www.roavs.com EISSN: 2223-0343
RESEARCH OPINIONS IN ANIMAL & VETERINARY SCIENCES

Effects of various levels of pennyroyal (*Mentha pulegium* L.) on carcass characteristics and serum cholesterol in broiler

Ramin Shamlo[1]*, Javad Nasr[1] and Farshid Kheiri[2]

[1]Department of Animal Science, College of Agriculture, Saveh Branch, Islamic Azad University, Saveh, Iran
[2]Department of Animal Science, College of Agriculture, Shahrekord Branch, Islamic Azad University, Shahrekord, Iran

Abstract

This study was conducted to investigate the effects of pennyroyal (*Mentha pulegium* L.) extract on carcass yield and serum cholesterol in broiler chickens. A total of 320 one-day old broilers (Ross 308) were randomly allocated to 4 treatments, 4 replicates with 20 birds in each in a completely randomized design. Treatments included were control and addition of various levels of pennyroyal extracts at 50, 100, and 150 ppm in diets. The results showed that inclusion of 150 ppm pennyroyal extract in diets increased live body weight, carcass relative weight, carcass efficiency and heart relative weight ($P<0.05$). In addition, inclusion of pennyroyal extract at levels of 100 or 150 ppm in diets increased relative weights of breast and wings ($P<0.05$). Furthermore, the lowest serum cholesterol and triglyceride and low density lipoprotein levels were obtained in birds fed 150 ppm pennyroyal group ($P<0.05$). The results of present study showed that pennyroyal (150 ppm) improved carcasses yield and serum cholesterol.

Keywords: broiler; carcass; pennyroyal; serum lipids

To cite this article: Shamlo R, J Nasr and F Kheiri, 2014. Effects of various levels of pennyroyal (*Mentha pulegium* L.) on carcass characteristics and serum cholesterol in broiler. Res. Opin. Anim. Vet. Sci., 4(8): 453-457.

Introduction

In poultry production, antibiotic growth promoters are being extensively used to promote intestinal health, manipulation of microbial population, and improve broiler growth parameters (Gibson and Fuller, 2000). However, main problem associated with antibiotics is antibiotic resistance (Joerger, 2002) which led to a ban on the use of irrational antibiotics in poultry diets in many countries (Patterson and Burkholder, 2003). Therefore, increasing attempts were widely made to achieve suitable antibiotic alternatives (Joerger, 2002; Jones and Rick, 2003). Numerous additives such as probiotics (Awad et al., 2006), prebiotics (Biggs and Parsons, 2007), organic acids (Gunal et al., 2006), enzymes (Viveros et al., 1994), and medicinal plants (Sakine et al., 2006; Yakhkeshi et al., 2012) are used or proposed as alternatives to antibiotic in broiler diets to improve health and growth (Joerger, 2002).

In organic broiler production, medicinal plants attracted much attention in recent years. Medicinal plants are used as feed additives to enhance growth performance (Panda et al., 2000; Yakhkeshi et al., 2012). Positive effects of variety of medicinal plants supplements have been demonstrated on production performance and carcass yield (Onibi et al., 2000; Gardzielewska et al., 2003; Guo et al., 2004; Tekeli et al., 2006; Mathivanan and Kalaiarasi, 2007; Yakhkeshi et al., 2012).

Mentha pulegium L. is one of the well known plants. *Mentha*, the genus in Labiatae family, includes 20 species that can be found all over the world. *M. pulegiumis*, one of the *Mentha* species commonly known as pennyroyal, is a native species in the Europe, North Africa, Minor Asia and the near East (Chalchat et al., 2000). The flowering aerial parts of *M. pulegium* L. have been traditionally used for the antimicrobial properties in the treatment of cold, sinusitis, cholera, food poisonings, bronchitis and tuberculosis (Zargari,

***Corresponding author:** Ramin Shamlo, Department of Animal Science, College of Agriculture, Saveh Branch, Islamic Azad University, Saveh, Iran; E-mail: raminmelody@yahoo.com

1990). Most of plants contain components with antiflatulent, carminative, expectorant, diuretic, antitussive and menstruation agent (Newall, 1996). Pennyroyal possess antimicrobial (Mahboubi and Haghi, 2008), antioxidant (Kamkar et al., 2010), cytotoxic (Shirazi et al., 2004) and abortifacient properties (Soares et al., 2005).

Although, it has been reported that many plants have potential to be use as substitute of antibiotic, yet the potential of few of them have been investigated. On the other hand, there are many inconsistent results regarding substitution of medicinal plant to antibiotic and their suitable levels in poultry diets. Therefore, the present study was carried out to determine the effects of various levels of pennyroyal extract on carcass yield and serum cholesterol in broiler chickens.

Materials and Methods

Birds and diets

A total of 320 one-day-old broilers (Ross 308) were randomly assigned to 4 treatments, 4 replicates with 20 birds in each. Treatments include control, and the addition of various levels of pennyroyal extract (Barijessence Company, Kashan, Iran) at 50, 100, and 150 ppm in diets for a 42 day period. Diets and water were provided *ad libitum* throughout the experiment. Lighting schedule was 23 h light and 1 h dark. The temperature was gradually reduced from initially 32°C by a decrease of 3°C in each week. Diets composition and formulation of starter (1-21 days) and grower (22-42 days) were based on NRC (1994) recommendation (Table 1).

Table 1: Diet formulation and calculated chemical composition[1]

Ingredients (%)	Starter (1-21 days of age)	Grower (22-42 days of age)
Corn grain	55.73	62.40
Soybean meal	37.50	30.48
Wheat	4.2	8.09
Soybean oil	1.1	1.29
Vegetarian oil	2.40	2.50
Di Calcium phosphate	1.90	2.00
Carbonate calcium	1.33	0.90
Salt	0.37	0.38
Vitamin premix[2]	0.30	0.30
Mineral permix[3]	0.30	0.30
DL-methionine	0.34	0.26
L-lysine	0.05	0.10
Calculated analysis		
ME (kcal/kg)	2945	3020
Crude protein%	21.11	18.76
Calcium%	1.00	0.90
Available P%	0.50	0.50
Methionine%	0.51	0.48
Lysine%	1.20	0.90

[1]Pennyroyal extract were add to the basal diet (control) at 50, 100, and 150 ppm in diets, respectively to make the respective diets; [2]Supplied the following per kilogram of diet: Vitamin A (retinyl acetate), 8,000 IU; vitamin D_3 (cholecalciferol), 3,000 IU; vitamin E (DL-alpha-tocopheryl acetate), 25 IU; K_3, 40 mg; vitamin B_{12} (cyanocobalamin), 0.02 mg; biotin, 0.1 mg; folacin (folic acid), 1 mg; niacin (nicotinic acid), 50 mg; pantothenic acid, 15 mg; pyridoxine (pyridoxine HCl), 4 mg; riboflavin, 10 mg; and thiamin, 3 mg (thiamin mononitrate); [3]Supplied the following per kilogram of diet: 10 mg of copper ($CuSO_4$); 1.0 mg of iodine (IO_3); 80 mg of iron ($FeSO_4H_2O$); 100 mg of manganese ($MnSO_4H_2O$); 0.15mg of selenium ($NaSeO_3$); 80 mg of zinc ($ZnSO_4H_2O$); and 0.5 mg of cobalt ($CoSO_4$)

Carcass yield characteristics

At 42 days of age two birds from each replicate were randomly selected and were sacrificed to measure carcass and organs weights. The complete intestinal tract of birds was removed immediately after dressing and the weights of gizzard, heart, liver as well as carcass weight and characteristics (breast, thighs, and wings) were measured.

Blood parameters assay

Two birds from each replicate were randomly selected and blood samples were taken via wing vein at 42 days of age. Serum samples were taken and glucose, cholesterol, triglyceride, low density lipoprotein (LDL), and high density lipoprotein (HDL) were measured using the specific kits (ShimiZist, Tehran-Iran).

Statistical analysis

A completely randomized design was employed to data analysis. One-way analysis of variance was performed using the GLM procedure of SAS software (SAS, 2004). Duncan's multiple range test was used to find the significance difference ($P<0.05$).

Results and Discussion

Carcass yield and relative organs weights

The effects of various levels of pennyroyal extract inclusion in diets on carcass characteristics of broiler chickens at 42 days of age are shown in Table 2. The results have shown that inclusion of 150 ppm pennyroyal extract in diets increased live body weight, carcass weight and carcass efficiency ($P<0.05$).

The effects of dietary treatments on carcass traits at 42 days of age are presented in Table 3. The results revealed that inclusion of pennyroyal extract at level of 100 and 150 ppm in diets increased breast and wings weight ($P<0.05$). There were no significant differences between treatments in thighs weights.

The effects of dietary treatments on different organs weights are illustrated in Table 4. Dietary treatments had no significant effects on liver as well as

gizzard weight. Moreover, the inclusion of 150 ppm pennyroyal extract in diets increased heart weight (P<0.05).

It has been suggested that inclusion of pennyroyal in the diet kills pathogenic bacteria or their toxins in intestines which help in improving the intestinal health (VukicVramjes and Wenk, 1995; Erhan et al., 2012). In our study, pennyroyal might have helped in nutrients absorption and increased live body weight gain and carcasses weight. There are a number of reports advocating the positive effect of medicinal plants in poultry production (Al-Ankari et al, 2004; Al-Kassie, 2010; Yakhkeshi et al., 2012; Kalantar et al., 2014). It has been reported that the addition of different levels of *M. longigolia* increased final body weight of broilers compared to those which were not fed (Al-Ankari et al., 2004). In addition, it is noted that *M. longigolia* supplementation in the diet of broilers increased weight gain (Al-Kassie, 2010). The improvement of carcass traits by pennyroyal is in agreement with the experimental results of other researches (Nobakht et al., 2010; Nobakht et al., 2011) who reported that a blend of pennyroyal significantly improved the carcass traits such as breast muscle of broilers. Also, the results of the present study are opposite to the findings of other studies (Zhang et al., 2005; Pelicano et al., 2005), who noted that the use of feed additives (essential oil, probiotic and antibiotic) had no effect on carcass weights. The differences in basal diets and the amount of added medicinal plant could explain some of these inconsistencies.

Any factor that increases activation of an organ above threshold levels can lead to increase organ weights by hypertrophy and hyperplasia of the related organs. It seems that inclusion of pennyroyal extract in diets in current study did not induce liver as well as gizzard weight which are in agreement with the results of other reports (Gunes et al., 2001; Zhang et al., 2005; Cabuk et al., 2006; Pelicano et al., 2005; Ghalamkari et al., 2012). It is propose that relative weights of organs in broiler chicken were mainly affected by genetic factors and less affected by nutritional factors (Gong et al., 2001).

Table 2: The effects of pennyroyal diets on carcass characteristics (g) of broilers at 42 days of age

Treatments	Live Body weight	Carcass weight	Carcass efficiency
Control	2460.00^{b}	2003.66^{b}	81.45^{ab}
Pennyroyal extract (50ppm)	2480.00^{b}	2010.00^{b}	81.02^{b}
Pennyroyal extract (100ppm)	2435.00^{b}	2093.33^{ab}	79.41^{b}
Pennyroyal extract (150ppm)	28560.66^{a}	2406.66^{a}	84.18^{a}
SEM	123.02	163.43	2.45

^{abc}Means in columns with different superscripts were significantly differ (P<0.05). SEM, Standard Means of Errors

Table 3: The effects of pennyroyal diets on carcass traits (Carcass weight) at 42 days of age

Treatments	Breast	Thighs	Wings
Control	576.66^{b}	430.00	138.33^{b}
Pennyroyal extract (50ppm)	563.33^{b}	418.33	138.32^{b}
Pennyroyal extract (100ppm)	630.00^{ab}	460.00	148.33^{a}
Pennyroyal extract (150ppm)	675.00^{a}	495.00	158.33^{a}
SEM	53.02	43.43	4.45

^{abc}Means in columns with different superscripts were significantly differ (P<0.05). SEM, Standard Means of Errors

Table 4: The relative weights (g) of different organs in response to pennyroyal diets at 42 days of age

Treatments	Liver	Gizzard	Heart
Control	65.00	12.33	75.00^{b}
Pennyroyal extract (50ppm)	70.00	12.10	90.33^{ab}
Pennyroyal extract (100ppm)	67.66	12.00	84.00^{ab}
Pennyroyal extract (150ppm)	71.66	12.05	98.33^{a}
SEM	4.32	2.23	5.34

^{abc}Means in columns with different superscripts were significantly differ (P<0.05). SEM, Standard Means of Errors

Table 5: The effects of diets on some blood parameters (mg/dl) of broilers at 42 days of age

Treatments	Glucose	CH[1]	TG[2]	HDL[3]	LDL[4]
Control	148.66	188.33^{a}	151.66^{a}	54.66^{c}	103.33^{a}
Pennyroyal extract (50ppm)	147.33	155.00^{b}	122.33^{ab}	62.33^{bc}	78.20^{b}
Pennyroyal extract (100ppm)	150.66	153.66^{b}	108.66^{ab}	71.66^{ab}	60.60^{b}
Pennyroyal extract (150ppm)	147.00	142.00^{b}	103.66^{b}	84.00^{a}	37.26^{c}
SEM	2.32	13.23	22.36	4.32	12.13

^{abc}Means in columns with different superscripts were significantly differ (P<0.05). SEM, Standard Means of Errors
[1]CH=Cholesterol; [2]TG=Triglyceride; [3]HDL=High density lipoprotein; [4]LDL= Low density lipoprotein

Blood parameters

The effects of different treatments on glucose, cholesterol, triglyceride, HDL and LDL are illustrated in Table 5. No significant difference was found in glucose concentration between different groups. Serum cholesterol, triglycerides and LDL decreased significantly (P<0.05) in birds fed pennyroyal at the rate of 150 ppm. The highest serum HDL was obtained in the same group (P<0.05).

Erhan et al. (2010) reported that the use of pennyroyal in broiler diets promotes the growth of Lactobacillus and Bifidobacterium in intestines and decreases blood cholesterol which is in agreement with the results of the current study. The use of medicinal plant in this study reduced blood cholesterol and triglyceride levels which agrees with the results of Sakine et al. (2006) who showed that the use of garlic powder can reduce cholesterol and triglyceride levels in blood. The lower serum cholesterol in response to pennyroyal supplementation may be due to the effect of reduction in liver 3-hydroxy-3-methylglutaryl-coenzyme A (HMG-COA), which is a key enzyme in cholesterol synthesis (Yu et al., 1994).

Conclusions

The findings of present study revealed that pennyroyal inclusion in diet at the level up to 150 ppm improved body growth and serum cholesterol profile in broilers.

References

Al-Ankari, A.S., Zaki, M.M. and Al-Sultan, S.I. 2004.Use of habek mint (*Menthalongifolia*) in broiler chicken diets. *International Journal of Poultry Science,* 3: 629-634.

Al-Kassie, G.A.M. 2010. The role of peppermint (*Menthapiperita*) on performance in broiler diets. *Agriculture and Biology Journal of North America,* 1: 1009-1013.

Awad, W.A., Bohm, J., Razzazi-Fazeli, E., Ghareeb, K. and Zentek, J. 2006.Effect of addition of a probiotic microorganism to broiler diets contaminated with deoxynivalenol on performance and histological alterations of intestinal villi of broiler chickens. *Poultry Science*, 85: 974-979.

Biggs, P. and Parsons, C.M. 2007. The effects of several oligosaccharides on true amino acid digestibility and true metabolizable energy in cecectomized and conventional roosters. *Poultry Science,* 86: 1161-1165.

Cabuk, M., Bozkurt, M., Alcicek, A., Akbas, Y. and Kucukyimaz, K. 2006. Effect of an herbal essential oil mixture on growth and internal organ weight of broiler from young and old breeder flock. *South African Journal of Animal Science*, 36: 324-354.

Chalchat, J.C., Gorunovlc, M.S., Maksimovlc, Z.A. and Petrovlc, S.D. 2000. Essential oil of wild growing Menthapulegium L from Yugoslavia. *Journal of Essential Oil Research,* 12: 598-600.

Erhan, M.K., Bolukbasi, S.C. and Urusan, H. 2012. Biological activities of pennyroyal (*Menthapulegium* L.) in broilers. *Livestock Science Journal*, 146: 189-192.

Gardzielewska. J., Pudyszak, K., Majewska, T., Jakubowska, M. and Pomianowski, J. 2003. Effect of plant-supplemented feeding on fresh and frozen storage quality of broiler chicken meat. Animal Husbandry Series of Electronic. *Journal of Polish Agriculture University,* 6. http://www.ejpau.media.

Ghalamkari, G.h., Toghyani, M.L., and Tavalaeian, E. 2012. Investigation the effects using different levels of Menthapulegium L. (pennyroyal) in comparison with an antibiotic growth promoter on performance, carcass traits and immune responses in broiler chickens. *Asian Pacific Journal of Tropical Biomedicine*, S1396-S1399.

Gibson, G.R. and Fuller, R. 2000. Aspects of *in vitro* and *in vivo* research approaches directed toward identifying probiotics and prebiotics for human use. *The Journal of Nutrition*, 130: 391-395.

Gong, J., Forster, R.J., Yu, H., Chambers, J.R., Sabour, P.M., Wheatcroft, R. and Chen, S. 2002. Diversity and phylogenetic analysis of bacteria in the mucosa of chicken ceca and comparison with bacteria in the cecal lumen. *FEMS Microbiology Letters*, 208: 1-7.

Gunal, M., Yayli, G., Kaya, O., Karahan, N. And Sulak, O. 2006. The effects of antibiotic growth promoter, probiotic or organic acid supplementation on performance, intestinal microflora and tissue of broilers. *Poultry Science,* 5: 149-155.

Gunes, H., Cerit, H. and Altinel, A. 2001. Effect of organic acid, probiotic and antibiotic on performance and carcass yield of broilers. *Anais da XXXV Reuniao da Sociedade Brasileira de Zootecnia*, 302-308.

Guo, F.C., Kwakkel, R.P., Soede, J., Williams, B.A. and Verstegen, M.W. 2004. Effect of a chinese herb medicine formulation, as an alternative for antibiotics, on performance of broilers. *British Poultry Science*, 45: 793-797.

Joerger, R.D. 2002. Alternatives to antibiotics: bacteriocins, antimicrobial peptides and bacteriophages. *Poultry Science*, 82: 640-647.

Jones, F.T. and Ricke, S.C. 2003. Observations on the history of the development of antimicrobials and their use in poultry feeds. *Poultry Science,* 82: 613-617.

Kamkar, A., Jebelli Javan, A., Asadi, F. and Kamalinejad, M. 2010. The antioxidative effect of Iranian *Menthapulegium* extracts and essential oil in sunflower oil. *Food and chemical Toxicology,* 48: 1796-1800.

Mahboubi, M. and Haghi, G. 2008. Antimicrobial activity and chemical composition of *Menthapulegium L.* essential oil. *Journal of ethnopharmacology,* 19: 325-327.

Mathivanan, R. and Kalaiarasi, K. 2007. *Panchagavya* and *andrographis panculata*as alternatives to antibiotic growth promoters on hematological, serum biochemical parameters and immune status of broilers. *Journal of Poultry Science*, 44: 198-204.

National Research Council. 1994. Nutrient Requirements of Poultry. 9th rev. ed. Natl. Acad. Press, Washington, DC.

Newall, C.A. 1996. A guide. In: Anderson L.A., Philipson, J.D., editors, Herbal Medicines.

Nobakht, A., Norani, J. and Safamehr, A. 2011. The effects of different amounts of *Menthapulegium L.* (pennyroyal) on performance, carcass traits, hematological and blood biochemical parameters of broilers. *Journal of Medicinal Plant Research*, 5: 3763-3768.

Nobakht, A., Rahimzadeh, M.R. and Mehmannavaz, Y. 2010. Investigation the effects using different levels of Nettle (*Urticadioica*), *Menthapulagum* (*Oreganumvulgare*) and Zizaphora (*Thymyus vulgaris*) medicinal plants in starter and grower periods on performance and carcasses traits of broilers. *Iranian Congress of Animal Science,* 4: 40-44.

Onibi, G.E., Scaife, J.R., Murray, I. and Fowler, V.R. 2000. Supplementary α-tocopherol acetate in full fat rape seed-based diets for pigs. Influence on tissue α -tocopherol content, fatty acid profile and lipid oxidation. *Journal of Science Food and Agriculture,* 80: 1625-1632.

Panda, A.K., Reddy, M.R., Rama Rao, S.V., Raju, M.V.L. and Praharaj, N.K. 2000. Growth, carcass characteristics, immunocompetence and response to *escherichia coli* of broilers fed diets with various levels of probiotic. *Archiv für Geflügelkunde,* 64: 152-156.

Patterson, J.A. and Burkholder, K.M. 2003. Application of prebiotics and probiotics in poultry production. *Poultry Science,* 82: 627-631.

Kalantar, M., Salary, J., Nouri Sanami, M., Khojastekey, M. and Hemati Matin, H.R. 2014. Dietary Supplementation of Silybum marianum or Curcuma spp on Health Characteristics and Broiler Chicken Performance. *Global Journal of Animal Scientific Research*, 2: 58-63.

Pelicano, E.R.L., Souza, P.A., Souza, H.B.A., Figueiredo, D.F., Boiago, M.M., Carvalho, S.R. and Bordon, V.F. 2005. Intestinal mucosa development in broiler chickens fed natural growth promoters. *Revista Brasileira Ciencias Avicenna,* 4: 221-229.

Sakine, Y., Ebru, E., Reisli, Z. and Suzan, Y. 2006. Effect of garlic powder on the performance, egg traits and blood parameters of laying hens. *Journal of Food Science,* 86: 1336-1339.

SAS Institute. 2003. SAS User's Guide. Version 9.1 ed. SAS Inst. Inc., Cary, NC.

Shirazi, F.H., Ahmadi, N. and Kamalinejad, M. 2004. Evaluation of Northern Iran. *Mentha Pulegium L. Cytotoxicity Daru,* 12: 106-110.

Soares, P.M., Assreuy, A.M., Souza, E.P., Lima, R.F. and Silva, T.O. 2005. Inhibitory effects of the essential oil of Menthapulegium on the isolated rat myometrium. *Planta Medica,* 71: 214-218.

Tekeli, A., Çelik, L., Kutlu, H.R. and Gorgulu, M. 2006. Effect of dietary supplemental plant extracts on performance, carcass characteristics, digestive system development, intestinal microflora and some blood parameters of broiler chicks. Proceedings of 12th European Poultry Conference, Sept. 10-14, Verona, Italy, pp: 307-308.

Viveros, A.A., Brenes, M., Pizarro, G. and Castanb, M. 1994. Effect of enzyme supplemention of a diet based on barly and actoclave apparent digestibility, growth performance and got morphology of broilers. *Animal Feed Science and Technology,* 48: 237-251.

Vukic Vramjes, M. and Wenk, C. 1995. Influence of dietary enzyme complex on the performance of broilers fed on bites with and without antibiotic supplementation. *British Poultry Science,* 36: 265-275.

Yakhkeshi. S., Rahimi, S. and Hemati Matin H.R. 2012. Effects of Yarrow (*Achilleam illefolium* L.), Antibiotic and Probiotic on Performance, Immune Response, Serum Lipids and Microbial Population of Broilers. *Journal of Agriculture and Science Technology*, 14: 799-810.

Yu, S.G., Hsu, J.C. and Chiou, P.W.S. 1998. Effects of β-glucanase supplementation of barley diets on growth performance of broilers. *Animal Feed Science and Technology,* 70: 353-361.

Zargari, A. 1990. Herbal medicines. Publication of Tehran University, Tehran, pp: 14-18.

Zhang, A.W., Lee, B.D., Lee, S.K., Lee, K.W., An, G.H., Song, K.B. and Lee, C.H. 2005. Effects of yeast (saccharomyces cerevisiae) cell components on growth performance, meat quality, and ileal mucosa development of broiler chicks. *Poultry Science*, 84: 1015-1021.