Adding Medicinal Herbs Including Garlic (*Allium sativum*) and Thyme (*Thymus vulgaris*) to Diet of Laying Hens and Evaluating Productive Performance and Egg Quality Characteristics

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Abstract: Problem statement: In trying to finding phytogenic antibiotic-substitutes this study was done and effects of adding graded levels of Medicinal Herbs (MH) including garlic (*Allium sativum*) and thyme (*Thymus vulgaris*) to laying hens’ diet on productive performance investigated. Approach: A total number of 108 Lohmann LSL-Lite hens after production peak were randomly divided in 18 cages (n = 6). Three iso-energetic and iso-nitrogenous experimental diets (ME = 2720 Kcal Kg\(^{-1}\) and CP = 154.2 g Kg\(^{-1}\)) including three levels (0, 1 and 2 g Kg\(^{-1}\)) of ground mixture of garlic and thyme (1:1) were fed to hens with 6 replicates per diet during 6 week trial period. Collected data of Feed Intake (FI), Egg Production (EP), Egg Mass (EM) and calculated Feed Conversion Ratio (FCR) as well as egg traits were analyzed based on completely randomized design using GLM procedure of SAS. Results: Dietary treatment did not have significant effect on EP, EM and FCR in laying hens (p>0.05). Dietary inclusion of MH decreased FI in weeks 1-6 (p ≤ 0.05). Including diet with 0.1% MP improved means of egg weight (g) comparing to the other two experimental diets. Adding 0.2% MH to diet increased egg yolk color as well as blood lymphocyte counts and decreased egg shell weight comparing to other dietary treatments (p≤0.05). Conclusion: In conclusion, dietary inclusion of garlic and thyme can have beneficial effects on performance of laying hens in terms of improving egg weight and yolk color.

Key words: Garlic, *Allium sativum*, thyme, *Thymus vulgaris*, performance, laying hens

INTRODUCTION

There are many records in literature working on including herbal plant powders or essential oils extracted from medicinal plants in animal diets (Botsoglou *et al.*, 2002; Burt and Reinders, 2003; Jamroz *et al.*, 2005; Lopez-Bote *et al.*, 1998; Miura *et al.*, 2002; Zheng and Wang, 2001). Thyme (*Thymus vulgaris* L.) is an herbaceous perennial plant belonging to the Lamiaceae family. Thymol, a major component of thyme-essential oils, has been widely studied for its antimicrobial properties (Dorman and Deans, 2000). Carvacrol, an isomer of thymol, is found in essential oils isolated from oregano and thyme. Like thymol, carvacrol also displays antimicrobial activity (Helander *et al.*, 1998). Given their antimicrobial activity, it would be expected that thymol and carvacrol could have positive effects on growth performance in broilers. Such studies showed that thyme plant could be considered as an alternative natural growth promoter for poultry instead of antibiotics (McDevitt *et al.*, 2007).

Garlic (*Allium sativum* Linn) the spices of life is unique among the members of plant kingdom. Several clinical reports, including meta-analyses, have revealed a cholesterol lowering effect of garlic in humans (Warshafsky *et al.*, 1993). Allicin (the active compound produced by garlic) may reduce the levels of serum cholesterol, triglyceride and LDL (Alder and Holub, 1997). Mottaghitalab and Taraz (2002) concluded that diets containing garlic powder has potential as feed additives, which may be beneficial in reducing serum and egg cholesterol in hens. Khan *et al.* (2008) also reported that feed consumption, feed efficiency, egg weight and egg mass were not affected over 6 weeks when 0, 2, 6 and 8% dietary garlic powder was fed to the laying hens. Serum and egg yolk cholesterol concentrations decreased with increasing levels of dietary garlic.

The aim of the study was to investigate whether the supplementation of a diet with a mixture powder of garlic and thyme may assist in improving performance of laying hens and egg quality traits.

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MATERIALS AND METHODS

A total number of 108, 32 week old laying hens with an average body weight of (1350±100 g) were housed in an environmentally controlled house. A corn-soybean-based layer ration (ME = 2720 kcal kg\(^{-1}\) and CP = 154.2 g kg\(^{-1}\)) and water were provided ad libitum. The daily photoperiod consisted of 16 h of light and 8 h of darkness (16L:8D). Temperature was maintained at 22±1°C throughout the experimental period. Eggs were collected daily. Thirty six hens were assigned randomly to each of three treatment groups. One group served as a control and the other two groups were fed with diets included 0.1 or 0.2% ground powder mixture of garlic and thyme from the beginning of week 32-39 of age. On week 37 of age, egg were taken from each experimental group for two consecutive days and albumen weight, yolk weight, shell weight and egg quality were measured at day 1 (fresh laid eggs). Egg mass was calculated on weeks where egg weights were measured. The collected data were subjected to analysis of variance using the GLM procedure of SAS Institute (2000).

RESULTS

In this experiment, EP (%) and EM (g hen\(^{-1}\) day\(^{-1}\)) were not affected by dietary treatment (Table 1). Dietary inclusion of MH decreased FI (weeks 1-6); however, did not affect FCR (Table 2). Average of egg weight (g) was increased in hens fed diet included 0.1% MH comparing to control or 2% MH-included diet (Table 3). Among the measured egg quality characteristics which are presented in Table 4, yolk index, Haugh unit and egg shell thickness were not significantly affected by dietary treatment; however, including diets with 2% MH increased egg yolk color and decreased shell weight (p≤0.01).

Table 1: Effect of dietary inclusion of ground mixture of garlic and thyme on egg production (%) and egg mass (g hen\(^{-1}\) day\(^{-1}\)) in laying hens

| Treatment            | Egg production (%) | Egg mass (g hen\(^{-1}\) day\(^{-1}\)) |
|----------------------|--------------------|--------------------------------------|
|                      | 1-3 week | 3-6 week | 1-6 week | 1-3 week | 3-6 week | 1-6 week |
| Control              | 96.290   | 92.980   | 94.640   | 59.180   | 57.220   | 58.200   |
| Herbal mixture 0.1%  | 95.600   | 93.940   | 94.770   | 59.960   | 59.250   | 59.600   |
| Herbal mixture 0.2%  | 95.760   | 93.910   | 94.840   | 58.780   | 58.190   | 58.490   |
| P value              | 0.780    | 0.840    | 0.980    | 0.360    | 0.320    | 0.280    |
| SEM                  | 0.375    | 0.538    | 0.332    | 0.422    | 0.716    | 0.395    |

Table 2: Effect of dietary inclusion of ground mixture of garlic and thyme on feed intake (g hen\(^{-1}\) day\(^{-1}\)) and feed conversion ratio (g: g) in laying hens

| Treatment            | Feed intake (g hen\(^{-1}\) day\(^{-1}\)) | Feed conversion ratio (g: g) |
|----------------------|----------------------------------------|------------------------------|
|                      | 1-3 week | 3-6 week | 1-6 week | 1-3 week | 3-6 week | 1-6 week |
| Control              | 120.000  | 119.720  | 119.860  | 2.030    | 2.090    | 2.060    |
| Herbal mixture 0.1%  | 118.640  | 116.960  | 117.810  | 1.980    | 1.980    | 1.980    |
| Herbal mixture 0.2%  | 118.990  | 117.280  | 118.140  | 2.020    | 2.020    | 2.020    |
| P value              | 0.070    | 0.140    | 0.030    | 0.250    | 0.120    | 0.110    |
| SEM                  | 0.364    | 0.624    | 0.257    | 0.016    | 0.024    | 0.010    |

Table 3: Effect of dietary inclusion of ground mixture of garlic and thyme on egg weight (g) in laying hens

| Treatment            | Egg weight (g) |
|----------------------|----------------|
|                      | 1-3 week | 3-6 week | 1-6 week |
| Control              | 61.470^a  | 61.530^b  | 61.500^b  |
| Herbal mixture 0.1%  | 62.750^a  | 63.060^a  | 62.900^a  |
| Herbal mixture 0.2%  | 61.960^a  | 61.960^a  | 61.680^b  |
| P value              | 0.050    | 0.010    | 0.020    |
| SEM                  | 0.239    | 0.236    | 0.266    |

Table 4: Effect of dietary inclusion of ground mixture of garlic and thyme on egg quality parameters

| Treatment            | Egg index | Yolk color | Yolk index | Haugh unit | Shell weight | Shell thickness |
|----------------------|------------|------------|------------|------------|--------------|-----------------|
| Control              | 74.67      | 8.33^a     | 46.98      | 70.28      | 7.26^a       | 37.83           |
| Herbal mixture 0.1%  | 75.29      | 8.50^a     | 47.18      | 69.42      | 7.06^a       | 37.83           |
| Herbal mixture 0.2%  | 76.18      | 9.50^b     | 47.94      | 66.36      | 6.60^b       | 35.33           |
| P value              | 0.28       | 0.01       | 0.34       | 0.06       | 0.01         | 0.06            |
| SEM                  | 0.38       | 0.19       | 0.43       | 0.74       | 0.10         | 0.51            |
**Table 5: Effect of dietary inclusion of ground mixture of garlic and thyme on blood lipids**

| Treatment            | Cholesterol | TG     | HDL   | LDL   |
|----------------------|-------------|--------|-------|-------|
| Control              | 167.000     | 2057.00| 50.750| 95.250|
| Herbal mixture 0.1%  | 181.500     | 1940.00| 59.000| 109.500|
| Herbal mixture 0.2%  | 199.250     | 1766.00| 59.250| 123.750|
| P value              | 0.430       | 0.91   | 0.520 | 0.430 |
| SEM                  | 9.711       | 249.80 | 3.232 | 8.522 |

**Table 6: Effect of dietary inclusion of ground mixture of garlic and thyme on white blood cell counts**

| Treatment            | Heterophile (%) | Lymphocyte (%) | Monocyte (%) | Eosinophile (%) | Basophil (%) |
|----------------------|-----------------|----------------|--------------|-----------------|-------------|
| Control              | 35.500          | 58.500         | 2.160        | 1.830           | 2.000       |
| Herbal mixture 0.1%  | 37.830          | 57.660         | 1.000        | 0.830           | 2.500       |
| Herbal mixture 0.2%  | 29.500          | 66.600         | 0.830        | 0.500           | 4.160       |
| P value              | 0.060           | <0.010         | 0.510        | 0.080           | 0.060       |
| SEM                  | 1.507           | 1.346          | 0.491        | 0.261           | 0.403       |

As it is presented in Table 5, dietary MH inclusion did not affect plasma levels of cholesterol, triglyceride, HDL and LDL (p>0.05). White blood cell counts (% of total) which are shown in Table 6 were not affected by dietary supplementation by MH, except for lymphocyte that was higher in hens fed diets included 2% MH comparing to the two other experimental diets (p≤0.01). The results of this research project presented in the “First Seminar of Medicinal Plants”, Jahad Daneshgahi, Kordestan Branch, Sanandaj, Iran.

**DISCUSSION**

In this study, EP, EM and FCR were not affected by dietary MP-inclusion; however, FI decreased. Chowdhury et al. (2002) also reported no differences among garlic-included diets in EW, EM, FI, FCR and BW gain as averaged over 6 week trial period. Zeweil et al. (2006) who supplemented diets with 1.0-2.0 g of thyme flowers kg⁻¹ reported no significant improvements for means EP, EW, EM and FCR when Japanese quail hens were fed with 1.0 g thyme flowers compared with control.

Means of egg weight were increased in hens fed diet included 0.1% MH comparing to control or 2% MH-included diet. Among the measured egg quality characteristics yolk index, Haugh unit and egg shell thickness were not significantly affected by dietary treatment; however, including diets with 2% MH increased egg yolk color and decreased shell weight. In the study by Chowdhury et al. (2002) yolk weight responded quadratically with increasing levels of dietary garlic and differed among strains.

In the present study, dietary including MH did not affect plasma levels of cholesterol, triglyceride, HDL and LDL. It has been reported that serum and egg yolk cholesterol concentrations decreased linearly with increasing levels of dietary garlic (Chowdhury et al., 2002). Clinical reports, including meta-analyses, have described the hypocholesterolemic effect of garlic in humans (Silagy and Neil, 1994; Warshafsky et al., 1993). Some studies, however, suggested that commercial garlic oil, garlic powder and commercially available garlic extract may not be hypocholesterolemic (Berthold et al., 1998; Isaacs et al., 1998; McCrindle et al., 1998). Although the reason for this is unknown, it likely relates to preparation methods, the stability of chemical components and the duration of the study (Amagase et al., 2001).

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