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Growth response and carcass characteristics of Japanese quail to *Mentha piperita* plant supplementation

[1]Babak Aminzade, [1]Behzad Karami, [2]Elias Lotfi

[1] Department of Animal Science, Gorgan University of Agricultural Sciences and Natural Resources; [2] Young Researchers Club, Gorgan Branch, Islamic Azad University, Gorgan, Iran.

Abstract. In current study, the effect of *Mentha piperita* plant (MPP) supplementation on performance and carcass characteristics in Japanese quail was investigated. A total of 180 quails (male and female) were carried out in completely randomized design with diet consisted of the basal diet as the control (0MPP), diets with MPP at 1.5% (15 g/kg MPP) and 3% (30 g/kg MPP). Four replicates with 15 quails were allocated to each experimental treatment and the birds were reared for 42 days. The diets were formulated according to NRC (1994) guidelines and contained 24% protein and 2900 kcal/kg ME. The results showed that weight gain, feed intake and feed conversation was significantly affected by levels of MPP ($p<0.05$). Quails fed with 1.5% MPP had more percentage of breast muscle compared to quails fed 0 and 3% MPP. Feed conversion ratio was significantly improved in quails received 1.5% compared to 3% ($p<0.05$). There was no significant difference for percentage of carcass and thigh muscle among experimental treatments. The result showed adding various levels of MPP was improved feed conversion ratio and increase body weight in Japanese quail.

Key Words: Japanese quail, performance, carcass, *Mentha piperita* plant.

Corresponding Author: E. Lotfi, Elias.lotfi@gmail.com

Introduction

In general, the use of various plant materials as dietary supplements may positively affect poultry health and productivity. There are some important bioactive components such as alkaloids, bitters, flavonoids, bioflavonoids, glycosides, mucilage, saponins, tannins (Vandergrift 1998) phenols, guinones, coumarins, essential oils and polypeptides (Cowan 1999) in the structures of nearly all the medicinal plants. *Mentha piperita* plant (MPP) is one of the world's oldest medicinal herbs and used in both Eastern and Western traditions. This plant is a perennial plant in Lamiaceae family and contains about 1.2-1.5% essential oils. The principal components of the oil are menthol (35-55%), menthone (20-30%) and menthyl acetate (3-10%) (Escop 2003). Supplementing diets with MPP addition basal requirements has been shown to enhance performance and primary immune responses by increasing number of antibody forming cells in broiler chicken. (Galib & Al-Kassie 2010; Abdulkarimi & Abdullahzadeh 2011). The immune system includes cell mediated and humoral immune responses, macrophage function and phagocytosis and improved resistance to disease (Finch & Turner 1996). In Japanese quail, as well as in chickens, medicinal plant supplementation in diet can be had effects on growth and performance. Therefore, the present study was conducted to elucidate the response of growing Japanese quail and carcass characteristics to *Mentha piperita* plant (MPP) supplementation.

Material and Method

Stock, husbandry and traits

A total of 180 one-day-old Japanese quails (*Coturnix japonica*) were randomly allocated to three treatment groups. The birds were randomly assigned, according to their initial body weights, into 3 groups with 4 replicates of 15 birds. The birds were reared in cages of identical size (100 x 100 cm floor area and 80 cm in height) for 42 days of experimental period. All the groups were subjected to similar management practices (brooding, lighting, feeding and watering) throughout the experiment except the diets offered. The birds received a diet consisted of the basal diet as the control (0MPP), diets with MPP at 1.5% (15g/kg MPP) and 3% (30g/kg MPP). Ingredients and chemical compositions of the basal diet are shown in Table 1. Crude protein contents of the diets were estimated by the method of AOAC (2005). The diets were formulated using NRC (1994) guidelines and contained 24% protein and 2900 kcal/kg ME. Quails were provided with feed and fresh water for ad libitum consumption. Body weight and feed consumption of each group were recorded weekly starting from one day of age and a sensitive electronic scale (0.01 g) was used to weigh. Growth performance was evaluated in terms of body weight gain, feed intake (FI) and feed conversion ratio (FCR). At the end of experiment, two birds from each replicate of the treatment (8 birds per each dietary treatment and 24 in total) were selected randomly and were submitted to 6 h of feed withdrawal prior to slaughter. After slaughter, carcass traits were measured on the chilled carcass after removal of feathers, head, lungs, liver, kidneys, gastrointestinal tract and abdominal fat.

Statistical analysis

The experiment was conducted as a completely randomized design. The obtained data growth performance and carcass composition were subjected to statistical analysis using the general linear model (GLM) procedures of the SAS software (SAS Institute, 2001). Significant differences among the means of treatments were determined by using Duncan test.

Table 1. Ingredients and chemical composition of base diet fed to Japanese quails[a]

Ingredients (Percentage)	Amount	Calculated chemical component	
Corn (CP= 7.89%)	50.5	Metabolizable energy (kcal/kg)	2900
Soybean meal (CP= 43.68%)	42.03	Crude Protein %	24
Fish meal (CP=55.32)	3	Calcium %	0.8
Soy oil	2.07	Availability P %	0.3
Dicalcium phosphate	0.32	Sodium %	0.15
Limestone	1.16	Lysine %	1.39
Salt	0.3	Methionine %	0.5
Mineral premix [b]	0.25	Methionine + cysteine %	0.88
Vitamin premix [b]	0.25	-	-
DL-Methionine	0.12	-	-

[a] Calculated composition was according to NRC (1994)

[b] Mineral premix Premix supplied for 2.5 kg: Mn 165350 mg; Fe 250000 mg; Zn 249000 mg; Cu 40000 mg; iodine 1600 mg; choline cloride 335350 mg.

[b] Vitamin Premix supplied for 2.5 kg: vitamin A 9000000 IU; vitamin D_3 2000000 IU; vitamin K_3 4000 mg; vitamin B_1 1800 mg; vitamin B_2 8250 mg; vitamin B_3 10000 mg; vitamin B_5 30000 mg; vitamin B_6 3000 mg; vitamin B_9 1250 mg; vitamin B_{12} 1500 mg; biotin 5000 mg.

Table 2. Effects of different levels of MPP on growth performance of Japanese quails at different periods of ages

	0-21 days of age			21-42 days of age			0-42 days of age		
Treatment	WG	FI	FCR	WG	FI	FCR	WG	FI	FCR
0 MPP	107.34	238.97[a]	2.23[a]	90.60[b]	504.66	5.56[a]	193.33[b]	793.48[a]	3.94[a]
1.5% MPP	113.23	206.61[b]	1.82[b]	121.29[a]	507.07	4.18[c]	234.52[a]	713.68[b]	3.05[b]
3% MPP	110.67	200.84[b]	1.80[b]	124.33[a]	518.3	5.01[b]	235[a]	719.14[b]	3.01[b]
SEM	3.94	4.06	0.017	3.18	5.39	0. 29	6.84	9.24	0.16
Probability	0.271	0.023	0.015	0.008	0.479	0.001	0.03	0.001	0.007

Values in the same column with different superscripts are significantly different

[1] Each value is the mean ± SEM

Table 3. Effects of different levels of MPP on percentage of carcass composition at 42 days of age

Treatment	Carcass	Breast	thigh	Abdominal fat	Liver	Bursa of Fabricius	spleen
0 MPP	62.61	20.23[b]	15.02	1.3	1.86[b]	0.08	0.05
1.5% MPP	65.78	25.17[a]	15.15	1.22	1.99[b]	0.09	0.05
3% MPP	64.32	24.53[a]	15.13	1.19	2.17[a]	0.12	0.07
SEM	2.09	0.98	0.84	0.1	0.05	0.005	0.005
Probability	0.392	0.04	0.93	0.26	0.03	0.29	0.48

Values in the same column with different superscripts are significantly different

[1] Each value is the mean ± SEM

Results and Discussion

Performance traits

The effect of MPP Supplementation on performance is shown in Table 1. The obtained results in this study showed that there was no difference among all treatments for weight gain in 0-21 and for feed intake in 21-42 days of age (P>0.05). But for the overall experimental period (0-42 days of age), using MPP in diet of Japanese quail had significant effects on weight gain, feed intake and feed conversion. No work containing detailed effect of MPP (performance and carcass characteristics) could be found for Japanese quail. Therefore, the results of the current study compared with the other poultry species. The results of the present study are in agreement with the observations reported by Ankari *et al* (2004), Ocak *et al* (2008) and Nobakht *et al* (2011) in broiler who reported that use of medicinal plant supplement could significantly improve the growth of broilers. The lowest amount of weight gain and the worst feed conversion were observed in the control group, whereas the highest amount of weight gain and the best feed conversion were observed in groups containing MPP. Using more than 1.5% of MPP did not have any significant effects on feed intake and feed conversion in 0-21 days of age but significantly difference was observed between levels of 1.5% and 3% MPP in 21-42 days of age for feed conversion ratio. According to studies of Souri *et al* (2004) and Jazani *et al* (2009) antimicrobial, antioxidant,

phenolic substances, essential oils, lectins and polypeptides in the structures of medicinal plants such as MPP may be the main cause of improvements in weight gain. The mechanism of action of medicinal plant has not been very clearly defined yet but there are suggestions that the antioxidants can prevent nutrients oxidation and the antimicrobial component can decrease the harmful bacterial populations in the gastrointestinal tract of birds. Lee *et al* (2003) reported that the presence of harmful bacterial populations in the gastrointestinal tract may cause the breakdown of amino acids and thereby reduce their absorption. Therefore, the antimicrobial properties of MPP can reduce the harmful bacterial populations in the gastrointestinal tract and improve the levels of absorbed amino acids.

Carcass characteristics

The effect of MPP Supplementation on carcass characteristic is shown in Table 2. However, MPP supplementation had no significant effect on carcass composition, but there were numerical increases when MPP was added to diets, compared to the control group. The improvement of carcass traits by using of MPP is in agreement with the experimental results of Nobakht *et al* (2010) and Nobakht (2011) who reported that a blend of *M. pulegium* L. with another medicinal herb significantly improved the carcass traits such as breast muscle of broilers. The carvacrol in *M. pulagum* plant has stimulatory effects on pancreatic secretions by increasing the secretions of digestive enzymes more amounts of nutrients like amino acids can be digested and absorbed from the digestive tract and thereby improves carcass traits. Although, MPP had no significant effect on abdominal fat but there was a linear decrease of abdominal fat with the increase in MPP which this is similar to the result of Yusrizal & Chen (2003), Norbakht (2011) and Hoseni Mansoub (2011). Also on the contrary with our result, Increased abdominal fat in broilers fed by thyme leaves is previously reported (Ocak *et al* 2008). The effect of supplements was not significant on the relative weights of the internal organs except liver. Similar to the results obtained in this study, Toghyani *et al* (2010), Galib & Kassie (2010) and Hosseini Mansoub (2011) also showed that liver weight of control group was lower than those of the other group containing medicinal plant. Supplementing dietary MPP had no significant effect on the relative weights of the bursa and spleen ($P>0.05$). According to our knowledge, no publications could be found about the effect of dietary MPP on lymphoid organs such as Bursa of Fabricius and spleen and this it's difficult to compare with other study. The high value of internal organ observed in quails fed the MPP diet may be related to the reported properties of menthol.

Conclusion

In conclusion, supplementation medicinal plant such as *Mentha piperita* can be helpful for poultry nutritionist although more detailed studies are still needed to elucidate the effect of *Mentha piperita* plant on poultry nutrition under various circumstances.

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Authors

•Babak Aminzade, Department of Animal Science, Gorgan University of Agricultural Sciences and Natural Resources, Iran, PO Box 386, Shahid Beheshti Street, Babak_Aminzade@yahoo.com

•Behzad Karami, Department of Animal Science, Gorgan University of Agricultural Sciences and Natural Resources, Iran, PO Box 386, Shahid Beheshti Street, Behzadkarami1363@yahoo.com

•Elias Lotfi, Young Researchers Club, Gorgan Branch, Islamic Azad University, Gorgan, Iran, e-mail: Elias_lotfi@gmail.com

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