Contents lists available at ScienceDirect

Asian Pacific Journal of Tropical Biomedicine

journal homepage:www.elsevier.com/locate/apjtb

Document heading doi:

Efficiency of ethanolic extract of peppermint (*Mentha piperita*) as an antibiotic growth promoter substitution on performance, and carcass characteristics in broiler chickens

Shahram Nanekarani[1*], Majid Goodarzi[1], Mohammad Heidari[2], Nasir Landy[3]

[1] *Department of Animal Science, Broujerd Branch, Islamic Azad University, Broujerd, Iran*
[2] *Department of Animal Science, Sanandaj Center,Pyame Nour, Sanandaj, Iran*
[3] *Young Researchers Club, Khorasgan Branch, Islamic Azad University, Isfahan, Iran*

ARTICLE INFO

Article history:
Received 27 September 2012
Received in revised form 30 September 2012
Accepted 11 November 2012
Available online 28 December 2012

Keywords:
Broilers
Mentha piperita
Performance
Carcass traits

ABSTRACT

Objective: This trial was conducted to examine the effect of usage different levels of ethanolic extract of peppermint (*Mentha piperita*) in drinking water in comparison with an antibiotic growth promoter (Virginiamycin) on the growth performance, and carcass traits of broiler chicks. **Methods:** Birds were assigned to 5 treatments: control feed, antibiotic group receiving 5 mg/kg virginiamycin, and 0.1, 0.2 and 0.3 % ethanolic extract of peppermint supplemented to drinking water. Body weights of broilers were determined at d 1, 21 and 42, feed intake was determined at the same periods, and feed conversion ratio was calculated accordingly. At day 42, two birds per replicate were slaughtered for the determination of carcass traits. **Results:** Performance indices were not significantly influenced by the dietary treatments at day 42. Carcass yield increased in broilers supplemented with 0.3 % peppermint extract in drinking water, also, abdominal fat pad decreased in broilers supplemented with 0.3 % peppermint in drinking water (P>0.05). **Conclusions:** In conclusion, the results of this study showed that addition of 0.3 % ethanolic extract of peppermint to drinking water seem to have a positive influence on broiler performance productive via more carcass yield and decrease abdominal fat deposition.

1. Introduction

For the past several decades, different strategies have been applied to improve poultry productivity and profitability. Antibiotics growth promoters (AGP) have been supplemented to animal diets to promote growth, protect health and maximize the genetic potential of poultry [1-4]. However, issues such as loss of antibiotic efficiency along time and risk of residues in food of animal origin, with the possible development of bacterial resistance in humans, have concerned consumers [5], creating a significant problem for poultry production.

After the ban of antibiotic growth promoters in the European Union countries many alternative substances have been investigated for their potential to replace AGPs. Phytobiotics are discussed as one promising alternative due to their high content of pharmacologically active compounds[6].

Peppermint (*Mentha piperita*) is a member of the Labiatae family and one of the world's oldest medicinal herbs, and is used in both Eastern and Western traditions. It is widely used in herbal medicine and believed to be particularly beneficial in building the immune system and fighting secondary infections. Mentha extract possesses essential oil, tannins, glycosides, saponins and other components. Menthol is the main phenolic component in oil of *Mentha piperita* which has antibacterial activities [7]. Also, peppermint contains polyphenolic compounds, and hence could possess strong antioxidant properties [8].

Al-Ankari *et al*[9] observed the beneficial influence of wild mint on broilers productive performance. On the other hand, Toghyani *et al*[10] and Ocak *et al*[11] did not observed any positive effect of dry peppermint on broiler performance and carcass traits. The present study was designed to examine the efficacy of different levels of ethanolic extract of peppermint (*Mentha piperita*) as an antibiotic growth promoter on growth performance, and carcass characteristics in broiler chickens when used as

*Corresponding author: Department of Animal Science, Broujerd Branch, Islamic Azad University, Broujerd, Iran.
Tel: +98 912 335 91 20; fax: +98 311 2681401-5.
E-mail address: sh.nanekarani@gmail.com.

supplements in the drinking water.

2. Materials and methods

2.1. Animals and dietary treatments

A total of 240 day-old Ross 308 broilers were assigned to 5 treatments with 4 replicates. Each replicate consisted of 12 as-hatched birds per pen. Chicks were raised on floor pens (120 × 120 × 80 cm) for 6 wk and had free access to feed and water throughout the entire experimental period. . The ambient temperature in experimental house was maintained at 32 °C during the first week and gradually decreased by 3 °C in the second and third weeks, and finally fixed at 22 °C thereafter. Feed was composed according to nutrient requirements of broilers provided by National Research Council [12] and it was the same for all groups, except added additives (Table 1). The birds were fed a starter diet from d 0 to 21, and finisher diet from d 21 to 42. The treatments were as follows:

Treatment 1: Control (no additive).

Treatment 2: 5 mg virginiamycin/kg of diet

Treatment 3: 0.1 % ethanolic extract of peppermint supplemented to drinking water.

Treatment 4: 0.2 % ethanolic extract of peppermint supplemented to drinking water.

Treatment 5: 0.3 % ethanolic extract of peppermint supplemented to drinking water.

2.2. Data collection

Body weights of broilers were determined at d 1, 21, and 42 of age. Feed intake and weight gain were recorded in different periods and feed conversion ratio (FCR) was calculated. Mortality was recorded as it occurred and was used to adjust the total number of birds to determine the total feed intake per bird and FCR. At d 42, two male broilers per replicate randomly selected, based on the average weight of the group and sacrificed. Carcass yield was calculated by dividing eviscerated weight by live weight. Abdominal fat, gizzard, liver, and pancreas were collected, weighed and calculated as a percentage of live body weight.

2.3. 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 (SAS Inst. Inc., Cary, NC). Means were compared using Tukey test. Statements of statistical significance are based on $P<0.05$.

3. Results

3.1. Performance and carcass traits

Data on performance indices are summarized in Table

Table 1
The ingredient and calculated composition of basal starter, and finisher diets.

Item	Starter	Grower
Ingredient, g/kg		
Corn	584.2	584.8
Soybean meal	315.8	300.7
Soybean oil	25.2	55.0
Fish meal	45	30
Dicalcium phosphate	9.3	8.0
CaCO3	10.6	11.7
NaCl	2.0	2.9
Oyster shell	1	1
Trace mineral premix1	2.5	2.5
Vitamin premix2	2.5	2.5
DL-Methionine	1.5	0.8
L-Lysine	0.4	0
Calculated composition		
Metabolizable energy (kcal/kg)	3000	3200
Crude protein (g/kg)	215.6	200.0
Calcium (g/kg)	9.7	9.0
Available phosphorus (g/kg)	4.2	3.5
Methionine + cysteine (g/kg)	8.4	7.2
Lysine (g/kg)	12.7	11.2

1. Vitamin premix per kg of diet: vitamin A (retinol), 2.7 mg; vitamin D3 (Cholecalciferol), 0.05 mg; vitamin E (tocopheryl acetate), 18 mg; vitamin k3, 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 ($CuSO4.5H_2O$), 10 mg; I (KI, 58% I), 1 mg; Se ($NaSeO_3$, 45.56% Se), 0.2 mg.

Table 2
Effect of experimental diets on performance indices of broilers at different ages.

Variables	Dietary treatments					
	Control	Virginiamycin	0.1 % extract	0.2% extract	0.3 % extract	SEM4
DFI1						
0–21 d	70.93	71.55	69.10	70.87	70.45	0.351
21–42 d	160.31	161.08	160.84	162.42	160.40	0.377
0–42 d	115.62	116.32	114.97	116.65	115.43	0.227
FCR2						
0–21 d	1.84	1.84	1.78	1.86	1.83	0.012
21–42 d	1.85	1.88	1.89	2.06	1.97	0.029
0–42 d	1.85	1.86	1.83	1.96	1.91	0.016
DWG3(g)						
0–21d	38.74	38.86	38.76	38.12	38.40	0.249
21–42 d	86.53	85.47	85.10	78.95	81.27	1.10
0–42 d	62.50	62.16	61.93	58.54	59.84	0.585

1. Daily Feed Intake (g per bird per day).
2. Feed Conversation Ratio (g/g).
3. Daily Weight Gain (g per bird per day).
4. Standard error of mean.

Table 3
Effect of experimental diets on carcass yield and internal relative organ weight of broilers at 42 d.

Variables	Dietary treatments					
	Control	Virginiamycin	0.1 % extract	0.2% extract	0.3 % extract	SEM1
Carcass (%)	71.08b	72.05ab	72.99ab	73.04a	73.85a	0.311
Abdominal fat (%)	2.32a	2.30a	2.37a	1.72b	1.66b	0.154
Gizzard (%)	1.28	1.35	1.29	1.28	1.08	0.034
Liver (%)	79	74	79	69	84	0.034
Pancreas (%)	19	13	18	19	15	0.009

1 Standard error of mean.

2. The treatments had not any significant effect on daily feed intake, and daily weight gain. The additives did not markedly ($P>0.05$) influence feed conversion ratios of chicks; nevertheless the most efficient feed conversion throughout the trial was observed in chicks supplemented with 0.1 % ethanolic extract of peppermint in drinking water. No differences because of treatment effects were observed on mortality. Table 3 shows relative weight means (as a percentage of live weight at slaughter) of organs as a function of treatments. The carcass yield obtained in birds supplemented with 0.2 % or 0.3 % ethanolic extract of peppermint in drinking water was greater than other groups at 42 d of age ($P<0.05$). Abdominal fat pad significantly reduced ($P<0.05$) in broilers supplemented with 0.2 % or 0.3 % ethanolic extract of peppermint in drinking water compared to other groups. Gizzard, liver, and pancreas weights were not markedly affected by dietary treatments.

4. Discussion

Performance and gizzard, liver, and pancreas weights were not significantly influenced by the dietary treatments at d 42. In accord with our findings Ocak *et al*[11] failed to monitor any significant effect of dry peppermint on performance and carcass characteristics of broiler chicks. Also, Toghyani *et al*[10], reported no effect of dry peppermint on broiler performance criteria. In contrast with our results Al-Ankari *et al*[9] observed the positive effect of wild mint on performance of broiler chicks. In the present study virginiamycin supplementation had not any significant effect on broiler performance and carcass traits. In this experiment virginiamycin had not any effect on performance criteria, whereas it is not in agreement with the findings of Miles *et al*[2] who find significant effects in using virginiamycin on performance of broilers. Also, Belay and Teeter[13] reported an increase weight gain and saleable carcass in broilers supplemented with virginiamycin. Landy *et al*[14-16] observed dietary supplementation of antibiotic growth promoter flavophospholipol increased final bodyweight of broilers at 42 d of age. The study conducted by Coates *et al*[17] showed that antibiotics did not promote the growth of broilers raised in a germ-free environment as compared to those raised in a conventional environment. In addition, it is known that well-nourished, healthy chicks do not respond to antibiotic supplements provided that they are housed under clean and disinfected conditions [18], thus it is possible in present trial the treatments had not any beneficial effect on performance indices due to hygienic status of trial.

Narimani-Rad *et al*[19] reported that dietary supplementation of medicinal plants mixture (1% Oregano, 0.5% Ziziphora and 0.5% Peppermint) caused performance and carcass quality improvement via more weight gain

increase in carcass yield and then decreases abdominal fat deposition. In accord with our results Toghyani et al[10] reported that, use of peppermint had not any significant effect on internal organ weights. Our results on carcass characteristics are consistent to those of Ocak *et al*[11] who did not observe any marked effect of dry peppermint on the internal organ weights of broiler chicks. Also, Hernández *et al*[20] reported that, use of antibiotic or mixtures of plant extracts had not any significant effect on carcass traits of broilers.

In conclusion, the results of this study showed that addition of 0.3 % ethanolic extract of peppermint to drinking water seem to have a positive influence on broiler performance productive via more carcass yield and decrease abdominal fat deposition.

Conflict of interest statement

We declare that we have no conflict of interest.

Acknowledgement

This study was supported by Islamic Azad University, Borujerd Branch, Iran, and resulted from research project number: 3945. The authors would like to acknowledge staffs of university.

References

[1] Eyssen H, DeSomer P. The mode of action of antibiotics in stimulating growth of chicks. *J Exp Med* 1963; **117**: 127-137.

[2] Miles RD, Janky DM, Harms RH. Virginiamycin and broiler performance. *Poult Sci* 1984; **63**: 1218-1221.

[3] Harms RH, Ruiz N, Miles RD. Influence of virginiamycin on broilers fed four levels of energy. *Poult Sci* 1986; **65**: 1984-1986.

[4] Engberg RM, Hedemann MS, Leser TD, Jensen BB. Effect of zinc bacitracin and salinomycin on intestinal microflora and performance of broilers. *Poult Sci* 2000; **79**: 1311-1319.

[5] Thomke S, Elwinger K. Review - Growth promotants in feeding pigs and poultry. II. Mode of action of antibiotic growth promotants. *Ann Zool Technol* 1998; **47**: 153-167.

[6] Grashorn MA. Use of phytobiotics in broiler nutrition an alternative to infeed antibiotics. *J Anim Feed Sci* 2010; **19**: 338-347.

[7] Schuhmacher A, Reichling J, Schnitzler P. Virucidal effect of peppermint oil on the enveloped herpes simplex virus type 1 and type 2 in vitro. *Phytomedicine* 2003; **10**: 504-510.

[8] Dorman HJD, Kosar M, Kahlos K, Holm Y, Hiltunen R. Antioxidant properties and composition of aqueous extracts from Mentha species, hybrids, varieties, and cultivars. *J Agric Food Chem* 2003; **51**: 4563-4569.

[9] Al-Ankari AS, Zaki MM, AI-Sultan SI. Use of habek mint (Mentha longifolio) in broiler chicken diets. I*nt J Poult Sci* 2004; **3**: 629-634.

[10] Toghyani M, Toghyani M, Gheisari AA, Ghalamkari Gh, Mohammadrezaei M. Growth performance, serum biochemistry, and blood hematology of broiler chicks fed different levels of black seed (Nigella sativa) and peppermint (*Mentha piperita*). *Livest Sci* 2010; **129**: 173-178.

[11] Ocak N, Erener G, Burak Ak F, Sungu M, Altop A, Ozmen A. Performance of broilers fed diets supplemented with dry peppermint (*Mentha piperita* L.) or thyme (Thymus vulgaris L.) leaves as growth promoter source. *Czech J Anim Sci* 2008; **53**: 169-175.

[12] NRC. Nutrient requirements of poultry. 9th ed. Washington, DC: National Academy Press; 1994.

[13] Belay T, Teeter RG. Virginiamycin effects on performance and saleable carcass of broilers. *J Appl Poult Res* 1994; 111-116.

[14] Landy N, Ghalamkari Gh, Toghyani M. Performance, carcass characteristics and immunity in broiler chicks fed dietary Neem (Melia azadirachta) as alternative for an antibiotic growth promoter. *Livest Sci* 2011a ; **142**: 305-309.

[15] Landy N, Ghalamkari Gh, Toghyani M, Moattar F. The effects of Echinacea purpurea L. (Purple Coneflower) as an antibiotic growth promoter substitution on performance, carcass characteristics and humoral immune response in broiler chickens. *J Med Plants Res* 2011b; **5**: 2332-2338.

[16] Landy N, Ghalamkari Gh, Toghyani M. Evaluation of St John's Wort (Hypericum perforatum L.) as an antibiotic growth promoter substitution on performance, carcass characteristics, some of the immune responses, and serum biochemical parameters of broiler chicks. *J Med Plants Res* 2012; **6**: 510-515.

[17] Coates ME, Fuller R, Harrison GF, Lev M, Suffolk SF. A comparison of the growth of chicks in the Gustafsson germ-free apparatus and in a convencional environment, with and without dietary supplements of penicilin. *British Jour Nutrition* 1963; **17**: 141-151.

[18] Lee KW, Everts H, Kappert HJ, Frehner M, Losa R, Beynen AC. Effects of dietary essential oil components on growth performance, digestive enzymes and lipid metabolism in female broiler chickens. *Br Poult Sci* 2003; **44**: 450-457.

[19] Narimani-Rad M, Nobakht A, Aghdam Shahryar H, Kamani J, Lotfi A. Influence of dietary supplemented medicinal plants mixture (Ziziphora, Oregano and Peppermint) on performance and carcass characterization of broiler chickens. *J Med Plants Res* 2011; **5**: 5626-5629.

[20] Hernandez F, Madrid J, Garcia V, Orengo J, Megias MD. Influence of two plant extracts on broilers performance, digestibility and digestive organ size. *Poult Sci* 2004; **83**: 169-174.