Effect of green tea and rosemary extracts on performance, organ weights and blood parameters of broilers

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Abstract

The effect of adding three levels of green tea (*Camellia sinensis*) extract (0, 0.5 and 1 g per kg of feed) and three levels of rosemary (*Rosmarinus officinalis*) extract (0, 0.5 and 1 g per kg of feed) to diet of broiler chickens was studied. This research was carried out as a 3×3 factorial experiment based on a completely randomized design with 9 treatments. At the end of the experiment period, from each replicate, three birds were selected and slaughtered in order to investigate different parts of the carcass and blood profile. The results of the experiment showed that the highest level of green tea extract for feed intake of the sixth week was 0 g/kg of feed (P<0.05). Also, the highest level of rosemary extract for feed intake of the sixth week was 0.5 g/kg of feed (P<0.05). Among the nine studied treatments, the highest feed intake at the sixth week belonged to treatment 2 (P<0.05)). The results of the experiment showed that the best level of green tea extract for weight gain of the sixth week was 0 g/kg of feed (P<0.05). Also, the best level of rosemary extract for weight gain of the sixth week was 0.5 g/kg of feed (P<0.05). Among the nine studied treatments, the best weight gain at the sixth week belonged to treatment 2 (P<0.05). The results of the experiment showed that the best level of green tea extract for feed conversion ratio at the sixth week was 0 g/kg of feed (P<0.05). Also, the best level of rosemary extract for feed conversion ratio at the sixth week was 0.5 g/kg of feed (P<0.05). Among the nine studied treatments, the best feed conversion ratio at the sixth week belonged to treatment 2 (P<0.05). The results of the experiment showed that the highest level of green tea extract for LDL/HDL was 1.0 g/kg of feed (P<0.05). Also, the highest level of rosemary extract for LDL/HDL was 0 g/kg of feed (P<0.05). Among the nine studied treatments, the highest LDL/HDL belonged to treatment 7 (P<0.05). The results of the experiment showed that the highest level of green tea extract for HDL was 0 g/kg of feed (P<0.05). Also, the highest level of rosemary extract for HDL was 0 g/kg of feed (P<0.05). Among the nine studied treatments, the highest HDL belonged to treatment 2 (P<0.05).

Keywords: chick; *Camellia sinensis; Rosmarinus officinalis;* growth.

Introduction

Nutritional methods for improving the quality of meat as well as the use of growth promoters and the prohibition of using antibiotic have led poultry nutritionists to think about some ways to produce high quality natural foods and livestock products, one of which is the use of antioxidants (Spernakova et al, 2007; Farahat et al, 2016). Antioxidants are added to feed for several reasons: to protect the feed from oxidation, as well as to improve the antioxidant status of the animal tissue, and thereby preventing or reducing the oxidation during the life and death of the animal. Antioxidants inhibit or delay oxidation by inhibiting the starter stage or releasing chain oxidation (Qwele, 2011). Synthetic antioxidants such as BHA (butylatedhydroxyanisol), BHT (butylatedhydroxy toluene) and TBHQ (tertiary butyl hydroquinole) are used to slow down or minimize oxidation damage (Fasseas et al., 2007). The antioxidants such as BHT and BHA can have toxic properties and there are strict rules and guidelines for using them in feed. These findings, coupled with an increase in consumer opposition to antibiotic use, have led to increase the likelihood of using natural plant-derived compounds that are healthier and more harmless and less risky for humans and animals (Polat et al, 2011; Haak et al, 2008; Farahat, 2016). The use of medicinal herbs in broiler chickens improves the immune system (Lavinia et al., 2009). Also, the antimicrobial activity of medicinal plant compounds is perhaps their most prominent property. Antibacterial properties of herbal essences can be attributed to their phenolic compounds (Mohiti-Asli et al, 2010).

Some herbal resources are an important reservoir of plant chemical compounds with antioxidant and antibacterial activity and potency and may therefore be used as preventative or therapeutic medicine for pathogenicagentsrather than antibiotics (Aires et al, 2016). The green tea scientifically called *Camellia Sinensis* is very healthy and non-toxic. In addition, due to its compounds, it has a maximum of 30% polyphenolic material, and due to the structure of these compounds having an aromatic ring and active hydroxyl group, it has antioxidant properties (Leung, 2001). Tea catechinsare effective and useful antioxidants. The main catechins found in green tea include epicatechins (EC), epigallocatechin (EGC), epicatechingallate (ECG) and epigallocatechingallate (EGCG) (Graham, 1992; Farahat, 2016).Strong and potent inhibitory effects of low density lipoprotein (LDL) on oxidation are mentioned for the use of catechins of tea, especially EGCG and ECG, in vitro, (Miura et al., 2000). Little research has been done on the effects of green tea on broiler diets (Alimohammadi-Saraei et al., 2014; Seidavi et al. 2014; Alimohammadi-Saraei et al. 2015; Seidavi and Simoes 2015; Alimohammadi-Saraei et al. 2016; Seidavi et al., 2017) and it requires more research.

Rosemary (*Rosmarinus officinalis*) is a Mediterranean herbaceous (Spranakova et al., 2007) belonging to the Lamiaceae family and has a natural source of an antioxidant with polyphenolic compounds (Polat et al., 2011). Rosemary extract has shown strong antioxidant activity in feed and food industries (Coulier et al., 1994). Rosemary extract includes a wide range of phenolic compounds with biological activity, for example, carnosic acid, carnosol, rosmanol and epirosmanol. Currently, karnosic acid is an active antioxidant in rosemary extract (Rickheimer et al., 1996; Offord et al., 1997). Antioxidant activity of rosemary extract is about three times higher than that of carnozol and seven times higher than that of BHA (Rickheimer et al., 1996). In addition, the synergistic effect of alpha-tocopherolhas been reported in vitro (Wada and Fang, 1992). Little research has been done about the effects of rosemary on the diet of broiler chickens (Norouzi et al., 2015; Khazaei et al., 2017; Rostami et al., 2017) and more research is necessary.

Therefore, despite all the research carried out in this field, further research is needed, especially on the various effects of different levels of green tea extract and rosemary extract on the performance of broiler diets, in the form of a comprehensive study. So far, there has not been a comprehensive study on comparative effects of using green tea and rosemary extracts together on broiler chicks.

Materials and methods

The effect of adding three levels of green tea extract (0, 0.5 and 1 g per kg of feed) and three levels of rosemary extract (0, 0.5 and 1 g per kg of feed) to the diet of broiler chicks was studied. This research was carried out as a 3×3 factorial experiment based on a completely randomized design with 9 treatments and 4 replicates and each replicate contained 15 broiler chickens. A total of 540 male Ross 308 broiler chicks were used. The treatments were:

Treatment 1: control diet: green tea extract (0 g per kg of feed) + rosemary extract (0 g per kg of feed) from 1 to 42 days old

Treatment 2: control diet + green tea extract (0 g per kg of feed) + rosemary extract (0.5 g per kg of feed) from 1 to 42 days old

Treatment 3: control diet + green tea extract (0 g per kg of feed) + rosemary extract (1 g per kg of feed) from 1 to 42 days old

Treatment 4: control diet + green tea extract (0.5 g per kg of feed) + rosemary extract (0 g per kg of feed) from 1 to 42 days old
Treatment 5: control diet + green tea extract (0.5 g per kg of feed) + rosemary extract (0.5 g per kg of feed) from 1 to 42 days old
Treatment 6: control diet + green tea extract (0.5 g per kg of feed) + rosemary extract (1 g per kg of feed) from 1 to 42 days old
Treatment 7: control diet + green tea extract (1 g per kg of feed) + rosemary extract (0 g per kg of feed) from 1 to 42 days old
Treatment 8: control diet + green tea extract (1 g per kg of feed) + rosemary extract (0.5 g per kg of feed) from 1 to 42 days old
Treatment 9: control diet + green tea extract (1 g per kg of feed) + rosemary extract (1 g per kg of feed) from 1 to 42 days old
Soy-maize-based diets were separately adjusted for starter (1 to 21 days) and growth (22-42 days) periods in order to meet all the needs of the chicks based on the advice of Ross Corporation (2007) (Table 1). The diets were adjusted to metabolizable energy and crude protein levels using UFFDA rationing software for broiler chicks, and then different levels of green tea extract and rosemary extract were added to the diet.

During the experiment, the environmental conditions were the same for all experimental groups. Light exposure consisted of 24-hour brightness in the first week, and one dark hour was given in the following weeks. The ambient temperature was controlled and the poultry had ad-libitum access to feed and water. Vaccination and other healthcare operations were also carried out in the region, with the advice of the responsible veterinarian. The room was adapted to enter the chicks in terms of substrate, moisture, ventilation and illumination. By random distribution of cages and adjustment of equipment, the condition of breeding all chicks, such as ventilation, humidity, temperature and light, was the same. Water was provided to the chickens at an appropriate temperature inside the chicken waterer and feed was provided in a tray for up to seven days and then in a hangover duct. After weighing the chicks with a scale and recording the average of each replicate, the chicks were divided into experimental cages. Feed intake and weight gain were weekly measured by weighing all the chicks and their consuming feed in their experimental units taking into account daily losses. According to the amount of consumed feed and the average weight gain of the chicks, the nutritional conversion ratio was measured and determined.

Two ml blood samples were taken from the wing vein of three birds from each replicate on days 21 and 42 to measure blood parameters. The sample containing the mixed blood of three birds was placed at room temperature for one hour and was centrifuged after clot formation and serum was separated after 15 minutes centrifuging at 1500 rpm. The density of blood parameters were then measured by the method ofJahanpour et al. (2013).

Also, three chickens from each replicate of the experimental unit, whose weight closer to the average weight of the chicks in that experimental unit, were selected and after four hours of starvation and after recording their live weight, they were slaughtered and their carcasses were weighed and the weight of the organs and the components of the carcass were evaluated after decomposition operation.

The results were analyzed using GLM method of SAS software in the form of a 3 × 3 factorial experiment based on a completely randomized design with 9 treatments and 4 replicate in each treatment. Duncan's test was used to compare the significance of difference between the treatments.

Results

The results of the experiment showed that the highest level of green tea extract for feed intake of the first week was 0 g/kg of feed ($P<0.05$) (Table 2). Also, the highest level of rosemary extract for feed intake of the first week was 0.5 g/kg of feed ($P<0.05$) (Table 2). Among the nine studied treatments, the highest feed intake at the first week belonged to treatment 2 ($P<0.05$) (Table 2). The results of the experiment showed that the highest level of green tea extract for weight gain of the first week was 0 g/kg of feed ($P<0.05$) (Table 2). Also, the highest level of rosemary extract for weight gain of the first week was 0.5 g/kg of feed ($P<0.05$) (Table 2). Among the nine studied treatments, the best weight gain at the first week belonged to treatment 2 ($P<0.05$) (Table 2). The results of the experiment showed that the best level of green tea extract for feed conversion ratio at the first week was 0 g/kg of feed ($P<0.05$) (Table 2). Also, the best level of rosemary extract for feed conversion ratio at the first week was 0 g/kg of feed ($P<0.05$) (Table 2). Among the nine studied treatments, the best feed conversion ratio at the first week belonged to treatments 2 and 3 ($P<0.05$) (Table 2).

The results of the experiment showed that the highest level of green tea extract for feed intake of the second week was 0 g/kg of feed ($P\geq0.05$) (Table 2). Also, the highest level of rosemary extract for feed intake of the second week was 1.0 g/kg of feed (P<0.05) (Table 2). Among the nine studied treatments, the highest feed intake at the second

Table 1.Ingredient composition and chemical analysis of basal starter and grower diets fed to broilers

Ingredients(%)	**Starter (1-14 days of age)**	**Grower (15-28 days of age)**	**Finisher (29-42 days of age)**
Corn	565.05	593.45	683.15
Soybean Meal	362	349	265
Soybean oil	19	24	23
Corn gluten	15	0	0
Mono-Calcium-Phosphate	10.7	9	6.5
CaCO3	13.5	12	10
Vitamin and Mineral Mixture	5	5	5
NaCl	3	3	3
Na-Bicarbonate	1	1	1
DL-Methionine	2.7	2	2
L-Lysine-HCl	2.5	1	1
L- Threonine	0.5	0.5	0.3
Phytase enzyme	0.05	0.05	0.05
Nutrient Analysis			
Metabolizable energy (kcal/kg)	2950	2966	3099.5
Crude protein (%)	21.55	20.05	17.01
Linoleic Acid (%)	1.1	1	0.91
Ether extract (%)	3.5	4	4.2
Crude fiber (%)	2.8	3	3
DCAB (mEq/kg)	235	226	19
Arginine (SID) (%)	1.27	1	0.96
Arginine (Total) (%)	1.45	1.22	1
Iso-Leucine (SID) (%)	0.81	0.78	0.63
Iso-Leucine (Total) (%)	0.92	0.87	0.73
Leucine (SID) (%)	1.37	1.1	0.99
Leucine (Total) (%)	1.51	1.24	1.02
Lysine (SID) (%)	1.22	1.07	0.88
Lysine (Total) (%)	1.33	1.17	0.96
Methionine + Cysteine (SID) (%)	0.87	0.76	0.68
Methionine + Cysteine (Total) (%)	0.95	0.84	0.75
Methionine (SID) (%)	0.58	0.49	0.45
Metionine (Total) (%)	0.61	0.51	0.48
Threonine (SID) (%)	0.76	0.72	0.61
Threonine (Total) (%)	0.88	0.84	0.75
Tryptophan (SID) (%)	0.19	0.16	0.13
Tryptophan (Total) (%)	0.22	0.18	0.16
Valine (SID) (%)	0.94	0.88	0.75
Valine (Total) (%)	1.06	1	0.84
Available Phosphorus (%)	0.5	0.46	0.4
Calcium (%)	1	0.96	0.81
Chloride (%)	0.17	0.17	0.17
Potassium (%)	0.8	0.75	0.65
Sodium (%)	0.16	0.16	0.16
Choline (g/kg)	1.7	1.5	1.35

Vitamin A: 3,600,000 IU/kg; Vitamin D3: : 800,000 IU/kg; Vitamin E: 7,200IU/kg; Vitamin K3: 800 mg/kg; Vitamin B1: 720 mg/kg; Vitamin B2: 2,640 mg/kg; Vitamin B3 (Calcium Pantothenate): 4,000 mg/kg; Vitamin B5 (Niacin): 12,000 mg/kg; Vitamin B6: 1,200 mg/kg; Vitamin B9 (Folic acid): 400 mg/kg; Vitamin B12: 6 mg/kg; Vitamin H2 (Biotin): 40 mg/kg; Choline: 100,000 mg/kg; Antioxidant: 40,000 mg/kg and 1mg/kg Excipient; Mn: 39,680 mg/kg; Fe: 20,000 mg/kg; Zn: 33,880 mg/kg; Cu: 4,000 mg/kg; I: 400 mg/kg; Se: 80 mg/kg; Choline: 100,000 mg/kg and 1 mg/kg Excipient.

Table 2. Performance of broilers fed the experimental diets at 1st to 6th week

Duration→		1-7 days of age			8-14 days of age			15-21 days of age			22-28 days of age			29-35 days of age			36-42 days of age		
Treatment↓		FI	WG	FCR	FI	WG	FCR	FI	WG	FCR	FI	WG	FCR	FI	WG	FCR	FI	WG	FCR
Green Tea	0 g/kg	21.683^{a}	15.556^{a}	1.394^{c}	57.485^{a}	41.194^{a}	1.396^{c}	89.066^{a}	70.260^{a}	1.269^{c}	141.474^{a}	82.273^{a}	1.722^{a}	179.208^{a}	101.204^{a}	1.774^{b}	174.004^{a}	68.727^{a}	2.566^{b}
	0.5 g/kg	21.275^{b}	14.963^{b}	1.422^{b}	56.791^{a}	39.239^{b}	1.448^{b}	90.678^{a}	67.900^{b}	1.336^{b}	140.587^{a}	78.685^{a}	1.791^{a}	179.447^{a}	97.689^{ab}	1.840^{ab}	165.885^{b}	61.956^{b}	2.684^{ab}
	1.0 g/kg	20.660^{c}	14.150^{c}	1.461^{a}	57.112^{a}	38.118^{b}	1.501^{a}	89.789^{a}	65.602^{c}	1.372^{a}	139.649^{a}	79.122^{a}	1.774^{a}	175.301^{a}	94.156^{b}	1.869^{a}	163.239^{b}	58.578^{b}	2.804^{a}
SEM		0.115	0.072	0.008	0.470	0.475	0.011	0.607	0.777	0.010	1.440	1.609	0.030	1.446	1.753	0.028	1.592	1.452	0.041
P		<0.0001	<0.0001	<0.0001	0.5846	0.0004	<0.0001	0.1901	0.0010	<0.0001	0.6730	0.2456	0.2439	0.0935	0.0291	0.0664	0.0001	0.0001	0.0016
Rosemary	0 g/kg	20.950^{b}	14.849^{b}	1.411^{b}	56.505^{b}	39.945^{a}	1.415^{b}	91.344^{a}	69.040^{a}	1.324^{a}	141.615^{a}	80.750^{a}	1.759^{a}	179.222^{a}	97.411^{a}	1.846^{a}	167.187^{ab}	60.559^{b}	2.773^{a}
	0.5 g/kg	21.947^{a}	15.392^{a}	1.427^{ab}	56.848^{ab}	39.510^{a}	1.442^{b}	91.686^{a}	69.436^{a}	1.321^{a}	140.499^{a}	80.541^{a}	1.750^{a}	179.780^{a}	99.849^{a}	1.807^{a}	170.905^{a}	66.672^{a}	2.589^{b}
	1.0 g/kg	20.721^{b}	14.428^{c}	1.439^{a}	58.035^{a}	39.095^{a}	1.488^{a}	86.505^{b}	65.285^{b}	1.332^{a}	139.596^{a}	78.788^{a}	1.777^{a}	174.954^{b}	95.789^{a}	1.830^{a}	165.037^{b}	62.030^{b}	2.692^{ab}
SEM		0.115	0.072	0.008	0.470	0.475	0.011	0.607	0.777	0.010	1.440	1.609	0.030	1.446	1.753	0.028	1.592	1.452	0.041
P		<0.0001	<0.0001	0.0865	0.0711	0.4595	0.0003	<0.0001	0.0012	0.7443	0.6162	0.6435	0.8142	0.0509	0.2739	0.6233	0.0453	0.0161	0.0150
T1		21.553^{b}	15.422^{b}	1.399^{b}	55.945^{bc}	40.890^{ab}	1.368^{d}	93.194^{a}	71.160^{a}	1.312^{b}	142.511^{a}	82.176^{a}	1.736^{a}	180.090^{a}	101.490^{a}	1.776^{a}	172.641^{ab}	59.122^{bc}	2.924^{ab}
T2		22.471^{a}	16.138^{a}	1.392^{b}	57.107^{abc}	41.802^{a}	1.366^{d}	92.381^{ab}	70.119^{a}	1.319^{b}	141.295^{a}	82.724^{a}	1.708^{a}	180.123^{a}	102.962^{a}	1.751^{a}	177.832^{a}	76.348^{a}	2.340^{d}
T3		21.024^{b}	15.108^{bc}	1.392^{b}	59.404^{a}	40.890^{ab}	1.453^{bc}	81.624^{d}	69.500^{a}	1.177^{c}	140.617^{a}	81.919^{a}	1.720^{a}	177.412^{a}	99.160^{a}	1.795^{a}	171.539^{ab}	70.712^{a}	2.435^{d}
T4		21.180^{b}	14.911^{c}	1.420^{b}	55.195^{c}	39.127^{ab}	1.411^{cd}	91.414^{abc}	68.816^{ab}	1.328^{b}	142.136^{a}	79.244^{a}	1.800^{a}	179.509^{a}	95.353^{a}	1.884^{a}	165.025^{bc}	61.041^{bc}	2.712^{bc}
T5		21.228^{b}	15.020^{c}	1.413^{b}	56.166^{bc}	38.515^{bc}	1.459^{bc}	92.371^{ab}	69.781^{a}	1.324^{b}	140.471^{a}	80.797^{a}	1.741^{a}	184.000^{a}	102.614^{a}	1.796^{a}	168.541^{b}	63.103^{b}	2.674^{c}
T6		21.417^{b}	14.958^{c}	1.432^{b}	59.011^{a}	40.076^{ab}	1.475^{b}	88.250^{c}	65.102^{bc}	1.355^{b}	139.155^{a}	76.013^{a}	1.832^{a}	174.831^{a}	95.100^{a}	1.840^{a}	164.090^{bc}	61.723^{bc}	2.665^{c}
T7		20.116^{c}	14.215^{d}	1.415^{b}	58.376^{ab}	39.819^{ab}	1.467^{bc}	89.423^{bc}	67.144^{ab}	1.332^{b}	140.198^{a}	80.831^{a}	1.742^{a}	178.068^{a}	95.390^{a}	1.878^{a}	163.895^{bc}	61.515^{bc}	2.682^{c}
T8		22.142^{a}	15.018^{c}	1.475^{a}	57.271^{abc}	38.214^{bc}	1.500^{ab}	90.305^{abc}	68.408^{ab}	1.321^{b}	139.731^{a}	78.102^{a}	1.802^{a}	175.216^{a}	93.970^{a}	1.874^{a}	166.342^{bc}	60.564^{bc}	2.754^{bc}
T9		19.721^{c}	13.217^{e}	1.492^{a}	55.690^{c}	36.320^{c}	1.537^{a}	89.640^{bc}	61.254^{c}	1.464^{a}	139.018^{a}	78.433^{a}	1.778^{a}	172.618^{a}	93.107^{a}	1.856^{a}	159.481^{c}	53.655^{c}	2.975^{a}
SEM		0.200	0.125	0.014	0.814	0.823	0.019	1.052	1.346	0.018	2.494	2.788	0.051	2.505	3.036	0.049	2.757	2.515	0.072
P		<0.0001	<0.0001	0.0002	0.0069	0.0025	<0.0001	<0.0001	0.0005	<0.0001	0.9789	0.7387	0.7045	0.1057	0.1599	0.4449	0.0028	<0.0001	<0.0001

Means within each column with no common superscripts differ significantly at $p \leq 0.05$.

FI- Feed Intake (g.chick/day); WG- Weight gain(g/chick/day) FCR- Feed Conversion ratio (g/kg), T1- Treatment1: (Green Tea 0- Rosemary 0); T2- Treatment 2: (Green Tea 0- Rosemary 0.5); T3- Treatment 3: (Green Tea 0- Rosemary 1.0); T4-Treatment 4: (Green Tea 0.5- Rosemary 0); T5-Treatment 5: (Green Tea 0.5- Rosemary 0.5); T6- Treatment 6: (Green Tea 0.5- Rosemary 1.0); T7- Treatment 7: (Green Tea 1.0- Rosemary 0); T8- Treatment 8: (Green Tea 1.0- Rosemary 0.5); T9-Treatment 9: (Green Tea 1.0- Rosemary 1.0) week belonged to treatment 3 ($P<0.05$) (Table 2). The results of the experiment showed that the best level of green tea extract for weight gain of the second week was 0 g/kg of feed ($P<0.05$) (Table 2). Also, the best level of rosemary extract for weight gain of the second week was 0 g/kg of feed ($P\geq0.05$) (Table 2). Among the nine studied treatments, the best weight gain at the second week belonged to treatment 2 ($P<0.05$) (Table 2). The results of the experiment showed that the best level of green tea extract for feed conversion ratio at the second week was 0 g/kg of feed ($P<0.05$) (Table 2). Also, the best level of rosemary extract for feed conversion ratio at the second week was 0 g/kg of feed ($P<0.05$) (Table 2). Among the nine studied treatments, the best feed conversion ratio at the second week belonged to treatment 2 ($P<0.05$) (Table 2).

The results of the experiment showed that the highest level of green tea extract for feed intake of the third week was 0.5 g/kg of feed ($P\geq0.05$). Also, the highest level of rosemary extract for feed intake of the third week was 0.5 g/kg of feed ($P<0.05$) (Table 2). Among the nine studied treatments, the highest feed intake at the third week belonged to treatment 1 ($P<0.05$) (Table 2). The results of the experiment showed that the best level of green tea extract for weight gain of the third week was 0 g/kg of feed ($P<0.05$) (Table 2). Also, the best level of rosemary extract for weight gain of the third week was 0.5 g/kg of feed ($P<0.05$) (Table 2). Among the nine studied treatments, the best weight gain at the third week belonged to treatment 1 ($P<0.05$) (Table 2). The results of the experiment showed that the best level of green tea extract for feed conversion ratio at the third week was 0 g/kg of feed ($P<0.05$) (Table 2). Also, the best level of rosemary extract for feed conversion ratio at the third week was 0.5 g/kg of feed ($P\geq0.05$) (Table 2). Among the nine studied treatments, the best feed conversion ratio at the third week belonged to treatment 3 ($P<0.05$) (Table 2).

The results of the experiment showed that the highest level of green tea extract for feed intake of the fourth week was 0 g/kg of feed ($P\geq0.05$) (Table 2). Also, the highest level of rosemary extract for feed intake of the fourth week was 0 g/kg of feed ($P\geq0.05$) (Table 2). Among the nine studied treatments, the highest feed intake at the fourth week belonged to treatment 1 ($P\geq0.05$) (Table 2). The results of the experiment showed that the best level of green tea extract for weight gain of the fourth week was 0 g/kg of feed ($P\geq0.05$) (Table 2). Also, the best level of rosemary extract for weight gain of the fourth week was 0 g/kg of feed ($P\geq0.05$) (Table 2). Among the nine studied treatments, the best weight gain at the fourth week belonged to treatment 2 ($P\geq0.05$) (Table 2). The results of the experiment showed that the best level of green tea extract for feed conversion ratio at the fourth week was 0 g/kg of feed ($P\geq0.05$) (Table 2). Also, the best level of rosemary extract for feed conversion ratio at the fourth week was 0.5 g/kg of feed ($P\geq0.05$) (Table 2). Among the nine studied treatments, the best feed conversion ratio at the fourth week belonged to treatment 2 ($P\geq0.05$) (Table 2).

The results of the experiment showed that the highest level of green tea extract for feed intake of the fifth week was 0.5 g/kg of feed ($P\geq0.05$) (Table 2). Also, the highest level of rosemary extract for feed intake of the fifth week was 0.5 g/kg of feed ($P<0.05$) (Table 2). Among the nine studied treatments, the highest feed intake at the fifth week belonged to treatment 5 ($P\geq0.05$) (Table 2). The results of the experiment showed that the best level of green tea extract for weight gain of the fifth week was 0 g/kg of feed ($P<0.05$) (Table 2). Also, the best level of rosemary extract for weight gain of the fifth week was 0.5 g/kg of feed ($P\geq0.05$) (Table 2). Among the nine studied treatments, the best weight gain at the fifth week belonged to treatment 2 ($P\geq0.05$) (Table 2). The results of the experiment showed that the best level of green tea extract for feed conversion ratio at the fifth week was 0 g/kg of feed ($P<0.05$) (Table 2). Also, the best level of rosemary extract for feed conversion ratio at the fifth week was 0.5 g/kg of feed ($P\geq0.05$) (Table 2). Among the nine studied treatments, the best feed conversion ratio at the fifth week belonged to treatment 2 ($P\geq0.05$) (Table 2).

The results of the experiment showed that the highest level of green tea extract for feed intake of the sixth week was 0 g/kg of feed ($P<0.05$) (Table 2). Also, the highest level of rosemary extract for feed intake of the sixth week was 0.5 g/kg of feed ($P<0.05$) (Table 2). Among the nine studied treatments, the highest feed intake at the sixth week belonged to treatment 2 ($P<0.05$) (Table 2). The results of the experiment showed that the best level of green tea extract for weight gain of the sixth week was 0 g/kg of feed ($P<0.05$) (Table 2). Also, the best level of rosemary extract for weight gain of the sixth week was 0.5 g/kg of feed ($P<0.05$) (Table 2). Among the nine studied treatments, the best weight gain at the sixth week belonged to treatment 2 ($P<0.05$) (Table 2). The results of the experiment showed that the best level of green tea extract for feed conversion ratio at the sixth week was 0 g/kg of feed ($P<0.05$) (Table 2). Also, the best level of rosemary extract for feed conversion ratio at the sixth week was 0.5 g/kg of feed ($P<0.05$) (Table 2). Among the nine studied treatments, the best feed conversion ratio at the sixth week belonged to treatment 2 ($P<0.05$) (Table 2).

The results of the experiment showed that the highest level of green tea extract for LDL/HDL was 1.0 g/kg of feed ($P<0.05$) (Table 3). Also, the highest level of rosemary extract for LDL/HDL was 0 g/kg of feed ($P<0.05$) (Table 3). Among the nine studied treatments, the highest LDL/HDL belonged to treatment 7 ($P<0.05$) (Table 3). The results of the experiment showed that the highest level of green tea extract for HDL was 0 g/kg of feed ($P<0.05$)

(Table 3). Also, the highest level of rosemary extract for HDL was 0 g/kg of feed (P<0.05) (Table 3). Among the nine studied treatments, the highest HDL belonged to treatment 2 (P<0.05) (Table 3).

Table 3. Effect of different levels of green tea and rosemary extracts on broilers blood constitutes at 21stday of age

Treatments		**LDL/HDL (mg/dl)**	**HDL (mg/dl)**
Green tea	0 g/kg	0.310^{a}	75.083^{a}
	0.5 g/kg	0.337^{ab}	67.167^{b}
	1.0 g/kg	0.369^{b}	70.917^{b}
SEM		0.016	1.304
P		0.0578	0.0009
Rosemary	0 g/kg	0.370^{b}	73.583^{a}
	0.5 g/kg	0.337^{ab}	73.333^{a}
	1.0 g/kg	0.308^{a}	66.250^{b}
SEM		0.016	1.304
P		0.0426	0.0005
T1		0.368^{bc}	75.000^{ab}
T2		0.312^{ab}	80.250^{a}
T3		0.250^{a}	70.000^{b}
T4		0.313^{ab}	73.250^{b}
T5		0.339^{abc}	70.250^{b}
T6		0.360^{bc}	58.000^{c}
T7		0.430^{c}	72.500^{b}
T8		0.361^{bc}	69.500^{b}
T9		0.315^{ab}	70.750^{b}
SEM		0.029	2.259
P		0.0135	<0.0001

Means (± standard error) within each column with no common superscripts differ significantly at p≤0.05.
T1- Treatment1: (Green Tea 0- Rosemary 0); T2- Treatment 2: (Green Tea 0- Rosemary 0.5); T3- Treatment 3: (Green Tea 0- Rosemary 1.0); T4-Treatment 4: (Green Tea 0.5- Rosemary 0); T5-Treatment 5: (Green Tea 0.5- Rosemary 0.5); T6- Treatment 6: (Green Tea 0.5- Rosemary 1.0); T7- Treatment 7: (Green Tea 1.0- Rosemary 0); T8- Treatment 8: (Green Tea 1.0- Rosemary 0.5); T9-Treatment 9: (Green Tea 1.0- Rosemary 1.0)

Table 4. Effect of different levels of green tea and rosemary extracts on broilers carcass and organ constitutes at 42ndday of age

Treatments		**Weight of pancreas (g)**	**Relative weight of pancreas (%)**	**Weight of heart (g)**	**Relative weight of heart (%)**	**Weight of proventiculus (g)**	**Relative weight of proventiculus (%)**
Green tea	0 g/kg	6.699^{a}	0.294^{a}	14.370^{b}	0.630^{c}	9.023^{a}	0.395^{a}
	0.5 g/kg	6.523^{a}	0.296^{a}	12.584^{a}	0.572^{a}	9.371^{a}	0.425^{a}
	1.0 g/kg	6.707^{a}	0.310^{b}	13.072^{a}	0.605^{b}	9.177^{a}	0.423^{a}
SEM		0.173	0.004	0.405	0.008	0.391	0.011
P		0.6984	0.0228	0.0123	0.0002	0.8210	0.1222
Rosemary	0 g/kg	6.906^{a}	0.312^{b}	13.765^{b}	0.620^{b}	9.507^{a}	0.428^{a}
	0.5 g/kg	6.512^{a}	0.298^{a}	13.926^{b}	0.636^{b}	8.896^{a}	0.407^{a}
	1.0 g/kg	6.510^{a}	0.291^{a}	12.334^{a}	0.551^{a}	9.168^{a}	0.409^{a}
SEM		0.173	0.004	0.405	0.008	0.391	0.011
P		0.1943	0.0053	0.0178	<0.0001	0.5490	0.3435
T1		6.671^{ab}	0.298^{abc}	14.196^{bc}	0.634^{d}	9.080^{a}	0.407^{ab}
T2		6.755^{ab}	0.299^{abc}	15.468^{c}	0.683^{e}	8.523^{a}	0.377^{a}
T3		6.670^{ab}	0.284^{a}	13.445^{bc}	0.573^{b}	9.465^{a}	0.402^{ab}
T4		6.872^{ab}	0.310^{bc}	14.269^{bc}	0.643^{de}	9.721^{a}	0.436^{ab}
T5		5.990^{a}	0.279^{a}	12.969^{b}	0.603^{bcd}	9.585^{a}	0.444^{b}
T6		6.705^{ab}	0.300^{abc}	10.513^{a}	0.471^{a}	8.806^{a}	0.394^{ab}
T7		7.174^{b}	0.327^{d}	12.831^{b}	0.583^{bc}	9.720^{a}	0.441^{ab}
T8		6.791^{ab}	0.317^{cd}	13.342^{bc}	0.621^{cd}	8.579^{a}	0.399^{ab}
T9		6.155^{a}	0.287^{ab}	13.044^{b}	0.609^{bcd}	9.233^{a}	0.431^{ab}
SEM		0.299	0.007	0.701	0.014	0.677	0.019
P		0.2214	0.0014	0.0048	<0.0001	0.8573	0.1820

Means (± standard error) within each column with no common superscripts differ significantly at p≤0.05. T1- Treatment1: (Green Tea 0- Rosemary 0); T2- Treatment 2: (Green Tea 0- Rosemary 0.5); T3- Treatment 3: (Green Tea 0- Rosemary 1.0); T4-Treatment 4: (Green Tea 0.5- Rosemary 0); T5-Treatment 5: (Green Tea 0.5- Rosemary 0.5); T6- Treatment 6: (Green Tea 0.5- Rosemary 1.0); T7- Treatment 7: (Green Tea 1.0- Rosemary 0); T8- Treatment 8: (Green Tea 1.0- Rosemary 0.5); T9-Treatment 9: (Green Tea 1.0- Rosemary 1.0)

The results of the experiment showed that the highest level of green tea extract for relative weight of pancreas was 1.0 g/kg of feed ($P<0.05$) (Table 4). Also, the highest level of rosemary extract for relative weight of pancreas was 0 g/kg of feed ($P<0.05$) (Table 4). Among the nine studied treatments, the highest relative weight of pancreas belonged to treatment 7 ($P<0.05$) (Table 4). The results of the experiment showed that the highest level of green tea extract for relative weight of hearth was 0 g/kg of feed ($P<0.05$) (Table 4). Also, the highest level of rosemary extract for relative weight of hearth was 0.5 g/kg of feed ($P<0.05$) (Table 4). Among the nine studied treatments, the highest relative weight of hearth belonged to treatment 2 ($P<0.05$) (Table 4). The results of the experiment showed that the highest level of green tea extract for relative weight of proventiculus was 0.5 g/kg of feed ($P\geq0.05$) (Table 4). Also, the highest level of rosemary extract for relative weight of proventiculus was 0 g/kg of feed ($P\geq0.05$) (Table 4). Among the nine studied treatments, the highest relative weight of proventiculus belonged to treatment 5 ($P\geq0.05$) (Table 4).

Discussion

Carcass composition has been very much considered in recent years because of health concerns. Unfortunately, the accumulation of excess fat in a chicken is an unwanted consequence of rapid growth and over consumption in high energy density diets. As the chicks reach the age of the market, the ratio of fat storage to protein increase is a major component of the body's weight gain. The increase in abdominal fat for producers is of low desirability; therefore fat loss can increase waste during processing. The accumulation of fat in today's chickens is to some extent dependent on the amount of appetite and voracity in chickens. Thus, animal scientists focused on achieving optimal growth characteristics and optimal composition of chicken carcasses. In other words, optimizing the growth rate, the conversion ratio of feed and lean meat in the market age has been considered in the recent years (AbdolHaiBisvas and Masaki, 2001).

Laboratory studies showed that the catechins extracted from tea are non-toxic, relatively inexpensive, and anti-cancer and are considered as antioxidants (Yamane et al., 1991). According to Kuroda and Hara (1999), tea polyphenols have anti-mutagenic and anticancer activity, and the mechanisms involved in it prevent mutation and cancer through extracellular and intracellular activity, as well as preventing the spread of disease and induction of programmed cell death (apoptosis).

Tang et al (2001) studied the antioxidant capacity of green tea catechinson the oxidative stability of raw ground meat, fish and poultry was evaluated and it was found that green tea has 2-4 times higher antioxidant potency compared to alpha-tocopherol at similar densities (Tang et al., 2001).

The rich presence of an antioxidant called chlorogenic acid in green tea controls the bacterial population of the intestine. This acid is absorbed unionized by bacteria and after ionization inside the bacteria, reduces the pH of the bacteria. The bacteria increase their activity to cope with this phenomenon and the process of decreasing pH increases due to anaerobic environment, and the bacteria eventually die. The unionized portion of acid is trapped inside bacteria and because it cannot pass the bacterial wall, it disturbs anionic balance and causes osmotic problems for the bacteria. The most important mechanism of the effect of organic acids is to limit the growth of bacteria within the digestive tract, which as a result, the competition of these bacteria to the host for consumption of nutrients decreases and their harmful metabolites are also reduced, and, on the other hand, the field is prepared for increasing the population of useful bacteria such as bifidobacteria and Lactobacilli and the growth of Salmonella, Escherichia coli and Campylobacter decreases in the intestine. They also found that the use of green tea can reduce the generation of toxic metabolites, such as ammonia and amines, by bacteria, which can prevent the growth of harmful intestinal bacteria (Kirchgessner and Roth, 1982).

In recent years, attention has been focused on the use of natural herbal antioxidants because they protect the human body from the attack of free radicals and many diseases. The raw extract of plants and seasonings and other materials of plants that are rich in phenolic compounds are considered into attention by the meat industry. Because it delays oxidative corruption of fats and improves the nutritional value of meat (Smet et al, 2008).

Yang et al. (2003) in a research aimed at the use of green tea by-product (GTB) in non-antibiotic diets and its evaluation on the performance of broiler chicks (140 Ross strains chickens),used 5 experimental diets (antibiotic-free control diet, base diet + 0.5% chlortetracycline, base diet + 1% GTB, base diet + 2% GTB) and completely randomized design, five treatments and four replicates for each treatment for a 42-day period. In the antibiotic group, weight gain was significantly higher than other treatments. However, no significant difference was observed in feed intake and feed conversion ratio among the treatments. Adding green tea by-product to the diet reduced the LDL cholesterol content in comparison with the control, but this difference was not significant. Adding green tea by-product caused increased Docosahexaenoic (DHA) in blood plasma and decreased cholesterol content in chicken meat, but no significant difference was observed. The content of crude protein in meat was a little decreased in the treatments containing green tea and additional antibiotic by-product. The body weight gain was significantly higher in the group fed with antibiotic-based diets compared to those receiving control diets and the diets containing green tea by-product. The application of various levels of green tea by-products in diets influenced the weight of broiler chickens. When broiler chickens fed a diet containing 1% green tea by-product, the weight gain was significantly reduced compared to the chicks fed by antibiotic diet. Generally, the weight gain of the body was reduced by increasing the level of green tea by-product, which was probably linked to high level of tannin content and high fiber content of green tea by-product used in the experiment.

Adding 400 mg epigallocatechingallate to Japanese quail diet increased feed intake. Also, application of different parts of the plant, geographical location of plant's growing site, plant development stage, growth conditions and harvesting time can also lead to changes in the effective material of chemical composition and biological activity of plant factors (Sahin et al, 2010).

In order to investigate the effect of green tea and fish oil on the performance and quality of antibodies against Newcastle disease, 405 one-day-old broiler chicks were tested in a completely randomized design. Chickens were divided into 9 groups and each group was divided into 3 classes of 15 Chickens. Chickens were fed with 9 diets containing 0, 0.75 and 1.5% dry green tea powder and 0, 0.75 and 1.5% fish oil. The results showed that during the whole period, the feed conversion ratio did not differ between the treatments and the lowest daily weight gain and the highest feed intake was observed in 1.5% of fish oil and 1.5% of green tea. Adding 1.5% of fish oil and adding 1.5% green tea to broiler chickens resulted instimulating and weakeninghumoral immune responses to Newcastle disease respectively (Zare-Zade et al, 2013).

In order to investigate the effect of green tea on the performance and blood metabolites of quail, an experiment using 200 quail chicks including adding 5 levels (0, 0.5, 1, 1.5 and 2%) of green tea powder to the diet, 4 replicates and 10 birds per experimental unit was performed. Corn and soybean meal based diets to meet Japanese quail nutritional needs and dietary nutrition analysis were arranged according to National Research Council tables. The tested birds had free access to feed and water throughout the test period. The results showed that the addition of green tea powder to quail diet did not have a significant effect on the indexes of production performance and relative weight of organs. Increasing the level of green tea powder into the diet resulted in a significant increase in high density lipoprotein concentrations and significant decrease of blood serum cholesterol concentrations. The results showed that adding green tea to the diet increases the level of high density lipoproteins (favorable fat) in the blood serum (Rezghi and Golian, 2014).

Farahat et al. (2016) tested the different levels of green tea extract (125, 250, 500, 1000 and 2000 mg per kg of feed) on growth performance, level of serum lipids, liver glutathione reductase, malondialdehyde of the femoris muscle, and humoral immune response against the Newcastle Virus vaccine from 1 to 42 days old. The results of feeding with the diets containing green tea extract were inconsistent with the diet containing 125 mg BHA per kilogram of feed or diet without supplementation. The results showed that there was no significant difference between treatments in growth performance (body weight, mean daily weight gain, mean feed intake, feed conversion ratio) and blood serum lipids. Consumption of the diet containing green tea extract resulted in a significant increase in liver glutathione reductase level in comparison with the control group. Level of glutathione reductase in BHA-containing diets had no significant difference to green tea extract-containing diet. Feeding with green tea extract and BHA resulted in a significant reduction in the level of malondialdehyde in meat tissue. The antibody titer against the Newcastle Vaccine was significantly increased at 28 and 35 days in the diets containing green tea extract compared to the BHA-containing diet. As a result, the diets supplemented with green tea extract showed antioxidant properties and improved immune system and its optimal inclusion level was in the range of 125-500 mg/kg.

Sprenakova et al. (2007) examined the effect of rosemary extract and alpha tocopherol acetate on the performance, quality and oxidation of fat in broiler chickens kept in cold storage. This experiment was performed on 90 one-day-old chicks. The chickens used a common feed until the age of twenty. From day 21, the chicks were divided into three groups: the first group received rosemary extract at a rate of 500 milligram per kilogram of feed daily, which was added to their feed. Feeding the second group was supplemented with 40 mg of alpha tocopherol daily for each bird; this amount was added daily to their water. And the third group (control) did not contain any antioxidants in their diet. The chickens having their diet supplemented with rosemary extract and alpha tocopherol received a higher weight (2497-2502 grams) compared to the control group (2457 grams) and the concentration of alpha tocopherol in their blood and muscle was increased. The changes in oxidation were evaluated based on the change in the amount of Malondialdehyde (MDA) of the breast and thigh muscles in the days of 0, 7 and 14 of storage in the refrigerator. The results showed that rosemary extract had an effect on delaying oxidation compared to control group, but its effect was lower than alpha tocopherol. Also, the addition of Rosemary extract improved the taste characteristics of meat.

Ghazale and Ali (2008) studied the use of rosemary leaves, as growth stimulus, on the performance and safety of broiler chicks. Three levels of half, one and two percent of rosemary plants were used in the diet of broiler chickens in growing (28-27 days) and finisher (29-49 days) periods. Compared to the control group, chicks fed with a half-percent rosemary-leaf diet had a higher weight gain and a better feed conversion rate during the experiment period, and the physical characteristics of chicken meat were better. In addition, adding 0.5% rosemary increased the total protein, albumin, and globulin of the plasma while reduced glucose, total fat and cholesterol. Rosemary plant did not affect the activity of liver and kidney enzymes.

Conclusion The findings of this study indicate that the use of a mixture of green tea extract and rosemary had more beneficiary effects on growth performance compared to their separate use. Adding different levels of green tea extract and rosemary and their mixture to the diet of broiler chickens improved some of the studied parameters. However, further research is recommended in order to have more stable results and also to determine the exact level of using these herbal additives in broiler diets.

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