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Full Length Research Paper

The effect of different levels of savory medicinal plant *(Satureja hortensis L.*) on growth performance, carcass traits, immune cells and blood biochemical parameters of broilers

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The present experiment was conducted to evaluate the effects of different levels of *Satureja hortensis L.* (Savory) medicinal plant dried aerial part powder on growth performance, carcass traits, immune cells and blood biochemical parameters of broilers. Three hundred broiler chicks (Ross 308) were used in a completely randomized design in five treatments and three replicates (20 birds per replicate) for a period of 42 days. The treatment groups consisted of a control group (1) with no *S. hortensis L.* supplementation, and 2, 3, 4 and 5 experimental groups with 0.5, 1, 1.5 and 2% of *S. hortensis L.* in the feedstuff. Results obtained indicated a significant differences between treatments on growth performance and carcass traits ($p<0.05$). The highest daily feed intake (94.86 g) was obtained by using 2% of *S. hortensis L.* the highest gizzard percent (3.22%) obtained in control group whereas the lowest percent of gizzard (2.52 %) was observed in group 3 by inclusion 1.5% of *S. hortensis L.* in broiler diets. Using different levels of *S. hortensis L.* did not have significant effects on immune cells response and blood biochemical parameters were unaltered among all treatments of broilers.

Key words: Antibiotic alternatives, blood metabolites, medicinal plant, *Satureja hortensis L.*

INTRODUCTION

The wide use of antibiotics and other chemical compounds have been experienced throughout the last 50 years which research have been directed back to natural antimicrobial products as indispensable resources. Different additives such as enzymes, organic acids, probiotics, prebiotics and phytogenics are used to improve the performance (Jamroz et al., 2005). Medicinal herbs, and their associated essential oils or extracts are being considered as potentially growth promoters (Nobakht et al., 2011). At present, the scientists are working to improve feed efficiency and growth rate of livestock using useful herbs (Bunyapraphatsara, 2007). Researches on the use of herbal mixtures in poultry diets have produced inconsistent results (Fritz et al., 1993). In an experiment, broilers fed with 0.5% of peppermint, grow faster performed better than those fed with 1.5% peppermint. There was no significant effect with the addition of the peppermint to the diet on blood traits (PCV, RBC, Hb and WBC), but liver weight decreased whereas the Heterophile/Lymphocyte ratio significant increased in treatments compared with control (Alkassie, 2010). Using 0.5% of *Mentha pulegium L.* aerial parts powder significantly improved the performance and carcass traits and reduced the blood glucose of broilers (Nobakht et al., 2011) reported that broilers fed plant extracts showed higher body weight gain if compared to control group (Jamroz et al., 2005). Supplementation of essential oils from medicinal plants improves the immune-defense in poultry (Lavina et al., 2009). Mixture of Mentha, Zizphora and peppermint aerial parts powder did not have any considerable effects on broiler serum biochemical measures such as total cholesterol, triglycerides and glucose, but whenever mixture as 1% Mentha, 0.5% Zizphora and

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Table 1. The ingredients and nutrients composition of starter diets of broilers (1 to 21 days).

Ingredients	Diets				
	Control group	0.5% *S. hortensis L.*	1% *S. hortensis L.*	1.5% *S. hortensis L.*	2% *S. hortensis L.*
Yellow corn	58.51	57.77	57.03	56.29	55.50
Soybean meal	32.72	32.77	32.81	32.86	32.96
Fish meal	3	3	3	3	3
Satureja hortensis L.	0	0.5	1	1.5	2
Vegetable oil	2.53	2.72	2.91	3.1	3.29
Dicalcium phosphate	1.06	1.06	1.07	1.07	1.07
Oyster shell	1.30	1.30	1.30	1.30	1.30
Salt	0.23	0.23	0.23	0.23	0.23
Vitamin premix[1]	0.25	0.25	0.25	0.25	0.25
Mineral premix[2]	0.25	0.25	0.25	0.25	0.25
DL- Methionine	0.15	0.15	0.15	0.16	0.16
Calculated composition					
Metabolisable energy (kcal/kg)	3000	3000	3000	3000	3000
Crude protein (%)	21.56	21.56	21.56	21.56	21.56
Calcium (%)	0.94	0.94	0.94	0.94	0.94
Available phosphorous (%)	0.42	0.42	0.42	0.42	0.42
Sodium (%)	0.14	0.14	0.14	0.14	0.14
Laysin (%)	1.25	1.25	1.25	1.25	1.25
Methionine+Cysteine (%)	0.87	0.87	0.87	0.87	0.87
Threonine (%)	0.9	0.9	0.9	0.9	0.9
Thryptophan (%)	0.28	0.28	0.28	0.28	0.28

[1]Vitamin premix per kg of diet: vitamin A (retinol), 2.7 mg; vitamin D3 (Cholecalciferol), 0.05 mg; vitamin E (tocopheryl acetate), 18 mg; vitamin k3, 2 mg; thiamine 1.8 mg; riboflavin, 6.6 mg; panthothenic acid, 10 mg; pyridoxine, 3 mg; cyanocobalamin, 0.015 mg; niacin, 30 mg; biotin, 0.1 mg; folic acid, 1 mg; choline chloride, 250 mg; Antioxidant 100 mg. [2] Mineral premix per kg of diet: Fe (FeSO4.7H2O, 20.09% Fe), 50 mg; Mn (MnSO4.H2O, 32.49% Mn), 100 mg; Zn (ZnO, 80.35% Zn), 100 mg; Cu (CuSO4.5H2O), 10 mg; I (KI, 58% I), 1mg; Se (NaSeO3, 45.56% Se), 0.2 mg.

and 0.5% peppermint stimulated immune system (Narimany-Rad et al., 2011). Mixture of three medicinal plants (0.5% *Malva silvestris,* 1% *Alhaji maurorum,* 0.5% *Mentha spicata*) improved the carcass percent and decreased the blood glucose, but did not have significant effects on immune cells of broilers (Nobakht and Shahryar, 2010).

S. hortensis L. is an annual, herbaceous aromatic and medicinal plant belonging to the Lamiaceae family. It is known as summer savory, native to southern Europe and naturalized in parts of North America (Sefidkon et al., 2006). It is widely distributed in different parts of Iran as one of the most important of classified 12 Satureja species. Its essential oil contains considerable amounts of two phenolic ketones that is carvacrol and thymol (Ghannadi, 2002). It has Regard to having anti-inflammatory (Hajhashemi et al., 2002), antioxidant (Güllüce et al., 2003), antibacterial (Güllüce et al., 2003; Şahin et al., 2003) and antifungal activities (Güllüce et al., 2003; Boyraz and Ozcan, 2006), which properties received major consideration. It is traditionally used in foods for herbal tea and flavor component and in folk and traditional medicine, to treat various ailments, such as cramps, muscle pains, nausea, indigestion, diarrhea and infectious diseases (Güllüce et al., 2003; Zargari, 1990).

This study was conducted to evaluate the effects of using different levels of *S. hortensis L.* dried aerial parts powder on performance, carcass traits, blood bio-chemical parameters and immunity cells of broilers.

MATERIALS AND METHODS

Animals and dietary treatments

Three hundred broiler chicks (Ross 308) were used in a completely randomized design in five treatments and three replicates (20 birds per replicate) for 42 days. The treatment groups consisted of a control group (1) with no *S. hortensis L.* supplementation, and experimental groups 2, 3, 4 and 5 receiving 1, 1.5 and 2% of *S. hortensis L.* respectively. The diets were formulated (Tables 1 and 2) to meet the requirements of broilers as established by the (NRC, 1994).

Dried aerial part of *S. hortensis L.* was supplied from the local market and the compositions of it were determined according to AOAC (1994). After fine milling, it was mixed with other ingredients.

Table 2. The ingredients and nutrients composition of grower diets of broilers (22 to 42 days) of broilers.

Ingredients	Diets				
	Control group	**0.5% *S. hortensis L.***	**1% *S. hortensis L.***	**1.5% *S. hortensis L.***	**2% *S. hortensis L.***
Yellow corn	67.91	67.13	66.35	65.58	64.80
Soybean meal	26.06	26.14	26.32	26.30	26.38
Fish meal	2	2	2	2	2
Vegetable oil	1.01	1.21	1.40	1.60	1.80
Satureja hortensis L.	0	0.5	1	1.5	2
Dicalcium phosphate	1.03	1.03	1.03	1.03	1.03
Oyster shell	1.20	1.20	1.20	1.20	1.20
Salt	0.25	0.25	0.25	0.25	0.25
Vitamin premix[1]	0.25	0.25	0.25	0.25	0.25
Mineral premix[2]	0.25	0.25	0.25	0.25	0.25
DL- Methionine	0.04	0.04	0.04	0.04	0.04
Calculated composition					
Metabolisable energy (kcal/kg)	3000	3000	3000	3000	3000
Crude protein (%)	18.75	18.75	18.75	18.75	18.75
Calcium (%)	0.84	0.84	0.84	0.84	0.84
Available phosphorous (%)	0.38	0.38	0.38	0.38	0.38
Sodium (%)	0.14	0.14	0.14	0.14	0.14
Lysine (%)	1.02	1.02	1.02	1.02	1.02
Methionine+Cysteine (%)	0.68	0.68	0.68	0.68	0.68
Threonine (%)	0.79	0.79	0.79	0.79	0.79
Thryptophan (%)	0.24	0.24	0.24	0.24	0.24

[1]Vitamin premix per kg of diet: vitamin A (retinol), 2.7 mg; vitamin D3 (Cholecalciferol), 0.05 mg; vitamin E (tocopheryl acetate), 18 mg; vitamin k3, 2 mg; thiamine 1.8 mg; riboflavin, 6.6 mg; panthothenic acid, 10 mg; pyridoxine, 3 mg; cyanocobalamin, 0.015 mg; niacin, 30 mg; biotin, 0.1 mg; folic acid, 1 mg; choline chloride, 250 mg; Antioxidant 100 mg. [2]Mineral premix per kg of diet: Fe (FeSO4.7H2O, 20.09% Fe), 50 mg; Mn (MnSO4.H2O, 32.49% Mn), 100 mg; Zn (ZnO, 80.35% Zn), 100 mg; Cu (CuSO4.5H2O), 10 mg; I (KI, 58% I), 1mg; Se (NaSeO3, 45.56% Se), 0.2 mg.

The diets and water was provided with *ad libitum*. The lighting program during the experimental period consisted of a period of 23 h light and 1 h of darkness. Environmental temperature was gradually decreased from 33 to 25℃ on day 21 and was then kept constant.

Performance parameters

Body weight, feed intake and feed conversion were determined weekly on bird bases. Mortality was also recorded.

Blood biochemical and immunity parameters

At 42 days of age, two birds from each replicate (male and female) were randomly chosen for blood collection and approximate 5 ml blood was collected from the brachial vein. One ml of collected blood was transferred to tubes with EDTA for determination of heterophil and lymphocyte blood cells counts. One hundred leukocytes per sample were counted by heterophil to lymphocyte separation under an optical microscope the heterophil to lymphocyte ratio was calculated and recorded (Gross and Siegel, 1983). The remaining 4 ml blood was centrifuged to obtain serum for determining the blood biochemical parameters include: glucose, cholesterol and triglyceride. Kits (T Kit) package supplied by (Pars Azmoon Company; Tehran, Iran) were used for determining the blood biochemical parameters using Anision-300 auto-analyzer system.

Carcass components

At 42 days of age, two birds per replicate were randomly chosen, slaughtered and carcass percent to total weight and percents of carcass parts (abdominal fat, breast, thigh, gizzard and liver) to carcass weight were calculated.

Statistical analysis

The data were subjected to analysis of variance using the general linear model procedures of SAS Institute (2005). Means were compared using the Duncan multiple range test. Statements of statistical significance are based on $P<0.05$.

RESULTS AND DISCUSSION

Performance and carcass traits

The effects of different levels of *Satureja hortensis L.* in

Table 3. The effects of different levels of experimental diets on performance of broilers (0 to 42 days).

Parameter	*S. hortensis L. (%)*					
	0	**0.5**	**1**	**1.5**	**2**	**SEM**
Feed intake (g)	88.24^{b}	91.77^{ab}	90.04^{ab}	90.97^{ab}	94.86^{a}	1.73
Weight gain (g)	42.78	44.46	45.02	45.84	45.96	1.16
Feed conversion	2.07	2.07	2	1.99	2.07	0.04

Values in the same row not sharing a common superscript differ significantly (p<0.05). SEM = Standard error of mean.

Table 4. The effects of different levels of experimental diets on carcass traits of broilers.

Carcass trait (%)	*S. hortensis L.* (%)					
	0	**0.5**	**1**	**1.5**	**2**	**SEM**
Carcass	69.97	70.14	69.82	69.82	72	0.68
Abdominal fat	4.17	3.96	3.99	3.44	4.06	0.35
Gizzard	3.22^{a}	2.60^{b}	2.87^{ab}	2.52^{b}	2.74^{ab}	0.12
Breast	31.14	32.21	31.65	32.61	32.51	0.69
Thigh	26.62	27.12	26.95	26.21	25.81	0.38
Liver	3.40	3.13	2.88	3.07	3.20	0.21

Values in the same row not sharing a common superscript differ significantly (P<0.05). SEM=Standard error of mean.

feeds on performance of broilers are summarized in Table 3.

Using different levels of *S. hortensis L.* had significant effects on performance of broilers (p<0.05). Addition of *S. hortensis L.* powder aerial parts significantly increased feed intake. The highest amount of daily feed intake (94.86 g) was resulted in group 5 by using 2% of *S. hortensis L.* However, using different levels of *S. hortensis L.* could not significantly affect the amount of daily feed intake. Significantly difference observed only between control group and group 5 by using 2% of *S. hortensis L.* Many microorganisms population live in the digestive tract of broilers that many of which have adverse effects on broiler health status so on their performance, as *S. hortensis L.* has antimicrobial effects (Sefidkon et al., 2006) so by reducing harmful microbial populations, can improve health and increase amount of daily feed intake. In addition medicinal herbs such as *S. hortensis L.* contain considerable amount of fibers. Dietary fibers in broilers are low digestible and by increasing the passage rate of digesta in gastrointestinal tract, can increase the amount of feed intake. There were not any significant difference between treatment about daily weight gain and feed conversion (p>0.05) but relative superiority of daily weight gain was observed by using 2% of *S. hortensis L.* Relative superiority of feed conversion was obtained by addition 1.5% of *S. hortensis L.* into broiler diets. These results were not in agreement with (Nobakht and Shahryar, (2010) and Nobakht et al., (2011) findings. Increase the amount of feed intake by using medicinal plants not reported by Nobakht and Shahryar (2010) and Nobakht et al. (2011) whenever in laying hens using 2% of peppermint increased significantly the amount of daily feed intake (Nobakht and Mehmannavaz, 2010).

The effects of *S. hortensis L.* on carcass traits of broilers are presented in Table 4. Between carcass traits only gizzard percent significantly affected by addition different levels of *S. hortensis L.* into broiler diets (P<0.05). *S. hortensis L.* significantly decreased the percent of gizzard. The lowest percent of gizzard (2.60%) was resulted by using 0.5% of *S. hortensis L.* whereas the highest percent (3.22%) belonged to control group. Increase the passage rate of digesta in the gastrointestinal tract and reduce remaining time of digesta may be affecting the size of gizzard. In addition microbial population have biological secretions those causes the gastrointestinal wall be thicker and heavier (Lee et al., 2003) as *S. hortensis L.* has antimicrobial effects, so by reducing the bacterial population, the amount of secretions decreased and reduce digestive organs weight. Findings about gizzard percent in this experiment were not supported by reports of Nobakht and Shahryar, (2010) and Nobakht et al., (2011). Improving of broiler carcass traits by using medicinal plants was reported by Mona et al. (2010) and Al-Kassi (2010). Numerically addition of *S. hortensis L.* improved the percents of carcass, abdominal fat. Relative improvement of abdominal breast percents were observed in group 4 whereas the highest percent of thigh was recorded in group 2. Like performance, the antimicrobial substances of *S. hortensis L.* can reduce the harmful bacterial populations in the gastrointestinal tract and improve the levels of absorbed nutrients especially amino

Table 5. The effects of different levels of experimental diets on blood parameters of broilers.

Blood parameter	*S. hortensis* L. (%)					
	0	0.5	1	1.5	2	SEM
Glucose (mg/dl)	242.98	211.27	210.82	184.90	214.88	29.16
Cholesterol (mg/dl)	108.95	123.97	111.62	111.80	123.35	7.83
Triglyceride (mg/dl)	39.87	51.95	42.25	26.15	32.83	7.79
Heterophil (%)	12.34	10.84	12	14.84	10.34	2.59
Lymphocyte (%)	83.67	86.67	86.50	83.50	88.67	2.56
Heterophil/lymphocyte	0.162	0.126	0.139	0.184	0.119	0.036

acids. By increasing the amount absorbed amino acids, the highest levels of them can accumulate in tissues like breast, not only the antimicrobial effects, but also the antioxidants and phenolic substance of *S. hortensis L.* can prevent nutrients against of oxidation and increase the amounts of absorbed and accumulated of them in broiler tissues (Lee et al., 2003).

The effects of different levels of *S. hortensis L.* on blood biochemical and immunity parameters of broilers are presented in Table 5. *S. hortensis L.* did not have significant effects on blood biochemical and immune cells of broilers ($p<0.05$). But in numerically using *S. hortensis L.* had positive effects in low decreasing of blood glucose, triglyceride and immunity cells. Although the difference was not significant a relative The lowest amounts of glucose and triglyceride were resulted in group 4 by using 1.5% of *S. hortensis L.* Whenever a low superiority of lymphocyte percentage and low inferiority of heterophile, and ratio of heterophile to lymphocyte were observed by addition 2% of *S. hortensis L.* into broiler diets. Our observation in this experiment about blood biochemical and immunity cells of broiler is in agreement with Narimani-Rad et al. (2011) reports. There concluded that using 0.5% of *S. hortensis L.* in mixture of medicinal plants has positive effects on immunity status of broilers.

Conclusion

It can be concluded that the use at least 0.5% of *S. hortensis L.* medicinal plant in broiler diets can effectively improve the amount of feed intake and has low positive effects on their performance, carcass traits, blood biochemical and immunity cells. However for more information, additional experiments are recommended.

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