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Effect of *Mentha caucasica* on Growth Performance and Carcass Characteristics of Japanese Quail (*Coturnix coturnix japonica*)

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Abstract: This study was conducted to determine the effect of *Mentha caucasica* on growth performance and carcass characteristics in Japanese quails. A total of 150 day old Japanese quail chicks were used in the study. The quails were allocated to 3 groups each comprising 50 animals including the control group, mint group I (given feed added with 0.75% of mint) and mint group II (given feed added with 1.5% of mint). Statistically significant differences were determined between the feeding groups for the body weights measured on days 35 and 42 ($p<0.05$; $p<0.01$). In conclusion, it was ascertained that the supplementation of the feed ration with mint (*Mentha caucasica)* affected both the growth performance and carcass characteristics of the Japanese quail. However, as *Mentha caucasica* decreases liver weight in quails, it should be used with caution.

Key words: *Mentha caucasica*, growth performance, carcass, Japanese quail, animal

INTRODUCTION

Today, quail breeding is rather common as an alternative poultry subsector. The main targets of quail breeding are to achieve high egg production as well as high body weight gain and high carcass yield with low feed consumption. For this purpose, feed additives are incorporated at varying levels into feed rations. It is reported that several feed additives used in poultry nutrition (i.e., antibiotics, hormones) have adverse effects on human health. Therefore, in recent years, aromatic plants which do not induce any adverse effect on human health have started to be used as feed additives (Erener *et al*., 2001; Adiyaman and Ayhan, 2010).

It has been determined that some aromatic plants incorporated into poultry rations have antioxidant, antimicrobial, anticoccidial and growth performance enhancing properties (Christaki *et al*., 2012). Kahraman (2009) reported mint to contain menthol and to display appetizing, digestive and antiseptic features. In their study on Japanese quails, Akkaya *et al.* (2008) determined that the supplementation of the feed ration with different rates of mint resulted in a positive effect on growth performance and some egg quality traits. In earlier research on the Japanese quail, it has been reported that the hatching weight ranges between 6.28-6.98 g and that the body weight at the 6th week ranges between 178.16-180.82 g (Yildirim and Yetisir, 1998; Ozcan *et al*., 2001). Caglayan and Inal (2006) ascertained that the hatching weight and the body weights at 1-6 weeks ranged between 6.84-11.16, 22.51-28.63, 46.10-53.97, 84.89-98.10, 117.41-136.85, 147.51-174.77 and 164.17-199.94 g, respectively. They also determined that the mean body weight gain between weeks 1-6 ranged between 157.34-188.78 g. Ocak *et al.* (2008) reported that the addition of mint into broiler rations increased body weight gain between days 7 and 35 but did not have any effect on carcass weight. In some other research on quails (Bahnas *et al*., 2008; Akkaya *et al*., 2008), it was observed that the incorporation of mint into the feed ration did not produce any effect on carcass weight.

This study was aimed at determining the effect of mint (*Mentha caucasica*) on growth performance and carcass characteristics in the Japanese quail.

MATERIALS AND METHODS

This study was approved by the decision dated 15.03.2013 and numbered 2013/07 of the Ethics Board for Animal Experiments of Kyrgyzstan-Turkey Manas University. The study was conducted at the premises of the Research and Practice Unit of the Faculty of

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Veterinary Medicine of Kyrgyzstan-Turkey Manas University. A hundred and fifty day old Japanese quails constituted the animal material of the study.

The quails were weighed on an electronic scale with a precision of 0.01 g and were allocated to three groups, each comprising 50 animals, namely, the control group, the mint group I (given feed added with 0.75% of mint) and the mint group II (given feed added with 1.5% of mint). These three groups were housed in 3 cages measuring 130×80×65 cm of which the floor was covered with wood shavings. The room was heated using quartz heaters. During the first 4 h the chicks were provided only with water added 5% of sugar. As from the 4th h, the animals were provided with *ad libitum* feed and water.

The quails were provided with feed containing 23% of Crude Protein (CP) and 2800 kcal kg^{-1} Metabolizable Energy (ME) (Ensminger, 1992). The composition of the feed ration used for the nutrition of the quails is shown in Table 1. Natural ventilation and a 24 h lighting period were applied in the room. The room temperature was adjusted to 35-36°C at chick level and was progressively decreased 2.5-3°C per week to a level of 20-21°C by the 6th week. The body weight of the quails was measured weekly using an electronic scale. In order to calculate the feed conversion rate, the amount of feed remaining in the feeders by the end of each week was weighed and recorded.

Table 1: Composition and nutrient value (%) of the rations fed to the animals

Ingredients (%)	Control group	Mint group I	Mint group II
Sunflower oil	0.33	0.33	0.33
Wheat bran	4.32	3.57	2.82
Wheat	19.00	19.00	19.00
Corn	30.00	30.00	30.00
Sunflower meal, 32% CP	20.00	20.00	20.00
Fish meal, 64% CP	5.20	5.20	5.20
Meat meal, 42% CP	2.25	2.25	2.25
Full-fat soybean	17.50	17.50	17.50
Limestone	0.80	0.80	0.80
Mint (*Mentha caucasica*)	-	0.75	1.50
Salt	0.30	0.30	0.30
Vitamin-mineral premix*	0.30	0.30	0.30

*Provided per 5 kg of premix: Vitamin A, 21 million IU; Vitamin D3, 2.8 million IU; Vitamin E 28000 mg; Vitamin K3, 7000 mg; Vitamin B1, 4900 mg; Vitamin B2, 10500 mg; Vitamin B6, 7000 mg; Vitamin B12, 28 mg; Nicotinamid, 35000 mg; Cal-D-Pan, 14000 mg; Folic acid, 1050 mg; D-biotin, 70 mg; Colin 560 000 mg; Mn, 112000 mg; Fe, 56000 mg; Zn, 84000 mg; Cu, 7000 mg; I, 2800 mg; Co, 700 mg; Se, 210 mg; Antioxidant 14000 mg

With an aim to determine the carcass characteristics, 10 (5 male and 5 female) and 8 weeks old quails, randomly selected from each group were slaughtered. Prior to slaughter, the body weight of the animals was measured. Following slaughter, the hot carcass weight of the carcasses without the skin and internal organs was determined. Subsequently, the carcass was cut into the legs, wings, breast and neck+back. Of the internal organs, the liver, gizzard, heart and spleen were weighed.

Statistical method: Variance analysis and Duncan's test were used for the comparison of the feeding groups whilst the t-test was performed for the comparison of the sex groups. Percentage values were transformed by the arcsin transformation. Statistical analyses were performed using the SPSS 15.0 Software Package.

RESULTS AND DISCUSSION

The body weight and body weight gain of the quails included in the different feeding groups established in this study are shown in Table 2. No interaction was determined between the feeding groups and sex groups. According to the results obtained in the feeding groups, the quails displayed statistically significant differences for body weight on days 35 and 42 ($p<0.05$; $p<0.01$). While the mean body weights of mint group I and mint group II were observed to be similar, the mean body weights measured in mint group I were higher than those measured in the control group (Table 2). The mean body weights determined in the present study were lower than some values earlierly reported for quails of similar age groups (Yalcin *et al*., 1995; Caglayan and Dere, 2007; Sahin *et al*., 2007; Alkan *et al*., 2010; Bonos *et al*., 2010) and higher than some values indicated in some other literature reports (Agiang *et al*., 2011; Tulobaev *et al*., 2012).

Table 2: Body weight and body weight gain (g) of quails in feeding groups (X±Sx)

Groups	n	Hatching	7 days	14 days	21 days	28 days	35 days	42 days
Body weight								
Control group	50	7.80±0.11	12.47±0.27	23.47±1.04	42.89±2.21	60.30±3.42	67.59±3.78^{b}	86.55±3.51^{b}
Mint group I	50	7.80±0.10	12.20±0.24	23.73±1.00	42.11±1.63	63.20±3.01	78.37±4.52^{ab}	99.34±3.77^{a}
Mint group II	50	7.81±0.12	12.17±0.29	24.86±1.13	43.91±2.37	65.10±3.62	85.99±3.64^{a}	100.87±3.51^{a}
Total	150	7.80±0.06	12.28±0.15	24.02±0.61	42.97±1.19	62.87±1.93	77.32±2.44	95.59±2.18
p-value		NS	NS	NS	NS	NS	**	*
Body weight gain								
Control group	50		4.40±0.34	11.00±1.02	19.42±2.00	17.42±3.03	7.28±4.49	18.96±4.63
Mint group I	50		4.36±0.29	11.52±1.03	18.38±2.03	21.09±2.93	15.17±4.11	20.97±5.72
Mint group II	50		4.48±0.34	12.70±1.14	19.04±2.78	21.19±3.87	20.89±4.89	14.88±4.52
Total	150		4.41±0.19	11.74±0.61	18.95±1.31	19.90±1.89	14.45±2.65	18.27±2.85
p-value			NS	NS	NS	NS	NS	NS

^{a,b}Differences between mean values shown with different superscripts in the same column are statistically significant (*$p<0.05$; **$p<0.01$), NS: $p>0.05$

Based on the values presented in Table 3, the feeding groups were determined not to differ from each other for body weight gain ($p>0.05$). The mean body weight gain values determined in the present study were lower than the values reported in some earlier studies (Erener *et al*., 2001; Caglayan and Inal, 2006) and higher than those reported in some other studies (Seven *et al*., 2011; Biricik *et al*., 2012). Contrary to this study, Seven *et al*. (2011) reported that the supplementation of quail rations with bee pollen had effect on body weight gain and Sharifi *et al*. (2013) suggested that the addition of mint into the feed ration induced positive effect on body weight gain in broiler chickens.

The daily feed consumption and feed conversion rates of the feeding groups are presented in Table 3. Accordingly, daily feed consumption between days 0-42 was ascertained as 11.05 g. The daily feed consumption values determined in the present study were observed to be lower than those reported in some earlierly conducted research (Erener *et al*., 2001; Bonos *et al*., 2010; Agiang *et al*., 2011; Aminzade *et al*., 2012) and were found to be in compliance with some other earlierly reported values (Biricik *et al*., 2012). The feed conversion rate between days 0-42 was calculated as 5.31. In general, it was observed that in the groups fed with mint, the feed conversion rate tended to decrease between days 8-28. The feed conversion rates determined in the present study were higher than those reported in some literature reports (Kahraman, 2009; Bonos *et al*., 2010; Agiang *et al*., 2011; Aminzade *et al*., 2012; Biricik *et al*., 2012) and complied with some other (Erener *et al*., 2001). Similarly, Sharifi *et al*. (2013) indicated that the supplementation of broiler rations with mint positively influenced feed conversion rates.

The slaughter and carcass characteristics determined in the feeding groups and sex groups are presented in Table 4-5. The groups did not differ for these traits, excluding liver weight, liver yield and gizzard yield. The incorporation of mint into the feed ration reduced the liver weight and in parallel, decreased the liver yield of quails ($p<0.05$). In this study, it was observed that the mean liver weight, liver yield and gizzard yield values of female quails were higher than those of male quails ($p<0.05$). The slaughter and carcass characteristics determined in the present study were found to be in compliance with values earlierly reported in some research (Alkan *et al*., 2010; Bahnas *et al*., 2008; Akkaya *et al*., 2008; Genchev *et al*., 2008; Bonos *et al*., 2010; Agiang *et al*., 2011;

Table 3: Daily feed consumption (g) and feed conversion rate of quails in feeding groups

Groups	n	0-7 days	08-14 days	15-21 days	22-28 days	29-35 days	36-42 days	0-42 days
Daily feed consumption								
Control group	50	5.35	10.27	13.67	11.07	11.62	13.96	10.77
Mint group I	50	5.35	9.94	15.03	11.77	12.10	14.95	11.35
Mint group II	50	5.66	10.22	13.11	12.47	12.12	13.19	11.02
Total	150	5.45	10.14	13.94	11.77	11.94	14.03	11.05
Feed conversion rates								
Control group	50	8.50	6.54	4.93	4.45	11.17	5.15	5.74
Mint group I	50	8.60	6.04	4.99	3.91	5.58	4.99	5.21
Mint group II	50	8.93	5.63	4.33	4.12	4.06	6.21	4.97
Total	150	8.68	6.07	4.75	4.16	6.94	5.45	5.31

Table 4: Slaughter and carcass characteristics of quails in feeding groups (X±Sx)

Characteristics	Control group (n = 10)	Mint group I (n = 10)	Mint group II (n = 10)	Total (n = 30)	p-value
Slaughter weight (g)	111.58±3.78	122.06±9.34	115.95±5.40	116.53±3.76	NS
Carcass weight (g)	65.70±2.66	70.12±4.33	68.46±3.14	68.09±1.95	NS
Carcass yield (%)	58.85±1.19	58.01±1.44	59.08±0.58	58.65±0.63	NS
Leg weight (g)	14.99±0.65	16.66±1.09	15.71±0.64	15.79±0.48	NS
Leg yield (%)	22.82±0.39	23.74±0.40	23.05±0.58	23.20±0.27	NS
Wing weight (g)	5.71±0.18	5.90±0.19	5.88±0.22	5.83±0.11	NS
Wing yield (%)	8.74±0.22	8.58±0.32	8.64±0.23	8.65±0.15	NS
Breast weight (g)	24.47±1.30	25.53±1.50	26.02±1.35	25.34±0.78	NS
Breast yield (%)	37.13±0.86	36.49±0.56	37.99±0.93	37.20±0.46	NS
Neck+back weight (g)	20.48±0.86	21.91±1.70	20.72±1.29	21.04±0.75	NS
Neck+back yield (%)	31.23±0.67	31.04±0.77	30.14±0.73	30.80±0.41	NS
Liver weight (g)	2.90±0.19^{a}	2.41±0.13^{b}	2.39±0.14^{b}	2.57±0.10	*
Liver yield (%)	4.49±0.36^{a}	3.49±0.16^{b}	3.55±0.24^{b}	3.84±0.17	*
Gizzard weight (g)	3.64±0.17	3.38±0.35	3.55±0.35	3.52±0.17	NS
Gizzard yield (%)	5.63±0.36	4.86±0.46	5.25±0.58	5.25±0.27	NS
Heart weight (g)	0.96±0.07	1.01±0.08	1.02±0.06	0.99±0.04	NS
Heart yield (%)	1.45±0.08	1.44±0.06	1.48±0.05	1.46±0.04	NS
Spleen weight (g)	0.15±0.03	0.11±0.01	0.11±0.01	0.12±0.01	NS
Spleen yield (%)	0.24±0.05	0.15±0.02	0.15±0.01	0.18±0.02	NS

^{a,b}Mean values shown with different superscripts in the same row are statistically significant ($^{*}p<0.05$), NS: $p>0.05$

Table 5: Slaughter and carcass characteristics of quails in sex groups (X±Sx)

Characteristics	Male (n = 15)	Female (n = 15)	p-value
Slaughter weight (g)	118.17±4.78	114.89±5.95	NS
Carcass weight (g)	70.41±3.06	65.77±2.38	NS
Carcass yield (%)	59.51±0.55	57.79±1.12	NS
Leg weight (g)	16.09±0.73	15.49±0.62	NS
Leg yield (%)	22.85±0.32	23.56±0.43	NS
Wing weight (g)	5.94±0.16	5.72±0.16	NS
Wing yield (%)	8.55±0.24	8.75±0.16	NS
Breast weight (g)	26.72±1.11	23.96±1.01	NS
Breast yield (%)	38.05±0.73	36.35±0.50	NS
Neck+back weight (g)	21.54±1.29	20.53±0.79	NS
Neck+back yield (%)	30.36±0.63	31.25±0.53	NS
Liver weight (g)	2.37±0.12	2.77±0.13	*
Liver yield (%)	3.42±0.18	4.26±0.25	*
Gizzard weight (g)	3.26±0.21	3.79±0.26	NS
Gizzard yield (%)	4.68±0.31	5.81±0.40	*
Heart weight (g)	1.06±0.06	0.93±0.04	NS
Heart yield (%)	1.50±0.05	1.41±0.05	NS
Spleen weight (g)	0.12±0.01	0.12±0.02	NS
Spleen yield (%)	0.17±0.02	0.20±0.03	NS

*p<0.05, NS: p>0.05

Table 6: Pearson's correlation coefficients between parts of the carcass in quails (n = 30)

Characteristics	Carcass weight	Leg	Wing	Breast	Neck+back	Liver	Gizzard	Heart	Spleen
Slaughter weight	0.907**	0.896**	0.718**	0.782**	0.866**	0.224	0.439*	0.651**	-0.036
Carcass weight		0.928**	0.830**	0.914**	0.931**	0.136	0.271	0.775**	0.030
Leg			0.717**	0.762**	0.875**	0.146	0.383*	0.642**	-0.047
Wing				0.806**	0.715**	0.180	0.158	0.654**	0.081
Breast					0.727**	0.008	0.086	0.726**	0.097
Neck+back						0.230	0.348	0.752**	0.002
Liver							0.421*	-0.071	0.411*
Gizzard								0.071	0.019
Heart									0.154

*p<0.05; **p<0.01

Aminzade *et al*., 2012; Biricik *et al*., 2012; Akram *et al*., 2013; Karami *et al*., 2013). Contrary to this study, no difference was reported in the weight of internal organs by Khaksar *et al*. (2012) as a result of the incorporation of thyme oil into quail rations or by Nanekarani *et al*. (2012) as a result of mint incorporation into broiler rations.

The pearson correlation coefficients between the quail carcass parts are given in Table 6. In the present study while slaughter weight was found not to be correlated with liver weight and spleen weight, a positive and strong correlation was found to exist between the other carcass parts (p<0.05; p<0.01). No correlation existed between liver weight and the other carcass parts. However, liver weight was ascertained to be strongly and positively correlated with gizzard weight and spleen weight. Heart weight was found not to be correlated with liver weight or gizzard weight. Contrary to this study, Alkan *et al*. (2010) reported that slaughter weight was not correlated with leg and neck+back weight. On the other hand, similar to this study, Vali *et al*. (2005) reported body weight to be positively and strongly correlated with carcass, breast and leg weights.

CONCLUSION

In conclusion, in the present study, it was determined that the incorporation of *Mentha caucasica* into quail feed rations affected both growth performance and carcass characteristics. Therefore, the supplementation of quail rations with *Mentha caucasica* could be recommended. However, as the addition of mint into the ration causes a decrease in liver weight and liver yield, *Mentha caucasica* should be used with caution in the nutrition of quails. The conduct of further studies and the generation of further results based on the use of different rates of mint in feed rations would provide a deeper insight into the potential use of *Mentha caucasica*.

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