462	10.275	22.13	10.03	21.92	12.26	64.78	0.032	0.035
Significance	NS	**	*	**	*	**	**	*	*

a-d:" Means in the same coulmn with different superscripts differ significantly (P≤ 0.05)".

Table (3): Effect of dietary supplementation of thyme and its essential oils on carcass traits, internal organs and related immune organelles of broiler chickens at marketing age

Treatment	LBW(g)	Carcass%	Liver%	Gizzard%	Heart %	Spleen%	Giblets%	Thymus%	Bursa%
Control (0.0 g/kg)	2186^{a}	76.96^{a}	5.505	3.507^{bc}	1.09	0.25	10.35	0.73	0.183
Thyme oil (0.5 g/kg)	1981^{cd}	75.48^{ab}	5.035	3.645^{bc}	1.24	0.27	10.20	0.85	0.177
thymeoil (1.0 g/kg)	1982^{cd}	74.27^{bc}	5.502	3.807^{abc}	1.43	0.27	11.02	0.80	0.201
Thyme oil (1.5g/kg)	1868^{d}	74.73^{abc}	5.550	4.345^{a}	1.31	0.26	15.28	0.83	0.189
Thyme (5g/kg)	2152^{ab}	74.69^{abc}	5.090	3.252^{bc}	1.28	0.27	13.08	0.76	0.208
Thyme (10g/kg)	2018^{bcd}	72.88^{c}	5.420	3.140^{c}	1.30	0.25	10.10	0.78	0.173
Thyme (15g/kg)	2033^{bc}	73.06^{bc}	5.462	3.942^{ab}	1.10	0.29	10.81	0.83	0.173
Pooled SEM	48.65	0.74	0.32	0.21	0.11	0.02	1.90	0.05	0.02
Significance	**	**	NS	**	NS	NS	NS	NS	NS

a-d:" Means in the same coulmn with different superscripts differ significantly (P≤ 0.05)".

Table (4): Influence of thyme oil and thyme supplementation on plasma total lipids, triglycerides, cholesterol, HDL and LDL in 6-week-old broiler chickens.

Treatment	Tlip(mg/dL)	Trig(mg/dL)	Chol(mg/dL)	HDL(mg/dL)	LDL(mg/dL)
Control (0.0 g/kg)	954.4	138.02	207.82	54.225^{c}	126.337^{a}
Thyme oil (0.5 g/kg)	963.6	144.47	200.37	57.650^{bc}	113.180^{ab}
Thyme oil (1.0 g/kg)	985.15	140.45	208.35	65.650^{ab}	117.420^{ab}
Thyme oil (1.5g/kg)	958.30	134.35	203.35	65.450^{ab}	108.435^{ab}
Thyme (5g/kg)	937.35	139.25	206.15	63.350^{ab}	112.760^{ab}
Thyme (10g/kg)	977.80	148.62	196.17	68.475^{a}	98.630^{b}
Thyme (15g/kg)	915.52	142.72	207.92	63.050^{ab}	131.230^{a}
Pooled SEM	17.234	4.726	7.258	2.574	7.893
Significance	NS	NS	NS	*	NS

a-c:" Means in the same coulmn with different superscripts differ significantly (P≤ 0.05)".

Table (5): Influence of thyme oil and thyme supplementation on plasma total protein, albumin, AST and ALT in 6-week-old broiler chickens.

Treatment	TP(g/dL)	ALB(g/dL)	AST(U/L)	ALT(U/L)
Control (0.0 g/kg)	4.610	2.4925^{cb}	58.4500	18.725^{b}
Thyme oil (0.5 g/kg)	4.905	2.6925^{abc}	63.5750	21.525^{ab}
Thyme oil (1.0 g/kg)	4.597	2.4600^{c}	60.1750	20.475^{ab}
Thyme oil (1.5g/kg)	4.850	2.7475^{ab}	63.5750	22.450^{ab}
Thyme (5g/kg)	4.835	2.7225^{abc}	66.7250	21.525^{ab}
Thyme (10g/kg)	5.022	2.9500^{a}	59.3250	20.200^{ab}
Thyme (15g/kg)	4.932	2.7450^{ab}	61.7500	23.775^{a}
Pooled SEM	0.152	0.083	3.625	1.252
Significance	NS	**	NS	NS

a-c:Means in the same coulmn with different superscripts differ significantly (P≤ 0.05)".

Table (6): Influence of thyme oil and thyme supplementation on immune response and antioxidant status in 6-week-old broiler chickens.

Treatment	IgA(mg%)	IgG(mg%)	IgM(mg%)	TAC(nmol/dL)	MDA(nmol/dL)
Control (0.0 g/kg)	5.932	4.135	1.797	0.965^{b}	33.750^{a}
Thyme oil (0.5 g/kg)	7.200	5.175	2.025	1.122^{ab}	30.300^{ab}
thymeoil (1.0 g/kg)	7.175	5.100	2.075	1.242^{a}	23.850^{c}
Thyme oil (1.5mg/kg)	7.362	5.322	2.040	1.232^{a}	25.075^{abc}
Thyme (5g/kg)	6.950	5.035	1.915	1.202^{a}	24.025^{c}
Thyme (10g/kg)	7.200	5.360	1.840	1.240^{a}	21.425^{c}
Thyme (15g/kg)	6.687	4.660	2.027	1.135^{ab}	24.550^{c}
Pooled SEM	0.3732	0.2757	0.166	0.0596	1.848
Significance	NS	NS	NS	*	**

a-c:"Means in the same coulm with different superscripts differ significantly (P≤ 0.05").

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الملخص العربي

تأثير المكملات الغذائية لمستويات مختلفة من الزعتر وزيوتها الأساسية على الأداء الانتاجي وبعض مقاييس الدم والاستجابات المناعية والتمثيلية للدجاج التسمين

فوزي صديق أسماعيل عبد الفتاح ، محمد رأفت الجوجري ، محمد نشأت المرسي
قسم إنتاج الدواجن ، كلية الزراعة ، جامعة المنصورة ، المنصورة ، 35516 ، مصر
المراسلات: محمد رأفت الجوجري ، قسم إنتاج الدواجن ، كلية الزراعة ، المنصورة
جامعة المنصورة 35516 ، مصر.

تهدف هذه الدراسة إلي بحث تأثير أستخدام الزعتر بثلاثة مستويات وهم (5 ، 10 و 15 جم / كجم) و كذلك زيت الزعتربثلاث مستويات وهم (0.5 ، 1.0 و 1.5 جم / كجم) على الأداء الانتاجي ومقاييس الدم والاستجابة المناعة و مضادات الأكسدة في الدجاج التسمين. حيث أجريت التجربة علي 140 كتكوت تسمين عمر يوم غير محدد الجنس وتم توزيع الكتاكيت عشوائيا علي عدد سبع معاملات متساوية وحيث قسمه كل معاملة الي اربع مكررات وتم وضعهم في بطاريات. تم تقديم التغذية والماء بصورة حرة حتى انتهاء التجربة في عمر 6 أسابيع. تم قياس الأداء الانتاجي ومقاييس الدم. كانت مجموعة الكنترول والمجموعة التي تغذت على 5 غرام / كيلوغرام من الزعتر أفضل بكثير في وزن الجسم و معدل الزيادة في وزن الجسم مقارنة مع المجموعات الأخرى في الأسابيع الثلاثة الأولى من الدراسة وفترة التجربة بأكملها. من ناحية أخرى ، فإن المجموعة التي غذيت علي عليقة تحتوي علي 5 جم / كم من الزعتر كانت اقل في استهلاك العلف خلال الثلاث اسابيع الاول من فترة التسمين مقارنة بالمجموعات الأخرى. وكتاكيت التسمين التي غذيت علي عليقة تحتوي علي 1.0 جم / كجم من زيت الزعتر كان أفضل في نسبة معدل التحويل الغذائي من المجموعات التجريبية الأخرى خلال الثلاث أسابيع الاول من فترة التسمين. لم يكن هناك تأثير كبيرعند اضافة الزعتر او زيت الزعتر علي مستويات البلازما في الدهون الكليه ، الدهون الثلاثية والبروتين الكلي أو نشاط AST و ALT وقد لوحظ أن دجاج التسمين الذي تم تغذيته علي عليقة تحتوي على الزعتر أو الزيوت الأساسية للزعتر أظهر تركيزًا أعلى من الكولسترول مرتفع الكثافة (HDL) في البلازما مقارنة مع مجموعة الكنترول ، حيث كان اعلي تركيز من الكولسترول مرتفع الكثافة في الكتاكيت التي غذيت علي 15 جم / كجم من الزعتر. من ناحية أخرى ، أدت أضافة الزعتر أو زيوتها الأساسية إلى انخفاض كبير في الكولسترول منخفض الكثافة (LDL) في البلازما مقارنة مع مجموعة الكنترول. تم تحسين الاستجابة المناعية الخلطية في كتاكيت التسمين التي غذيت علي عليقة تحتوي علي الزعتر او زيوته الاساسية كما يتضح من زيادة كبيرة في الجلوبولين المناعي IgG ، IgAو IgM مقارنة مع مجموعة الكنترول. ومن ناحيه اخري وجد ان العلائق التي تحتوي علي الزعتر والزيوت العطرية له أدت الي زيادة قدرة مضادات الأكسدة (TAC) ولكن انخفض MDA بالمقارنة مع لمجموعة الكنترول. أكدت النتائج المستخلصة من هذه الدراسة التأثير المفيد لمكملات الزعتر في الوجبات الغذائية بمعدل 5.0 جم / كجم على الكولسترول والمناعة و مضادات الأكسدة للدجاج التسمين.