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EFFECTS OF DIETARY ROSEMARY LEAVES AND BLACK SEED ON BROILER PERFORMANCE

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ABSTRACT: A 49 days experiment was conducted to evaluate the effects of different levels of rosemary leaves (RML) or black seeds (BS) powder, as natural feed additives, on growth performance, carcass traits and some blood plasma constitutes of broiler chicks. A total of 210 one-day-old unsexed Hubbard chicks were divided into seven treatments of three replicates of ten chicks each. Treatments were 0.25, 0.50, 0.75 and 1.0% (RML), 0.50 and 1.0% (BS) and no additives (control). Supplementation of RML (up to 0.5%) and BS (up to 1.0%) increased birds body weight (BW) at all ages; the highest final BW was obtained by 0.5% RML and 1.0% BS in comparison with the rest of the treatments. A reduction in BW was noticed with increasing RML levels over 0.5%. All various contrasts of treatments vs. control did not show any significance in average daily gain or feed intake. Significant feed, crude protein and caloric conversion ratios were obtained by 0.5% RML vs. control during the total period. Most dietary RML or BS levels versus control significantly improved the livability and the European production efficiency factor. No significant effects on most carcass traits, plasma total protein and total lipids were detected. Plasma total cholesterol was decreased by 0.75 RML and 1.0% BS compared to 0.25% RML. A significant reduction in plasma triglycerides by 1.0% RML vs. control was reported. All treatments (except 1.0% RML and 0.5% BS) significantly increased plasma uric acids. A significant increment in percentages of bursa by RML (0.25 and 1.0%) vs. control and in spleen by RML (0.75 and 1.0%) was noticed. Supplementation of 0.5% RML and 1.0% BS significantly reduced abdominal fat percentage compared with the control. It was concluded that 0.5% RML and 1.0% BS, as natural feed additives, enhanced broilers performance.

Key Words: Broiler – Rosemary - Black seed - Growth performance - Carcass characteristics

INTRODUCTION

Poultry meat is known to have several nutritional advantages due to its high content of essential fatty acids, proteins and minerals together with low lipid levels (Baranová et al., 2001). For this reason, poultry production is now a major source of meat worldwide (Manafi et al., 2014). Poultry nutrition has become the focus of many research studies; there are elevated interests in the study of alternative dietary additives that can improve bird performance to satisfy consumer's demand of safe food products (Rizzo et al., 2008). The supplementation of herbs, spices and their extracts may have several favorable effects such as (1) improving flavor which increases feed intake; (2) stimulating endocrine and digestive enzymes secretion and increasing gastric and intestinal motility; (3) enhancing antimicrobial, anti-viral, anthelminthic and coccidiostat activities; (4) stimulating immune, anti-inflammatory and anti-oxidative activity; (5) imparting color (Cengiz et al., 2016).

Rosemary (Rosmarinus officinalis L.) is a natural aromatic plant that has a high antioxidant activity which improves bird performance. It contains polyphenolics (carnosol, carnosic acid, methyl carnosol, rosmarinic acid, ursolic acid and many others) which are the most biologically active compounds and have antimicrobial, antioxidant, antiparasitic, antiprotozoal, antifungal and anti-inflammatory properties that can change bird physiology (Christaki et al., 2012). Due to the contributions of rosemary and rosemary oil in antioxidants and other metabolites activities, the addition of these natural products to chicken diets could be important to chicken and human health (Yesilbag et al., 2011). Similarly, ELnaggar et al. (2016) found that 0.25% rosemary leaves meal significantly improved production performance, the digestibility of crude protein and ash and it could be used in broiler diets as a natural antioxidant and immune stimulant. Moreover, a broiler diet supplemented with 1.0% rosemary powder significantly improved gain and feed conversion ratio (Al-Kassie, 2008). However, Rostami et al. (2015) reported negative effects on performance and gut gross morphometry when rosemary powder increased in the broiler diet from 0.5% to 1.0%.

Black seed (Nigella sativa) is an herbal plant that is considered a good feed additive for poultry. It has a number of nutritive ingredients (proteins, amino acids, fats, crude fiber, minerals and vitamins) and pharmacologically active substances (thymoquinone, dithymoquinone, thymohydroquinone, nigellone and thymol) which are effective in sustaining the health and enhancing the performance of poultry. It has been reported to stimulate the secretion of digestive enzymes (lipase and amylase) and intestinal mucous in broilers which stimulate feed digestion, impair adhesion of pathogens and stabilize microbial balance in the gut, leading to better feed utilization and assimilation (Khan et al., 2012; Azeem et al., 2014). Rahman and Kim (2016) concluded that black seed (1 and 2%) supplementation is effective in improving broiler performance and meat quality due to its antioxidant activities. Therefore, it should be considered a good supplement in the broiler industry. Dissimilar, Al-Mufarrej (2014) demonstrated that up to 2.8% black seed in broiler diets had no significant effect on body weight and lymphoid organs (thymus, bursa and spleen). Nevertheless, due to potential beneficial effects of herbs on broiler performance, different inclusion levels of rosemary leaves and black seed powders were used as feed additives to evaluate their effects on growth performance, carcass traits and some blood parameters.

MATERIALS AND METHODS

Birds and management:

The present study was carried out at the Poultry Experimental Farm, Faculty of Agriculture, Suez Canal University, Ismailia**,** Egypt. Two-hundred-ten one-day old unsexed Hubbard broiler chicks were wing-banded, weighed individually and sorted into similar body weights. Chicks were randomly distributed into seven groups (three replicates of 10 birds each) and caged in brooder batteries with wire mesh floors. Feed was supplied *ad-libitum* and birds had free access to water. A constant-light program was provided (24 hr/day) through the experimental period, which lasted for 7 weeks. All birds were kept in the same management, hygienic and environmental conditions and were vaccinated against the regular local poultry diseases. The experiment was performed in accordance with institutional guidelines concerning animal use.

Diets and Treatments:

There were seven treatments: control (no additives), rosemary leaves (RML) at 0.25, 0.5, 0.75 and 1.0% and black seed (BS) at 0.5 and 1.0%. Three types of diets were used: starter (0-4 wks), grower (5-6 wks) and finisher (7^{th} wk). Experimental diets were fed in mash form, composed of corn-soybean meal and formulated to contain adequate levels of nutrients required for broiler chicks. Diets were formulated to be isocaloric and isonitrogenous. Chemical analysis of rosemary, black seeds were determined according to A.O.A.C. (2005). The composition of the basal diet and the chemical analysis of herbs are shown in Table 1.

Growth performance:

Birds individual body weight (BW) and pen feed consumption were recorded at 2, 4, 6 and 7-week of age. Mortality was observed daily and total livability percentages per treatment were calculated. Average daily weight gain (ADWG) and average daily feed intake (ADFI) were recorded. Feed conversion ratio (FCR), crude protein conversion ratio (CPCR) and caloric conversion ratio (CCR) were calculated. The European Production Efficiency Factor (EPEF) was calculated according to Marcu et al. (2013) with the following formula:

$$\text{EPEF} = \frac{\text{Live body weight (kg)} \times \text{Livability (\%)}}{\text{age (days)} \times \text{FCR (kg feed/Kg gain)}} * 100$$

Blood constitutes and carcass traits:

At the end of the experiment, six birds were chosen from each treatment to be near the average final weight. Selected birds were individually weighed and slaughtered by severing the jugular vein. Blood samples were collected from each bird in a heparinized tube at slaughter. Plasma was separated by centrifugation at 3000 rpm for 15 minutes and the pooled sample within each replicate was stored at -20°C for subsequent analysis. Total protein, total lipids, triglycerides, cholesterol and uric acid were determined in plasma by colorimetric methods using commercial kits, following the procedure described by manufactures (Diamond Diagnostics). After bleeding, feather, legs and viscera of each bird were removed. Weights of each eviscerated carcass, liver, heart, empty gizzard, breast meat yield, average drumsticks, spleen, bursa and abdominal fat were recorded to the nearest gram and expressed as a percentage of each bird live body weight.

Statistical analysis:

One-way analysis of variance was performed using General Linear Models procedure (GLM) of SAS (SAS®, Institute Inc., 2004). The following linear mathematical model: $Y_{ij} = \mu + t_i + e_{ij}$ was used, Where: Y_{ij} = the observation of the j^{th} individual from the i^{th} treatment, μ = the overall mean, t_i= the fixed effect of the i^{th} treatment and e_{ij} = the random error associated with the ij individuals. Multiple comparisons were performed using Duncan's multiple range test (Duncan, 1955), as well as some chosen contrast statements.

RESULTS AND DISCUSSION

The chemical composition values of RML and BS used in this study are shown in Table 1. The values of RML were comparable to those reported by Ghazalah and Ali (2008) and ELnaggar et al. (2016) in dry matter and crude fiber while different in crude protein, ether extract, ash and nitrogen-free extract. In addition, the values of BS were comparable to those reported in the former studies except for a higher content of ether extract (Ayaşan, 2011; Khan et al., 2012) and higher content of crude fiber (Hermes et al., 2009). The variation between chemical composition of RML and BS used in the current study and in previous studies could be due to differences in the climate of growing regions as well as the differences in pre-harvest treatment or harvesting time.

Growth performance:

Growth performance measurements as affected by different levels of RML and BS powders and their statistical analysis are shown in Tables 2 and 3. Supplementation of RML (up to 0.5%) and BS (up to 1.0%) powder increased birds BW at all ages and the highest final BW was obtained by 0.5% RML followed by 1.0% BS compared to the rest of the treatments. A reduction in birds BW was noticed with increasing RML level. Similar trends for treatment effects were also observed with average daily gain. In contrast with the control, significant improvements in BW were obtained by the inclusion of 0.5% RML (P = 0.041) and 1.0% BS (P = 0.007) at 2 weeks of age. Birds fed RML at 0.25, 0.50, and 0.75% significantly ($P \leq 0.05$) consumed less feed than those fed BS at 0.05%; however at RML 1.0% FI was slightly higher in comparison with the other RML levels with no significant differences. The reduction in feed intake associated with RML treatments may be due to low diet palatability. All contrasts did not show any significant differences in average daily gain or average daily feed intake. European production efficiency factor (EPEF) and livability were affected by supplementation of RML and BS powder (Table 2). The lowest EPEF was noticed with the control treatment while the highest factor was recorded with 0.25% RM treatment. In contrast with the controls, the EPEF values were significant at 0.25% or 0.75% RML (P = 0.020 or 0.043, respectively). Various treatment contrasts versus control revealed significant livability values except for 0.5% RM or 1.0% BS vs. control as well as RML vs. BS. The significant increase in the EPEF obtained in this study may be due to the improvements in body weight, FCR, livability and a decrease in feed intake. The overall results of feed, crude protein and caloric conversion ratios (FCR, CPCR and CCR) were significantly affected by RML and BS powder addition. The best conversion ratios were recorded by 0.25 and 0.5% RML supplementation (Table 3). However, treatments contrasts with control demonstrated significance in the whole period conversion ratios of FCR, CPCR and CCR at 0.5% RML with corresponding P-values 0.039, 0.042 and 0.041, respectively, and RML vs. BS with corresponding P-values 0.033, 0.031 and 0.032, respectively.

The tested aromatic herbs (RML and BS) used herein are common dietary spices for humans and used as feed additives in animal diets because of their favorable effect on performance, low-cost and availability. The present results were in harmony with Ghazalah and Ali (2008), Rostami et al. (2015) and ELnaggar et al. (2016) who demonstrated that 0.25 and 0.5% RML diets improved growth performance, feed utilization, economical efficiency as well as production index than 1.0 and 2.0% which negatively affected broiler performance. However, feed intake was significantly decreased by 0.25 and 0.5% RML meal (ELnaggar et al., 2016) compared with the high levels (0.75 and 1.0 %) and control. The negative effect on growth performance associated with the inclusion of RML high levels could be attributed to the high crude fiber content of RML which may obstruct the chicks from utilizing the nutrients in their diets (Ghazalah and Ali, 2008). Also, 1.0% RML diet resulted in poor development of gut gross morphometry (jejunum, cecum and colon) compared to 0.5% RML diet. This could be related to the high fiber content of RML that affected physiology and function of the gut and resulted in a negative effect on performance (Rostami et al., 2015). Furthermore, Franciosini et al. (2016) stated that aqueous extracts (0.2%) of RML could improve broilers performance as a result of improving the immune function and balancing gut microflora that is essential for the digestion process and protection against enteropathogenic organisms.

In partial concord with the observed data, Al–Kassie (2008) found that supplementation of 0.5 and 1.0% RML to broiler diets significantly improved daily gain and feed conversion ratio. They elicited the different responses between the levels to the amount of active ingredient in the herb (borneol, carnosol, carnosic acid and caffeic); having digestive stimulating effects and affecting pathogen microorganism in the digestive system which resulted in a positive effect on performance. Later on, it was reported by Yasar et al. (2011) that herbal effect was depending on the level of herbs used and birds' age. In conflict with the trends observed here, RML powder (up to 1.5% of diet) improved broiler BW gain, feed efficiency and had no effect on feed intake (Yesilbag et al., 2011; Norouzi et al., 2015). However, Loetscher et al. (2013) used a higher level of RML (2.5% of diet) and found a negative effect on weight gain, the apparent digestibility of nitrogen and acid detergent fiber as well as the metabolizability of energy and nitrogen.

This study revealed an improvement in growth by the dietary inclusion of BS. In accordance with the earlier studies, broiler diets supplemented with BS at 1.0 or 1.5% significantly improved BW, BW gain, FCR and had no effect on feed intake and mortality. However, growth performance inversely decreased with increasing the BS level to 3.0% (Guler et al., 2006; Abu-Dieyeh and Abu-Darwish, 2008; AL-Hothaify and Al-Sanabani, 2016). Likewise, Hermes et al. (2009) evaluated the effect of 1.0% BS and its oil (0.5%) inclusion in broiler diets and showed that BW gain, feed intake, conversion ratios (FCR, CPCR and CCR) and relative economical efficiency were improved compared to the control. In the same way, significant improvements in final BW, BW gain and FCR with a reduction in feed intake were obtained by the inclusion of 1.0 and 2.0% BS in broilers diets (Rahman and Kim, 2016). In contrast, higher levels of BS (2.5 and 5.0%) significantly increased BW gain and improved feed efficiency than the lower one (1.25%) and the control. On the other hand, there were no significant differences between different levels of BS (from 0.7 to 2.8%) of broiler diets on body weight (Al-Mufarrej, 2014).

The improvements resulted here could be related to that RML and its components were identified to have antibacterial, antifungal and powerful antioxidant activities and immune function due to the presence of phenolic compounds which improved performance (Yasar et al., 2011; Franciosini et al., 2016). Also, BS and its oil contains several active materials such as the pharmacological substances (including volatile and essential oils) that have favorable effect on the health and resulted in enhanced poultry performance. The effect of BS on the livability may be attributed to improving the bird's immunity (evaluated as a percentage of lymphoid organs) and antibacterial activity that suppressed the pathogenic bacteria and revealed better overall health of birds (Khan et al., 2012; Al-Mufarrej, 2014). In the same way, Windisch et al. (2008) stated that birds fed diets supplemented with herbs or their essential oils had healthy and stable intestine and are less exposed to microbial toxins and other undesired microbial metabolites, such as ammonia and biogenic amines.

Carcass traits:

Percentages of carcass characteristics as affected by different levels of RML and BS dietary inclusion and their statistical analysis are presented in Table 4. Treatments revealed significant effect ($P \leq 0.05$) on percentages of heart, liver, abdominal fat, breast meat yield, spleen and bursa. The highest heart, abdominal fat and spleen were reported by 1.0% RML while 0.75% recorded the highest liver in comparison with the rest of the treatments. The highest breast meat yield was observed by 0.25% RML. In contrast with the control, all treatments, except 1.0% RML, increased dressing percentages but data failed to show significance. However, 1.0% RML vs. control recorded the highest percentages of spleen ($P = 0.004$) and also increased bursa % ($P = 0.037$). Liver and giblets were increased by all herbs supplementation and the highest significant values ($P = 0.027$ and 0.048, respectively) were obtained by 0.75%

RML vs. control and also increased spleen % (P = 0.006). Also, RML up to 0.75% and both levels of BS reduced abdominal fat % and the lowest significant values observed by 1.0% BS (P = 0.017) or 0.5% RML (P = 0.018) vs. control. Besides, the highest bursa % was recorded by 0.5% RML vs. control. Herbs versus each other revealed that BS reduced abdominal fat % while RML increased spleen and bursa percentages.

The numerical increment in the dressing percentages (0.5% RML and 1.0% BS) was obtained as a result of increased body weight and decreased abdominal fat. Supplementation of RML improved bird's immunity than BS and the control as indicated by the increment in spleen and bursa percentages. Data stated herein partially agree with some previously published researches. Ghazalah and Ali (2008) concluded that RML had no significant effect on percentages of carcass, liver, heart, abdominal fat, spleen and thymus; however, gizzard percentages significantly decreased with increasing the RML level. Broiler fed RML (0.57, 0.86 and 1.15% of diet) had better carcass yield (Yesilbag et al., 2011). Similarly, ELnaggar et al. (2016) stated that 0.25% RML meal supplementation increased dressing and total edible parts while decreasing abdominal fat, bursa and spleen percentages. It was reported that diet supplemented with a high level of RML powder (2.5% of diet) significantly increased pancreas and liver percentages and lowered carcass weights but had no influence on dressing percentage or ratios of muscles from breast and thigh to the total carcass (Loetscher et al., 2013). Supplementation of RML powder at 0.5, 1.0 or 1.5% revealed no significant effects on most of the carcass traits (Norouzi et al., 2015).

In regard to BS, its effect on some carcass traits of the previous research concurred with the current results and others were opposed. Improvements in carcass characteristics were resulted by supplementation of 1.0% BS in broiler diet (Guler et al., 2006; Hermes et al., 2009). Correspondingly, Khan et al. (2012) concluded that BS (1.25, 2.5 and 5.0%) significantly increased dressing and lymphoid organs percentages (bursa, thymus and spleen) compared to the control. However, dietary 1.0% BS significantly increased carcass dressing, breast and thigh percentages with no significant variation in giblets and abdominal fat percentages compared with the control (AL-Hothaify and Al-Sanabani, 2016). On the contrary, no significant differences in lymphoid organs weight were observed as affected by different levels of BS powder (0.7 - 2.8%) of broiler diets (Al-Mufarrej, 2014)

Plasma blood parameters:

Table 5 shows the data of some blood plasma parameters as affected by different levels of RML and BS dietary inclusion and their statistical analysis. Plasma total protein was higher with herbs inclusion than the control with no significance. Herbs treatments significantly ($P \leq 0.05$) affected plasma uric acid content; the highest significant values had been noticed by 0.5% RML and 1.0% BS (P = 0.001) followed by 0.25 (P = 0.001) and 0.75% (P = 0.038) RML vs. control. Plasma total lipids were lower with herbs inclusion than the control with no significance. Treatments significantly ($P \leq 0.05$) affected plasma triglycerides content, the lowest significant values were obtained by 1.0% RML vs. control (P = 0.010) and RML vs. BS (P = 0.001). The lowest (P<0.05) plasma cholesterol content was obtained by birds fed 1.0% BS or 0.75% RML compared to 0.25% RML. A hypocholesterolemic effect due to diets rich in fiber content may block intestinal cholesterol absorption, leading to reduce its level in the blood (Lansky et al., 1993). The current results agreed to some extent with Lansky et al. (1993), because plasma total cholesterol was reduced by RML up to 0.75% and slightly increased with RML 1.0% with no significant difference. Besides, the reduction in cholesterol levels by BS perhaps due to a general decrease in lipid mobilization. Also, the active ingredients of BS have indirect inhibitory effects on HMG-CoA reductase, which control the rate of enzymes involved in cholesterol biosynthesis, as suggested by Khan et al. (2012). In addition, the polyunsaturated fatty acids content is almost double than the mono-unsaturated fatty acids in BS oil, thus it decreases the total cholesterol content.

In agreement with the current data, Ghazalah and Ali (2008) stated that 0.5% RML powder of broiler diet significantly increased plasma total protein and decreased total lipids and cholesterol contents.

It was notified by the authors that the increment in broilers' plasma total protein indicated that those chicks could store reserve protein even though their bodies had its maximum capacity for depositing protein in tissues. Also, the current results agreed to some extent with ELnaggar et al. (2016) stated that 0.25% RML meal supplementation to broilers diet significantly decreased serum urea, creatinine, triglycerides and cholesterol while increased total protein. On the contrary to the results here, Rostami et al. (2015) reported that the dietary addition of 0.5% RML powder reduced uric acid levels compared with 1.0%.

The lowest plasma cholesterol in this study was recorded by 1.0% BS diet which was inconsistent with those obtained by Khalaji et al. (2011) who reported that 1.0% BS in broiler diets was not effective in the reduction of the total serum cholesterol. However, Khan et al. (2012) demonstrated that 2.5 and 5.0% BS significantly increased total protein in comparison with 1.25% BS and the control diets because of the availability of more proteins by higher BS levels. Serum cholesterol level was significantly decreased with BS levels elevation.

Similarly, feeding different levels (0.25, 0.5 and 2%) of BS decreased birds' blood total cholesterol; however, serum total protein was significantly increased by dietary 1.0% BS compared to the control (AL-Hothaify and Al-Sanabani, 2016).

The improvement variations in broiler performance between studies might be attributed to the differences in homogeneity of herbal powder tested by different authors, although they came from the same plants. Besides, the physiological status of birds, infections, diet composition, doses, the content of active substances, inclusion method and trial conditions could cause a lot of variation (Windisch et al., 2008).

CONCLUSION

This study showed that 0.5% RML increased body weight followed by 1.0% BS and improved conversion ratios of feed, crude protein and caloric. Dietary herbs inclusion increased the livability and the European production efficiency factor. The Immune organs percentages were mostly improved by RML inclusion while the abdominal fat was reduced by 0.5% RML and 0.1% BS. It is not recommended to increase the inclusion level of RML over 0.5% in broiler diet because no beneficial effects on broilers performance were obtained and 1.0% BS level was appropriate under the conditions of this experiment.

Table (1): Composition, calculated analysis of the experimental basal diets and the chemical analysis of herbs.

Ingredients%	Diets		
	Starter	**Grower**	**Finisher**
Yellow corn	55.63	62.52	70.73
Soybean meal (44%)	34.09	30.06	23.79
Corn gluten (60%)	3.78	2.43	2.50
Limestone	1.42	1.34	1.30
Dicalcium phosphate	1.72	1.40	0.95
*Vit. & Min. Mixture	0.25	0.25	0.25
NaCl	0.35	0.35	0.35
Sunflower oil	2.58	1.60	0.13
DL-Methionine	0.18	0.05	-
Total	100	100	100
Calculated analysis of diets:			
ME (kcal/kg)	3009.53	3007.15	3005.32
Crude protein	22.00	20.00	17.99
Crude fiber	3.66	3.51	3.25
Ether extract	2.48	2.68	2.94
Calcium	1.03	0.92	0.79
Available phosphorus	0.46	0.40	0.30
Methionine	0.55	0.39	0.31
Methionine + Cystine	0.91	0.72	0.62
Lysine	1.10	1.00	0.85
Chemical analysis of herbs (%).		**Rosemary leaves**	**Black seed**
Dry matter		91.59	93.43
Crude protein		6.53	21.90
Ether extract		11.12	23.10
Crude fiber		18.50	6.80
Ash		9.20	4.53
Nitrogen free extract		46.24	37.10

*Supplied per kilogram of diet: Vitamin A, 12000 IU; Vitamin D_3, 2000 IU; Vitamin E, 10 mg; Vitamin K_3, 2.0 mg; Thiamin, 1.0 mg; Riboflavin, 5.0 mg; Pyridoxine, 1.5 mg; Cyanocobalamin, 0.01 mg; Pantothenic acid, 10 mg; Nicotinic acid, 30 mg, Folic acid, 1.0 mg; Biotin, 0.05 mg; Choline chloride, 250 mg; Cu, 10 mg; I, 1.0 mg; Fe, 30 mg; Zn, 50 mg; Mn, 60 mg;Co, 0.1 mg; and Se, 0.1 mg.

Table (2): Body weight, gain, feed intake, European production efficiency factor (EPEF) and total livability of broiler chicks as affected by dietary rosemary leaves and black seeds powder during 0-7 weeks of age.

Items	Treatments (%)							MSE
	Control	Rosemary leaves				Black seed		
		0.25	0.50	0.75	1.00	0.50	1.00	
Body weight (g)								
2 weeks	343.29^{bc}	355.83^{ab}	358.10^{ab}	351.67^{ab}	338.67^{c}	346.90^{bc}	364.00^{a}	± 2.37
P-value Treatment vs. Control	-	0.077	0.041	0.106	0.494	0.592	0.007	
P-value Rosemary vs. Black seed		0.383						
4 weeks	1039.08	1061.53	1072.09	1069.00	1053.50	1058.70	1095.17	± 7.06
6 weeks	1822.25	1860.31	1919.90	1807.36	1817.86	1869.17	1924.23	± 15.28
7 weeks	2210.50^{ab}	2214.32^{ab}	2274.61^{a}	2174.72^{ab}	2149.04^{b}	2241.79^{ab}	2258.22^{ab}	± 14.68
Average daily weight gain (g)								
0-4 wks	36.73	37.56	37.95	37.83	37.25	37.45	38.80	± 0.26
5-6 wks	55.94	57.06	60.56	52.74	54.60	57.89	59.22	± 0.98
7th wk	55.46	50.57	50.67	52.48	47.31	53.23	47.71	± 0.136
0-7 wks	45.06^{ab}	45.15^{ab}	46.40^{a}	44.32^{ab}	43.77^{b}	45.71^{ab}	46.06^{ab}	± 0.31
Average daily feed intake (g)								
0-4 wks	61.92	60.17	61.70	62.53	62.12	62.43	63.45	± 0.52
5-6 wks	128.17	115.83	117.78	120.62	122.80	129.55	131.11	± 2.21
7th wk	113.66	111.02	110.95	102.32	116.76	127.30	110.02	± 2.37
0-7 wks	101.25^{ab}	95.67^{b}	96.81^{b}	95.16^{b}	100.56^{ab}	106.43^{a}	101.53^{ab}	± 1.20
EPEF	170.48^{b}	218.73^{a}	198.00^{ab}	211.37^{a}	194.94^{ab}	200.75^{ab}	199.24^{ab}	± 5.17
P-value Treatment vs. Control	-	0.020	0.156	0.043	0.204	0.122	0.140	
P-value Rosemary vs. Black seed		0.616						
Livability (%)	83.33^{b}	100^{a}	86.67^{ab}	100^{a}	100^{a}	100^{a}	93.33^{ab}	± 2.14
P-value Treatment vs. Control	-	0.030	0.637	0.030	0.030	0.030	0.169	
P-value Rosemary vs. Black seed		1.000						

All contrasts of body weight (at 4, 6 and 7wk), average daily gain and feed intake (during all periods) were not significantly different.
^{abc}Means with different superscripts in the same row are significantly different ($P \leq 0.05$).

Table (3): Feed, crude protein and caloric conversion ratios of broiler chicks as by dietary rosemary leaves and black seeds powder during 0-7 weeks of age.

Items	Control	Treatments (%) Rosemary leaves 0.25	0.50	0.75	1.00	Black seed 0.50	1.00	MSE
Feed conversion ratio (g feed/g gain)								
Starter(0-4 wks)	1.69	1.60	1.62	1.65	1.67	1,67	1.64	± 0.01
Grower (5-6 wks)	2.29	2.02	1.95	2.30	2.25	2.25	2.24	± 0.05
Finisher (7th wk)	2.05	2.20	2.20	1.97	2.47	2.43	2.43	± 0.08
Total (0-7 wks)	2.25^{abc}	1.12^{c}	2.09^{c}	2.15b^{c}	2.30^{ab}	2.33^{a}	2.21^{abc}	± 0.03
P-value Treatment vs. Control	-	0.085	0.039	0.186	0.527	0.304	0.556	
P-value Rosemary vs. Black seed		0.033						
Crude protein conversion ratio (g protein/g gain)								
Starter(0-4 wks)	0.371	0.352	0.358	0.363	0.367	0.367	0.360	± 0.003
Grower (5-6 wks)	0.459	0.405	0.389	0.459	0.450	0.451	0.447	± 0.010
Finisher (7th wk)	0.369	0.396	0.396	0.354	0.444	0.437	0.437	± 0.014
Total (0-7 wks)	0.449^{abc}	0.423^{c}	0.417^{c}	0.430^{bc}	0.459^{ab}	0.466^{a}	0.441^{abc}	± 0.005
P-value Treatment vs. Control	-	0.088	0.042	0.192	0.497	0.264	0.555	
P-value Rosemary vs. Black seed		0.031						
Caloric conversion ratio (Kcal ME/g gain)								
Starter(0-4 wks)	5.07	4.80	4.88	4.95	5.00	5.01	4.91	± 0.04
Grower (5-6 wks)	6.88	6.08	5.84	6.88	6.75	6.76	6.70	± 0.14
Finisher (7th wk)	6.15	6.60	6.61	5.90	7.40	7.28	7.29	± 0.24
Total (0-7 wks)	6.74^{abc}	6.35^{c}	6.26^{c}	6.45b^{c}	6.89^{ab}	6.99^{a}	6.61^{abc}	± 0.08
P-value Treatment vs. Control	-	0.087	0.041	0.190	0.507	0.277	0.555	
P-value Rosemary vs. Black seed		0.032						

All contrasts of feed, crude protein and caloric conversion ratios (FCR, CPCR and CCR) during starter, grower and finisher periods were not significantly different. ^{abc}Means with different superscripts in the same row are significantly different (P≤0.05).

Table (4): Carcass traits of broiler chicks as affected by dietary rosemary leaves and black seeds powder at 7 weeks of age.

Items	Treatments (%)							MSE
	Control	Rosemary leaves				Black seed		
		0.25	0.50	0.75	1.00	0.50	1.00	
Dressing	73.89	74.96	75.17	74.60	73.52	74.46	75.30	± 0.38
Gizzard	1.43	1.22	1.38	1.35	1.44	1.34	1.41	± 0.03
Heart	0.46^{ab}	0.50^{ab}	0.46^{ab}	0.46^{ab}	0.53^{a}	0.42^{b}	0.47^{ab}	± 0.01
Liver	1.90^{b}	2.24^{ab}	2.53^{ab}	2.64^{a}	2.20^{ab}	2.09^{ab}	2.12^{ab}	± 0.09
P-value Treatment vs. Control	-	0.279	0.052	0.027	0.334	0.532	0.477	
P-value Rosemary vs. Black seed		0.126						
Giblets	3.79	3.96	4.37	4.45	4.17	3.85	4.00	± 0.09
P-value Treatment vs. Control	-	0.591	0.077	0.048	0.234	0.854	0.513	
P-value Rosemary vs. Black seed		0.112						
Abdominal fat	2.04^{ab}	1.67^{bc}	1.53^{c}	1.97^{abc}	2.26^{a}	1.65^{bc}	1.52^{c}	± 0.07
P-value Treatment vs. Control	-	0.070	0.018	0.696	0.286	0.062	0.017	
P-value Rosemary vs. Black seed		0.040						
Average drumstick	5.22	5.36	5.12	5.50	5.47	5.36	5.62	± 0.07
Breast meat yield	16.53^{ab}	17.54^{a}	17.05^{ab}	15.62^{ab}	16.57^{ab}	15.08^{b}	16.34^{ab}	± 0.28
Spleen	0.084^{b}	0.098^{b}	0.109^{ab}	0.145^{a}	0.149^{a}	0.099^{b}	0.094^{b}	± 0.007
P-value Treatment vs. Control	-	0.491	0.206	0.006	0.004	0.440	0.604	
P-value Rosemary vs. Black seed		0.028						
Bursa of fabricius	0.160^{b}	0.216^{ab}	0.241^{a}	0.187^{ab}	0.233^{ab}	0.179^{ab}	0.181^{ab}	± 0.010
P-value Treatment vs. Control	-	0.101	0.023	0.409	0.037	0.559	0.512	
P-value Rosemary vs. Black seed		0.064						

All contrasts of dressing, gizzard, heart, breast meat yield and average drumstick percentages were not significantly different.
^{abc}Means with different superscripts in the same row are significantly different (P≤0.05).

Table (5): Someplasma parameters of broiler chicks as affected by dietary rosemary leaves and black seeds powder at 7 weeks of age.

Items	Treatments (%)							MSE
		Rosemary leaves				Black seed		
	Control	0.25	0.50	0.75	1.00	0.50	1.00	
Total protein (g/dl)	2.88	3.30	3.06	3.09	3.55	3.37	3.46	± 0.10
Uric acid (mg/dl)	2.18^{cd}	3.53^{ab}	3.81^{a}	2.96^{b}	2.04^{d}	2.84^{bc}	3.79^{a}	± 0.17
P-value Treatment vs. Control	-	0.001	0.001	0.038	0.674	0.074	0.001	
P-value Rosemary vs. Black seed		0.288						
Total lipid (g/dl)	4.14	3.77	3.55	3.34	3.95	4.02	4.04	± 0.16
Triglycerides (mg/dl)	40.30^{ab}	39.35^{ab}	34.05^{bc}	34.24^{bc}	30.03^{c}	44.76^{a}	41.57^{ab}	± 1.32
P-value Treatment vs. Control	-	0.788	0.093	0.103	0.010	0.220	0.720	
P-value Rosemary vs. Black seed		0.001						
Cholesterol (mg/dl)	106.24^{ab}	112.17^{a}	106.90^{ab}	103.48^{b}	105.89^{ab}	106.64^{ab}	102.61^{b}	± 1.00

All contrasts of cholesterol, total lipids and protein were not significantly different.

[abc]Means with different superscripts in the same row are significantly different (P≤0.05).

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الملخص العربى

تأثير الإضافة الغذائية لأوراق إكليل الجبل والحبة السوداء على آداء كتاكيت اللحم

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أجريت تجربة لمدة 49 يوم لتقييم تأثير مستويات مختلفة من مسحوق اوراق إكليل الجبل والحبة السوداء كإضافات غذائية طبيعية على أداء النمو، صفاتالذبيحة وبعض مكونات بلازما الدم لكتاكيت اللحم. قسم 210 كتكوت هابرد عمريوم غيرمجنس إلى سبع معاملات بكل منها ثلاثة مكررات وبكل مكررة عشرة كتاكيت. وكانت المعاملات 0.25 ، 0.5 ، 0.75 و 1.0% من العليقة من مسحوق أوراق إكليل الجبل و0.5 و 1.0% من العليقة من مسحوق الحبة السوداء بالإضافة إلى الكنترول بدون إضافات .أدت إضافة مسحوق أوراق إكليل الجبل (بنسبة تصل إلى 0.5%) والحبة السوداء (بنسبة تصل إلى 1.0%) إلى زيادة وزن جسم الطيور لجميع الاعمار؛ وكان أعلى وزن جسم نهائى بإضافة 0.5 % من أوراق إكليل الجبل و 1.0 % من الحبة السوداء بالمقارنة مع بقية المعاملات. لوحظ انخفاض في وزن الجسم مع زيادة مستويات إضافة أوراق إكليل الجبل أعلى من 0.5%. لم تظهرجميع المقارنات المختلفة للمعاملات مقابل الكنترول أي أختلافات معنوية للمتوسط اليومي لزيادة الوزن أو الاستهلاك الغذائي. وجدت أختلافات معنوية فى الكفاءة التحويلية للغذاء والبروتين الخام والطاقة بأستخدام أوراق إكليل الجبل بنسبة 0.5% مقارنة بالكنترول خلال فترةالتجربة الاجمالية. حسنت معظم مستويات أوراق إكليل الجبل أوالحبة السوداء معنويا من نسبة بقاء الطيور حية وعامل كفاءة الإنتاج الأوروبي مقارنة بالكنترول. لاتوجد اختلافات معنوية لمعظم صفات الذبيحة، البروتين الكلي والدهون لبلازما الدم. انخفض الكولسترول الكلي للبلازما بإضافة أوراق إكليل الجبل بنسبة 0.75% والحبة السوداء بنسبة 1.0% مقارنة بإضافة 0.25% من إكليل الجبل، مع وجود إنخفاض معنوى للدهون الثلاثية في البلازما بإضافة 1.0%من إكليل الجبل مقارنة بالكنترول. أدت جميع الإضافات (باستثناء 1.0% من إكليل الجبل و 0.5% من الحبة السوداء) إلى زيادة معنوية لحمض اليوريك فى البلازما مقارنة بالكنترول. لوحظ زيادة معنوية فى غدة البرسا بإضافة أوراق إكليل الجبل بنسبة 0.25 و 1.0% والطحال بإضافة أوراق إكليل الجبل بنسبة0.75% و 1.0%. إنخفضت نسبة دهن البطن معنويا بإضافة أوراق إكليل الجبل بنسبة 0.5% والحبة السوداء بنسبة 1.0% مقارنة بالكنترول. يستنتج مما سبق أن أوراق إكليل الجبل بنسبة 0.5 والحبة السوداء بنسبة 1.0% كإضافات غذائية طبيعيةعززت من أداء كتاكيت اللحم.