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Original Article

Growth Performance, Blood Metabolites, Antioxidant Stability and Carcass Characteristics of Broiler Chickens Fed Diets Containing Nettle (*Urtica dioica. L*) Powder or Essential Oil

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ABSTRACT

Objective: A research was carried out to investigate the effects of nettle (*Urtica dioica*) powder (NP) and essential oil (NE) on performance, blood metabolites, carcass characteristics and antioxidant stability in broiler chicks. **Methods:** The treatments were T1: control diet, T2: control diet + 5g/kg NP, T3: control diet + 10 g/kg NP, T4: control diet + 5g/kg NE and T5: control diet + 10 g/kg NE. Blood sampling was performed at 35 days of age to evaluate the blood hepatic enzymes and biochemical parameters. At the end of experiment carcass characteristics were determined. The thigh meat samples were used to evaluate meat oxidative stability. **Results:** There were no significant differences in broiler performance among the treatments. In contrast, some of the carcass internal organs such as liver, bile sac, gizzard, proventriculus, and lungs weight were affected by the different level of NP and NE ($p<0.05$). The results of blood metabolites indicated that use of NP and NE decreased AST (IU/L) in birds ($P<0.05$). However, blood parameters such as ALP, ALT, glucose, cholesterol and triglyceride were not affected by dietary treatments. Thiobarbituric acid reactive substances (TBARS), as an indicator for meat lipid oxidation after storage, were not influenced by adding NP and NE in broiler diets. This study concluded that inclusion of 10g/kg nettle (*Urtica dioica*) essential oil in diet probably can induce a potential toward improve internal organs. However, broilers performance did not altered by dietary nettle supplementation.

1.INTRODUCTION

Lately, there is a large consideration of the people living in urban areas to plant products and natural matters by using traditional medicines including medicinal herbs to meet their primary health care needs (WHO, 2002). The effective influences of herbal plants on chickens have been suggested by researchers (Osman et al., 2005). Nettle (*Urtica dioica*) is one of the medicinal plants that widely grow in north part of Iran. This herbal plant belongs to the family of Urticaceae, which is one of the continual plants that grow in temperate and tropical areas (Chaurasia and Wichtl, 1987). Nettles are a very nutritious food that easily digested and are high in minerals, especially Iron and vitamins such as C and A (Alcicek et al., 2004). Herbs and their extracts with antioxidant capacity are being tested to improve animal performance and the quality of meat products (Jang et al., 2008). A study on the pigs showed that the use of nettle extract have positive effects on meat quality, improving oxidative stability and the polyunsaturated saturated fatty acid ratio (Hanczakowska et al., 2007). Kwiecien and Mieczan (2009) indicated that use of 2% of nettle to broilers diets had positive effects on body weight gain.

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Furthermore, the administration of nettle extract to diet can stimulate the innate cell mediated immune reaction by lymphocyte propagation in laying hens (Sandru et al., 2007). It is cleared that spices and various plant ingredients induced the relishing, digestion-stimulating and antimicrobial properties in animal (Alcicek et al., 2004; Zhang et al., 2005), which can stimulated the growth of useful bacteria and minimize harmful bacteria activity in the gut of birds (Wenk, 2000). However, little information has been published on the effects of nettle leaves powder and essential oil as feed additive in broiler diets. Therefore, the aim of this study was to evaluate the effects of different levels of nettle powder and essential oil on the performance, carcass traits, meat quality and some blood biochemical parameters of broilers.

2. MATERIALS AND METHODS

2.1.Sample preparation

Fresh nettle harvested in June was purchased from a local market in Mazandaran province (north of Iran). Fresh nettle cut into slices and samples were cleaned and plant leaves were separated from stems. A part of leaves was dried under room temperature for 2 days. The air-dried samples were finely ground to powder and stored at 4 ^{o}C until used. The other part of nettle sample was used to extract of leaves essential oil. The volatile oil of the nettle was collected by a steam distillation. The fixed oil was extracted with the help of a rotary evaporator using diethyl ether as solvent.

2.2. Birds and diets

The experimental procedures used in this research were carried out under the guidelines of the animal science department of Qaemshahr University. One-hundred and fifty 1-d-old chicks (Cobb strain) were obtained from a local hatchery and randomly allocated to five groups (3 replicates of 10 birds per each). The treatments were T1: control diet, T2: control diet + 5g/kg NP, T3: control diet + 10 g/kg NP, T4: control diet + 5g/kg NE and T5: control diet + 10 g/kg NE. Experimental diets were formulated to meet broiler nutrient requirements NRC (1994) for starter (1 to 21 d) and grower (21 to 42 d) phases (Table 1). Feed and water were provided *ad libitum* throughout the experimental period. Chicks and feed were weighed on d 1, 7, 14, 21, 28, 35 and 42 to determine weight gain, feed intake and feed conversion ratio. No mortality was observed in this research.

2.3. Experimental procedure and sampling

Blood samples were collected from four birds per each pen from the wing vein using sterilized syringe and needles at 35 days of age. Samples were then centrifuged at 2000 × g for 30 min and serum was separated. Serum samples were stored at -20 ^{o}C for determination of serum biochemical metabolites such as cholesterol, triglyceride and glucose and blood enzymes such as aspartate amino transferase (AST), alanine amino transferase (ALT) and alkaline phosphatase (ALP). The plasma enzymes activities were determined by using biochemical analysis kits (Pars Azmoon, Iran). At the end of the experiment (d 42) birds were fasted for 6 h. Four birds randomly selected from each pen, were transferred to slaughterhouse. The birds were weighted and slaughtered by cervical dislocation. The weight of the live bird, internal organs and carcass components (thigh and breast) were measured.

The thigh meat sample of each slaughtered bird was removed and used for meat lipid oxidation study (TBARS). The extent of lipid oxidation was determined by measuring the Thiobarbituric Acid Reactive Substances (TBARS) at d 4 after refrigerated storage and was expressed as gram of malonaldehyde per kilogram of thigh meat using the procedure described by Strange et al. (1977). Briefly, twenty grams of bone meat were blended with 50 ml of cold 20% trichloroacetic acid (TCA) for 2 minutes. The blender contents were rise with 50 ml of water, mixed together, and filtered through a Whatman#1. This filtrate is termed the TCA extract and is used in the TBA assessment. A 5 ml of the TCA extract was mixed with 5 ml of 0.01 M 2-thiobarbituric acid (TBA). This solution kept for 14 h at room temperature. Absorbance at 532 nm is reported as TBARS.

2.4. Statistical analysis

The experiment design was a completely randomized design with five treatments. Statistical analysis was performed using the General Linear Models procedure of SAS (1990). Probability values <0.05 were taken to indicate statistical significance using Duncan multiple range test.

Table 1.

Ingredients and chemical composition of the diets

Ingredients	Starter (1-21 d)	Grower (21-42 d)
Corn grain	58.73	54.20
Wheat grain	-	15.00
Soybean meal	32.67	23.82
Fish meal	3.00	3.00
Soybean oil	2.45	1.17
Oyster shell	0.65	0.50
Bone powder	1.60	1.51
Salt	0.25	0.23
Min premix[1]	0.25	0.25
Vit premix[1]	0.25	0.25
DL-methionine	0.15	0.07
Total	100	100
Chemical composition (%)		
ME kcal/kg	3000	3000
Crude protein	21.56	18.57
Calcium	0.94	0.84
Available phosphorous	0.42	0.38
Sodium	0.14	0.14
Linoleic acid	1.43	1.29
Lys	1.25	1.02
Met + Cys	0.87	0.68

[1]Provides per kg of diet: 9000 I.U. vitamin A; 2000 I.U. vitamin D3; 18 I.U. vitamin E; 2 mg menadion; 1.8 mg thiamine; 6.6 mg riboflavin; 30 mg niacin; 3 mg pyridoxine; 15 mg vitamin B12; 100 mg D-pantothenic acid; 1 mg folic acid; 0.1 mg biotin; 500 mg choline chloride; 100 mg antioxidant; 100 mg manganese; 84.7 mg zinc; 50 mg iron; 10 mg copper; 1 mg iodine; 0.2 mg selenium.

3. RESULTS AND DISCUSSION

The results of broiler growth performance are shown in Table 2. These results indicated that the supplementation of starter and grower diets with NE and NP had no significant effect on all growth parameters. Feed conversion ratio was improved in birds fed control diet and 10g/kg NP, numerically. The results of carcass characteristics are presented in Table 3. Effects of dietary treatments on carcass traits were not statistically significant. In contrast, the results of Table 4 showed that liver, gizzard and lungs weight were affected by dietary treatments. These organs increased in the birds fed diets supplemented with either NP or NE. The other internal

organs did not influence by diets supplemented with NE and NP.

Table 2.

The effects of different levels of nettle on performance of broiler chicks

Treatments	**1-21**	**21-42**	**1-42**
		Weight gain (kg/pen/week)	
Control	2.28	3.79	3.04
5 g/kg NP[1]	2.41	3.60	3.00
10 g/kg NP	2.31	3.49	2.90
5 g/kg NE[2]	2.45	3.52	2.99
10 g/kg NE	2.33	3.54	2.93
SEM[3]	0.07	0.16	0.08
		Feed intake (kg/pen/week)	
Control	3.88	7.82	5.85
5 g/kg NP	3.94	7.67	5.80
10 g/kg NP	3.93	7.62	5.77
5 g/kg NE	3.98	7.58	5.78
10 g/kg NE	3.89	7.40	5.64
SEM	0.05	0.15	0.09
		FCR	
Control	1.68	2.10	1.89
5 g/kg NP	1.62	2.19	1.91
10 g/kg NP	1.67	2.23	1.95
5 g/kg NE	1.60	2.19	1.90
10 g/kg NE	1.64	2.14	1.89
SEM	0.04	0.06	0.03

[1] NP: nettle powder, [2] NE: nettle essential oil, [3] SEM: standard error of the mean

The means within the same columns with at least one common letter, do not have significant difference (P>0.05).

The mean values of serum biochemical constituents in broiler chicken fed different dietary treatments are shown in table 5. The results indicated that serum cholesterol, triglyceride and glucose were not influenced by supplementation of NP and NE in broiler diets. However the serum cholesterol concentration decreased in birds fed diets supplemented with 5 and 10g/kg NE, numerically.

Table 3.

The effects of different levels of nettle on external organs percentage of broiler chickens

Treatments	Carcass yield	Breast %	Thigh %	Wing %
Control	66.9	23.49	18.88	7.50
5 g/kg NP[1]	69.40	25.10	18.31	7.30
10 g/kg NP	71.62	24.91	19.75	7.42
5 g/kg NE[2]	71.64	23.73	20.29	7.89
10 g/kg NE	70.23	22.79	19.59	7.77
SEM[3]	1.66	1.13	1.05	0.32

[1] NP: nettle powder, [2] NE: nettle essential oil, [3] SEM: standard error of the mean
The means within the same columns with at least one common letter, do not have significant difference (P>0.05).

Table 4.

The effects of different levels of nettle on internal organs (%) of broiler chickens

Treatments	Liver	Pancreas	Gizzard	Lung	Burse	Ceca	Intestine
Control	2.13^{b}	0.22	1.69^{b}	0.40^{b}	0.09	0.55	2.84
5 g/kg NP[1]	3.14^{a}	0.18	1.65^{b}	0.46^{ab}	0.13	0.73	2.89
10 g/kg NP	2.35^{ab}	0.23	1.93^{ab}	0.46^{ab}	0.11	0.59	2.96
5 g/kg NE[2]	2.44^{ab}	0.20	2.02^{ab}	0.41^{ab}	0.12	0.67	3.14
10 g/kg NE	2.51^{ab}	0.18	2.20^{a}	0.52^{a}	0.14	0.59	3.11
SEM[3]	0.24	0.02	0.12	0.03	0.02	0.08	0.28

[1] NP: nettle powder, [2] NE: nettle essential oil, [3] SEM: standard error of the mean
The means within the same columns with at least one common letter, do not have significant difference (P>0.05).

The results of serum biochemical enzymes and meat lipid peroxidation are presented in table 6. AST concentration was affected by dietary treatments. The lowest and highest AST concentration was in broilers fed 10g/kg NE and control diets, respectively. The dietary treatments had no significant effects on concentration of serum ALT and ALP in broilers. Also the results of meat quality in this table indicated that use of NP and NE had no effect on TBARS in broiler chickens. However, TBA number decreased in thigh meat of broilers fed diets supplemented with NE, numerically.

Table 5.

The effects of different levels of nettle on blood metabolites (mg/dl) of broiler chickens

Treatments	Cholesterol	Triglyceride	Glucose
Control	132.33	141.33	202.17
5 g/kg NP[1]	130.17	134.67	214.00
10 g/kg NP	135.50	134.83	203.17
5 g/kg NE[2]	121.17	139.17	207.00
10 g/kg NE	111.67	145.50	195.17
SEM[3]	8.06	18.81	11.64

[1] NP: nettle powder, [2] NE: nettle essential oil, [3] SEM: standard error of the mean
The means within the same columns with at least one common letter, do not have significant difference (P>0.05).

Use of nettle extract or essential oil did not alter growth performance in present study. These results are not in accordance with findings of Safamehr et al. (2012) who found that a level of 1-2% nettle supplementation had positive effects on performance and carcass traits of broiler chickens. In this regard, Mansoub (2010) reported that the carvacrol in nettle has stimulatory influence on pancreatic secretions by increasing the secretions of digestive enzymes, which more amounts of nutrients like amino acids can be digested and absorbed from the intestine and thereby improve some of carcass characteristics. Herbs and phytogenic products could control and limit the growth and colonization of numerous pathogenic and nonpathogenic species of bacteria in chicks guts. This may lead to a greater efficiency in the utilization of food, resulting in enhanced growth and improved feed efficiency (Bedford, 2000). Jamroz and kamel (2002) reported that diet supplementation with 300 ppm caravacrol, cinnamaldehyde and capasaicin improved daily gain and feed conversion ratio in poults. Results of present study are not in agreement with these reports. It is reported that herbs can stimulate the production of endogenous secretion in the small intestinal mucosa, pancreas and liver, and thus help digestion (Safamehr et al., 2012). The numerical reduction of serum cholesterol observed in broilers fed diets supplemented with 5 and 10g/kg NE might be due to the reduction of synthetic enzyme activities. Qureshi et al. (1983) reported some of the medicinal plants with inhibit of HMG-COA reductase, decreased the cholesterol α7-Hydroxylase and fatty acid synthesis as a results induced blood cholesterol reduction in poultry. Lee et al. (2003) indicated that dietary carvacrol reduces plasma triglyceride and phospholipids. They suggested that carvacrol may have more impact on lipogenesis than on cholesterol biosynthesis. In contrast, Khosravi et al. (2008) reported that the addition of nettle extract to a broiler diet had no significant effect on total cholesterol. It was suggested that *Urtica dioica* extract may have a direct role on lipoprotein synthesis and metabolism (Nassiri-asl et al., 2009). Thus, further study needed thereby clarify the mechanism of hypolipidemic actions of nettle or other herbs.

Table 6.

The effects of different levels of nettle on some of the plasma enzymes (U/L) and thibarbituric acid reactive substances of thigh meat (g MDA/kg meat) in broiler chickens

Treatments	AST	ALT	ALP	TBARS
Control	348.67[a]	4.66	4076	2.32
5 g/kg NP[1]	318.33[ab]	3.16	4418	2.39
10 g/kg NP	286.00[b]	2.50	6957	2.02
5 g/kg NE[2]	282.17[b]	3.50	6118	1.92
10 g/kg NE	314.00[ab]	3.66	5388	2.04
SEM[3]	18.75	0.79	917.38	0.16

[1] NP: nettle powder, [2] NE: nettle essential oil, [3] SEM: standard error of the mean
The means within the same columns with at least one common letter, do not have significant difference (P>0.05).

The role of medicinal plant on hepatic enzymes production has been studied by some researchers. It has been suggested that the extract of nettle is effective in inducing glutathione transferase and catalase activity in mice (Ozen and Korkmaz, 2003). El-Ashmawy et al., (2005) found that the reduction in the serum levels of aminotransferases enzymes (AST, ALT) as a result of herbal administration might probably be due in part to the presence of isoflavones, polyphenols and other antioxidants. In this respect, Rodriguez-Meizoso et al., (2006) demonstrated that the effect of administration volatile oil, alcoholic and aqueous induced a significant decrease in serum activities of aminotransferases enzymes (AST, ALT). Several researchers have reported the possibility of antioxidant effects for some traditional medicinal plants (Mehmet et al., 2005; Choi et al., 2010). Daba and Abdel-rahman(1998) found that nettle seed has a protective effect against oxidative damage in rats. Loetcher et al. (2013a) suggested that nettle contained alpha tocopherol, flavonoids, ferulic acid and carotenoids as natural antioxidants. Diets supplementation with nettle had a positive effect on the lipid oxidation stability in broiler meat (Loetcher et al. 2013b). Jang et al., (2008) reported that dietary medicinal herb extract mix appeared to delay the lipid oxidation of broiler chicken breast meat. It is cleared that some medicinal herbs contain several compounds, mainly polyphenoles, which have antioxidant activities, so they can improve the quality of meat products (Botsoglou et al., 2002). Mehmet et al. (2005) reported that Nettle seed decreased the elevated MDA and liver enzyme levels and also increased the antioxidant enzyme levels in rats. Diets supplemented with rosemary and sage essential oil extract to broilers resulted in a decrease in the lipid and cholesterol oxidation of broiler meat during storage for 9 d (Lopez-bote et al., 1998).

CONCLUSION

This study concluded that inclusion of 10g/kg nettle (Urtica dioica) essential oil in diet probably can induce a potential toward improve internal organs. However, broilers performance did not altered by dietary nettle supplementation. More research studies are needed to conduct for drawing a rigid conclusion especially on nettle because of limited works are done in potential of this medicinal plant.

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