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Full Length Research Paper

Effects of different levels of chicory *(Cichorium intybus* L.), zizaphora *(Zizaphora tenuior* L.), nettle (*Urtica dioica* L.) and savoury *(Satureja hortensis* L.) medicinal plants on carcass characteristics of male broilers

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Four feeding trials were conducted to investigate the effects of using different levels of some medicinal plants on carcass characteristic of male broilers. In each of these experiments 300 broilers (Ross 308) from 1 to 42 days of age in two breeding periods, starter (1 to 21) and grower (22 to 42) days of age were used in a completely randomized design in 5 treatments and 3 replicates (with 20 birds in each replicate). The amounts of each medicinal plant powder were 0 to 2% for the control and the 5 experiment groups. The results showed that there were significant difference between treatments in all experiments about the carcass characteristics ($p<0.05$). By using chicory, the lowest percent of abdominal fat (2.16%) was observed in group 3, whereas the highest percent (3.61%) was observed in group 2. The highest and the lowest percents of thigh (27.70 and 25.37%) were observed in experiment groups 4 and 5. In using different levels of zizaphora the lowest and the highest percents of gizzard (2.54 and 3.1%) were observed in the control and the 5 groups. About nettle the highest and the lowest intestine percents (5.26 and 3.91%) were observed in control and 3 experiment groups, whereas the highest and the lowest gizzard percents (2.90 and 2.44%) were observed in 2 and control groups, the highest and the lowest percents of liver (3.85 and 2.87%) were observed in groups 5 and 3. Different levels of savoury could not affect the carcass characteristic in broilers, whereas different levels of chicory, zizaphora and nettle could effectively improve the carcass characteristics of broilers.

Key words: Broilers, carcass traits, medicinal plants.

INTRODUCTION

With the development and wide use of synthetic and semi-synthetic antibiotics, pros and cons have been experienced throughout the last 50 years which have directed the research back to natural antimicrobial products as indispensable resources (Ferrini et al., 2008). Several compounds like, enzymes, organic acids, probiotics, prebiotics and phytogenics are used to improve the performance (Patterson and Barkholder, 2003). Recently, aromatic plants, and their associated essential oils or extracts are being used as potentially growth promoters. At present the scientists are working to improve feed efficiency and growth rate of livestock using useful herbs (Banyapraphatsara, 2007). Some plants were found to have natural effects, for example, tonics, antiparasitic, anti-bacterial, stimulant, carminative, anti-fungial, anti-microbial and antiseptic (El- Emary, 1993; Soliman et al., 1995). As antibiotics, plant extracts could control and limit the growth and colonization of numerous pathogenic and nonpathogenic species of bacteria in the gut. The plant extracts clearly demonstrate antibacterial properties, although the mechanistic processes are poorly understood (Dorman and Deans, 2000). Thymol and carvacrol present in plants like thyme and zizaphora disrupt the membrane integrity, which further affects pH homeostasis and equilibrium of inorganic ions (Lambert et al., 2001). It was reported that some medicinal plants like black cumin seeds could be considered as a natural potential antioxidant promoter for poultry (Guler et al., 2007). In broilers using 5, 10 and 15 ml/L aqueous extracts of some plant extract mixtures significantly

improved dressing percent, breast and leg weight (Javed et al., 2009). Birds fed with 1% of parsley had the significant highest carcass weight after evisceration and dressing (Mona et al., 2010). In an experiment, using 1% of cumin increased the dressing percent of broilers carcass (Al-Kassi, 2010). Findings by the effects of some herb mixtures on carcass quality showed that using of them had no effects on dressing percent, but significantly increased gizzard weight (Franciszek et al., 2010). Modiry et al. (2010) reported that the use of 1.5% of different mixtures of *Urtica dioica*, *Mentha pulegium* and *Thymyus vulgaris* medicinal plants in broiler diets improved their performance and carcass quality. Adding chicory fructans in broiler feed significantly decreased their abdominal fat pad (Yusrizal and Chen, 2003).

The main components of those find in *Cichorium intybus L.* are inulin and oligofructose. It was reported that in feeding male broilers, a 0.375% level of oligofructose improved the percent of hot carcass weight and percent breast weight, while percent fat pad was lowered (Ammermal et al., 1989). Thymol and carvacrol are essential oils those find in *Zizaphora tenuior L.* and *T. vulgaris L.* medicinal plants that they have antimicrobial activity against fungi (Porte and Godoy, 2008).

Satureja hortensis L. is an annual, herbaceous aromatic and medicinal plant belonging to Lamiaceae. It is known as summer savoury, native to southern Europe and naturalized in North America (Sefidkon et al., 2006). Also it is widely distributed in different characteristic of Iran as one of the most important of twelve classified *Satureja* species. Its essential oil contains considerable amounts of two phenolic ketones that is, carvacrol and thymol (Ghannadi, 2002). With regards to having anti-inflamatory (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), *S. hortensis L.* received major consideration.

Nettle (*U. dioica*) is widely grown in different parts of the world and has been used to promote health. Numerous analyses of nettle have revealed the presence of more than fifty different chemical constituents. It has been extensively studied and found to contain starch, gum, albumen, sugar and two resins. Histamine, acetylcholine, choline and serotonin are also present. In a study an anti-coagulant was isolated from nettle leaves (Gülçin et al., 2004).

MATERIALS AND METHODS

Four feeding trials were conducted to investigate the effects of using different levels of some medicinal plants on carcass characteristic of male broilers. In each of these experiments 300 broilers (Ross 308) from 1 to 42 days of age in two breeding period such as starter (1 to 21 days) and grower (22 to 42 days) of age were used in a completely randomized design of 5 treatments and 3 replicates with 20 birds in each replicate. The amounts of each medicinal plant powder were 0 to 2% for the control and 5experiment groups. Dried aerial parts of medicinal plants were obtained from local market and the compositions of them were determined according to AOAC (1994). After fine milling, mixed with other ingredients the diets and water was provided *ad libitum*. The treatments in each of these experiments consisted of a control group (1) with no medicinal plant supplementation, and 0.5, 1, 1.5 and 2% in groups 2, 3, 4 and 5 respectively. The diets were formulated (Tables 1 and 2) to meet the requirements of broilers as established by the NRC (1994). The lighting programme 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°C 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.

Carcass components

At 42 days of age, six birds/per treatment were randomly chosen, slaughtered and carcass percent to total weight and percent of carcass characteristic to carcass weight were calculated.

Statistical analysis

The data were subjected to analysis of variance procedures appropriate for a completely randomized design 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

The effects of chicory on the carcass characteristic of the male broilers are given in Table 3. According to Dancan's test a significant differences were recorded among groups with respect to abdominal fat and thigh percent ($P<0.05$). The lowest percent of abdominal fat and the highest percent of thigh were observed by using 1 and 1.5% of chicory. Using different levels of chicory numerically improved the small intestine, gizzard and liver percent. The lowest percent of abdominal fat in group 3 and the highest percent of thigh in group 4 by using 1 and 1.5% of chicory could be related to relatively the lowest percent of carcass and breast percent of male broilers in these groups.

The highest percent of abdominal fat was obtained by using 0.5% of chicory in group 2. Chicory possibly promotes fat deposition along with live weight gain or since the increase in live weight gain is possibly increased by fat deposition. Increased abdominal fat in broilers fed by thyme leaves is previously reported (Ocak et al., 2008). On the contrary, Yusrizal and Chen (2003) observed that dietary inclusion of chicory fructans in broiler feed had significantly decreased the abdominal fat pad size.

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

Ingredients	Diets				
	Control group	0.5% Medicinal plants	1% Medicinal plants	1.5% Medicinal plants	2% Medicinal plants
Yellow corn	58.51	57.81	57.12	56.43	55.50
Soybean meal	32.72	32.77	32.81	32.86	32.96
Fish meal	3	3	3	3	3
Medicinal plants	0	0.5	1	1.5	2
Vegetable oil	2.53	2.72	2.91	3.1	3.29
Dicalcium phosphate	1.06	1.07	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
Crude fiber	3.71	3.79	3.88	3.97	4.06
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 D_3 (cholecalciferol), 0.05 mg; vitamin E (tocopheryl acetate),18 mg; vitamin K_3, 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 ($FeSO_4.7H_2O$, 20.09% Fe), 50 mg; Mn ($MnSO_4.H_2O$, 32.49% Mn), 100 mg; Zn (ZnO, 80.35% Zn), 100 mg; Cu ($CuSO_4.5H_2O$), 10 mg; I (K_1, 58% I), 1 mg; Se ($NaSeO_3$, 45.56% Se), 0.2 mg.

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

Ingredients	Diets				
	Control group	0.5% Medicinal plants	1% Medicinal plants	1.5% Medicinal plants	2% Medicinal plants
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	1.4	1.6	1.8
Medicinal plants	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

Table 2. Contd.

Crude protein (%)	18.75	18.75	18.75	18.75	18.75
Calcium (%)	0.85	0.85	0.85	0.85	0.85
Available phosphorous (%)	0.38	0.38	0.38	0.38	0.38
Sodium (%)	0.14	0.14	0.14	0.14	0.14
Crude fiber	3.20	3.34	3.48	3.62	3.76
Lysine (%)	1.02	1.02	1.02	1.02	1.02
Methionine + Cysteine (%)	0.67	0.67	0.67	0.67	0.67
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 D_3 (cholecalciferol), 0.05 mg; vitamin E (tocopheryl acetate), 18 mg; vitamin K_3, 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 ($FeSO_4.7H_2O$, 20.09% Fe), 50 mg; Mn ($MnSO_4.H_2O$, 32.49% Mn), 100 mg; Zn (ZnO, 80.35% Zn), 100 mg; Cu ($CuSO_4.5H_2O$), 10 mg; I (K_1, 58% I), 1 mg; Se ($NaSeO_3$, 45.56% Se), 0.2 mg.

Table 3. The effects of different levels of chicory on carcass traits of male broilers.

Carcass traits (%)	Chicory percent					
	0	0.5	1	1.5	2	SEM
Carcass	72.29	71.46	71.80	72.27	72.04	0.75
Abdominal fat	3.38^{ab}	3.61^{a}	2.16^{b}	3.35^{ab}	3.33^{ab}	0.42
Small intestine	6.02	7.30	5.70	6.51	5.91	0.67
Gizzard	2.54	2.79	2.48	2.74	2.59	0.14
Breast	34.44	33.35	34.04	31.81	32.23	1
Thigh	25.87^{ab}	25.79^{ab}	26.17^{ab}	27.70^{a}	25.37^{b}	0.59
Liver	2.89	3.01	3.02	3.11	3.18	0.21

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 zizaphora on carcass traits of male broilers.

Carcass traits (%)	Zizaphora percent					
	0	0.5	1	1.5	2	SEM
Carcass	72.29	73.2	71.15	71.35	71.48	1.45
Abdominal fat	3.38	2.47	2.75	2.55	2.88	0.38
Small intestine	6.02	6.61	7.07	7.19	7.76	0.55
Gizzard	2.54^{b}	2.68^{ab}	2.64^{ab}	2.56^{b}	3.1^{a}	0.15
Breast	34.44	34.34	29.77	32.14	32.04	1.91
Thigh	25.87	26.05	25.28	25.75	26.58	0.71
Liver	2.89	2.92	2.95	2.98	3.1	0.21

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

The effects of different levels of zizaphora in feeds on carcass characteristic of male broilers are shown in Table 4. Only gizzard percent was significantly affected by using different levels of zizaphora (P<0.05). The highest percent of gizzard was observed by using 2% of zizaphora, whereas the lowest percent was observed in control group. Using different levels of zizaphora numerically improved the abdominal fat pad size. Carvacrol is an essential oil found in *Zizaphora tenuior L.* and it has antimicrobial activity against fungi (Porte and

Table 5. The effects of different levels of nettle on carcass traits of male broilers.

Carcass traits (%)	Nettle percent					
	0	0.5	1	1.5	2	SEM
Carcass	70.14	71.58	72.47	69.07	69.15	1.04
Abdominal fat	4.07	4.14	4.32	3.9	3.42	0.26
Small intestine	5.26^{a}	4.09^{bc}	3.91^{c}	4.74^{ab}	4.35^{bc}	0.21
Gizzard	2.44^{b}	2.9^{a}	2.61^{ab}	2.80^{ab}	2.66^{ab}	0.12
Breast	29.93	32.37	32.58	32.06	32.57	1.06
Thigh	27.13	26.90	27.47	27.68	26.02	0.7
Liver	3.42^{ab}	3.40^{ab}	2.87^{b}	3.26^{ab}	3.85^{a}	0.22

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

Table 6. The effects of different levels of savoury on carcass traits of male broilers.

Carcass traits (%)	Savoury percent					
	0	0.5	1	1.5	2	SEM
Carcass	69.81	69.58	69.61	72.41	71.58	0.85
Abdominal fat	3.81	4.15	3.59	3.66	3.97	0.33
Small intestine	5.41	5.23	5.3	4.37	4.95	0.34
Gizzard	2.99	2.71	2.79	2.57	2.78	0.2
Breast	30.71	30.88	31.23	32.13	30.99	0.9
Thigh	27.65	27.73	27.88	25.99	27.17	0.58
Liver	3.15	3.11	3.29	3.01	3.03	0.25

Godoy, 2008). Contrary to the findings of this study, it was reported that carvacrol additives increased the abdominal fat weight compared to control and menthol groups (Erener et al., 2005). Significantly, the increase of the gizzard size in group 5 could be associated with an increased amount of dietary fiber by using 2% of zizaphora in this group.

The effects of different levels of nettle in feeds on carcass characteristics of male broilers are summarized in Table 5. Using different levels of nettle had significant effects on carcass characteristic of male broilers (P>0.05). The highest percent of gizzard and liver were observed by using 0.5 and 2% of nettle, whereas the lowest percent of small intestine, gizzard and liver were observed in 3 and control groups. Decreasing the small intestine percent may be attributed to the stimulatory and promotive effects of nettle components. Similar to this finding Alcicek et al. (2004) expressed that herbal essential oil mixtures decreased intestine weights. Whereas, Cabuk et al. (2006) stated that plant essential oil mixtures did not have any effects on small intestine weight of broilers. Increase in gizzard weight by using nettle may be related with an increased amount of dietary fiber. The effects of different levels of savoury in feeds on carcass characteristic of male broilers are summarized in Table 6. Using different levels of savoury did not have significant effects on carcass characteristic of male broilers (P<0.05). It can be concluded that medicinal plants contain substances which have positive effects on carcass characteristics in male broilers.

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