Original paper

EFFECT OF DIFFERENT LEVELS OF *LAVANDULA STOECHAS* ESSENCE ON PRODUCTION PERFORMANCE AND EGG QUALITY OF LAYING HENS

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Abstract

The objective of this study was to evaluate the effects of different levels of *Lavander stoechas* essence on performance and egg quality of laying hens for 8 weeks. This experiment was conducted with 160 Hy-Line (W36) laying hens (30 wks of age), randomly divided into 4 experimental groups, 5 replicates and 8 birds per each (2 cages for each replicate and 4 birds in each cage). Treatments were control (without *Lavander* essence), and levels of 200, 400, and 600 ppm *Lavander* essence. All hens were provided the layer diets (2870 kcal/kg ME and 15.5 % CP) ad- libitum and received 16 h of light/ 8 h of dark. Performance parameters including egg weight and egg production were recorded daily and feed intake, feed conversion ratio (grams of feed:grams of egg) and egg quality were measured weekly. The following characteristics were recorded for the individual eggs: weight, shape index, eggshell breaking strength, shell thickness, yolk color, and Haugh unit. Levels of 200 and 400 ppm of *Lavander* essence showed a significant increase in production percentage and egg weight but these parameters decreased at level of 600 ppm. Feed intake was highest for control, 200 and 400 ppm essence dietary levels but level of 600 ppm showed significant decrease. Addition of essence to the diet had no effect on FCR. Shape index and Haugh unit were not significantly affected by the treatments. Higher yolk color score was observed in treatments containing *Lavander* essence in comparison with control ($p<0.05$). Levels of 200 and 400 ppm essence increased significantly egg shell quality including thickness, weight and shell breaking strength. The results showed that the addition of essences of *Lavender* up to 400 ppm increased production performance and improved egg quality.

Key words: *egg quality, Lavender essence, laying hens, performance*

Introduction

In the commercial egg type chicken industry profits depend on the cost and nutritive value of the feed. One of the promoting enhances productive performance of layers are antibiotics. Antibiotics have been used as growth promoting substance. However, the use of antibiotics as feed additives is risky due to not only cross-resistance but also to multiple resistances in pathogens (Bach Knudsen, 2001; Schwarz et al., 2001). Consequently, the animal feed industry is under increasing consumer pressure to reduce the use of antibiotics as a feed additive and to find substitutes for antibiotics in the diet (Hertrampf, 2001; Humphrey et al., 2002). Many scientists have searched for alternatives to antibiotics (Langhout, 2000; Mellor, 2000; Wenk, 2000; Kamel, 2001). Recently, it has been found that natural additives such as herbs and edible plants have some properties as growth enhancers to replace antibiotics. These additives are given to animals or birds to improve their physiological and productive performance. The antimicrobial effect of the medicinal plants is well documented (Valero and Salmeron, 2003). Lavander stoechas is a flowering plant in the family of *Lamiaceae*. The medicinal parts are the essential oil from the fresh flowers and/or the inflorescence, the flowers collected just before opening and dried, the fresh flowers and the dried flowers. Lavender oil has been reported to contain more than 100 components. The essential oil (1 to 3%) of *Lavandula* is rich in linalool and linalyl acetate. Further aroma components are β-ocimene, cineol, camphor and caryophyllene epoxide. Linalyl acetate is the major compound found in flowers. The plant contains also rosmarinic acid, and coumarin. Because no information is available about the administration of *Lavandula* in laying hens diet, this experiment was conducted to investigate the effect of using Lavander stoechas as additive on productive traits and egg quality traits of laying hens.

Material and methods

Birds and housing

One hundred and sixty Hy-Line (W36) laying hens (30 wks of age) were individually weighed and randomly housed in cages and allotted for four dietary treatment groups of five replicates and six birds in each replicate for ten weeks (three birds in each cage and two cages for each replicate). Two weeks were for adaptation and eight weeks for sampling. The birds were maintained under commonly 16 h light:8 h dark cycle throughout the experimental period. Hen house temperature was 17- 20°C during the experiment. Feed and water were offered ad-libitum. Treatments were basal diet (Corn-Soybean diet with 2870 kcal/kg ME and 15.5 % CP) and increasing levels of Lavander stoechas essence (200, 400 and 400 ppm) added to basal diet. The experimental diets were in mash form and formulated to meet or exceed NRC (1994) recommendations.

Productive and egg quality traits

Egg production performance was expressed as a percentage of hen-day egg production. During the entire experimental period, eggs from each replicate were collected daily and weighed to determine average egg weight. Feed intake was recorded on a weekly basis. Egg mass and feed conversion ratios were calculated as below:

Daily egg mass (g/hen) = hen-day egg production (%) × egg weight (g)/100.

Feed conversion ratio (g feed/g egg) = daily feed intake (g/hen)/daily egg mass (g/hen).

To evaluate egg quality, 10 eggs from each treatment every week were randomly collected. Eggs were weighed individually, then broken and the inner contents were placed on a leveled glass surface to determine the inner egg quality.

Eggshell thickness, eggshell strength, yolk colour score, Haugh unit (HU) and albumen height as egg quality parameters were examined. When determining egg quality characteristics, the samples of eggs were individually weighed at initiation, and then egg shell breaking strength was measured using egg shell tester equipment (Futura resistant tool), and expressed as unit of compression force exposed to unit egg shell surface area (kg/cm^2). Then, eggs were cracked and carefully separated from the shells. Egg shell thickness (with membrane) was measured at three different points (i.e. the top, middle and bottom) using a micrometer (model IT-014UT, Mitutoya, Kawasaki, Japan). The average of three different thickness measurements from each egg was used to describe egg shell thickness. The shell was weighted and the relative proportion of shell was determined. Albumen height was measured by Futura equipment. A Haugh unit was calculated according to the formula given as follows:

Haugh unit = 100 log [albumen height (mm) + 7.57 - 1.7 egg weight 0.37 (g)]

Yolk colour was determined according to the Roche Yolk Colour fan.

All the results were statistically analyzed by General Linear Models (GLM), one way analysis of variance, using SAS software (SAS Institute, 1999). Differences among means were separated using Duncan's multiple range test (Duncan, 1955).

Results and discussion

Productive traits

Table 1. *Effect of treatments on performance parameters of laying hens during the experiment*

Level of essence (ppm)	Egg Weight (g)	Production Percentage (d/h)	Feed Intake (g/h/d)	Feed Conversion Ratio
0	57.30^{b}	87.18^{ab}	100.4^{a}	2.01
200	58.47^{a}	88.03^{a}	100.2^{a}	1.92
400	58.44^{a}	87.12^{ab}	99.4^{a}	1.96
600	57.25^{b}	85.58^{b}	94.6^{b}	1.92
SEM	0.41	2.16	1.87	0.05

^{a,b} Column means with different superscripts differ significantly ($P < 0.05$)

The productivity data of laying hens are summarized in Table 1. Data from Table 1 indicate that egg weight during the experiment was significantly affected by treatments. It can be observed from this table that hens fed 200 and 400 *ppm* of *Lavandula* essence had higher egg weight when compared with other treatments. Supplementation layer diet with different levels of *Lavandula* essence had no significant effect on production percentage compared to the control. But as numerical, the highest production percentage was found in 200 *ppm* essence that had significant effect with 600 *ppm*.

Supplementation layer diet with different levels of *Lavandula* essence had a significant effect on the amount of feed intake through the experiment. Hens fed the levels of 200 and 400 *ppm* of essence and control diet had significantly ($p<0.05$) greater feed intake than hens fed diet supplemented with 600 *ppm* essence. However, there was no significant ($p>0.05$) difference in feed intake between hens fed control and essence up to 400 *ppm* (Table 1). Feed conversion ratio was not affected by the treatments ($p>0.05$). The results of this experiment are in accordance with the results of Hassan *et al.* (2011) that observed increase in egg weight, feed intake and production percentage by using Eucalyptus powder in the diets of quail. Previous studies reported that plant extract supplementation to diet showed different effect on egg production and egg quality of laying hens. This might stem from the amount of plant extract and the source of it. Our findings related to egg production traits did not confirm some earlier works that indicated beneficial effects from essential oils in the diets for laying hens. In our study, egg weights of 200 and 400 *ppm* essence were significantly higher compared to control treatment. Bozkurt *et al*. (2009) showed that mixture of essential oil supplementation in diet did not affect egg production and egg weight of broiler breeders. In another study (Botsoglou *et al*., 2005), the effects of dietary aromatic plant extracts on the laying performance of hens from 32 to 40 wk of age were investigated and the results showed no significant differences in egg production and egg weight among the treatment groups.

Egg quality traits

Table 2. *Effects of treatments on egg quality of laying hens during the experiment*

Level of essence (ppm)	Haugh unit	Egg yolk colour score[1]	Breaking strength (kg/cm^2)	Eggshell thickness (mm)	Eggshell weight (g)	Eggshell weight ratio (%)
0	79.84	6.06^{b}	1.67^{c}	0.341^{b}	5.66^{b}	9.87^{b}
200	80.76	7.46^{a}	2.22^{a}	0.374^{a}	6.20^{a}	10.60^{a}
400	81.36	7.31^{a}	2.04^{ab}	0.368^{a}	5.97^{ab}	10.20^{ab}
600	79.70	7.03^{a}	1.88^{bc}	0.353^{b}	5.86^{b}	10.23^{ab}
SEM	1.18	0.17	0.094	0.120	0.12	0.35

[a,b] Column means with different superscripts differ significantly ($P < 0.05$); [1] Roche yolk colour score: 1 light yellow; 15 orange

Supplementation layer diet with different levels of *Lavandula* essence had no significant effect on Haugh unit (Table 2). Egg yolk colour was affected by dietary treatments. Yolk colour of the essence groups was higher compared to the control. The outer egg quality parameters (eggshell weight, eggshell thickness, eggshell weight ratio and eggshell strength) were affected by dietary treatments ($p<0.05$) (Table 2). Layers fed diets supplemented with 200 *ppm* essence had highest eggshell weight among treatments. Eggshell weight ratio was significantly increased by increasing levels of essence in the diet ($p<0.05$). Layers fed diets supplemented with *Lavandula* essence (200 and 400 *ppm*) had thicker egg shell, while the lowest one was detected for control diet and 600 *ppm* essence. Layers fed diets supplemented with 200 *ppm* essence had highest breaking strength among treatments. The results of our study showed significant differences in eggshell weight, eggshell weight ratio, eggshell thickness, eggshell strength and egg yolk colour among treatments. However, there were no significant differences in Haugh unit score. Since there is not enough information about *lavandula* essence on egg quality of layers we use the results of other plant extracts in poultry nutrition. Results reported herein are in agreement with those reported by Bacha *et al*. (1997) saying that anise is rich in mineral elements what plays an important role in increased egg shell intensities. In contrast with the result of our study, there are several studies that oregano essential oil supplementation in diet did not affect eggshell thickness (Botsoglou *et al*., 2005). On the other hand, Haugh unit results of our study agree with the results of Botsoglou *et al*. (2005) who reported that Haugh unit score was not affected by oregano essential oil supplementation of diet.

Conclusion

Lavandula essence showed a significant positive effect on performance of layers up to 400 *ppm* in diet. Moreover, *Lavandula* essence supplementation in diet increased eggshell quality of layers. Collectively, these findings suggest that *Lavandula* essence supplementation in commercial layer diets might be beneficial up to 400 *ppm*. More detailed studies are still needed to determine the function of *Lavandula* essence supplementation to laying hen diets.

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