

The Effect of the Clove Essential Oil to the Production and Quality of Laying Hens Eggs

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Abstract

The aim of this study was to determine the effect of the clove (*Syzygium aromaticum*) essential oil to the egg production parameters and egg quality of laying hens. A total of 40 Isa Brown laying hens were divided into 4 groups (n=10). The laying hens were fed 20 weeks *ad libitum*. The control group was fed with complete feed mixtures without additives. The first group of hens was fed a diet with complete feed mixtures with 0.3 ml.kg⁻¹ of clove essential oil. The second group of hens was fed a diet with complete feed mixtures with 0.6 ml.kg⁻¹ of clove oil and the third group of hens was fed a diet with complete feed mixtures with 1 ml.kg⁻¹ of clove oil. Egg production, egg weight (g), specific egg weight, albumen weight (g), albumen index, Haugh Units (HU), yolk weight (g), yolk index, yolk colour (HLR) were studied. The results show that the addition of clove oil, especially in the group of laying hens with the addition of 1 mg.kg⁻¹ clove oil had no significantly different (P>0.05) to the egg production (the order of the groups: 90.3; 91.8; 91.3; 92.6%). In egg weight were found no significant differences between groups. The addition of 1 ml.kg⁻¹ clove oil had significant (P>0.05) influenced the albumen index and the addition of 0.6 ml.kg⁻¹ and 1 mg.kg⁻¹ clove oil had significant (P>0.05) influenced Haugh units. In the control group was found not significant (P>0.05) different in yolk weight compared with other groups. In the other parameters of egg quality (albumen weight, yolk index, yolk colour) with the addition of clove oil were found no significant differences between groups.

Key words: clove essential oil (*Syzygium aromaticum*), egg production, egg quality, laying hens

1. Introduction

Throughout the world antibiotics had been used extensively as growth promoters in animal feeds for a large number of years, especially in the fields of poultry and pig production. However, objections to the use of growth-promoting antibiotics were increasing as consumers fear that their use in livestock feeds may lead to the development of antibiotic resistant bacteria which are harmful to humans. As a result efforts have been made in many countries to ban the inclusion of all types of antibiotic growth promoters in animal feeds [1]. In Europe the prohibition of antibiotic use in poultry feed has forced

investigators to research growth promoting alternatives [2].

Essential oils are intensive fragrant, oily liquid substances contained in different parts of the plant [3]. Essential oils are complex compounds, and their chemical composition and concentrations of various compounds are variable [4]. Essential oils basically consist of two classes of compounds, the terpenes and phenylpropenes, depending on the number of five-carbon building blocks. 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. Besides antibacterial properties, essential oils or their components have been shown to exhibit antiviral, antimycotic, antioxigenic, antiparasitic, and insecticidal properties [3].

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Clove (*Syzygium aromaticum*), belonging to the family *Myrtaceae*, is one of the most efficient antioxidant medicinal herbs recently attracting the attention of researchers. Clove oil contains very valuable bioactive constituents including eugenol, isoeugenol, caryophyllene, α -humulene, and eugenyl acetate [5].

The objective of this study was to examine the dietary effect of the clove (*Syzygium aromaticum*) essential oil at different levels to laying performance and egg quality.

2. Materials and methods

Animals, diets and treatments

Hens (n=40) of the laying hybrid Isa Brown, 17 weeks old, were randomly divided into 4 groups (n=10) and fed for 20 weeks with diet containing of different amounts of the clove essential oil. 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.

In the control group hens received feed mixture without additions. Hens in the first experimental group were fed a diet with complete feed mixtures with 0.3 ml.kg⁻¹ of clove essential oil. Hens in the second experimental group were fed a diet with complete feed mixtures with 0.6 ml.kg⁻¹ of clove oil and hens in the third group were fed a diet with complete feed mixtures with 1 ml.kg⁻¹ of clove oil. Laying hens accepted fodder *ad libitum*.

Sample Analysis

Eggs of laying hens of Isa Brown strain were collected regularly one a month (n=30 per group) and were assessed immediately after collection. Egg production, egg weight (g), specific egg weight, albumen weight (g), albumen index, Haugh Units (HU), yolk weight (g), yolk index, yolk color (HLR) were studied.

Statistical analysis

Data were analyzed by analysis of variance using the general linear model procedure of the software program Statistical Analysis System. Differences between the indicators were tested using one-way analysis of variance by Duncan's test. Significance was considered at $P \leq 0.05$.

3. Results and discussion

The aim of the presented study was to investigate the dietary effect of the clove (*Syzygium aromaticum*) essential oil at different levels to laying performance and egg quality of Isa Brown laying hybrid. Hens fed a diet containing 1.0 ml.kg⁻¹ of clove essential oil showed the largest producer of eggs quantity, but with no significantly different ($P > 0.05$) between groups. The values in the order of groups: (1361; 1372; 1378; 1390 pieces). These results agreed with results of Kaya et al., [6], Gandomani et al., [7], Bozkurt et al. [8], who observed improvement of egg production of laying hens.

Egg weight (g) and specific egg weight are presented in Table 1. Egg weight was the highest in control group with the complete feed mixtures without additives. The addition of clove essential oil supplementation to diets had not a significant effect ($P > 0.05$). These results are in contrast with Gandomani et al., [7], who introduced that the clove buds added into hens feed had significant effect ($P < 0.05$) egg weight. The specific egg weight were in experimental groups same or very similar to the control group (the values in the order of groups: 1.081; 1.079; 1.081; 1.081) without statistically significant different ($P > 0.05$). The influence of clove (*Syzygium aromaticum*) essential oil addition on egg yolk quality is presented in Table 2. The results indicate that the addition of clove essential oil into complete feed mixtures for laying hens had a negative impact on egg yolk weight. Between control group and groups of hens with 0.6 and 1.0 ml.kg⁻¹ of clove essential oil are recorded statistically significant different ($P < 0.05$). Our results are in contrast with those of Radwan et al., [9], and Basmacioglu-Malayoglu et al., [10]. In egg yolk index was recorded among all experimental groups and control group a statistically nonsignificant difference ($P > 0.05$). This agree with Nasiroleslami et al., [11], who adding essential oils of fennel (*Foeniculum vulgare*) and ginger (*Zingiber officinale*) to diets did not affect on egg index and yolk index ($P > 0.05$). In egg yolk colour was recorded the best effect in experimental groups with 0.3 and 0.6 ml.kg⁻¹ of clove essential oil, but with no significantly different ($P > 0.05$) between groups. Shades of yellow colours on the colour scale Hoffman La Roche were in the normal range for the add clove essential oil.

Gandomani et al., [7] observed after the addition of clove bud no significant different ($P>0.05$) to the yolk colour [12] increased the intensity in yolk colour of addition 2% concentration of green tea

[13, 14] recorded in the experimental group with the addition of saffron in a dose of 20 mg.kg significantly different in yolk colour.

Table 1. Influence of clove essential oil addition into laying hens feed mixture on the alterations of Isa Brown laying hen's egg weight and specific egg weight

Parameter	Control BD	BD+clove oil	BD+clove oil	BD+clove oil
		0.3 ml/kg	0.6 ml/kg	1.0 ml/kg
Egg weight (g)				
mean	59.85	59.67	59.24	59.09
S.D.	3.90	3.25	5.34	5.21
CV%	6.51	5.44	9.01	8.81
min.	51.30	49.40	48.90	48.20
max.	71.10	71.40	73.70	73.30
P value		0.3686	0.0688	0.0557
Specific egg weight (g/cm ³)				
mean	1.081	1.079	1.081	1.081
S.D.	0.008	0.006	0.008	0.009
CV%	0.74	0.55	0.74	0.83
min.	1.064	1.063	1.047	1.070
max.	1.096	1.093	1.110	1.098
P value		0.575	0.6149	0.7113

Table 2. Influence of clove essential oil addition into laying hens feed mixture on the alterations of Isa Brown laying hen's egg yolk quality

Parameter	Control BD	BD+clove oil	BD+clove oil	BD+clove oil
		0.3 ml/kg	0.6 ml/kg	1.0 ml/kg
Egg yolk weight (g)				
mean	16.62	16.44	16.18	16.17
S.D.	1.56	1.22	1.37	1.35
CV%	9.38	7.43	8.46	8.34
min.	13.20	13.70	12.10	13.10
max.	20.10	19.50	18.40	20.40
P value		0.3114	0.0425	0.0420
Egg yolk index				
mean	47.61	47.29	48.76	48.34
S.D.	3.40	3.73	3.49	3.66
CV%	7.14	7.88	6.74	7.27
min.	39.50	37.94	39.13	36.62
max.	56.78	56.40	64.54	64.38
P value		0.3532	0.0534	0.1324
Egg yolk colour (°HLR)				
mean	6.53	6.56	6.57	6.49
S.D.	0.54	0.53	0.52	0.54
CV%	8.26	8.03	7.91	8.32
min.	7.00	7.00	7.00	7.00
max.	9.00	9.00	9.00	9.00
P value		0.2618	0.2423	0.2289

The influence of clove (*Syzygium aromaticum*) essential oil addition on egg albumen quality is presented in Table 3. In groups with clove essential oil supplement was albumen weight comparable to the control group with no significant different ($P>0.05$). Radwan et al., [8]

found that supplementation diet with essential oil mixture significantly improved relative albumen weight. In parameter index of the albumen were in experimental groups with clove essential oil in all groups higher values (the values in the order of groups: 84.02; 85.93; 87.44; 88.83), but only in

the group of hens with 1.0 ml.kg⁻¹ was recorded significantly higher values compared to the control group (P<0.05). A significant difference in the index of albumen in the group with the addition of garlic meal found [13]. In the groups with addition of 0.6 and 1.0 ml.kg⁻¹ were found

the significantly different (P<0.05) in Haugh Units compared to the control group. This agree with results of many researchers [14; 15; 16; 17], who have shown a positive influence of essential oils on Haugh Units.

Table 3. Influence of clove essential oil addition into laying hens feed mixture on the alterations of Isa Brown laying hen's egg albumen quality

Parameter	Control BD	BD+clove oil 0.3 ml/kg	BD+clove oil 0.6 ml/kg	BD+clove oil 1.0 ml/kg
Egg albumen weight (g)				
mean	37.97	38.07	37.54	37.46
S.D.	4.10	4.02	4.51	4.96
CV%	10.79	10.55	12.01	13.21
min.	31.80	30.30	28.10	28.90
max.	59.60	56.80	50.20	63.60
P value		0.7623	0.6409	0.6960
Egg albumen index				
mean	84.02	85.93	87.44	88.83
S.D.	16.04	16.69	18.41	16.47
CV%	19.10	19.42	21.05	18.53
min.	47.06	38.72	29.64	42.20
max.	138.47	142.87	118.52	138.47
P value		0.2654	0.0543	0.0032
Haugh Units (HU)				
mean	79.88	80.57	82.52	81.54
S.D.	7.23	7.61	12.87	9.97
CV%	9.05	9.44	15.60	9.77
min.	62.69	59.06	31.33	55.73
max.	95.97	99.70	99.64	98.56
P value		0.3529	0.0182	0.0410

4. Conclusions

Based on the obtained results, it can be concluded that addition of clove (*Syzygium aromaticum*) essential oil slightly increased egg production. The results suggest that egg weight, specific egg weight, yolk index, yolk colour and albumen egg weight were not significantly influenced with clove essential oil addition (P>0.05). In the groups with addition of 0.6 and 1.0 ml.kg⁻¹ clove essential oil were recorded significantly (P<0.05) positive effect on yolk weight, albumen index and Haugh Units.

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