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Evaluating the Effects of Different Levels of Medicinal Plant Powder of Teucrium Polium on Performance, Carcass Characteristics, Intestinal Morphology and Antioxidant Status of Blood Serum in Broiler

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Abstract

This study was done to evaluate the effects of different levels of powdered medicinal plant of Teucrium polium on performance, carcass characteristics, intestinal morphology and antioxidant status of blood serum in broiler. For this experiment, 180 one-day old broilers of Soye of 308- Ras were randomly allotted with 5 treatments and 3 replicates (12 broilers per replicate). Experimental treatments consisted of: 1) basal ration without additives as a control, 2) treatment with 0.5% Teucrium powder, 3) treatment with 1% Teucrium powder, 4) treatment with 1.5% Teucrium powder and 5) treatment containing 2% Teucrium powder. The results showed that the use of Teucrium powder had no significant effect on feed intake and feed conversion ratio ($P<0.05$). Although level of 1.5% significantly increased the weight in growing period and the level of 2% significantly decreased weight during the beginning and total period of experiment ($P >0.05$). Birds recipient of Teucrium powder had no significant difference in carcass components and different parts of the intestine ($P<0.05$), except the level of 2% that decreased the percent of breast and increased the percent of gizzard. Treatments containing 1.5 and 2% of Teucrium were significantly increased the antioxidant capacity of total blood serum ($P>0.05$), but the level of malondialdehyde was not affected by experimental treatments ($P<0.05$). The present research's results indicated that the use of Teucrium powder improves growth performance, antioxidant status in broilers.

Keywords: Teucrium, broiler, antioxidant status, performance

Introduction

Increasing concerns about the spread of pathogenic bacteria resistant to the antibiotics, in the 80s decade caused most of European countries and the United States decided to prohibit the use of many of these compounds in the animal and poultry feed. In this context, food additives such as probiotics and prebiotic-and growth-stimulating peptides, organic acids, enzymes, and herbs or their oil extracts were introduced into poultry farming industry (Valizadeh, & Moghadam, 1994). Medicinal herbs because of the effective ingredients in their tissues including phenols and polyphenols, terpenoids and volatile oils, alkaloids, lectins and polypeptides and other compounds have the effects of antibacterial and immune stimulating, stimulating the digestive process, decreasing concentration of fat and blood cholesterol antioxidant property and ultimately their growth stimulating. Teucrium is a medicinal plant with scientific name of Teucrium polium from Labiate spices (Zargari, 1993). Scientific studies have shown that this herb has the effects of anti-diabetic, lowering serum cholesterol and triglycerides, anti-inflammatory, antipyretic, antimicrobial, analgesic, antioxidant and growth-stimulating (Cross, Mcdevitt, Hillman, Acamovic, 2007 & Capasso Cerri Morrica Senatore, 1983).

Materials and Methods

In this study of 180 male broilers of Soye of 308- Ras were used. Broilers were randomly placed in rearing cages in 5 treatments and each treatment with 3 replicates and 12 broilers were placed inside each cage. Sampling was randomly done and a part of broiler was selected and bled from each cage. Broilers were feed with a starter diet up to 10 days of age. Experimental rations for starter periods (11-24 days old) and growing (25-42 days old) were set in accordance with the Soye of 308- Ras Catalog and by using UFFDA diet writing software. Experimental treatments consisted of: 1) basal ration without additives as a control, 2) treatment with 0.5% Teucrium powder, 3) treatment with 1% Teucrium powder, 4) treatment with 1.5% Teucrium powder and 5) treatment containing 2% Teucrium powder. During the 42-day trial period and at 10, 24 and 42 old day broilers' weight and feed consumption for each cage was measured as a group. Daily weight gain and feed intake and ratio of feed intake to weight gain in intended age periods were calculated according to the daily chicken. Experimental diets for starter periods (11-25 days old) and grower (26-42 days old) according to recommendations in the fed manual of Soye of 308- Ras broilers and were formulated by using UFFDA diet writing software (Tables 1 and 2).

Table 1. Diets used in starter period (11-25 days old) for broilers

Food (%)	Control	Teucrium 0.5%	Teucrium 1%	Teucrium 1.5%	Teucrium 2%
Corn	53.93	53.31	52.61	51.91	51.24
Soybean meal	38.32	38.34	38.38	38.43	38.47
Canola oil	3.80	3.93	4.09	4.25	4.41
Teucrium	0	0.5	1	1.5	2
Oyster shell	0.19	0.25	0.25	0.25	0.24
Bone Meal	2.35	2.26	2.26	2.26	2.26
NaCl	0.45	0.44	0.44	0.44	0.43
Mineral supplements	0.25	0.25	0.25	0.25	0.25
Vitamin Supplements	0.25	0.25	0.25	0.25	0.25
D- L-methionine	0.31	0.32	0.32	0.31	0.31
L-lysine hydrochloride	0.15	0.15	0.15	0.15	0.14
Calculating dietary nutrients					
Metabolizable energy (kcal / kg)	3100	3100	3100	3100	3100
Crude protein (%)	21.16	21.16	21.16	21.16	21.16
Crude fiber (%)	3.38	3.52	3.65	3.79	3.96
Calcium (%)	0.89	0.89	0.89	0.89	0.89
Available phosphorus (%)	0.44	0.44	0.44	0.44	0.44
Sodium (%)	0.20	0.20	0.20	0.20	0.20
Lysine (%)	1.22	1.22	1.22	1.22	1.22
Methionine + cysteine (%)	0.94	0.94	0.94	0.94	0.94
Tryptophan (%)	0.26	0.26	0.26	0.26	0.26

Vitamin and mineral supplements added to diets of broiler chickens supply following amounts in per kilogram of the food. 10,000 international units of vitamin A, 82.5 micrograms backpack of Calci ferrule, 25 international units of vitamin E, 8 mg riboflavin, 50 mg niacin, 15 mg of D-pantothenic acid, 1 mg folic acid, 15 mg vitamin B-12, 1000 mg choline chloride, 5.2 mg of thiamine, 0.1 mg biotin, 100 mg Ethoxy Quinn, 3.3 mg Mena Dion January de-sulfate, 1 mg Peroxiding, 15 mg manganese, 50 mg zinc, 1.5 mg iodine, 30 mg iron, 6 mg Cu, 0.2 mg selenium.

Table 2. Diets used in growing period (26-42 days old) for broilers

Food (%)	Control	Teucrium 0.5%	Teucrium 1%	Teucrium 1.5%	Teucrium 2%
Corn	56.37	55.67	54.98	54.29	53.59
Soybean meal	35.95	36.00	36.05	36.09	36.14
Canola oil	4.19	4.35	4.50	4.66	4.82
Teucrium	0	0.5	1	1.50	2
Oyster shell	0.24	0.24	0.24	0.24	0.24
Bone Meal	2.14	2.13	2.12	2.11	2.10
NaCl	0.40	0.40	0.40	0.40	0.40
Mineral supplements	0.25	0.25	0.25	0.25	0.25
Vitamin Supplements	0.25	0.25	0.25	0.25	0.25
D- L-methionine	0.21	0.21	0.21	0.21	0.21
Calculating dietary nutrients					
Metabolizable energy (kcal / kg)	3150	3150	3150	3150	3150
Crude protein (%)	20.18	20.18	20.18	20.18	20.18
Crude fiber (%)	3.29	3.42	3.47	3.71	3.86
Calcium (%)	0.84	0.84	0.84	0.84	0.84
Available phosphorus (%)	0.41	0.41	0.41	0.41	0.41
Sodium (%)	0.18	0.18	0.18	0.18	0.18
Lysine (%)	1.06	1.06	1.06	1.06	1.06
Methionine + cysteine (%)	0.82	0.82	0.82	0.82	0.82
Tryptophan (%)	0.25	0.25	0.25	0.25	0.25

During the implementation period of this experiment, all broiler chickens had free access to water and feed. Feed intake and weight gain were weekly measured and feed conversion ratio was determined according to the losses and chicken's day determination. Lighting schedule consisted of 24 hours light in the first three days and 23 hours light and one hour of darkness in the rest of the experimental period. In 42 days old, two part broiler chickens (one male and one female) were selected from each replication, and after 12 hours starvation, they were slaughtered to explain their carcasses then the percentage of their carcasses were determined based on the carcass weight according to live weight and percentage of abdominal fat, gizzard, liver, breast and thigh. To determine the percentage of different parts of the intestine (including duodenum, pancreas, jejunum, ileum and cecum), at first entire of the intestines were cleaned and weighted, then different parts of the intestine were removed and weighted and their percentage was measured and determined towards the total weight of the intestine. About 2 cm of the jejunum was isolated for conducting histologic experiments then mentioned samples were stabilized in 10% buffered formalin solution for 72 hours and stored in refrigerator at suitable temperature until the experiment stage and experiments were conducted by using recommended methods (Bradly et al. 1994).

Finally, the data obtained in the form of completely randomized design was analyzed by using statistical software (SAS 9) and means were compared through Duncan's multiple range Test (Valizadeh & Moghadam, 1994) at 5% probability level.

The mathematical model of design is as follows:

$Y_{ij} = \mu + T_i + \varepsilon_{ij}$

In the above formula:

Y_{ij} = the numerical value of each observation in the test, μ = population mean, T_i = the effect of diet, ε_{ij} = experimental error effects

Results and Discussion

The effects of different levels of Teucrium on feed intake, body weight gain and feed conversion ratio in the starter periods (11-25 days old), growing (25-42 days old) as well as the entire experiment period (11-42 days old), are respectively shown in Tables 1, 2 and 3. Feed intake and feed conversion ratio of broilers during the starter period was not affected by adding different levels of Teucrium powder to the diet ($P>0.05$). Body weight gain was significantly affected by experimental groups during the starter periods in a way that the control treatment has the highest weight gain and its difference with the group receiving 1.5 and 2% levels of Teucrium was statistically significant ($P <0.05$). Treatments supplemented with 1% and 0.5 % of Teucrium had no significant difference with control treatments and treatments containing 1.5% Teucrium ($P>0.05$).

Table 3. The effect of the parameters of the experimental groups in the starter period (11-25 days)

Treatment	Feed intake (g)	weight gain (g)	Conversion ratio
Control	31.78	26.23^{a}	1.23
0.5% of Teucrium	29.63	23.64^{ab}	1.26
1% of Teucrium	27.60	22.58^{ab}	1.23
1.5 % of Teucrium	28.34	21.12^{ab}	1.36
2% of Teucrium	26.58	16.54^{c}	1.60
SEM	1.63	1.47	0.093
Probability level	0.2665	0.0101	0.0779

SEM = standard error of the mean, P Value = Probability level, [a, b, c] = in each column means with dissimilar letters are significantly different from each other (P<0.05).

Significant effect on feed intake during the growing period was observed by the experimental groups (P>0.05). Body weight increasing was significantly affected during the period of 25-42 days by experimental treatments and treatment supplemented with 1.5% of Teucrium powder had the highest increase in body weight and its difference with the control group and the group receiving 2% of Teucrium was statistically significant (P<0.05).

Feed conversion ratio was not affected by experimental treatments during the growing period (P>0.05). Adding different levels of Teucrium powder to the broiler chickens' diet had no significant effect on feed intake during the entire experiment period (P>0.05). In contrast, the increase in body weight was significantly affected by the experimental groups so that the treatment containing 2% Teucrium powder had the lowest weight enhancement and compared to the 0.5, 1, 1.5 % as well as control treatment significantly decreased this parameter (P <0.05).

Table 4. The effect of experimental groups on parameters of the performance in growing period (25-42 days old)

Treatment	Feed intake (g)	weight gain (g)	Conversion ratio
Control	82.95	44.38^{bc}	1.93
0.5% of Teucrium	79.60	51.47^{ab}	1.54
1% of Teucrium	78.79	49.64^{ab}	1.61
1.5 % of Teucrium	83.56	53.85^{a}	1.55
2% of Teucrium	82.30	40.37^{c}	2.06

SEM = standard error of the means, [a, b, c] = in each column means with dissimilar letters are significantly different from each other (P<0.05).

Supplementing the broiler's diets with different levels of Teucrium had no significant effect on feed conversion ratio in the entire experiment period (P>0.05).

Table 5. The effect of experimental groups on parameters of the performance in the entire experiment period (11-42 days old)

Treatment	Feed intake (g)	weight gain (g)	Conversion ratio
Control	57.37	35.31^{a}	1.67
0.5% of Teucrium	54.62	37.56^{ab}	1.45
1% of Teucrium	53.20	36.12^{a}	1.47
1.5 % of Teucrium	55.95	37.49^{a}	1.49
2% of Teucrium	54.44	28.46^{b}	1.92
SEM	3.77	1.25	0.147
Probability level	0.9444	0.0091	0.2043

SEM = standard error of the means, [a, b, c] = in each column means with dissimilar letters are significantly different from each other (P<0.05).

The results of the present study are consistent with findings of Jafari and colleagues (2011) and Khosravi Manesh and colleagues (2012). Jafari et al (2011) reported that supplementing the broiler's diets with 100 mg per kg of essential of Teucrium significantly increases body weight and reduces feed conversion ratio. On the other hand Khosravi Manesh et al (2012) concluded that the

addition of 100 mg per kg of essential of Teucrium has no significant effect on feed intake and feed conversion ratio compared with the control group. Possible reasons for the significant improvement observed for live weight increase in this study for the level of 105% in growth period (25-42 days old) as well as the insignificant improvement to levels below 2% in the total growing period can be due to the increasing number of lactic acid bacteria in the small intestine and reduction of colony formation and other enter bacteria due to the herbal additives and antimicrobial properties of these additives (Valizadeh, & Moghadam, 1994). On the other hand, Teucrium polium contains the active ingredients and compounds such as beta - citostrol, Kampostrol, limonene linalool and alpha-Flandren which each of them having a different health benefits.

For example, linalool and alpha-Flandren have strong anti-oxidant effect (Capasso, Cerri, Morrica, Senatore, 1983) that can have effective role in occurrence of positive effects and observed improvement to increase the body weight.

Carcass traits

Carcass components

As Table 4 indicates that the addition of Teucrium powder in the applied levels (0.5, 1, .1.5 and 2%) to broilers' diet had no significant effect on the relative percentage of empty stomach carcass, intestine, abdominal fat, liver, and thigh (P>0.05). The experimental diets had significant effect on the relative weight of gizzard (P <0.05). So that treatment receiving 2% Teucrium powder had the highest weight of gizzard and its difference with control treatments and treatments receiving 0.5 and 1% Teucrium powder was significant (P <0.05). Supplementing broiler chickens diet with levels of 1 and 2 % Teucrium was significantly reduced the relative weight percent of breast compared to the 0.5 and 1.5% treatments as well as the control treatment (P <0.05) that this weight increase of gizzard can be due to crude fiber existing in Teucrium. Crude fiber of diet increases the gizzard activity in order to digest and this increase can make it more masculine and increase its weight. Breast percentage reduction observed in the treatment containing 2% Teucrium powder may be also relevant to the crude fiber and antimicrobial agents existing in Teucrium. Crude fiber by preventing the digestion and absorption of antimicrobial agents through effective reduction of microbial population prevents the digestion and absorption of nutrients including protein and amino acids (Teymori et al, 2001) and thus prevents adequate deposition of protein in the breast and reduces its size.

Table 6. The effect of experimental groups on the relative percent of each internal component of broiler chicken carcasses

Treatment	carcasses	intestine	Fat	Gizzard	Liver	Chest	Thigh
Control	73.21	7.63	2.72	2.54^{b}	3.20	34.04^{a}	25.07
0.5% of Teucrium	71.03	9.01	1.71	2.47^{b}	2.96	34.57^{a}	26.21
1% of Teucrium	69.64	9.14	2.21	2.54^{b}	3.27	30.20^{b}	27.57
1.5 % of Teucrium	72.51	9.03	2.31	2.63^{ab}	3.32	35.22^{a}	25.49
2% of Teucrium	69.45	10.00	4.11	3.55^{a}	3.76	29.59^{b}	27.09
SEM	1.41	1.30	0.90	0.26	0.23	1.07	0.73
Probability level	0.296	0.783	0.4344	0.0795	0.2520	0.0097	0.1615

SEM = standard error of the means, P Value = Probability level

Components of intestinal

The results of this study indicated that the different levels of Teucrium had no significant effect on any part of the gastrointestinal tract (pancreas, duodenum, jejunum, ileum and cecum) (P>0.05). However, as it is clear from the table, there is significant difference between weight of the cecum in treatments containing 2% Teucrium with other experimental groups as well as the control treatment and in this treatment the weight of the cecum is decreased compared to the other treatments but this difference were not statistically significant.

Table 7. The effect of experimental groups on percentage of different parts of the intestine of broiler chickens

Treatment	pancreas	duodenum	jejunum	ileum	Cecum
Control	4.78	16.29	34.13	34.65	10.19
0.5% of Teucrium	3.70	14.78	37.93	32.49	11.10
1% of Teucrium	4.07	16.29	34.73	33.28	11.45
1.5 % of Teucrium	3.55	12.96	37.07	33.96	12.45
2% of Teucrium	4.10	14.54	36.83	36.86	7.71
SEM	0.63	1.20	2.43	3.57	2.57
Probability level	0.6918	0.2898	0.7697	0.9225	0.7439

SEM = standard error of the means, P Value = Probability level

Histomorphology intestine

The results of the supplementing different levels for Histomorphology characteristics of the intestine in broilers are shown in Table 7. Villus height was not affected by the addition of various levels of Teucrium (P>0.05). Although, by briefly looking at the data obtained it can be realized that the addition of the level of 0.5, 1, 1.5, 2% Teucrium was increased villus height compared to the control treatment, and the level of 2% Teucrium was significantly different from control treatment (1722.8 compared to 1312.2), however, because of the distribution of data or sampling errors these differences are not statistically significant. Other Histomorphology intestine parameters such as the width of the head of lint, the width of the base of the lint, crypt depth and lint's height to crypt depth were not affected by the experimental groups (P>0.05). Lint's height ratio to crypt depth also in birds receiving 1.5 and 2% Teucrium had non-significant improvement compared to the control treatment.

Table 8. The effect of experimental groups on Histomorphological characteristics of intestine of broiler chickens

Treatment	Length of lint (µ m)	width of the head of lint (µ m)	width of the base of the lint (µ m)	crypt depth (µ m)	lint's height to crypt depth
Control	1312.2	88.89	144.77	231.15	6.042
0.5% of Teucrium	1398.5	88.47	141.38	241.77	5.855
1% of Teucrium	1629.3	94.62	133.97	310.69	5.247
1.5 % of Teucrium	1559.8	104.31	153.34	229.59	7.496
2% of Teucrium	1722.8	75.65	131.15	204.04	8.989
SEM	73.464	5.396	8.315	14.745	0.644
Probability level	0.425	0.622	0.947	0.2009	0.391

SEM = standard error of the means, P Value = Probability level

Antioxidant status

Total antioxidant capacity and malondialdeide levels in serum were measured to determine the antioxidant status. As it is observed, total antioxidant capacity was significantly affected by the addition of various levels of Teucrium powder. Treatment containing 1.5% Teucrium powder had the highest antioxidant capacity and its difference with the control groups and groups receiving 0.5 and 1% Teucrium in diet was significant (P <0.05). Birds receiving 0.5 Teucrium as well as the control treatment's birds had the lowest antioxidant capacity and except treatment receiving 1% Teucrium were significantly different from other experimental groups (P <0.05). Group containing 2% Teucrium also showed no significant difference with treatments containing 1 and 1.5% in antioxidant capacity (P>0.05), however it had significant difference with control treatments and treatments containing 0.5%. MDA levels of serum was not affected by supplementing the diet with 0.5, 1, 1.5 and 2% levels of Teucrium (P>0.05). Although by overviewing the data obtained for the level of MDA, it can be concluded that all treatments containing Teucrium powder had lower MDA levels compared to the controls group and control group had the highest amount and group receiving 1.5% Teucrium powder had the lowest MDA level, however these differences are not statistically significant (P> 0.05).

Table 8. The effect of experimental groups on antioxidant status in serum of broilers

Treatment	Total antioxidant capacity (mmol)	MDA (nmol ml)
Control	0.767^{c}	3.49
0.5% of Teucrium	0.739^{c}	3.28
1% of Teucrium	1.068^{bc}	3.22
1.5 % of Teucrium	1.453^{a}	2.41
2% of Teucrium	1.295^{ab}	2.82
SEM	0.086	0.172
Probability level	0.003	0.319

SEM = standard error of the means, P Value = Probability level, $^{a, b, c}$ = in each column means with dissimilar letters are significantly different from each other (P<0.05).

The test results for the antioxidant status showed that the addition of Teucrium can increase the antioxidant capacity of the body and in the meantime, treatment containing 1.5% had the best performance that consequently it can be considered that this treatment also contains the lowest amount of MDA which indicates the low level of the lipid peroxidation. The results of this study are consistent with the research results of Astankuik et al (2012), Youdim and Deans (2000) and Zhang et al (2009). Astankuik and colleagues (2012) showed that the plant extract of Teucrium contains large amounts of phenolic compounds (140.18 microg/ ml) and flavonoids (192.69 micrograms/ml) that these compounds can release free radicals in body through its oxidation and thereby can increase the antioxidant activity and also decrease the level of lipid peroxidation that took place by free radicals (Pietta, 2000). Current research's findings for the antioxidant status can be attributed to these compounds. Also Capasso et al (1983) showed the presence of compounds such as linalool and alpha-Flandren. Misharina and his colleagues (2009) showed that these compounds can eliminate them by giving the proton ions to the free radicals and this can be also effective in boosting the body's antioxidant system and strengthen it.

References

Capasso F, Cerri R, Morrica P, & Senatore F. (1983). Chemical composition and anti-inflammatory activity of an alcoholic extract of Teucrium polium L. Boll Soc Ital Biol Sper. 59, 1639-43.

Cross, D.E., R.M. Mcdevitt, K. Hillman, & T. Acamovic. (2007). The effect of herbs and their associated essential oils on performance, dietary digestibility and gut microflora in chickens from 7 to 28 days of age. Br. Poult. Sci. 48, 496-506.

Jafari, B., A. Rezaie, A. Ebadi, M. Ghiamirad & C. Ahmadizadeh. (2011). Evaluation of Medicinal PlantOil(TeucriumPolium)in Diets of Broilers. J. Appl. Environ. Biol. Sci., 1(12), 583-586.

Khosravi Manesh, M., S. Kazemi & M. Asfari (2012). Influence of poly germander (Teucrium polium)and watercress (Nasturtium officinale)extract on performance, carcass quality and blood metabolites of male broilers. Res. Opin. Anim. Vet. Sci. 2(2), 66-68.

Misharina, T. A., M. B. Terenina & N. I. Krikunova. (2009). Antioxidant properties of essential oils. Appl. Biochem. Micro. 45, 710-716.

Pietta, P. G. (2000). Flavonoids as antioxidants. J. Nat. Prod. 63, 1035-1042. Zargari, A. (1993). Herb, Tehran University Press, Tehran, Fourth, Fifth Edition, 130-131.

Stankovic M. S., N. Niciforovic, V. Mihailovic, M. Topuzovic & S. Solujic.(2012). Antioxidant activity, total phenolic content and flavonoid concentrations of different plant parts of Teucrium poliuml. Subsp. polium. Acta. Soc. Bot. Pol. 81(2),117-122.

Valizadeh, M., & Moghadam, M. (1994). Pilot projects in agriculture First edition, Pishtaze Elm publication, 25-100.