The Effect of Selected Feed Additives on the Shell Qualitative Parameters of Table Eggs

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Abstract

Herbs, spices and their extracts (botanicals) have a wide range of activities. It may have a beneficial effect on the gastrointestinal micro flora of animals, performance and quality of animal products. In this experiment the effects of supplementation of the diet for laying hens with different doses of thyme or oregano essential oil addition on egg shell quality parameters were studied. Hens of laying hybrid Hy-Line Brown (n=50) were randomly divided into 5 groups (n=10) and fed for 20 weeks with diets with thyme or oregano essential oil supplemented. In the control group hens received feed mixture with no additions. The diets in the first and second experimental groups were supplemented with 0.5 ml/kg or 1.0 ml/kg thyme essential oil. The diets in the third and fourth experimental groups were supplemented with 0.5 ml/kg or 1.0 ml/kg oregano essential oil. The egg shell weight (g), specific egg shell weight (g/cm^3), percentage of egg shell (%), egg shell strength (N/cm^2) and egg shell thickness (μm) were evaluated. The egg shell weight for the whole period was in the order of the groups 5.70±0.52; 5.65±0.44; 5.54±0.42; 5.62±0.38 and 5.49±0.48 g±S.D ($P>0.05$). Egg shell strength during the reporting period was in order of the groups: 27.81±6.00; 27.63±6.43; 27.17±6.36; 27.76±6.27 and 28.41±6.36 (N/cm^2±S.D). Similarly, in the egg shell specific weight (g/cm^3), egg shell percentage ratio (%) and egg shell thickness (μm) were observed statistically non-significant differences compared to the control group ($P>0.05$). The results suggest that the qualitative parameters of egg shell were not significantly influenced with thyme or oregano oil addition ($P>0.05$).

Keywords: egg shell, essential oil, oregano, quality, thyme

1. Introduction

Removal and restriction of sub therapeutic antibiotics from poultry diets in many parts of the world has amplified interest in improving intestinal health and nutrient utilization [1]. The use of feed additives is more and more questioned by the consumers. Therefore, the feed industry is highly interested in valuable alternatives which could be accepted by the consumers [2]. Feed additives cannot replace the negative impact of diet, feeding regime or unbalanced nutrients in the ration. They are not a source of nutrients for poultry. When absent in the ration, the animals have not signs of nutritional deficiency [3].

Phytobiotics is a term used to describe the natural bioactive substances of plant origin, which affect the growth and health of the animal. Essential oils and plant extracts [5] are often applied in the form of powder [4]. Essential oils are intensive fragrant, oily liquid substances contained in different parts of the plant. Their function is based on organoleptic effect and stimulation of organism to the production of digestive juices. Result is a higher digestibility and absorption of nutrients [6]. Besides antibacterial properties [7], essential oils or their components have been shown to exhibit antiviral [8] antimycotic, antioxigenic, antiparasitic, and insecticidal properties [6].

Based on the work of several authors may have a beneficial effect on the gastrointestinal micro flora

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of poultry [9], [8] the quality of poultry meat [10] and eggs [11].

The aim of this work was to observe the influence of different doses of thyme essential oil and oregano essential oil addition on qualitative parameters of shell of laying hens eggs of hybrid Hy-Line Brown in pilot system.

2. Materials and methods

Animals, diets and treatments

Hens (n=50) of the laying hybrid Hy-Line Brown, 17 weeks old, were randomly divided into 5 groups (n=10) and fed for 20 weeks with diet containing of different amounts of thyme or oregano essential oils.

At the beginning of the experiment, the hens were kept in the three–deck cage technology system, model AGK 2000/616. The technology system was in accordance with requirements specified by the Directive 1999/74 EC. The layer hens were kept by the standard bioclimatic conditions. The composition of the basal diet (BD) fed to the laying hens is shown in Table 1 and Table 2.

Table 1. Composition of the trial diets

Component	Participation in the Diet (%)
Wheat	26.30
Rye	15.00
Barley	20.00
Soybean meal (47% crude protein)	22.00
Soybean oil	2.50
Fat	2.00
Monocalcium phosphate	1.70
Calcium carbonate	9.14
Natrium chloride (38 % Na)	0.30
Sodium bicarbonate (28 % Na)	0.10
Methionin (99 % DL-Methionin)	0.16
Vitamin Premix	0.40
Mineral Premix	0.10
Choline chloride	0.20
Caroten premix	0.10

Table 2. Nutrient content in the trial diets

Nutrient	Nutrient Content in Mixture
MEN ($MJ.kg^{-1}$ of DM)	11.5
CP ($g.kg^{-1}$ of DM)	177
LYS ($g.kg^{-1}$ of DM)	8.81
MET ($g.kg^{-1}$ of DM)	4.17
M + C ($g.kg^{-1}$ of DM)	7.41
THR ($g.kg^{-1}$ of DM)	6.27
LA ($g.kg^{-1}$ of DM)	19.0
Ca ($g.kg^{-1}$ of DM)	39.1
Pavail. ($g.kg^{-1}$ of DM)	3.8
Na ($g.kg^{-1}$ of DM)	1.5

* MEN: metabolisable energy for poultry, CP: crude protein, LYS: lysine, MET: methionine, M+C: methionine plus cysteine, THR: threonine, LA: linoleic acid, Ca: calcium, Pavail.: available phosphorus, Na: natrium.

In the control group hens received feed mixture without additions. The diets in the first and second experimental groups were supplemented with 0.5 ml/kg and 1.0 ml/kg thyme essential oil. The diets in the third and fourth experimental groups were supplemented with 0.5 and 1.0 ml/kg oregano essential oil (Calendula a.s. Nová Ľubovňa, SR). Laying hens accepted fodder *ad libitum*.

All kinds of feed supplements used in the experiment were homogenously incorporated into the feed mixture in the feed mill.

Sample Analysis
Eggs of laying hens of Hy-Line Brown strain were collected regularly one a month (n= 30 per group) and were assessed immediately after collection. The egg shell weight (g), specific egg shell weight (g/cm^3), percentage of egg shell (%), egg shell strength (N/cm^2) and egg shell thickness (μm) were evaluated. All these parameters were detected using routine methods. Egg shell weight was detected using analytical weighting machine and the growth intensity and percentage contents were calculated from weight data. Egg shell strength was detected using Egg Crusher 1.1 (VEIT Electronics, Czech Republic). Experiment lasted 20 weeks.

Statistical analysis
Statistical analysis was done using one–way analysis of variance (ANOVA) with the post hoc Tukey's multiple comparison test in the program SAS.

3. Results and discussion

Table 3 present the changes in egg shell qualitative parameters with plant essential oil addition to feed.
The scientific information related to the dietary effects of essential oil in terms of layer hens is still very limited. Some hopeful signs were reported in performance, immune response, and eggshell quality of laying hens fed diets supplemented with essential oil of thyme, sage, and rosemary [12], [13], and an essential oil mixture [14].
The weight of the shell. The recorded value in our experiment was lower (P>0.05) between the group with supplement of oregano essential oil in compared to the control group. [15] indicate the other hand the increase in the egg shell weight used of the addition of dietary essential oil combination (sage, thyme, and mentha extracts), but did not affect other egg quality parameters. In the experiment [16] adding of 0.2% medicinal herbs including garlic (*Allium sativum*) and thyme (*Thymus vulgaris*) to diet increased egg yolk color as well as blood lymphocyte counts and decreased egg shell weight comparing to other dietary treatments. Similarly [17] found insignicant effect of addition of thyme on qualitative parameters of egg shell. In the contrary [18] suggest that powder of garlic (*Allium sativum*) or thyme (*Thymus vulgaris*) did not have significant effect on egg production, egg mass, feed intake and feed conversion ratio of laying hens. Egg weight, egg index, Haugh unit, egg gravity and egg shell weight were not significantly affected by dietary treatment, too.
The egg shell strength. Impact of two essential oils added to the feed mixture, eggshell strength in our experiment does not influence significantly (P>0.05). A similar results reached [19] who reported an insignificant effect on egg weight and quality parameters of individual parts of the egg. In contrast, in experiments of the [14], the percentage of cracked and broken eggs in the group with complement of essential oils is lower compared to the control group.
The results of [20] show that the supplementation of thyme or hyssop essential oil into laying hens' diet significantly decreased the egg shell weight. The addition of thyme essential oil into the diet significantly decreased the egg shell percentage ratio and egg shell specific weight, too. The thyme or hyssop essential oils addition did not influence the egg shell strength.
The average thickness of the shell in our experiment in all groups was relatively balanced. In groups with the addition of thyme and oregano oil, differences between groups were statistically insignificant (P>0.05). The highest average thickness of the shell was in a group with addition of oregano at 1 ml.kg^{-1}. A similar finding has also [21]. Results of [22] showed that there were no significant (P>0.05) differences in egg production, feed consumption, feed conversion ratio, egg weight and shape, yolk diameter, height and color, Haugh units, and shell thickness, among the dietary treatments. Results of [23] showed that different thyme and oregano levels had no significant effects on feed intake, egg whites, shell percentage and egg shell thickness. While, thyme and oregano 1.5% showed significant positive effects on egg weight, egg masses, egg yolk percentage and albumen to yolk ratio. In the experiments of the [24], was the value of the thickness of the shell in the experimental group with complement of phytobiotics lower, but not statistically different. [25] reported statistically significant differences after addition of oregano, rosemary and saffron. Also in experiment [26] was not internal quality of eggs include of the egg shell thickness, with the addition of herbal mixtures significantly affected.

Table 3. Influence of thyme and oregano essential oil addition into laying hens feed mixture on the alterations of Hy-Line Brown laying hens egg shell quality

Parameter	Groups				
	Control BD	BD+thyme oil 0.5 ml/kg	BD+thyme oil 1 ml/kg	BD+oregano oil 0.5 ml/kg	BD+oregano oil 1 ml/kg
Egg shell weight (g)					
mean	5.70	5.65	5.54	5.62	5.49
S.D.	0.52	0.44	0.42	0.38	0.48
CV%	9.09	7.82	7.62	6.76	8.74
min.	3.90	4.50	4.20	4.10	4.30
max.	7.10	6.70	6.50	6.80	6.80
P value		0.3851	0.0520	0.5401	0.0517
Egg shell specific weight (g/cm^3)					
mean	2.03	2.03	2.00	2.01	2.04
S.D.	0.09	0.13	0.14	0.12	0.11
CV%	4.73	6.23	7.24	5.77	5.56
min.	1.74	1.66	1.60	1.70	1.76
max.	2.35	2.37	3.10	2.86	2.35
P value		0.9525	0.0619	0.2331	0.1319
Egg shell percentage ratio (%)					
mean	9.49	9.64	9.36	9.47	9.30
S.D.	0.74	0.60	0.80	0.83	0.77
CV%	7.79	6.23	8.55	8.75	8.27
min.	7.47	7.86	7.93	7.58	8.20
max.	11.55	11.68	12.00	13.05	11.64
P value		0.0596	0.1725	0.7647	0.0520
Egg shell strength (N/cm^2)					
mean	27.81	27.63	27.17	27.76	28.41
S.D.	6.00	6.43	6.36	6.27	6.36
CV%	21.56	23.27	23.40	23.08	21.62
min.	16.40	15.25	14.60	14.25	15.27
max.	42.00	44.95	40.55	44.95	46.70
P value		0.2837	0.0955	0.4563	0.0688
Egg shell thickness (μm)					
mean	376.50	374.00	380.74	374.09	387.22
S.D.	24.46	26.65	20.06	21.19	25.77
CV%	6.50	7.13	5.27	5.66	6.65
min.	293.33	273.33	320.00	316.66	326.66
max.	440.00	436.66	436.66	433.33	456.66
P value		0.3020	0.4609	0.3551	0.4321

4. Conclusions

The addition of oregano in the dose 1ml/kg slightly increased egg shell strength and egg shell thickness. The results suggest that the qualitative parameters of egg shell were not significantly influenced with thyme or oregano oil addition (P>0.05).

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