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Effects of Thyme Oil, Peppermint Oil and their Combination on Productive Performance, Carcass Criteria and Blood Profile of Broiler Chickens

Hassan, H. A.
Dept. of Animal and Poult. Prod., Fac. of Agric., SVU, 83523 Qena, Egypt

ABSTRACT

Feeding trials were conducted to elucidate the influence of thyme and peppermint oils or their combination on productive performance and some blood biochemical parameters of broiler chickens. A total of 96 day-old boiler chicks (Ross-308) were divided into four treatment groups. The first one was fed the basal diet, while the 2nd, 3rd, and 4th groups were fed the same diet supplemented with thyme oil (100 mg/kg), peppermint oil (100 mg/kg) or a combination of both. Each treatment had three replicates with 8 broilers each. The daily weight gain was significantly (P<0.01) increased while feed conversion ratio and abdominal fat measures were enhanced by the dietary inclusion of the thyme oil and peppermint oil or their combination compared with the control corn-soybean-fed broilers. Interestingly, the addition of thyme oil and peppermint oil or their combination significantly reduced (P<0.01) the total cholesterol and triglycerides levels whereas the other blood profile including total protein, T3 and glucose levels were increased. There were significant variations in carcass characteristics including the percentages of dressed carcass, heart, gizzard, spleen and liver. In conclusion, the of thyme oil and peppermint oil or their combination displayed a greater response as growth promoters compared to the standard diet in order to improve growth performance and decreased cholesterol levels without adverse effect on carcass criteria of broilers.

Keywords: thyme, peppermint, biochemical parameters, carcass criteria, broilers

INTRODUCTION

Dietary inclusion of herbs essential oils was reported to increase daily gain of weight and enhance the efficiency of feed utilization. The antibacterial properties of thyme and peppermint oils due mainly to their beneficial chemical compounds (*i.e.* thymol and menthol), which degrade the outer bacterial membranes resulting in the elaboration of their materials from the cells to the surround environment (Helander *et al.,* 1998). Both herbs could improve immunity, antioxidant properties, and enhance appetite (Dorman *et al.,* 2003; Yalcin *et al.,* 2012; Abdel-Wareth *et al.,* 2012, 2013, 2016, and 2018). Toghyani et al. (2010) observed better feed: gain ratio by adding 10 g/kg thyme in contrast to 5 g/kg diet. Abdel-Wareth et al. (2019) elucidated that BW and BWG were increased by peppermint leaves addition to broiler diets. Moreover, supplementation of peppermint leaves improved productive performance laying hens (Abdel-Wareth and Lohakare, 2014). There are scarce data about the possible effects (*in vivo*) of both thyme and peppermint oils in contrast to that of leaves of these herbs. Therefore the purpose of this research was to evaluate the impact of thyme and peppermint oils either singly or in combination on productive performance, carcass traits and some blood parameters of broiler chicks.

MATERIALS AND METHODS

Experiment Procedures

This trail was conducted at the Department of Animal and Poultry Production farm, Faculty of Agriculture, South Valley University, Egypt. Rearing of birds was done according the Animal Health and Care Committee guides applied in the university.

Total of 96 day old (Ross 308) boiler chickens were allocated into four experimental groups, the 1st one was fed the basal (control) diet, while the 2nd, 3rd, and 4th groups were fed the basal diet supplemented with thyme oil (100 mg/kg), peppermint oil (100 mg/kg) or a combination of thyme oil (100 mg/kg) and peppermint oil (100 mg/kg), respectively. Each treatment had three replicates with 8 broilers each. Diets were formulated to satisfy the recommended requirements of broiler chickens (NRC, 1994). Composition and chemical analysis of diets are presented in Table-1. The following materials and methods procedures were previously descried by Abdel-Wareth *et a*l.(2019).

Table 1. Composition and calculated analysis of the basal-fed diets

Ingredients (g/kg)	Starter	Grower
Yellow corn	275.90	300.00
Sorghum	275.90	300.00
Soyabean meal (44% CP)	285.00	250.00
Corn-gluten (60% CP)	95.00	60.00
Vit & Min. Premix[a]	3.00	3.00
Sunflower oil	30.0	55.2
Di- Cal phosphate	20.0	18.00
Limestone	10.0	10.00
Salt	3.80	3.80
DL-methionine	0.40	---
L- lysine HCl	1.00	---
Total	1000	1000
Calculated analysis:		
ME (kcal/ kg)	3000	3187
CP (g/kg)	236.7	204.6
Cal. (g^{-1}kg)	10.0	10.0
Av. Phos(g^{-1}kg).	5.00	5.00
Lys (g^{-1}kg)	11.6	11.6
Meth (g^{-1}kg)	5.20	5.20

[a] **Vit.-Min. premix contains per kg: as has been reported by Abdel-Wareth *et al*.(2019).**

Management and housing of birds

Chicks were housed in 3-tier battery (97 cm length × 50cm width × 45 cm height) in an equipped closed farm. The chicks of each replicate were set in one wire cage supplied with nipple drinkers and slatted iron floor. Feed and water were provided all time.

Growth performance data

Live body weight, gain, feed consumption, mortality rate, and feed: gain ratio (FCR) were recorded at 1, 21, and 42 days of age. The experiment duration was 42 days. All data (FC, BWG, FCR) were measured at definite intervals *i.e.*, from 1 to 21, 22 to 42 and for the whole period (1 to 42 d).

Measurement of Carcass traits

At the end of the experiment (42 d), 20 chicks / treatment group were randomly chosen (two /replicate), overnight fasted but with access to water, then slaughtered according to Islamic regulations, and de-feathered. After evisceration the dressing percentage and relative organs weights were calculated (liver, heart, gizzard, spleen).

Abdominal fat (%), small intestine and caecum length also measured.

Blood biochemical analyses

Blood samples were withdrawn from 20 chicks per treatment group by wing vein puncture using sterilized needles in vacutainer tubes. Birds were still feeding before blood collection and feed was not withdrawn from the feeder. Blood was let for short time to allow separation of serum naturally, then centrifugation (4000 rpm for 15 minutes) of all samples were done to harvest all serum. Sera were decanted in dry and clean Eppendorf tubes and stored frozen (at -20^{o}C) till the biochemical analysis. Serum proteins, glucose, cholesterol, LDL-cholesterol and triglycerides were measured by spectrophotometer by using available commercial kits according to the manufacturer outlines. Thyroid gland hormones concentration (triiodothyronine, T_3 and thyroxine, T_4) were analyzed by ELISA technique using kits purchased from Spectrum Chemical Company, Obour City - Cairo, Egypt.

Statistical analysis of data

The obtained results were subjected to one way ANOVA using the general linear model (GLM) procedure of SAS 9.2 software (SAS Institute, 2005). Significance differences between means were detected by Duncan multiple range test (Duncan, 1955), where P<0.05; P-values less than 0.001 are expressed as "<0.001" rather than the actual value.

RESULTS AND DISCUSSION

Results

Productive performance

Supplementation with thyme oil, peppermint oil or the combination had an obvious effect on productive performance of broiler (Table 2). Live body weight and gain in weight were significantly increased with supplementation of thyme oil, peppermint oil or their combination to broiler diet compared to control group at the two experimental periods (21 and 42 d of age). However, both feed consumption and conversion were significantly decreased with supplementation of thyme oil, peppermint oil or their combination to broiler diet in comparison with those fed the control (un-supplemented) ones of the same ages.

Table 2. Effect of thyme oil, peppermint oil and a combination of them on feed intake and growth performance of broiler chickens

Items	Treatments				SEM	P-Value
	Control	Thyme oil	mint oil	Mix		
Body weight, g						
1 d	45.167	46.667	46.333	46.000	0.285	0.306
21 d	766.667^{a}	716.667^{b}	713.333^{bc}	696.667^{c}	8.196	0.001
42 d	2133.33^{a}	2086.66^{b}	2070.00^{b}	2040.00^{c}	10.810	0.001
Body weight gain, g						
1 to 21 d	721.5^{a}	670^{b}	667^{b}	650.67^{c}	8.14	0.001
21 to 42 d	1366.667^{a}	1370^{a}	1356.66^{ab}	1343.33^{b}	3.84	0.027
1 to 42 d	2088.16^{a}	2040^{b}	2023.66^{c}	1994^{d}	10.45	0.001
Feed intake, g						
1 - 21 d	1260^{a}	1113^{b}	1037^{bc}	1001^{c}	31.77	0.001
21 - 42 d	2814^{a}	2626.66^{bc}	2671^{b}	2562^{c}	29.312	0.001
1 - 42 d	4074.00^{a}	3739.66^{b}	3708.00^{b}	3563.00^{c}	58.642	0.001
Feed to gain ratio						
1 - 21 d	1.747	1.661	1.555	1.538	0.030	0.188
21 - 42 d	2.059^{a}	1.917^{bc}	1.969^{b}	1.907^{c}	0.020	0.006
1 - n 42 d	1.951^{a}	1.833^{b}	1.832^{b}	1.787^{b}	0.020	0.002

$^{a-c}$Means within rows with common superscript differ significantly (P<0.05)

SEM: Standard error of the means

Some blood biochemical responses

Table 3 shows the efficaccy of diets without or with thyme oil, peppermint oil or their combination on serum biocheical parameters of broiler chicks. It is clear from the data that serum levels of cholesterol and triglyceride were significantly reduced (P<0.001) in chicks that fed diets with thyme oil, peppermint oil or their combination compared by the control ones. Serum glucose and total protein were increased (P<0.001) in the thyme oil, peppermint oil or their combination supplemented birds in comparison with those of controlchicks. There were insignificant differences between birds of different treatments in terms of serum albumin level and thyroxine (T_4) concentration.

Table 3. Effects of thyme oil, peppermint oil and their combination on serum biochemistry and thyroid hormones analysis of broiler chickens

Items	Treatments				SEM	P-Value
	Control	Thyme oil	Mint oil	Mix		
Total protein (g/dl)	4.470	5.073	5.060	5.043	0.043	0.001
Glucose (mg/dl)	117.66	123.00	122.00	122.00	1.054	0.020
Cholestrol (mg/dl)	120.00	109.66	110.00	108.00	2.147	0.015
Triglyceride (mg/dl)	121.66	101.00	110.00	98.66	4.017	0.013
T3 (ng/ml)	1.388	1.548	1.524	1.745	0.051	0.008
T4 (ng/ml)	1.982	2.669	2.307	2.440	0.310	0.502
Albumin (g/dl)	2.873	3.076	2.983	3.133	0.086	0.241

$^{a-c}$ Different superscript letters in each row indicate a significantl (P<0.05) difference

Carcass criteria

The effects of thyme oil, peppermint oil or their combination on eviscerated carcasses criteria and some internal organs weight are presented in Table 4. There were significant effects of thyme oil, peppermint oil or their combination supplementaions on dressing percentage, liver, gizzard, spleen, small intestine length and cecum length (Tables 4). Dietary thyme oil, peppermint oil or their combination had a reducuction enffect (P<0.01) on the percentages of abdominal fat and heart weights in contast with the values recoded for control group.

Table 4. Effect of thyme oil, peppermint oil and their combination on the relative weights of internal organs and carcass traits of broiler chickens

Items	Treatments				SEM	P-Value
	Control	Thyme oil	Mint oil	Mix		
Carcass characteristics percentage						
Dressing	76.97	80.54	80.41	80.63	1.097	0.001
Abdominal fat (%)	1.613	0.645	0.713	0.599	0.212	0.001
Liver (%)	2.772	2.574	2.911	2.959	0.297	0.001
Gizzard(%)	1.681	1.658	1.552	2.068	0.181	0.001
Heart(%)	0.720	0.580	0.585	0.613	0.047	0.001
Spleen(%)	0.140	0.123	0.195	0.122	0.027	0.001
Small intestine length (cm)	192.66	191.33	204.33	193.33	2.368	0.001
Cecum length (cm)	31.33	31.66	32.33	33.00	0.500	0.001

$^{a-c}$ Means within rows with different superscripts are significantly (P<0.05) different

Discussion

The possible effect(s) of dietary inclusion of thyme oil, peppermint oil or their combination on performance, carcass traits and serum biochemistry of broiler chicks were investigated. Both BW gain and FCR were significantly improved in birds fed diets supplemented with thyme oil, peppermint oil or their combination. Similar results were observed in broilers that fed with diets supplemented with thyme leaves (Abdel-Wareth *et al.,*2012) peppermint leaves (Abdel-Wareth *et al.,* 2019). Moreover, supplementations of peppermint leaves improved productive performance laying hens (Abdel-Wareth and Lohakare, 2014). Toghyani et al. (2010) reported better FCR and an improved growth performance when they used thyme at 10 g/kg diet in contrast to a low supplementation of 5 g/kg diet. Also, Khempaka et al. (2013) found that peppermint leaves in broilers diet, enhanced the antioxidant defense system, reduced the deposition of abdominal fat, and emission of ammonia. Amad et al. (2011) concluded that inclusion of thyme essential thyme and star anise oils to broiler diets had improved feed conversion ratio and meat yield. Similarly, Mimica-Dukic et al. (2003), used mint oil in broiler diet, and found an improvement in the intestine health, bile secretion rate, and better growth rate and lower feed consumption, leading to better FCR.

In the present study the noticable reduction in abdominal fat percentage in treated versus control group may be a positive response of birds to thyme and peppermint oils (or their combination) supplementation to diets. On the other hand, the reduction in serum total cholesterol and triglyceride could be attributed to the increased digestive enzymes secretion, which in close agreement Lee et al.(2003) and Jang et al.(2004) or better bile acids release (Platel and Srinivasan, 2000; Williams and Losa, 2001; Amad *et al.,* 2011).

CONCLUSION

It could be stated that dietary inclusion of thyme oil and peppermint oil either singly or their combination improved broiler performance traits and had positive hypolipidemic effect on carcass fat and serum cholesterol level.

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تأثير زيت الزعتر وزيت النعناع وخليطهما على الادء الإنتاجى وخصائص الذبيحة وبعض قياسات الدم فى بدارى التسمين

حمدي أحمد حسن

قسم الإنتاج الحيواني والدواجن – كلية الزراعة بقنا - جامعة جنوب الوادي

اجريت هذه التجربة لدراسة تأثير إضافة زيت الزعتر وزيت النعناع وخليطهما على اداء النمو وصفات الذبيحة ووزن الاعضاء الداخلية وبعض صفات الدم فى بدارى التسمين. استخدم فى هذه التجربة عدد 96 كتكوت تسمين عمر يوم من سلالة الروس 308 قسمت الى اربع مجموعات المجموعة الاولى غزيت على عليقة المزرعة بدون اضافات واستخدمت ككنترول ، المجموعة الثانية غذيت على عليقة المزرعة مضاف اليها زيت الزعتر بمعدل (100 ملجم / كجم) ، المجموعة الثالثة غذيت على عليقة المزرعة المضاف اليها زيت النعناع بمعدل (100 ملجم / كجم) ، المجموعة الرابعة غذيت على عليقة المزرعة المضاف اليها خليط من كلاً من زيت الزعتر بمعدل (100 ملجم / كجم) وزيت النعناع بمعدل (100 ملجم / كجم). كل معاملة تتكون من 3 مكررات بكل مكررة 8 طيور. اظهرت النتائج ان معدل الزيادة اليومية فى وزن الجسم يزيد زيادة معنوية ($P<0.01$) بينما معدل التحويل الغذائى ودهن البطن يقل معنويا ($P<0.01$) فى المجموعات التى تأخذ زيت الزعت وزيت النعناع او الخليط بينهما وذلك مقارنتاً بالكنترول. كما اظهرت النتأئج ان اضافة زيت الزعتر وزيت النعناع او الخليط بينهما ادت الى انخفاض معنوى فى مستوى الكوليسترول والجلسريدات الثلاثية بنما ادت الاضافات الى حدوث زيادة فى باقى قياسات الدم والتى تتضمن البروتين الكلي و T3و مستوى الجلوكوز. كما تظهر النتائج وجود اختلافات فى قيم صفات الذبيحة من نسبة التصافى و النسبة المؤية لكل من القلب و القونصة والكبدنتيجة للمعاملات. الخلاصة : اظهرت النتائج ان اضافة زيت الزعتر وزيت النعناع والخليط بينهما ادت الى تحسن كبير فى الزيادة اليومية فى وزن الجسم كما ادت الى انخفاض نسبة الكوليسترول فى الدم بدون اى تأثيرات ضارة على صفات الذبيحة.