The effect of BAV addition as feed additive in laying hen ration on quality and chemical composition of egg

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Abstract. This study aimed to investigate the effect of BAV (blend of 9-natural EO mixed with iodized salt) as feed additive in the ration of laying hens, on the quality and chemical compositions of egg. Thirty laying hens (Lohmann Brown, aged 50 weeks) were divided into two groups (control and 2 g/kg BAV) and given for 6 six weeks. Data on hen daily average (HDA), feed intake, feed conversion ratio (FCR), egg quality (weight, length, width, albumen high and width, yolk high and width, yolk colour, shell thickness, shell weight and Haugh unit) and egg’s chemical composition (yolk cholesterol, yolk protein, albumen protein, xanthophyll) were analyzed. The results showed that BAV significantly increased HDA (P<0.05), and had no effect on feed intake and FCR. The addition of BAV increased yolk wide (P<0.05) and tended to improved egg mass and albumen width, but no difference on egg quality observed. The BAV significantly (P<0.05) decrease cholesterol content of yolk, but no effect to xanthophyll level and both of protein content of yolk and albumen. It is concluded that the addition of BAV as feed additive in the ration of laying hens has potential to improve the quality and chemical compositions of egg.

1. Introduction
Formulation of the feed additive with objective to substitute the Antibiotic as Growth Promoter (AGP) in the poultry ration has been developing. The replacement of AGP in the ration of poultry has been developing [1, 2]. In this regards, the potential role of essential oils (EO) as immune-stimulator have gained much interest recently. Some reports indicated that the EO have an antibacterial property against pathogen bacteria and health improvement [3-5]. Supplementation of EO can improve laying hen productivity and egg quality [4-7].

Feed additive namely BAV is consist of blend of 9-natural EO mixed with iodized salt. Since the application of feed additive commonly aimed to improve the poultry productivity, for that the purpose of this study was to investigate the effect of the addition of BAV as feed additive in the ration of laying hens on egg quality and its chemical compositions.

2. Material and methods

2.1. Experimental design and animals
In total 30 chickens of Lohman Brown laying hens, 50-week-old, were randomly allotted to two equal groups according to dietary treatments. The hens were fed with basal diet based on corn (47.7%),
laying concentrate (40%), rice bran (6%), mineral premix (0.3%), palm oil (2%), limestone (2%), and DCP (2%) which containing 17.10% crude protein, and corresponding to a metabolisable energy of 11.52 MJ/kg. Meanwhile, the treatment group was supplemented with BAV 0.2% of kg feed.

Initial and final body weight (BW) of hens were recorded and Hen Daily Average (HDA) was recorded daily as well as the Feed intake (FI) and egg weight (EW). The feed conversion ratio (FCR) was calculated using the formula FCR = FI/EW.

At day 31 to 37, 10 eggs from each treatment was collected for analysis eggs exterior analysis (length, width and weight). The interior egg quality characteristics (specific gravity, shell breaking strength, shell weight, and shell thickness) were evaluated using random samples of eggs. The eggs were broken down to determine eggshell, albumen and yolk weights. The eggshells were rinsed in running water and dried in oven at 60°C for 12 h. Further, eggshells were weighed using a 0.01 g precision scale and the eggshell percentage was calculated using the formula: eggshell weight (% EW) = [eggshell weight (g)/EW (g)]. Eggshell thickness (including the membranes) was determined at three points on the eggs (one point on the air cell and two randomized points on the equator) using a micrometer (Mitutoyo Inc., Kawasaki, Japan). Lastly, chemical composition of eggs was measured according to AOAC [8] for lipid and protein of yolk, Plummer [9] for cholesterol, albumen protein and ANRC [10] for yolk xanthophyll.

2.2 Statistical analysis
Data in this study were analysed using t-test. All comparisons were done at 5% level of significance.

3. Result and discussion
The laying performance of hens fed by BAV supplementation are presented in Table 1. Compared with control group, addition of BAV to the diets significantly increased HDA (P<0.05). However, birds fed with the BAV shown had no effect in their feed intake and FCR (P>0.05).

| Parameters | Control | BAV |
|------------|---------|-----|
| Feed Intake (g) | 119.92±0.19 | 118.80±0.69 |
| HDA (%) | 97.86±0.33a | 99.52±0.65b |
| FCR | 1.85±0.02 | 1.81±0.07 |

*a,b Means in the same row not sharing a common superscript differ significantly at P<0.05.

The exterior and interior quality of laying hens egg fed by BAV supplementation are shown in Table 2. Addition of BAV in laying hen diets had no significant effect (P>0.05) on neither exterior nor interior quality of egg, except yolk color. Yolk color of laying hens that fed by BAV supplementation was higher (P<0.05) than control.

| Parameters | Control | BAV |
|------------|---------|-----|
| Egg mass (g) | 63.98±3.60 | 63.81±4.79 |
| Length (cm) | 5.71±0.22 | 5.69±0.31 |
| Wide (cm) | 4.42±0.29 | 4.42±0.28 |
| Albumen height (cm) | 0.75±0.11 | 0.77±0.21 |
| Albumen wide (cm) | 7.38±0.57 | 7.53±1.23 |
| Yolk height (cm) | 1.63±0.11 | 1.67±0.15 |
| Yolk wide (cm) | 3.93±0.15 | 3.96±0.21 |
| Yolk color(cm) | 7.65±0.58a | 8.27±0.60b |
| Thick shell (cm) | 0.29±0.03 | 0.29±0.03 |
| Shell mass (g) | 6.53±0.56 | 6.50±0.59 |
| Haugh Unit | 85.49±4.73 | 86.07±4.58 |

*a,b Means in the same row not sharing a common superscript differ significantly at P<0.05.
The effect of BAV supplementation on egg chemical composition of laying hens are shown in Table 3. The BAV supplementation had no significant effect (P>0.05) on albumen protein, yolk protein and xanthophyll. However, cholesterol was reduced in BAV supplemented laying hens (P<0.05) compared to control.

| Parameters     | Control       | BAV            |
|----------------|---------------|----------------|
| Cholesterol    | 12.137±0.76b  | 9.523±0.47a    |
| Albumen protein | 11.300±0.42   | 11.563±0.17    |
| Yolk protein   | 17.597±0.46ns | 18.101±0.58    |
| Xanthophyll    | 0.947±0.05ns  | 1.109±0.15     |

a,b Means in the same row not sharing a common superscript differ significantly at P <0.05
ns Non significant

In this study, dietary BAV essential oils supplementation significantly increased total egg per pen and HDA compared with control group. Similar to the results of this study, the addition of EO from *Ligustrum lucidum* [11] and cinnamon [12] in the diet had a positive effect on increasing of egg production. The essential oils affect to the utilization of nutrients in the intestine and consequently increase egg production in laying hens [13].

Increasing in yolk color with BAV supplementation can be influenced by material content of essential oils. Plant materials containing carotenoids affect the egg yolk color of laying hens [14]. The types of herbs belonging to the basil family (*Ocimum sanctum* and *Ocimum album*) Holy basil and White basil, respectively, have a significant effect on egg yolk color, when fed to egg laying hens as inclusion in the feed at 3 g/kg [15]. The yolk color was significantly improved in the saffron supplementation (10 mg/kg diet). Improvement in yolk color indicated a passage of crocins, lycopene and carotene, the coloring components of saffron, from hen diet into egg yolk [16].

Essential oil from *Nigella sativa* significantly reduced cholesterol content until 8.5% compared control [17]. The action mode of EO to reduce cholesterol production by inhibiting activity of HMG-CoA enzymes that affect cholesterol synthesis. This inhibition performed during the conversion process of lathosterol to cholesterol [18]. The BAV contains *Cymbopogon citratus* which has a role in inhibiting HMG-CoA activity [19].

4. Conclusions

The dietary supplement with BAV significant affected egg production, yolk color and decreasing of cholesterol content. The BAV has positive effect on hen performance and egg quality.

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