EFFECTS OF DIFFERENT LEVELS OF SAVORY (*SATUREJA HORTENSIS* L.) POWDER ON PERFORMANCE, SOME BLOOD BIOCHEMICAL AND INTESTINAL CHARACTERISTICS OF COBB 500 BROILER CHICKS

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In this study we evaluated the effects of Savory powder on the performance, blood biochemical and intestinal characteristics of female Cobb 500 broiler chicks. Total of 240 one day broiler chicks were randomly divided into 4 treatments. Treatments were further divided into 6 replicates. Broilers were fed a basal diet as control group, basal diet with 0.2% Savory powder (S1), basal diet with 0.4% Savory powder (S2) and basal diet with 0.6% Savory powder (S3). The experiment was carried out for 6 weeks. Feed intake (FI) and body weight gain (BWG) was calculated for estimation of feed conversion ratio (FCR). At the end of the experimental period four birds from each replicate were randomly slaughtered to determine carcass characteristics and other parameters. The blood serum samples were subjected to biochemical analysis. For determination of intestinal characteristics and small intestine tissues samples were collected. All data were analyzed as a completely randomized design using General Linear Models (GLM). The significance of the differences among least square means of main effects was tested by Duncan's new multiple-range test. Data from this study showed BWG and FCR in broilers improved underfed different levels of Savory powder ($P \leq 0.05$). There were significant differences between carcasses traits under effect of feed Savory powder levels ($p \leq 0.05$). The results of this study showed that serum triglyceride, cholesterol LDL content decreased in groups fed by savory powder and HDL increased significantly ($p \leq 0.05$) instead. In addition, villus height decreased in S1 and S2 groups. An increasing crypt depth was seen on S2. According to these data villus widths, epithelium layer and goblet cells increased by using Savory, especially by using S2 ($p \leq 0.05$). In conclusion we could demonstrate that the savory powder may be used as ingredient in broilers ration without harming effects on carcass characteristics, blood biochemical parameters, and intestinal morphology of Cobb 500 broiler chicks.

Keywords: blood biochemical, performance, intestinal characteristics, Cobb 500 broiler.

INTRODUCTION

Natural feed additives had beneficial effect for stimulation and activity of digestive system by improving the diet palatability and enhancing appetite of poultry, thus increasing the amount of feed consumed (Kamel, 2001). Aromatic plants powder, and their associated essential oils or extracts are used as potentially

growth promoters (Dibner & Richards, 2005). In this case, the scientists are working to improve feed efficiency and growth rate of livestock using herbal plants (Bunyapraphatsara, 2007). Savory plant (*Satureja hortensis* L.) is an annual, herbaceous aromatic and medicinal plant belonging to the Lamiaceae family (Zargari, 1997). It is known as summer savory, native to southern Europe, Asia and naturalized in parts of North America (Ghalamkari *et al*., 2011). It is widely distributed in different parts of Iran as one of the most important of classified twelve Satureja species. It's essential oil contains considerable amounts of two phenolic ketones that is carvacrol (Ultee *et al*., 1998) and thymol (Ghannadi, 2001). The savory is traditionally used in foods for herbal tea and flavor component and in folk and traditional medicine and to treat various ailments, such as cramps, muscle pains, nausea, indigestion, diarrhea and infectious diseases (Leung & Foster, 1996). Also, Zamani Moghaddam *et al*. (2007) reported that the beneficial effects of savory in poultry disease treatment. The pharmacological action of herbal extracts and their active materials in humans is also well known, but in animal nutrition the number of experimental studies is relatively low (Faghani *et al*., 2014), hence the objectives of this study was to explore the potential use of different levels of savory powder as a feed additive and growth promoter, on performance, some blood biochemical and intestinal characteristics in Cobb 500 broiler chicks.

MATERIAL AND METHODS

This study was conducted last during 42 days at the poultry farm of the Veterinary College, Islamic Azad University, Shahrekord branch, ShahreKord, Iran during April until June 2017.

Experimental plan

A total of 240 commercial (Cobb 500) one days old broiler chicks were divided into four treatment groups and they were further sub-divided into six replicates within 10 birds per each. The savory powder purchased from herbalists, cleaned was mixed and adding different levels to control (basal) diet as four experimental diets as shown in the Table 1. The treatments were as control (basal) diet with no savory powder; basal diet + 0.2% of savory powder (S1), basal diet + 0.4% of savory powder (S2), basal diet+ 0.6% savory powder (S3) respectively. All diets of each period were prepared with the same composition and they were both iso-nitrogenous and iso-caloric. Diets were formulated to exceed the requirements of NRC, 2007 recommendations. Feed and fresh water was provided ad-libitum during this experiment.

Data collection

The data on growth performance were collected for the following parameters: body weight gain (g), feed intake (g), feed conversion ratio (g), carcass yield (%),

and edible part weight (g). The body weight of individual bird was recorded on a weekly basis. Daily feed intake was calculated for weekly recorded and then calculated feed conversion ratio (FCR) on base daily feed intake. At the end of growth period, four birds form each replicate (i.e. 24 replicate) were randomly slaughtered for determination of carcass traits and the other parameters. Body sections were separated and weighed as percentage weight. Dressing percentage was calculated free from giblets and the organs were weighed separately as percentage of carcass weight. The point spread, performance index and production efficiency factor were also calculated for evaluating the growth performance. The blood samples were taken from the brachial vein from four birds per replicate and stored at 4^0C in refrigerator. The blood serum samples were subjected to biochemical analysis by Pars Azmoon commercial kits. Samples from small intestine tissue were collected for determination intestinal characteristics such as villus height, crypt depth, villus width, epithelium layer and goblet cells. The histomorphometric investigation was performed by light microscopy, and the measurement was done using public domain image analysis software Image J version xx (National Institute of Mental Health, Bethesda, MD, USA).

Statistical Analysis

Data were collected and analyzed using as a completely randomized design using the General Linear Models procedure of SAS 9.2. The significance of the differences among least square means of treatments main effects was tested by Duncan's multiple-range test.

Table 1

Composition of the experimental diets for Cobb 500 broiler chicks

Ingredients %	**0–7 (days old)**	**7–14 (days old)**	**15–29 (days old)**	**29–42 (days old)**
Corn grain	52.22	53.30	49.25	43.20
Soybean meal	37.5	33	27	23.5
Wheat	6	10	20	30
Calcium Carbonate	1.60	1.50	1.55	1.40
NaCl	0.18	0.20	0.20	0.20
Vitamin Premix*	1.25	1	1	0.85
Mineral Premix*	1.25	1	1	0.85
Calculated nutrient content				
ME($_{Kcal/Kgr}$)	2830	2870	2920	2960
CP (%)	22	20.5	18.5	17.5
Ca (%)	1	0.95	0.85	0.85
Available Phosphorus (%)	0.50	0.45	0.45	0.40
Lysine (%)	1.34	1.20	1.05	0.95
Methionine+Cystine (%)	0.92	0.85	0.80	0.75

Supplied per kilogram of feed: 7.500 IU of vitamin A, 2000IU vitamin D3, 30 Mg vitamin E,1.5 µg vitamin B12,2Mg B6,5 Mg Vitamin K,5 Mg vitamin B2,1 Mg vitamin B1,40 Mg nicotinic acide,160µg vitamin Biothine,12 Mg Calcium pantothenate,1MgFolic acid 20 Mg Fe,71 Mg Mn,100µg Se,37Mg Zn,6 Mg Cu,1.14 Mg I,400 µg Cu.

RESULTS AND DISCUSSION

Performance

The results obtained from performance of broiler chickens fed by savory powder are shown in the Table 2. Data showed that use of S1, S2 and S3 experimental feed treatments increased feed intake (FI) significantly (P<0.05) compared to control group. Body weight gain and final live weight were also significantly higher in S2 and S3 experimental feed treatments (P<0.05). Amiriandi (2015) reported that adding savory essential oil to the drinking water of chicken in 1–42 days period, this result showed that the live weight gain of chicks was significantly decreased in comparison to the than control group. Additionally, Kamel (2001) and Dibner & Richards (2005) also mentioned that the herbal powder and their essential oil mixture may be considered as a potential growth promoter.

Table 2

The effects of savory powder levels added as experimental diets on broilers performance

Treatments	FI (g.d)	BWG (g.d)	FCR	Live weight (g)	Carcass yield (g)
Control	103.20^{b}	48.94^{b}	2.00^{a}	2090.30^{c}	1440.11^{b}
S1	104.11^{a}	50.21^{b}	1.97^{ab}	2114.40^{c}	1495.00^{a}
S2	104.24^{a}	52.11^{a}	1.95^{ab}	2168.80^{b}	1516.25^{a}
S3	104.39^{a}	53.30^{a}	1.92^{b}	2199.41^{a}	1516.14^{a}
SEM	0.028	0.500	0.023	9.700	7.400

^{a,b} and ^{c} means within columns with different superscripts are different (P<0.05).

Overall means in the Table 2 showed the significant difference in body weight among treatments (P≤0.05). Ahmadian-Attari *et al*. (2011) showed that the herbal can improve growth and have beneficial effect on broilers. Cross *et al*. (2007) by studying on savory, rosemary, marjoram and their essential oil on growth and digestibility in 7 to 28 days broiler chicks, were suggested that the improvement of body weight gain and feed conversion ration may be due to the active compounds such as cinnamaldehyde and ugenol that they found in this herbal. Lee *et al*. (2003) showed that the herbal active compounds were caused better efficiency in the utilization of nutrients and better growth and performance. In the present study FCR was at the lowest in broilers fed by the highest savory powder. These results proved that savory though being more effective performed to certain extent and have a great potential to be utilized as an alternative. Data from this study also showed that significant differences for live weight (g) between treatments, and the higher live weight was for S2 and the lesser was for control group (Table 2).

The results of other studied showed that body weight gain, feed conversion ratio and dressing percentages increased (P≤0.05) in birds that supplemented with herb extract than control group birds, also mortalities and sudden deaths were minimized via used of herbal supplementation in birds diets (Kamel, 2001).

Zhang *et al*. (2005) reported that some plants or specific combinations of herbs in formulations may act as antioxidants by exerting superoxide scavenging activity or by increasing superoxide dismutase activity in various tissue sites (Khosravinia *et al.*, 2013). These results are in agreement with researchers who indicated that, addition of medicinal herbal plants had significant effects on improving digestibility coefficient and nutritive values (Shahin *et al*., 2003).

Edible Organs

According to the Table 3 data, using of different levels of savory powder were decreased abdominal fat statistically ($p \leq 0.05$). The liver weight was higher when broilers fed by S2 ($p \leq 0.05$) and intestine weight were at the highest for S3 group than others.

Table 3

The effects of savory powder levels added as experimental diets on some edible organs of broilers

Treatments	Liver (g)	Abdominal Fat (g)	Spleen (g)	Intestine (g)
Control	39.77^{c}	48.45^{a}	1.70^{b}	76.16^{c}
S1	41.73^{b}	44.71^{b}	1.83^{a}	78.35^{bc}
S2	43.32^{a}	42.43^{b}	1.80^{a}	80.44^{b}
S3	44.17^{a}	39.21^{c}	1.89^{a}	83.67^{a}
SEM	0.500	1.061	0.031	0.980

^{a,b} and ^{c} means within columns with different superscripts are different ($P<0.05$).

Blood Biochemical Assay

Blood biochemical assay showed that the blood triglyceride, cholesterol and LDL content tended to decrease by using savory powder and HDL increased significantly ($p \leq 0.05$). The supplemented diets with different levels of savory powder had a beneficial effect on broiler performance and blood plasma cholesterol and glucose. Result of Ebrahimi *et al*. (2013) study showed that lowest cholesterol content was for savory powder and the highest of cholesterol was related to the control ($P \leq 0.05$). Inconsistent with the results of this study results (Ghalamkari *et al*., 2011) showed that the use of savory powder had no significant effect on blood serum biochemical of broilers. The result of our finding are in agreement with those obtained by Lee *et al*. (2003), who found that dietary carvacrol, but not thymol, reduces plasma triglycerides and suggested that carvacrol may have more impact on lipogenesis than on cholesterol biosynthesis. In parallel with other investigation by (Ebrahimi *et al.*, 2013) they noted that the different levels of savory essential oil in drinking water had no effects on blood metabolites. Khalaf *et al*. (2008) showed that the phenolic compounds in some herbals may inhibit lipid per oxidation, scavenge and have the superoxide anion and hydroxyl radical, so they could enhance the activities of detoxifying enzymes such as glutathione-S-transferase (Ultee *et al*., 1998). For example, Kurucuet *et al*. (2013) mentioned

that the D-limonene (l-methyl-4-(1-methylethenyl)-cyclohexane) is a monocyclic monoterpene component of some herbals have hypo-cholesterolemic effects. The hypo-cholesterolaemic action of herbals is possibly related to its poly-phenolic components (Shahin *et al*., 2003; Seidavi *et al*., 2017). Polyphenols have been shown to depress the reverse cholesterol transport, reduce the intestinal cholesterol absorption and even increase bile acid excretion (Faghani *et al*., 2014).

Table 4

The effects of savory powder levels added as experimental diets on several blood biochemical of broilers (mg. dl)

Treatments	Triglyceride	Cholesterol	LDL	HDL
Control	73.26^{a}	136.02^{a}	60.15^{a}	66.14^{c}
S1	70.15^{b}	134.10^{a}	57.12^{b}	68.21^{bc}
S2	68.15^{bc}	130.26^{b}	56.12^{b}	70.02^{b}
S3	66.21^{c}	128.14^{b}	54.10^{c}	73.65^{a}
SEM	1.060	1.075	1.017	0.850

^{a,b} and ^{c} means within columns with different superscripts are different (P<0.05).

According to the Table 5 data, the savory powder affects villus height, crypt depth, villus width, epithelium layer and goblet cells significantly (P≤0.05). The villus height was decreased by using S1 and S2 respectively and the highest crypt depth was related to the S1 and S2 groups. According to our data the villus widths, epithelium layer and goblet cells were increased by using savory powder significantly (P≤0.05).

Intestinal Morphology

Table 5

The effect of savory powder levels added as experimental diets on intestinal characteristics of broilers (Micrometers)

Treatments	Villus height	Crypt depth	Villus width	Epithelium
Control	57.70^{b}	18.65^{b}	5.76^{b}	2.21^{b}
S1	58.17^{b}	19.20^{b}	6.65^{ab}	2.84^{a}
S2	60.21^{b}	20.44^{ab}	7.68^{a}	2.94^{a}
S2	63.50^{a}	22.55^{a}	7.87^{a}	3.10^{a}
SEM	1.091	1.076	0.840	0.120

$^{a\ a,b}$ and ^{c} means within columns with different superscripts are different (P<0.05).

Yeganeparast *et al*. (2016) showed that most active principles of plant extracts and powders are absorbed in the intestine by enterocytes and readily metabolized by the body and the products of this metabolism are transformed into polar compounds

by conjugation with glucoronate and excreted in the urine. As the active compounds are readily metabolized and have short half-lives, the risk of tissue accumulation is probably minimal.

CONCLUSIONS

According to the results of this study, using of different levels of Savory powder have beneficial effects on performance of Cobb 500 broiler chicks. The savory powder could reduce the blood serum cholesterol and LDL content, but did not affect on HDL levels. In conclusion, we could conclude that the basal diet with 0.6% of savory powder have beneficial effect on performance, some blood biochemical and intestinal characteristics on experimental broiler chicks.

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