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RESEARCH ARTICLE

Use of sage (*Salvia triloba L.*) and laurel (*Laurus nobilis L.*) oils in quail diets

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Adaçayı *(Salvia triloba L.)* ve defne *(Laurus nobilis L.)* yağının bıldırcın rasyonlarında kullanımı

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Öz

Amaç: Bu araştırma bıldırcın rasyonlarında adaçayı (*Salvia triloba* L.) ve defne (*Laurus nobilis* L.) yağı kullanımının bazı performans ve karkas özellikleri üzerine olan etkisini belirlemek amacıyla yapıldı.

Gereç ve Yöntem: Araştırmada toplam 800 adet üç günlük yaşta karışık cinsiyette Japon bıldırcını (*Coturnix coturnix japonica*) her biri 80 bıldırcından oluşturulan 10 gruba ayrıldı. Her bir grup kendi içinde, 20 bıldırcın içeren dört alt gruba bölündü. Buna göre deneme gruplarını hiçbir yağ katkısı yapılmayan grup (Kontrol), 100 mg/kg adaçayı yağı içeren grup, 200 mg/kg adaçayı yağı içeren grup, 400 mg/kg adaçayı yağı içeren grup, 100 mg/kg defne yağı içeren grup, 200 mg/kg defne yağı içeren grup, 400 mg/kg defne yağı içeren grup, 100 mg/kg adaçayı yağı + 100 mg/kg defne yağı içeren grup, 200 mg/kg adaçayı yağı + 200 mg/kg defne yağı içeren grup ve 400 mg/kg adaçayı yağı + 400 mg/kg defne yağı içeren grup oluşturdu. Araştırma 35 günde tamamlandı.

Bulgular: Araştırmada adaçayı, defne ve adaçayı + defne yağı katkılı tüm deneme gruplarında canlı ağırlıklar, canlı ağırlık artışı, yem tüketimi ve yemden yararlanma oranı yönünden değişiklik oluşmadığı belirlendi (P>0.05). Sıcak ve soğuk karkas ağırlıkları ile karaciğer, kalp, dalak, taşlık ve bezli mide + taşlık gibi organların canlı ağırlığa oranlarının da adaçayı, defne ve adaçayı + defne yağı katkılarıyla etkilenmediği tespit edildi (P>0.05).

Öneri: Sonuç olarak, bıldırcın rasyonlarına adaçayı, defne ve adaçayı + defne yağı katılmasının performans ve karkas özellikleri üzerine etkisinin olmadığı ifade edilebilir.

Anahtar kelimeler: Adaçayı, defne, performans, karkas, bıldırcın

Abstract

Aim: This study was carried out to determine the effects of the usage of sage (*Salvia triloba* L.) and laurel (*Laurus nobilis* L.) oils in diets on some performance and carcass parameters of quails.

Materials and Methods: A total of 800 three-day-old Japanese quails (*Coturnix coturnix japonica*), including both males and fe-males, were divided into 10 groups containing 80 quails. Each group was divided into four replicates containing 20 birds each. These groups were as follow: No oil group (Control), 100 mg/kg sage oil group, 200 mg/kg sage oil group, and 400 mg/kg sage oil group, 100 mg/kg laurel oil group, 200 mg/kg laurel oil gro-up, 400 mg/kg laurel oil group, 100 mg/kg sage oil + 100 mg/kg laurel oil group, 200 mg/kg sage oil + 200 mg/kg laurel oil group, and 400 mg/kg sage oil + 400 mg/kg laurel oil group. The experimental period was lasted for 35 days.

Results: It was determined that in all experimental groups supplemented with sage, laurel and sage + laurel oils, no diffe-rences (P>0.05) were observed in terms of body weights, body weight gain, feed intake and feed conversion ratio. Morover, hot and cold carcass weights and relative weight of liver, heart, spleen, gizzard and proventriculus plus gizzard were not affec-ted by supplementation with sage, laurel and sage + laurel oils (P>0.05).

Conclusion: It may be concluded that sage, laurel and sage + la-urel oils supplementation in the quails' diets had no effect on performance and carcass parameters.

Keywords: Sage, laurel, performance, carcass, quail

Introduction

Intensive feeding programs implemented in poultry production culminate in the highest body weight at the shortest time period by consuming minimum feed. Accordingly, the nutrient content of the diet given to the poultry is increased; some growth factors are added into the diet as the growth stimulants. Due to the bacterial resistance and residual risk in animal products resulting from the long term use of antibiotics, which are among the growth stimulating agents, the use of antibiotics as growth stimulants has been prohibited mainly in European Union countries and in our country as well. Hence, in recent years, natural and reliable growth stimulants which may be alternative to antibiotics have gained importance (Langhout 2000, Brenes and Roura 2010, Christaki et al 2012). In this context, aromatic plants and essential oils extracted from these plants have been shown antibacterial (Dorman and Deans 2000, Aksu and Bozkurt 2009), anticoccidial (Giannenas et al 2003), antifungal (Jantan et al 2008), antioxidant (Bulbul et al 2012, 2014) effects and the beneficial effect on digestive systems (Lee et al 2003, Jang et al 2007). Furthermore, many studies have reported that the supplementation of essential oils to poultry diets, individually or in combination, resulted in improve performance (Denli et al 2004, Garcia et al 2007, Biricik et al 2012, Yesilbag et al 2012) and carcass quality (Simsek et al 2007).

Essential oils are obtained from various parts of the plant such as flowers, buds, seeds, leaves, twigs, bark, herbs, wood, fruits, and roots (Brenes and Roura 2010). Sage (*Salvia triloba* L.) from the Lamiaceae or Labiatae family and laurel (*Laurus nobilis* L.) from the Lauraceae family which are widely produced in Mediterranean and European countries are valuable essential oil resources (Baytop 2000, Bernath 2009). These species coming from the mentioned families have been reported to have antiseptic, antibacterial, and antioxidant properties as well as increasing appetite and stimulating digestion (Baratta et al 1998, Kamel 2000). These useful properties of these aromatic plants are due to the content of the active ingredient (Brenes and Roura 2010, Christaki et al 2012).

Studies conducted on broilers have evaluated the effects of combined use with other essential oils of sage and laurel oils on performance (Alcicek et al 2003, Hernandez et al 2004, Cabuk et al 2006, Bozkurt et al 2009, Kucukyilmaz et al 2012) and carcass parameters (Hernandez et al 2004, Cabuk et al 2006, Sengul et al 2008). However, no available scientific data has been found about the utilization of sage and laurel oils' different levels in the diets of quails.

The aim of this study was to investigate the individual and combined effects of two dietary essential oils, sage (*Salvia triloba* L.) and laurel (*Laurus nobilis* L.), on performance and some carcass parameters of quails.

Materials and Methods

Animals, experimental design and diets

This study was carried out at the Animal Research Center of Afyon Kocatepe University, Turkey, following ethical committee approval (AKÜHADYEK-303-13). A total of 800 three-day-old Japanese quails (*Coturnix coturnix japonica*), including both males and females, were divided into 10 groups containing 80 quails. Each group was divided into four replicates containing 20 birds each. California-type cages were used in the study. Feed and water were provided ad libitum. Quail were exposed to light for 24 h throughout the experimental period. The experimental period was lasted for 35 days.

Experimental groups were as follow: No oil group (Control), 100 mg/kg sage oil group (S100), 200 mg/kg sage oil group (S200), 400 mg/kg sage oil group (S400), 100 mg/kg laurel oil group (L100), 200 mg/kg laurel oil group (L200), 400 mg/kg laurel oil group (L400), 100 mg/kg sage oil + 100 mg/kg laurel oil group (SL100), 200 mg/kg sage oil + 200 mg/kg laurel oil group (SL200), and 400 mg/kg sage oil + 400 mg/kg laurel oil group (SL400). Experimental design is shown in Table 1.

The control and other treatment groups were fed the basal diet including 24.28% crude protein and 2934 kcal/kg metabolizable energy. The basal diet was formulated to meet the NRC (1994) nutrient requirements of quails. Sage (*Salvia triloba* L.) and laurel (*Laurus nobilis* L.) oils were purchased from Talya Herbal Products Trade and Industry Limited Company (Antalya, Turkey). The chemical composition of the oils was evaluated by GC/MS in Directorate of West Mediterranean Agricultural Research Institute, Food Medicinal and Aromatic Plants Research Laboratory (Table 2). The nutrient composition of the basal diet was determined according to the AOAC (2000). The metabolizable energy (ME) level of the basal diet was calculated according to Carpenter and Clegg

Table 1. Dietary design used in the study.

Groups	Diets
Control	Basal diet without oil
S100	100 mg/kg sage oil
S200	200 mg/kg sage oil
S400	400 mg/kg sage oil
L100	100 mg/kg laurel oil
L200	200 mg/kg laurel oil
L400	400 mg/kg laurel oil
SL100	100 mg/kg sage oil + 100 mg/kg laurel oil
SL200	200 mg/kg sage oil + 200 mg/kg laurel oil
SL400	400 mg/kg sage oil + 400 mg/kg laurel oil

Table 2. Chemical composition of oils used in the study (%).

Sage (*Salvia triloba* L.) oil	%	Laurel (*Laurus nobilis* L.) oil	%
α-pinene	61.59	1,8-cineole	58.99
1,8-cineole	18.96	Sabinene	6.65
β-pinene	8.49	α-terpinyl acetate	6.00
Limonene	3.00	Cymene	3.20
Caryophyllene	1.46	α-pinene	2.94
Camphene	1.32	β-pinene	2.71
Camphor	1.25	Spathulenol	2.56
β-myrcene	1.20	4-terpineol	2.50
Thujone	1.10	Unidentified	1.87
α-terpineol	0.87	Phellandral	1.53
3-carene	0.76	α-terpineol	1.39
		Myrtenol	1.28
		Limonene	1.08
		Terpinyl acetate	1.08
		Gama-terpinene	1.02
		Others	5.20

(1956): ME kcal/kg = 53 + 38 [(crude protein, %) + (2.25 x crude fat, %) + (1.1 x starch, %) + (1.05 × sugar, %)]. The ingredients and chemical composition of basal diet is presented in Table 3.

Table 3. Ingredients and chemical composition of the basal diet (%).

Ingredients	%
Corn	43.1
Wheat	3
Soybean meal (48%)	33
Full fat soybean	12.6
Meat and bone meal (38%)	2
Vegetable oil	4
Limestone	1
Salt	0.25
Dicalcium phosphate	0.8
Vitamin-mineral premix[1]	0.25
Chemical composition (analyzed)	
Crude protein (%)	24.28
Metabolizable energy [2] (kcal/kg)	2934
Calcium (%)	0.85
Total phosphorus (%)	0.3

[1]Composition per 2.5 kg: 12.000.000 IU vitamin A, 2.400.000 IU vitamin D3, 30 g vitamin E, 2.5 g vitamin K3, 2.5 g vitamin B1, 6 g vitamin B2, 4 g vitamin B6, 20 mg vitamin B12, 25 g niacin, 8 g calcium-D-panthotenate, 1 g folic acid, 50 g vitamin C, 50 mg D-biotin, 400 g choline chloride, 1.5 g canthaxanthin, 80 g Mn, 60 g Zn, 60 g Fe, 5 g Cu, 1 g I, 0.5 g Co, 0.15 g Se. [2]Metabolizable energy level of diet was calculated according to Carpenter and Clegg (1956).

Performance parameters

The quails were weighed individually at the beginning of the study. Body weight and body weight gain of the quails were determined weekly throughout the study.

Mortality rate was also recorded daily. Feed intake (g/quail) and feed conversion ratio (g feed/g gain) were recorded weekly.

Carcass parameters

At the end of the experimental period, 4 males and 4 females from each group (80 quails in total) were randomly selected. Following measurement of individual body weights, quails were slaughtered for determining the carcass parameters.

The liver, heart, spleen, gizzard and proventriculus plus gizzard were removed. Relative organ weights [(g)/body weight (g)] were calculated. Hot carcass weight was determined after slaughter. Cold carcass weight was determined after storage at +4^{o}C for 18 h.

Statistical analyses

Statistical analyses were done using the SPSS programme (SPSS, Inc., Chicago, IL, USA). The Variance Analysis Method was used for all statistical calculations and to test the significance of differences between the mean values of the groups. The significance of mean differences between groups was separated by Tukey test. Level of statistical significance was taken as $P<0.05$.

Table 4. Effects of dietary sage, laurel and sage + laurel oils supplementation on performance of quails.

Parameters	Control	S100	S200	S400	L100	L200	L400	SL100	SL200	SL400	SEM	P
Initial body weight (g)	9.16	9.55	9.51	9.72	9.23	9.37	9.45	9.71	9.32	9.64	0.103	0.975
Final body weight (g)	153.56	151.66	161.00	150.00	157.00	166.33	160.66	148.66	152.00	156.00	1.49	0.147
Body weight gain (g)	144.50	142.11	151.49	140.27	147.77	156.95	151.21	138.95	142.67	146.36	1.552	0.156
Feed intake (g)	586.18	580.02	638.11	561.12	606.86	634.76	607.57	556.83	590.91	569.08	6.96	0.075
Feed conversion ratio (g feed/g)	4.05	4.07	4.08	4.06	4.10	4.04	4.01	4.06	4.05	4.05	0.02	0.953

Table 5. Effects of dietary sage, laurel and sage + laurel oils supplementation on carcass (g) and relative organ (%) weights of quails.

Parameters	Control	S100	S200	S400	L100	L200	L400	SL100	SL200	SL400	SEM	P
Hot carcass weight	112.26	118.09	112.37	107.74	120.34	113.62	109.65	110.71	120.60	111.35	1.73	0.482
Cold carcass weight	104.31	111.54	104.54	100.95	112.68	106.36	101.45	103.97	108.72	105.51	1.23	0.321
Liver	3.32	3.03	3.41	3.53	3.02	3.14	3.52	0.90	0.92	0.87	0.06	0.478
Heart	0.86	0.99	0.97	0.86	1.03	0.96	0.87	3.23	3.31	3.09	0.014	0.059
Spleen	0.10	0.09	0.12	0.10	0.10	0.13	0.10	0.11	0.09	0.12	0.006	0.701
Gizzard	2.45	2.37	2.52	2.64	2.30	2.30	2.48	2.52	2.17	2.40	0.04	0.351
Proventriculus plus gizzard	3.33	3.49	3.63	3.60	3.50	3.31	3.62	3.60	3.24	3.40	0.06	0.727

Results

The main active components of Salvia triloba L. oil identified were α-pinene (61.59%), 1.8–cineole (18.96%), and β-pinene (8.49%), whereas it was 1.8–cineole (58.99%), sabinene (6.65%), α-terpinyl acetate (6.00%), and α-pinene (2.94%) for Laurus nobilis L. oil (Table 2).

Supplementation of sage, laurel and sage + laurel oils to the diets of quails did not affect initial and final body weights, body weight gain, feed intake and feed conversion ratio (P>0.05, Table 4). Hot and cold carcass weights and relative weight of liver, heart, spleen, gizzard and proventriculus plus gizzard of quails at 35 days were not affected by dietary treatments, as well (P>0.05, Table 5).

Discussion

The present study was conducted to investigate the individual and combined effects at different levels of sage and laurel oils supplementation to the diets of quails on the performance and some carcass parameters. The levels of oils used in this study were calculated in accordance with the levels of the other essential oil studies (Lee ve ark 2003, Simsek et al 2007, Kirkpinar et al 2010, Biricik et al 2012, Yesilbag et al 2012) due to no available data about sage and laurel oils supplementation to quail diets.

The oil of sage was particularly rich in α-pinene (61.59%) and 1,8-cineole (18.96%), while 1,8-cineole (58.99%) was the major compound in the oil of laurel as shown in Table 2. Cineol was the active component of both a sage oil and laurel oil. These results are consistent with other studies investigating the components of laurel oils (Baratta et al 1998, Alcicek et al 2007, Kucukyilmaz et al 2012). However, contradictory results have been obtained by Baratta et al (1998) who reported change of the components of laurel oils. The composition of the essential oils and amounts of their components may change according to the plant parts and their physical properties, age of the plant, different level used, extraction method, harvest time, geographic and climatic factors (Windisch et al 2008). In present study, the main characteristic compounds of sage and laurel oils may be associated with these factors.

In the present study sage oil, laurel oil and both essential oil supplementations in diets resulted in no differences between the groups in terms of initial and final body weights, body weight gain, feed intake and feed conversion ratio (P>0.05, Table 4). Similarly, Kucukyilmaz et al (2012) observed that essential oil mixture including sage and laurel added to broiler's diets did not change the body weight, feed intake and feed conversion ratio. It has also been reported that essential oil supplementation at different types did not change the body weight, body weight gain, feed intake and feed conversion ratio (Botsoglou et al 2002, 2004, Lee et al 2003, Papageorgiou et al 2003, Basmacioglu et al 2004, Jang et al 2007). However, there are significant differences in terms of performance due to many factors such as their compositions, drying conditions, distillation techniques, geographic and

climatic conditions (duration of daylight, temperature, water stress and plant growth phase), ingredients and chemical composition of the basal diet (Jamroz and Kamel 2002, Lee et al 2003, Cross et al 2007, Bozkurt et al 2009). Moreover, some studies reported that the individual supplementation of essential oils in quails (Denli et al 2004, Ciftci et al 2005, Parlat et al 2005) and the supplementation of mixtures including sage and laurel oils in broilers (Alcicek et al 2003, Hernandez et al 2004, Cabuk et al 2006, Bozkurt et al 2009, Kucukyilmaz et al 2012) had positive effect on the performance. In the current research, sage, laurel and sage + laurel oils supplementation in quail diets did not change the performance parameters which might be because of appropriate diet and environmental conditions in the groups.

In this study, carcass weights and relative weight of liver, heart, spleen, gizzard and proventriculus plus gizzard were not affected by sage oil, laurel oil and both essential oil supplementations in combination to the diets (P>0.05, Table 5). Similarly, supplementation of essential oil mixtures including sage and laurel oils to broiler diets did not change some inert organ weights (Hernandez et al 2004, Cabuk et al 2006), carcass weight (Sengul et al 2008) and carcass yield (Cabuk et al 2006). Morever, some studies have been reported that the supplementation of other essential oils in broilers did not effect on some organ weights (Lee et al 2003, 2004, Jamroz et al 2005, Simsek et al 2007, Aksu and Bozkurt 2009, Kirkpınar et al 2010, Biricik et al 2012), hot and cold carcass weights (Simsek et al 2007, Biricik et al 2012) and carcass yield (Lee et al 2003, Denli et al 2004, Jamroz et al 2005, Zhang et al 2005, Kirkpınar et al 2010). However, essential oil supplementation to broiler diets has been reported to increase carcass weight (Yesilbag et al 2012) as well as relative weights of the liver and gizzard (Simsek et al 2007). In our study no differences were observed in carcass and relative organ weights in the groups which might be because of no effect on body weight within these groups.

Conclusion

It may be concluded that the supplementation of sage and laurel essential oils to quail diets, individually or in combination, did not affect body weight, body weight gain, feed intake and feed conversion ratio as well as carcass parameters. However, more studies are needed to determine the effect of sage and laurel essential oils supplementation on the performance of poultry with regard to various environmental conditions, effective dosage, active oil substances, dietary ingredients and nutrient density.

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