American Journal of Animal and Veterinary Sciences 5 (2): 151-154, 2010
ISSN 1557-4555

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

R. Ghasemi, M. Zarei and M. Torki
Department of Animal Science, Agricultural Faculty, Razi University,
Imam Avenue, Kermanshah, Iran

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 ($p\leq0.05$). 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 ($p\leq0.05$). **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.

Corresponding Author: M. Torki, Department of Animal Science, Agricultural Faculty, Razi University, Postal Code: 67155-1158, Imam Avenue, Kermanshah, Iran

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 ($p \leq 0.01$).

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

	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
Treatment 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

	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
Treatment control	120.000	119.720	119.860[a]	2.030	2.090	2.060
Herbal mixture 0.1%	118.640	116.960	117.810[b]	1.980	1.980	1.980
Herbal mixture 0.2%	118.990	117.280	118.140[b]	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

	Egg weight (g)		
	1-3 week	3-6 week	1-6 week
Treatment control	61.470[b]	61.530[b]	61.500[b]
Herbal mixture 0.1%	62.750[a]	63.060[a]	62.900[a]
Herbal mixture 0.2%	61.390[b]	61.960[b]	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

	Egg index	Yolk color	Yolk index	Haugh unit	Shell weight	Shell thickness
Treatment control	74.67	8.33[b]	46.98	70.28	7.26[a]	37.83
Herbal mixture 0.1%	75.29	8.50[b]	47.18	69.42	7.06[a]	37.83
Herbal mixture 0.2%	76.18	9.50[a]	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

	Cholesterol	TG	HDL	LDL
Treatment 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

	Heterophile (%)	Lymphocyte (%)	Monocyte (%)	Eosinophile (%)	Basophile (%)
Treatment control	35.500	58.500[b]	2.160	1.830	2.000
Herbal mixture 0.1%	37.830	57.660[b]	1.000	0.830	2.500
Herbal mixture 0.2%	29.500	66.660[a]	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 ($p\leq0.01$). 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; Isaacsohn *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).

CONCLUSION

From the result of this investigation it can be concluded that dietary inclusion of garlic and thyme can have beneficial effects on performance of laying hens in terms of improving yolk color. As far as supplementing diets with garlic and thyme in the present study decreased FI and increased egg weight with no adverse effect on EP and EM, this kind of feed additive would be beneficial in egg production industry.

ACKNOWLEDGMENT

The authors appreciate the research center of Jahade Daneshgahi of Kurdistan branch for their financial support.

REFERENCES

Alder, A.J. and B.J. Holub, 1997. Effect of garlic and fish-oil supplementation on serum lipid and lipoprotein concentrations in hypercholesterolemic men. Am. J. Clin. Nutr., 65: 445-450. http://www.ajcn.org/cgi/content/abstract/65/2/445

Amagase, H., B.L. Petesch, H. Matsuura, S. Kasuga and Y. Itakura, 2001. Intake of garlic and its bioactive components. J. Nutr., 131: 9555S-9625S. http://jn.nutrition.org/cgi/content/abstract/131/3/955S

Berthold, H.K., T. Sudhop and K. Von Bergmann, 1998. Effects of a garlic oil preparation on serum lipoproteins and cholesterol metabolism. J. Am. Med. Assoc., 279: 1900-1902.

Botsoglou, N.A., P. Florou-Paner, E. Chiristaki, D.J. Fletouris and A.B. Spais, 2002. Effect of dietary oregano essential oil on performance of chickens and on iron-induced lipid oxidation of breast, thigh and abdominal fat tissues. Br. Poult. Sci., 43: 223-230. DOI: 10.1080/00071660120121436

Burt, S.A. and R.D. Reinders, 2003. Antibacterial activity of selected plant essential oils against *Escherichia coli* O157: H7. Lett. Applied Microb., 36: 162-167. DOI: 10.1046/j.1472-765X.2003.01285.x

Chowdhury, S.R., S.D. Chowdhury and T.K. Smith, 2002. Effects of dietary garlic on cholesterol metabolism in laying hens. Poult. Sci., 81:1856-1862. http://ps.fass.org/cgi/reprint/81/12/1856

Dorman, H.J.D. and S.G. Deans, 2000. Antimicrobial agents from plants: Antibacterial activity of plant volatile oils. J. Applied Microb., 88: 308-316. DOI: 10.1046/j.1365-2672.2000.00969.x

Helander, I.M., H.L. Alakomi, K. Latva-Kala, T. Mattila-Sandholm and I. Pol *et al*., 1998. Characterization of the action of selected essential oil components on gram-negative bacteria. J. Agric. Food Chem., 46: 3590-3595. DOI: 10.1021/jf980154m

Isaacsohn, J.L., M. Moser, E.A. Stein, K. Dudley and J.A. Davey *et al*., 1998. Garlic powder and plasma lipids and lipoproteins: Amulticenter, randomized, placebo controlled trial. Arch. Int. Med., 158: 1189-1194. PMID: 9625398

Jamroz, D., A. Wiliczkiewicz, T. Wertelecki, J. Orda and J. Sukorupinska, 2005. Use of active substances of plant origin in chicken diets based on maize and locally grown cereals. Br. Poult. Sci., 46: 485-493. DOI: 10.1080/00071660500191056

Khan, S.H., S. Hasan, R. Sardar and M.A. Anjum, 2008. Effects of dietary garlic powder on cholesterol concentration in Native Desi laying hens. Am. J. Food Tech., 3: 207-213. http://www.doaj.org/doaj?func=abstract&id=428504

Lopez-Bote, C.J., J.I. Gray, E.A. Gomaa and C.I. Flegal, 1998. Effect of dietary administration of oil extracts from rosemary and sage on lipid oxidation in broiler meat. Br. Poult. Sci., 39: 235-240. DOI: 10.1080/00071669889187

McCrindle, B.W., E. Helden and W.T. Corner, 1998. Garlic extract therapy in children with hypercholesterolemia. Arch. Pediatr. Adolesc. Med., 152: 1089-1094. http://archpedi.ama-assn.org/cgi/reprint/152/11/1089

McDevitt, D.E., R.M. Hillman, K. Acamovic and T. Cross, 2007. The effect of herbs and their associated essential oils on performance, dietary digestibility and gut micro flora in chickens from 7-28 days of age. Br. Poult. Sci., 48: 496-506. DOI: 10.1080/00071660701463221

Miura, K., H. Kikuzaki and N. Nakatani, 2002. Antioxidant activity of chemical components from sage (*Salvia officinalis* L.) and oregano (*Thymus vulgaris* L.) measured by the oil stability index method. J. Agric. Food Chem., 50: 1845-1851. DOI: 10.1021/jf0113140

Mottaghitalab, M. and Z. Taraz, 2002. Effects of garlic (*Allium sativum*) on egg yolk and blood serum cholesterol in Aryan breed laying hens. Br. Poult. Sci., 43: 42-43. DOI: 10.1080/000716602762388608

SAS Institute, 2000. SAS SQL Procedure User Guide, Version 8. 1st Edn., SAS, Cary, ISBN: 13: 978-158025599X, pp: 576.

Silagy, C. and A. Neil, 1994. Garlic as a lipid lowering agent. A meta-analysis. J. R. Coll. Phys. Lond. 28: 39-45. PMID: 8169881

Warshafsky, S., R.S. Kamer and S.L. Sivak, 1993. Effects of garlic on total serum cholesterol. A meta-analysis. Ann. Intern. Med., 119: 599-605. http://www.annals.org/content/119/7_Part_1/599.full

Zeweil, H.S., S.G. Genedy and M. Bassiouni, 2006. Effect of probiotic and medicinal plant supplements on the production and egg quality of laying Japanese quail hens. Proceeding of the 12th European Poultry Conference, Sept. 10-14, ZWANS, Verona, Italy, pp: 1-6. http://lba.zwans.com/fullpapers/10224.pdf

Zheng, W. and S.Y. Wang, 2001. Antioxidant activity and phenolic compounds in selected herbs. J. Agric. Food Chem., 49: 5165-5170. DOI: 10.1021/jf010697n