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EFFECT OF COLD PRESSED OILS OF MARJORAM AND THYME ON GROWTH PERFORMANCE, CARCASS TRAITS AND BLOOD CHEMISTRY OF GROWING JAPANESE QUAIL

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ABSTRACT: The present study was carried out to investigate the effect of dietary supplementation of two cold pressed oils and their combination on productive performance, carcass traits and some blood parameters of growing Japanese quails. A total number of 400 chicks of unsexed one week old Japanese quail were distributed into four dietary treatment groups according to diets fed as; (T1) fed basal diet (BD) representing the control; (T2) fed BD + Thyme Oil (TO) 250mg/ Kg; (T3) fed BD + Marjoram Oil (MO) 250 mg/ Kg and (T4) fed BD + TO 125 mg/Kg plus MO 125mg/Kg. Each treatment comprised of 100 chicks in 5 replicates of 20 chicks each. Results showed that groups fed diets supplemented with thyme or its combination with marjoram oil exhibited significantly better ($P \leq 0.01$) live body weight (LBW) at 3 and 6 week of age as well as body weight gain (BWG) through 1-3 and 1-6 week of age ($P > 0.01$), comparing with that of control or marjoram groups. Daily feed intake (DFI) showed no significant ($P > 0.05$) differences among different groups. However, feed conversion (FC) values demonstrated no significant variation among dietary treatments during 1-3 and 3-6 weeks of age, while results of the whole period, 1-6 weeks of age, indicated significant ($P \leq 0.01$) enhancement of FC due to dietary supplementation of thyme oil and its combination with marjoram comparing with control or marjoram groups. All carcass traits were not significantly affected by different dietary treatments. The experimental groups had no significant effect on plasma total protein, albumin, globulin, albumin/globulin ratio and aspartate aminotransferase (AST) while, alanine aminotransferase (ALT) values were significantly reduced due to treatments of cold pressed oils comparing to control treatment. In conclusion, supplementing marjoram and thyme cold pressed oils into the Japanese quails improved productive performance without any detrimental impacts on blood parameters.

Key words: Marjoram oil, thyme oil, quail, performance, carcass, blood parameters.

INTRODUCTION

Recently, several antibiotic growth promoters had been used in poultry feed aiming to prevent disease, to improve growth performance and feed utilization, and to increase some useful microorganisms in intestinal microflora. However, because of emergence of bioresistance, researchers are now focusing for alternatives in place of antibiotics; for this, spices, plant extracts and herbs received increasing attentions (Dhama *et al.,* 2015). Natural feed additives and supplements are attaining importance nowadays in animal and poultry production, as well as in health care systems, because of their wide spectrum of beneficial effects, such as promoting growth and production, immune enhancement and health protection (Alagawany *et al.,* 2015a,b). On the same context, cold pressed oils or essential oils are found to have antibacterial ability, and also exhibit antioxidant, anti-inflammatory, anticarcinogenic, digestion stimulating, and hypolipidemic activities (Viuda-Martos *et al.,* 2010). Thus, cold pressed oils can be used as growth promoters in poultry production (Abd El-Hack *et al*., 2015).

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Thyme (*Thymus vulgaris* L.) and marjoram or their effective components enhance the digestive activity of enzymes like protease, amylase and lipase, which results in improved digestibility of nutrients (Abd El-Wareth *et al*., 2012; Badiri and Saber, 2016). Also, these plants of the Labiatae family are used as disinfectants and to improve digestion and absorption. The last two effects are attributed to increase in intestine length and in the depth and width of the villi, thus creating better conditions for nutrient absorption. Nonetheless, there is limited knowledge about the effects of thyme alone, in contrast to data on the essential oils of this herb. Phytogenic feed additives, including thyme, exert their antioxidant mechanism *via* eradication of free radicals, constitution of chelates with metal ions, and prevention or reduction of oxygen formation (Rice-Evans *et al*., 1995; Khan *et al*., 2012). Supplemented broiler diets with oregano essential oil significantly improved growth performance without any effect on blood parameters or carcass characteristics. (Bozkurt *et al*., 2009 ; Galal *et al.*, 2016)

Therefore, this study aimed to examine the effects of the supplementation of thyme and marjoram oils in growing Japanese quail diets on growth performance, carcass yield and some blood metabolites.

MATERIALS AND METHODS

The present study was carried out at Poultry Research Farm, Poultry Department, Faculty of Agriculture, Zagazig University, Zagazig, Egypt on December 2014.

A total number of 400 unsexed one week old Japanese quail were randomly assigned in a complete randomized design into 4 treatment groups (100 chicks in each). Each group of birds was subdivided into five replicates, each of 20 chicks. Each replicate was housed in a cage (90 × 40 × 40 cm^3). The basal diet was formulated according to NRC 1994 (Table 1). Quails were distributed into four dietary treatment groups according to diets fed as; (T1) fed basal diet (BD) representing the control; (T2) fed BD + Thyme Oil (TO) 250 mg/Kg; (T3) fed BD + Marjoram Oil (MO) 250 mg/Kg and (T4) fed BD + TO 125 mg/Kg plus MO 125mg/Kg.

Chicks were grown in brooders with raised wire floors and were reared under the same managerial and hygienic conditions. The lighting pattern was 23 hours light: 1 hour dark. Feed and water were offered *ad-libitum* throughout the whole experimental period (6 weeks of age). All chicks received feeds from placement until 42 days of age in mash form, according to its treatment.

Chicks were weekly weighed individually at intervals to obtain live body weight (LBW). Average daily feed intake (FI), body weight gain (BWG) and feed conversion (FC) were calculated from these data by period and cumulatively. Feed wastage was daily recorded and the data were used to estimate the feed consumption.

Protein utilization efficiency (PUE) was calculated from protein intake divided by body weight gain divided by protein intake (Kamran *et al*., 2008). Also, energy utilization efficiency (EUE) was calculated as follows: EUE = ME consumed (Kcal) during the studied period/ weight gain (g) during the same period.

At the termination of the experiment, 20 birds (five from each group) were sampled randomly for carcass evaluations at 6 weeks of age, weighed and manually slaughtered. The carcasses were weighed and the weights of the liver, gizzard and heart were recorded and expressed as (%) of slaughter weight (SW). Dressing percentage was calculated according to the following formula: (carcass weight plus giblets weight/pre-slaughter weight) × 100.

Blood samples were randomly collected from 5 birds per treatment after slaughtering into sterilized tubes that were closed with rubber stoppers. Samples were left to coagulate and centrifuged at 3500 rpm for 15 min to obtain serum, and the serum samples were kept in Eppendorf tubes at –20°C until analyzed. The following serum biochemical parameters including total protein (g/dl), albumin (g/dl), globulin (g/dl), ALT (U/L) and AST (U/L) levels were determined by using available commercial kits as described by the manufacturer companies (spectrum, Diagnostics, Egypt, Co. for Biotechnology, SAE) as mentioned by Akiba *et al*. (1982).

Table 1. Composition and nutrient contents of experimental basal diet of growing Japanese quail

Ingredient	(%)
Maize 8.5%	51.80
Soybean meal 44%	36.70
Maize gluten meal 62 %	5.21
Soybean oil	2.90
Limestone	0.70
Di-calcium phosphate	1.65
Nacl	0.30
Premix[1]	0.30
L-Lysine	0.13
Dl-Methionine	0.11
Choline chloride (50%)	0.20
Total	100
Calculated analysis[2] (%)	
ME, Kcal/Kg	2995
Crude protein	24.00
Calcium	0.80
Phosphorus available (%)	0.45
Lysine	1.30
TSAA	0.92
Price /ton diet [3], LE	4159

[1]Provides per kg of diet: Vitamin A, 12,000 I.U; Vitamin D3, 5000 I.U; Vitamin E, 130.0 mg; Vitamin K3, 3.605 mg; Vitamin B1 (thiamin), 3.0 mg; Vitamin B2 (riboflavin), 8.0 mg; Vitamin B6, 4.950 mg; Vitamin B12, 17.0 mg; Niacin, 60.0 mg; D-Biotin, 200.0 mg; Calcium D-pantothenate, 18.333 mg; Folic acid, 2.083 mg; manganese, 100.0 mg; iron, 80.0 mg; zinc, 80.0 mg; copper, 8.0 mg; iodine, 2.0 mg; cobalt, 500.0 mg; and selenium, 150.0 mg.

[2]Calculated according to NRC (1994).

[3]Caculated according to the price of feed ingredients when the experiment was started.

Statistical Analysis

Data was subjected to ANOVA procedure using a completely randomized design using the GLM procedures of SAS (SAS Institute Inc., 2001). The differences among means were determined using the *post-hoc* Tukey's test. Statements of statistical significance are based on $P<0.05$ unless otherwise stated. $Yij = \mu + T i + eijk$

Where:

Yij = an observation, μ = the overall mean, Ti = effect of treatments and eijk = Experimental random error

RESULTS AND DISCUSSION

Live Body Weight and Body Weight Gain

The effects of cold pressed oils (thyme, marjoram and their combination) on growth performance of growing Japanese quail are presented in Table 2. No significant differences ($P>0.05$) were observed in the initial body weight of Japanese quail among the different dietary treatments. Quail fed diets supplemented with thyme or its combination with marjoram exhibited, significantly better ($P\leq0.01$) live body weight (LBW) at 3 and 6 weeks of age, body

Table 2. Effects of cold pressed oils on growth performance of Japanese quail from 1 to 6 weeks of age

Item	Cold pressed oils				SEM[1]	P-value[2]
	Control	Thyme (250 mg/kg)	Marjoram (250 mg/kg)	Thyme + Marjoram (125+125 mg/kg)		
Live body weight (g)						
1 Wk	33.11±0.02	33.09±0.01	33.09±0.02	33.10±0.02	7.63	0.549
3Wk	110.44^{c}±0.84	113.61^{a}±0.46	111.17^{bc}±0.63	112.87^{ab}±0.63	3.81	0.005
6 Wk	221.74^{c}±1.29	227.19^{a}±0.67	223.19^{bc}±0.73	225.47^{ab}±1.25	9.31	0.003
Daily body gain (g)						
1-3Wk	5.52^{c} ±0.06	5.75^{a} ±0.04	5.58^{bc} ±0.05	5.70^{ab} ±0.05	0.020	0.005
3-6Wk	5.30±0.06	5.41±0.04	5.33±0.06	5.36±0.06	0.022	0.461
1-6 Wk	5.39^{c} ±0.04	5.55^{a} ±0.02	5.43^{bc} ±0.03	5.50±0.04^{ab}	0.007	0.004

Means in the same row within each classification bearing different letters are significantly different.
[1]SEM = Standard Error Mean.
[2]Linear and quadratic effect of cold pressed oils.

weight gain (BWG) through 1-3 and 1-6 week of age (P > 0.01), comparing with that of control or marjoram groups, while BWG through 3-6 week of age was not affected significantly by cold pressed supplementation. The best means of LBW and BWG were achieved by birds fed diet supplemented with thyme as compared to the other dietary groups. Results concerning thyme effect are in accordance with those reported by Bolukbasi *et al.* (2008) who found that body weight and weight gain of male broilers were significantly increased in group supplemented with 200 mg thyme oil/kg diet. Moreover, supplementation of 0.1 g/kg diet of thyme essential oil significantly increased live body weight of Japanese quail compared with the control group (Khaksar *et al.*, 2012). Also, Shad *et al.* (2016) stated that, feeding 250 mg/kg thyme significantly increased body weight gain of broiler chicks. On the other hand, Sengul *et al.* (2008) reported no significant differences in live body weight and body weight gain of Japanese quail due to supplementations of thyme oil extract (0.0 and 2.5 ml/kg) in the diet. The positive effect of thyme dietary supplementation on growth performance of quail, reported herein, might be related to thyme antibacterial action or to its stimulating effect on the nutrient digestibility of the experimental diets.

Results regarding marjoram cold pressed oil effect are in agreement with Ghazi *et al.* (2015) who reported that feeding broiler with diet supplemented with 250 mg oregano essential oil significantly increased body weight and body weight gain.

Feed Intake and Feed Conversion Efficiency

Daily feed intake (DFI) presented in Table 3 showed no significant (P > 0.05) differences among different treatments groups. However, feed conversion efficiency (FCE) values demonstrated no significant variation among dietary treatments during 1-3 and 3-6 weeks of age, while results of the whole period, 1-6 weeks of age, reflect the favorable effect of thyme and its combination with marjoram in enhancement of FCE comparing with control or marjoram groups (P≤0.01). The obtained results concerning to thyme cold pressed oil are in agreement with those obtained by Denli *et al.* (2004) who reported that, the addition of thyme essential oil to the diet resulted in significantly better feed efficiency as compared to that of control group, while feed intake was not affected significantly by thyme essential oil supplementation. On the contrary, Sengul *et al.* (2008) reported no significant differences in feed conversion ratio due to thyme oil extract dietary supplementation while, thyme extract

Table 3. Effects of cold pressed oils on daily feed intake and feed conversion of Japanese quail from 1 to 6 weeks of age

Item	Cold pressed oils				SEM[1]	P-value[2]
	Control	Thyme (250mg/kg)	Marjoram (250mg/kg)	Thyme + Marjoram (125+125 mg/kg)		
Daily feed intake (g/bird)						
1-3Wk	13.54±0.18	13.60±0.13	13.33±0.16	13.33±0.14	0.203	0.436
3-6Wk	22.85±0.24	22.19±0.20	22.59±0.18	22.24±0.20	0.360	0.087
1-6 Wk	19.13±0.18	18.76±0.12	18.88±0.14	18.68±0.12	0.165	0.122
Feed conversion (g feed /g gain)						
1-3Wk	2.45±0.05	2.37±0.03	2.39±0.03	2.34±0.04	0.011	0.131
3-6Wk	4.31±0.08	4.10±0.05	4.24±0.06	4.16±0.07	0.032	0.080
1-6 Wk	3.55^{a} ±0.05	3.38^{b} ±0.03	3.48^{ab} ±0.04	3.40 ± 0.04^{b}	0.011	0.007

Means in the same row within each classification bearing different letters are significantly different.
[1]SEM = Standard Error Mean.
[2]Linear and quadratic effect of cold pressed oils.

significantly decreased feed consumption. In addition, the obtained results respecting to marjoram effect are in partial agreement with those stated by Soliman *et al* (2016) who showed that there was insignificantly effect due to oregano essential oil addition to the diets on feed intake and feed conversion ratio compared with the control group. The improvement in FCE of quail fed diet containing thyme and/or marjoram through 1-6 weeks of age might be related to superior BWG and/or improved nutrient digestibility since their feed intakes were not affected.

Energy and Protein Utilization Efficiency

Results of the effects of dietary thyme, marjoram and their Interaction on energy and protein efficiency are presented in Table 4. The obtained results indicated that use of thyme, marjoram and their interaction significantly (P>0.05) affected on energy utilization at 1-6 weeks of age but did not affect on protein efficiency at least of the experiment period. The effect on protein and energy utilization may be due to protein and energy in the diet according to Mosaad and Iben (2009).

Carcass Traits

Results in Table 5 indicate that dietary thyme, marjoram and their combination on carcass traits of 6-week-old Japanese quail did not show significant differences (P>0.05) among dietary treatments in carcass traits of quail, measured in the present study, including relative weights of carcass yield, individual edible organs (*i.e.* liver, heart and gizzard) or dressing percentage.

In accordance with the present results, Raya *et al.* (2014) reported no significant differences due to dietary thyme (0.0, 0.5, 1.0 and 2.0%) supplementation in carcass traits of growing Japanese quail. including relative weights of carcass yield, total giblets, individual edible (*i.e.* lever, heart and gizzard) or dressing percentage. On the other side, Khaksar *et al.* (2012) revealed that the supplementation of thyme essential oil in Japanese quail diet resulted in significant higher carcass percentage.

Blood Plasma Parameters

Results of plasma total protein, albumin, globulin, albumin/globulin ratio, AST and ALT at 6 week of age are presented in Table 6. The obtained results indicated that using of cold pressed oils had no significant (P>0.05) effects on all measured parameters, except, ALT, where, dietary supplementation of thyme and marjoram or their combination significantly ($P \leq 0.05$) reduced ALT compared to that of control group. In this connection, Raya *et al.* (2014) reported that blood plasma levels of total protein and albumin were increased due to dietary thyme supplementation. In conclusion, supplementing marjoram and thyme cold pressed oils into the Japanese quails improved productive performance without any detrimental impacts on blood parameters.

Table 4. Effects of cold pressed oils on energy and protein utilization efficiency of Japanese quail from 1 to 6 weeks of age

Item	Cold pressed oils				SEM[1]	P-value[2]
	Control	Thyme (250mg/kg)	Marjoram (250mg/kg)	Thyme+ Marjoram (125+125 mg/kg)		
Energy utilization (ME consumed /g gain)						
1-3 Wk	7.35±140.03	7.08±66.47	7.15±71.05	7.02±115.62		0.1387
3-6 Wk	12.93±216.90	12.29±121.03	12.69±159.13	12.44±196.47		0.0749
1-6 Wk	10.63^{a} ±147.54	10.13^{b} ±69.94	10.41^{ab} ±95.55	10.18^{b} ±98.70		0.0076
Protein utilization (g protein intake/g gain)						
1-3 Wk	0.59±0.01	0.57±0.01	0.57±0.01	0.56±0.01		0.5654
3-6 Wk	1.03±0.01	0.98±0.02	1.02±0.02	0.99±0.01		0.3093
1-6 Wk	0.85±0.01	0.81±0.01	0.83±0.01	0.81±0.01		0.2522

Means in the same row within each classification bearing different letters are significantly different.
[1]SEM = Standard Error Mean.
[2]Linear and quadratic effect of cold pressed oils.

Table 5. Effects of cold pressed oils on carcass traits of Japanese quail at 6 weeks of age

Item	Cold pressed oils				SEM[1]	P-value[2]
	Control	Thyme (250mg/kg)	Marjoram (250mg/kg)	Thyme + Marjoram (125+125 mg/kg)		
Dressing (%)	80.41±0.52	81.25±0.52	81.64±0.44	82.15±0.36	1.908	0.0726
Carcass (%)	75.33±0.50	75.94±0.59	76.28±0.54	76.69±0.28	2.143	0.2681
Giblets (%)						
Liver (%)	2.55±0.12	2.83±0.08	2.85±0.11	2.96±0.12	0.096	0.057
Gizzard (%)	1.67±0.06	1.63±0.08	1.62±0.08	1.62±0.06	0.038	0.940
Heart (%)	0.85±0.03	0.85±0.05	0.89±0.02	0.89±0.05	0.011	0.734

Means in the same row within each classification bearing different letters are significantly different.
[1]SEM = Standard Error Mean.
[2]Linear and quadratic effect cold pressed oils.

Table 6. Effect of cold pressed oils on blood chemistry of Japanese quail at 6 wk of age

Item	Cold pressed oils				SEM[1]	P-value[2]
	Control	Thyme (250mg/kg)	Marjoram (250mg/kg)	Thyme + Marjoram (125+125mg/kg)		
Total protein (g/dl)	3.88±0.13	4.10±0.14	4.04±0.09	4.04±0.11	0.123	0.610
Albumin (g/dl)	2.20±0.09	2.37±0.12	2.32±0.06	2.30±0.09	0.067	0.544
Globulin (g/dl)	1.69±0.05	1.73±0.04	1.72±0.05	1.74±0.03	0.013	0.798
A/G ratio	1.30±0.03	1.37±0.05	1.35±0.03	1.32±0.05	0.012	0.514
AST (IU)	72.56±1.15	68.44±1.44	67.33±3.03	65.67±3.04	48.888	0.212
ALT (IU)	16.18^{a}±1.31	13.38^{b}±0.52	12.84^{b}±0.66	12.53^{b}±0.82	6.916	0.023

Means in the same row within each classification bearing different letters are significantly different.
[1]SEM = Standard Error Mean
[2]Linear and quadratic effect of cold pressed oils.

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تأثير استخدام الزيوت العطرية للبردقوش والزعتر على الأداء الإنتاجى وصفات الذبيحة وبعض صفات الدم للسمان اليابانى النامى

ليلة على محمد - محمد محمد الهنداوى - على عبد الرازق عسكر - محمود العجوانى

قسم الدواجن – كلية الزراعة – جامعة الزقازيق – مصر

تهدف هذه الدراسة إلى بحث تأثير إضافة نوعين من الزيوت العطرية والتداخل بينهما على النمو وصفات الذبيحة وبعض صفات الدم للسمان اليابانى النامى، تم تقسيم عدد ٤٠٠ كتكوت سمان يابانى غير مجنس عمر أسبوع إلى أربع مجموعات تجريبية تحتوى كل مجموعة على خمس مكررات بكل مكررة ٢٠ كتكوت وكانت المجموعات كالتالى: المجموعة الأولى (المقارنة) تم فيها تغذية الكتاكيت على العليقة الأساسية دون أى إضافات بينما أضيف للعليقة الأساسية للكتاكيت فى المعاملة الثانية والثالثة والرابعة ٢٥٠ ملجم زيت البردقوش، ٢٥٠ ملجم زيت الزعتر، ١٢٥ ملجم زيت البردقوش + ١٢٥ملجم زيت الزعتر/كجم عليقة على التوالى، أظهرت النتائج أن المجموعات التى غذيت على عليقة مضاف إليها زيت الزعتر فقط أو زيت الزعتر مع زيت البردقوش تحسن فيها وزن الجسم تحسناً معنوياً ($P>0.01$) خلال الأسبوع الثالث والسادس من العمر، كذلك تحسن معنوياً ($P>0.05$) معدل الزيادة فى وزن الجسم خلال ١-٣ و١-٦ أسابيع من العمر مقارنة بمجموعة المقارنة ومجموعة البردقوش، لم يلاحظ أى تغير معنوى ($P>0.05$) فى معدل استهلاك الغذاء بين المجموعات التجريبية وكذلك لم توجد اختلافات معنوية فى الكفاءة الغذائية بين المجموعات التجريبية خلال ١-٣ و١-٦ أسابيع من العمر بينما تأثرت معنوياً ($P>0.01$) خلال الفترة التجريبية الكلية ١-٦ أسابيع بإضافة زيت الزعتر فقط أو إضافته مع زيت البردقوش مقارنة بمجموعة المقارنة أو مجموعة البردقوش فقط، لم تتأثر صفات الذبيحة معنوياً بالمجاميع التجريبية المختلفة، لم يكن للمعاملات التجريبية أى تأثيرات معنوية على كل من البروتين الكلى، الألبيومين، الجلوبيولين، نسبة الألبيومين إلى الجلوبيولين وكذلك AST بينما انخفض ALT معنوياً بالإضافة المنفردة أو المشتركة للزيوت مقارنة بمجموعة المقارنة، أوضحت نتائج هذه الدراسة أن إضافة زيت البردقوش والزعتر معاً إلى علائق السمان اليابانى النامى كان له بعض التأثيرات الإيجابية على الأداء الإنتاجى والكفاءة الغذائية وبدون أي تأثير سلبى على مكونات الدم للسمان اليابانى النامى.

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