

Evaluation the Effects of Using of Probiotic and Pennyroyal (*Mentha pulegium L.*) Medicinal Plant on Performance of Laying Hens

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ABSTRACT

This experiment was conducted to evaluate the effects of probiotic (Pr) and pennyroyal (*Mentha pulegium L.*) on performance of laying hens. Hy-Line laying hens (n=216), 34 wk old, were randomly housed in windowed cages in a completely randomized design with factorial arrangement of 3×2 with six treatments and three replicates (12 birds per each) and were fed 1 of 6 diets: control (treatment 1, T1), Probiotic (T2), 1% pennyroyal (T3), Probiotic + 1% pennyroyal (T4), 2% pennyroyal (T5), Probiotic + 2% pennyroyal (T6) throughout 12 wk experimental feeding period. Diets supplemented according to the manufacturer's recommendation with amounts of probiotic (0.005%). Results indicated that using 2% of pennyroyal significantly decreased egg production percent and egg mass ($p<0.05$). In interaction effects using 2% pennyroyal with probiotic significantly decreased the amounts of egg production per cent, egg mass and feed intake. From the results of the present study, it was concluded that using 2% pennyroyal individually, or in combination with probiotic, have adverse effects on performance of laying hens performance.

KEY WORDS: Pennyroyal, probiotic, laying hens, performance

INTRODUCTION

To date, probiotics are one of the major food supplements for poultry industry. According to concerns about cholesterol, there are a lot of attempts to produce foods with low cholesterol. Probiotics prescription is a good alternative for antibiotics in birds for several reasons: suitable function, nonexistence of residue in poultry productions, environmental protection and also prohibition of antibiotics usage in Europe union [1, 2].

Pennyroyal (*Mentha pulegium L.*, Figure 1), also called Squaw Mint, Mosquito Plant [3], and Pudding Grass [4], is a medicinal plant in the mint genus, within the family Lamiaceae [5]. Crushed pennyroyal leaves exhibit a very strong fragrance similar to spearmint. Pennyroyal is a traditional culinary herb, folk remedy, and abortifacient. The essential oil of pennyroyal is used in aromatherapy (therapeutic use of fragrances and plant essences to improve mood or physical and emotional health, an alternative medicine technique), and is also high in pulegone (naturally occurring organic compound obtained from the essential oils of a variety of plants such as *Nepetacataria* (catnip), *Menthapiperita*, and pennyroyal [6]. It is classified as a monoterpene), a highly toxic volatile and has the molecular formula $C_{10}H_{16}O$. Pennyroyal was commonly used as a cooking herb by the Greeks and Romans. Although still commonly used for cooking in the middle ages, it gradually fell out of use as a culinary herb and is seldom used so today. Even though pennyroyal oil is extremely poisonous, people have relied on the fresh and dried herb for centuries, such as Iran. Early settlers in colonial Virginia used dried pennyroyal to eradicate pests. Pennyroyal was such a popular herb that the Royal Society published an article on its use against rattlesnakes in the first volume of its Philosophical Transactions in 1665 [7].



Fig.1. Pennyroyal (*Mentha pulegium L.*)

Nowadays, there are a lot of concerns to finding non-synthetic alternatives for antibiotics among the scientists. The positive effects of herbal plants on poultry have been reported by many studies [8, 9, 10, 11].

The main objective of the poultry industry is the production of saleable laying egg and or chicken meat. To this end, it is important to limit to a minimum the number of negative parameters of meat product such as unlike fats and to maximize yield, its enrichment and quality attributes. Diet supplementation with pennyroyal as an antibiotic growth promoter could improve performance of broiler [9]. In addition, inclusion of this medicinal herb can boost healthy and quality of produced eggs which called as herbal eggs; However, more adequate toxicological study must be carried out to verify the possibility of using it for decline probable poisonous of this culinary herb [12].

In the present study it was examined if supplementation of Probiotic and *Mentha pulegium L.* (Pennyroyal) in the diet, individual or in combination influences produce performance in laying hens (Hy-Line, 34 wk old).

MATERIALS AND METHODS

Two hundred sixteen Hy-Line laying hens, 34 wk old, were randomly housed in windowed cages in a completely randomized design with factorial arrangement of 3×2 with six treatments and three replicates (12 birds per each) and were

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fed 1 of 6 diets: control (treatment 1, T1), Probiotic (T2), 1% Pennyroyal (T3), Probiotic +1% Pennyroyal (T4), 2% Pennyroyal (T5), Probiotic + 2% Pennyroyal (T6) throughout 12 wk experimental feeding period. Diets supplemented according to the manufacturer's recommendation with amount of probiotic (0.005%). To determine performance of laying hens fed experimental diets, a lighting program of 16 hours light and 8 h dark were exposed to the birds. The day temperature was controlled and all chickens had free access to drinking water and diet. Rate of feed intake and egg production, egg mass weekly measured. Composition of diet ingredients and analyzed chemical composition are presented in Table 1.

Statistical Analysis

All data were analyzed by ANOVA using the general linear model (GLM) procedures of the SAS Institute [13]. The fixed effects were the amounts of pennyroyal added (0, 1% or 2% of diet) and probiotic supplement (0 and 0.005% of diet). The differences between means were determined using the Duncan test.

Table 1. Composition of diet ingredients and their analyzed chemical compositions

Diet ingredient and composition	control (T1),	Probiotic (T2)	1% Pennyroyal (T3)	Probiotic + 1% Pennyroyal (T4)	2% Pennyroyal (T5)	Probiotic + 2% Pennyroyal (T6)
Corn	55	55	55	55	55	55
Soybean meal (44% CP)	16.46	16.46	16.49	16.49	16.52	16.52
Wheat	18.8	18.8	17.49	17.49	16.19	16.19
Added oil	0.05	0.05	0.33	0.33	0.62	0.62
Pennyroyal	0	0	1	1	2	2
Oyster shell	7.85	7.85	7.85	7.85	7.85	7.85
Dicalcium phosphate	1.08	1.08	1.08	1.08	1.08	1.08
Salt	0.26	0.26	0.26	0.26	0.26	0.26
Trace-Mineral premix ¹	0.25	0.25	0.25	0.25	0.25	0.25
Vitamin premix ²	0.25	0.25	0.25	0.25	0.25	0.25
Analyzed chemical composition (g/kg)						
ME by calculation (MJ/kg)	2800	2800	2800	2800	2800	2800
Crude protein%	14	14	14	14	14	14
Calcium%	3.28	3.28	3.28	3.28	3.28	3.28
Available Phosphorus %	0.31	0.31	0.31	0.31	0.31	0.31
Sodium %	0.15	0.15	0.15	0.15	0.15	0.15
Lysine	0.64	0.64	0.64	0.64	0.64	0.64
Methionine+cystine	0.54	0.54	0.54	0.54	0.54	0.54
Teronin	0.57	0.57	0.57	0.57	0.57	0.57
Tryptophan	0.17	0.17	0.17	0.17	0.17	0.17

^{1,2} Provides per kilogram of diet: vitamin A, 8,500,000 IU; vitamin D3, 2,500,000, IU; vitamin E, 11000 IU; vitamin K3, 2200 mg; vitamin B1, 1477 mg; vitamin B2, 4000 mg; vitamin B3, 7840 mg; vitamin B5, 34650 mg; vitamin B6, 2464 mg; vitamin B9, 110 mg; vitamin B12, 10 mg; choline chloride, 400,000 mg; Fe, 75000 mg; Mn, 74,400 mg; Cu, 6000 mg; Zn, 64,675 mg; I, 767 mg; Se, 200 mg.

RESULTS

Table 1 is shown the effects of probiotic and pennyroyal (*Mentha pulegium L.*) on performance of laying hens. The presented results indicated that using 2% of pennyroyal significantly decreased egg production percent and egg mass ($p < 0.05$). In interaction effects using 2% pennyroyal with probiotic significantly decreased the amounts of egg production per cent, egg mass and feed intake. From the results of the present study, it was concluded that using 2% pennyroyal individually, or in combination with probiotic, have adverse effects on performance of laying hens performance.

Table 2. Effects of probiotic and pennyroyal (*Mentha pulegium L.*) on performance of laying hens.

Items	Average egg weight	Production Percent	Egg mass production	Feed Intake	Feed Conversion Ration
Probiotic level (%)					
0	61.33	73.75	45.54	105.67	2.35
0.005	61.02	73.71	45.04	104.48	2.34
SEM	0.25	0.64	0.48	0.52	0.03
Pennyroyal level (%)					
0	61	75.64 ^a	46.22 ^a	105.44	2.30
1	61.54	73.62 ^{ab}	45.52 ^{ab}	105	2.32
2	60.98	71.93 ^b	44.14 ^b	104.78	2.40
SEM	0.31	0.78	0.59	0.64	0.04
Probiotic × Pennyroyal interactions					
0×0	61.16	74.94 ^{ab}	45.82 ^a	104.97 ^a	2.34
0×1	61.40	73.17 ^{ab}	45.40 ^a	104.10 ^a	2.32
0×2	61.43	73.03 ^{ab}	45.39 ^a	107.95 ^a	2.41
0.005×0	60.85	76.34 ^a	46.61 ^a	105.04 ^a	2.29
0.005×1	61.69	74.08 ^{ab}	45.63 ^a	106.78 ^a	2.32
0.005×2	60.52	70.84 ^b	42.88 ^b	101.62 ^b	2.40
SEM	0.43	1.11	0.83	0.90	0.045

DISCOSSION

In the present trial, it is detected that adding 2% pennyroyal individual or in combination with probiotic to laying hen diets influenced production performance. Researches that worked by medicinal herbs in poultry field reported an improved effects of these feed additives (pennyroyal and probiotic) on performance of broiler [14, 15] and laying hens (by probiotic: Abdulrahim et al. [16]; by pennyroyal: Chalchat et al. [17]; Cook et al. [18]; El-Ghorab, [19]; Mahboubi and Haghi, [20]).

Haddadin et al. [21] reported that the use of probiotic in the rearing of laying hens prevents the proliferation of pathogenic bacteria in the intestine and here by improves digestive enzymes activity and thus ability of feed nutrients. Goodling [22] found that an improved production performance of white leghorn layers fed Lactobacillus fermentation products. Tortuero and Fernandez [2] reported that inclusion of microbial culture in barley-based diets fed to laying hens increased weight and daily production of egg accompanying an improved egg albumin.

Halle et al. [14] reported that adding graded supplements of herbs and essential oils (1g oil contained 1:1 ratio of oregano and clove, or oregano and cinnamon per kilogram of body weight) in broiler diet could not influence live weight and growth after 35 days feeding, while decreased feed intake in birds, significantly.

It is known from the literature that pennyroyal herb contains 1-2% essential oil of which pulegone is the principal component (60-90%) [23]. In later studies the liver toxicity of pulegone has been confirmed and a mechanism of action has been proposed based on its metabolism to menthofuran and other reactive metabolites, which are the ultimate hepatotoxins (substance which is poisonous to the liver) [24]. Therefore, because of toxicity of this herbal medicinal plants or products containing pennyroyal, peppermint and mint (plant / oil), probability of increasing liver damage and in severe cases (use of the above) can result in a pulmonary edema and internal haemorrhage which subsequently it can influence performance of body especially in laying hens that are sensitive to toxic herbals. In the current study performance of laying hens significantly decreased by pennyroyal in spite of adding probiotic in the diet that this result was expected based on reports related to toxicity of this medicinal plant, pennyroyal (*Mentha pulegium L.*).

CONCLUSION

From the results of the present study, it was concluded that using 2% pennyroyal individually, or in combination with probiotic, have adverse effects on performance of laying hens.

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