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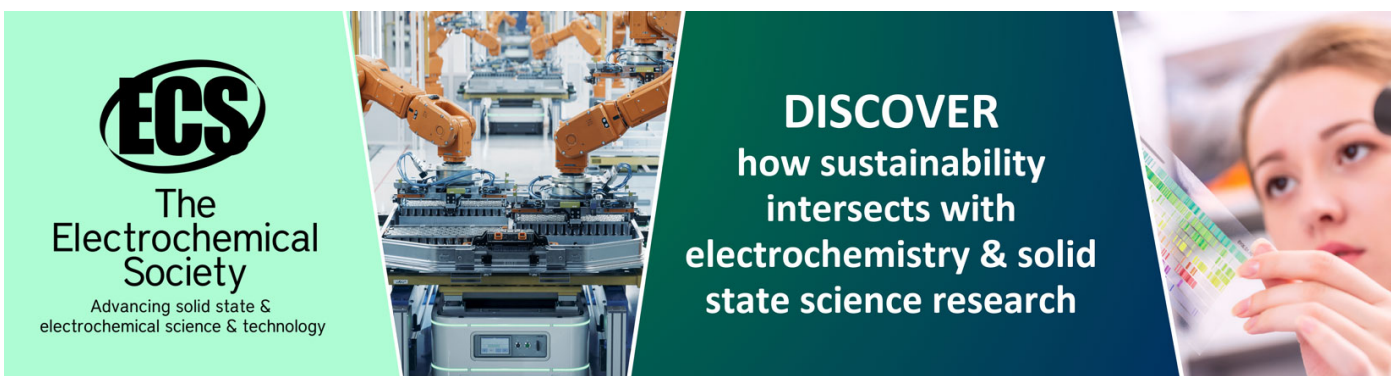
Enhancing quality of chicken egg by adding *Moringa oleifera* leaves extract in drinking water

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Enhancing quality of chicken egg by adding *Moringa oleifera* leaves extract in drinking water

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Abstract. Nowadays consumer are very concerned about food safety of chicken eggs. This condition makes researchers look for other ways to create solution on its feed to make safety feed. This study was designed to investigate *Moringa oleifera* leaf ethanol extract in drinking water on the performance and egg quality of laying hens. One hundred and twenty Isa Brown laying hens on twenty-two-week-old with homogenous body weight were used in this complete randomized design study with four treatments and six replications. Each replication consist of of five chickens on each cage. The laying hens were randomly divided into four treatment groups: T1: without *Moringa oleifera* leaves ethanol extract, T2: drinking water with 0.5% *Moringa oleifera* leaves ethanol extract, T3: drinking water with 1% *Moringa oleifera* leaves ethanol extract and T4: drinking water with 1.5% *Moringa oleifera* leaves ethanol extract. This study showed that supplementation of 0,5-1,5% *Moringa oleifera* leaves ethanol extract in drinking water increased increasead egg weight, eggshell thickness, haugh unit, albumen index, and yolk color in laying hens without increased of feed consumption, egg production, and yolk index.

1. Introduction

Nowadays, consumers are very concerned about the safety and quality of chicken eggs. This condition makes researchers look for other ways to create solution on its feed to make safety feed. To fulfil the need for high quality, safe and healthy chicken eggs, and free from antibiotic residues is a challenge for future scientists. One alternative that can be used to replace the use of antibiotics is phytogenic. Phytogenic can be used because it contains antimicrobials and antioxidants so that it has a positive impact on the production of laying hens[1,2].

One of the phytobiotic that can be used as an alternative to antibiotics is *Moringa oleifera* leaves. *Moringa* leaves contain antibacterial, several phenolic compounds, and phytochemical compounds such as flavonoids, saponins, and tannins [3]. *Moringa oleifera* is very useful as an animal feed supplement,



because the leaves are very nutritious, being important source of B-complex vitamins, vitamin C, pro-vitamin A as beta-carotene, vitamin K, manganese and other essential protein nutrition [4].

Moringa is a plant that has been widely researched and has the potential to be used in animal feed including for laying hens. Supplementation of Moringa leaves in the diet of laying hens can improve production performance and egg quality [5,6]. Supplementation of 5% Moringa oleifera leaves in laying hen rations increased yolk color, albumen height and Haugh units [7]. Other studies have shown that Moringa leaf extract in 22-30 week old Lohmann Brown chickens through drinking water at doses of 3% and 6% can improve the color and protein content of eggs, on the contrary, it can reduce fat and cholesterol levels in chicken yolks [8], as well as in 30-40 week old Lohmann Brown chickens the use of 2-6% Moringa leaf extract in drinking water significantly increases egg weight, number of eggs, production per day, ration efficiency, and yolk color [9].

Overall the study showed that Moringa oleifera has potential as a feed additive for laying hens, and can improve egg production and quality. The differences in the results of research on the use of Moringa oleifera are caused by dosage, duration of feeding, composition, processing methods, aspects of environmental stress or the age of the birds. The addition of moringa leaf ethanol extract to the drinking water of laying hens is still not widely developed. Ethanol extract of Moringa leaves contains alkaloid, flavonoid, saponin, triterpenoid/steroid and tannin compounds [10] which are not yet known how they affect laying hens. Research is needed to determine the optimum level of moringa leaf ethanol extract as a feed supplement in drinking water to increase egg production and egg quality of laying hens.

2. Materials and Methods

In this study, four treatments consisting of 0%, 0.5%, 1% and 1.5% ethanol extract of Moringa leaves in drinking water were conducted on 120 Isa Brown laying hens aged 22 weeks with an average weight of 1650 ± 60.41 g. Each treatment was repeated six times and each replicate consisted of five hens. For eight weeks the chickens were kept in 60 x 60 x 40 cages, complete with feed and water containers and a 16-hour lighting program. The mash ration was prepared based on NRC recommendations. The nutrient content of the ration is listed in Table 1.

Table 1. Nutrient composition on the ration

Parameter	Content (%)
Moisture	13
Crude protein	18
Crude fat	3
Crude fiber	6
Calcium	3,5
Phosphor	0,45

2.1. Preparation of Ethanol Extract Moringa oleifera leaves

The preparation of Moringa leaf ethanol extract was carried out by mixing commercial moringa leaf powder and 96% ethanol in a ratio of 1:10 in a glass jar and kept for 72 hours and stirred every day. After 72 hours, the results of soaking were filtered and the water was taken. The filtered water was evaporated using a vacuum rotary evaporator with a temperature of 35°C until the ethanol droplets were small or not left. The result obtained is a liquid extract which is then put into a closed bottle and stored in the refrigerator.

2.2. Production Performance Parameters

The Production performance parameters measured daily during the experimental period were the number and weight of eggs in each replicate. Egg production was calculated based on the percentage of

hen day and feed consumption was measured based on the difference between feeding and remaining feed on that day.

2.3. Egg Quality Parameters

Egg quality parameters were measured when the hens were 31 weeks old. Twenty-four eggs from each treatment were used to assess egg quality. Eggs were weighed to determine egg weight, then cracked on a glass table for albumen and yolk measurements. Yolk color measured with Roche yolk color fan Egg shell thickness was measured at the center of the egg shell using a micrometer, Haugh Unit (HU) was calculated from egg weight (W) and albumen height (H) recorded through the following formula: $HU = 100 \log_{10} (H - 1.7W^{0.37} + 7.56)$, according to Haugh.

3. Statistical Analysis

The research method was carried out experimentally using a complete randomized design with four treatments of different levels of moringa leaf ethanol extract supplementation. Each treatment was repeated six times, and each replication used five chickens as experimental units. The research data were analyzed for variance and Least Significant Differences Test were deemed to be statistically significant at $P < 0.05$.

4. Result

4.1. Production Performance

The results showed that the average ration consumption of laying hens at 22 weeks to 30 weeks ranged between 95.65 ± 8.06 g/head/day and 100.3 ± 5.81 g/head/day. During the experimental period the hens were healthy and there were no mortalities were recorded.. Supplementation of Moringa oleifera leaves ethanol extract in drinking water at 0.5%; 1% and 1.5% did not increase feed consumption and egg production compared to the control group (Table 2).

Table 2. Production performance of layer chickens

Variabel	Treatment			
	T1 (0%)	T2(0,5%)	T3 (1,0%)	T4(1,5%)
Feed intake (g/head/day)	100,3±5,81	98,83±5,31	99,81±2,88	95,65±8,06
Hen day Production (%)	87,92 ±8,72	84,50 ±6,62	80,71± 2,62	80,02± 8,07

4.2. Egg Quality

Table 3 shows the effect of Moringa oleifera leaf ethanol extract supplementation on egg quality. An increase in egg weight, eggshell thickness, albumen index, yolk index, yolk color and Haugh Units occurred in 22-30 week old hens fed Moringa oleifera leaves extract at the levels of 0.5%, 1% and 1.5% in drinking water compared to control treated hens ($P < 0.05$), without significantly affecting yolk index.

Table 3. The effects of *Moringa oleifera* leaves extract supplementation on egg quality.

Variabel	Treatment			
	T1:0%	T2:0,5%	T3:1%	T4: 1,5%
Egg weight (g)	54,56 ±1,09 ^a	55,91±1,21 ^{ab}	57,08 ±1,30 ^b	56,33±0,89 ^b
Eggshell thickness (mm)	0,38±0,02 ^a	0,41±0,02 ^b	0,42±0,02 ^b	0,43 ±0,01 ^b
Albumen index	0.11 ± 0,02 ^a	0.12 ± 0,01 ^{ab}	0.14 ± 0,01 ^b	0.13 ± 0,01 ^b
Yolk index	0,44±0,02	0,41±0,03	0,44±0,02	0,41±0,01
Haugh Unit	91,70±2,34 ^a	93,76±2,35 ^a	96,94±0,88 ^b	96,46±1,14 ^b
Yolk color	9,18±0,42 ^a	9,39±0,39 ^{ab}	9,93±0,37 ^b	9,65±0,31 ^b

5. Discussion

This study showed that the addition of *Moringa oleifera* leaves ethanol extract to the drinking water of laying hens at a dose of 0.5%-1.5% (T2 to T4), had no significant effect ($P>0.05$) on ration consumption. The fact of this study means that the provision of *Moringa* leaf ethanol extract in 22-30 week old chickens is thought to be because the chickens are still in the same physiological condition in preparing for egg production. In this case, although *moringa* leaf extract contains flavonoids that have antibacterial, antifungal, anti-inflammatory properties [11], but the dose is still low to be able to work in helping balance the intestinal microflora, optimize the digestive tract, improve the digestive process and increase ration consumption. This means that the process of optimizing digestion in all treated chickens is relatively the same, intestinal emptying is relatively the same, the tendency of hunger is relatively the same as a result, ration consumption is relatively the same. Feed consumption in this study is similar to the results of research by [12] that supplementation of seeds, leaves, and their combinations of *Moringa oleifera* did not significantly ($P>0.05$) affect feed consumption, feed conversion, and egg weight compared to the control.

On the other hand, the addition of *Moringa oleifera* leaf meal at 10% significantly increased egg production of laying hens [13], a ten-times higher dose than the present study. Similarly, the results of research by [9] showed that the provision of *Moringa oleifera* leaf extract at a concentration of 2-6 cc/100 cc of drinking water significantly increased egg weight, number of eggs, hen-day production, ration use efficiency of Lohmann Brown chickens aged 30-40 weeks. Many researchers reported that *Moringa oleifera* supplementation levels ranging from 0.5% to 10% can provide a positive response in improving the productive performance and health status of laying hens [13, 14]. Differences in poultry strains, chicken age, production phase, *Moringa* leaf parts, agro-climatic conditions, herb composition, addition rate, application, and cultivation methods [15] are thought to be the cause of inconsistent research results on the production performance of chickens fed *Moringa* leaves

Egg weight in chickens given 1% and 1.5% *moringa oleifera* ethanol extract was significantly higher ($P < 0.05$) compared to the control. It is suspected that the provision of *moringa* leaf extract at a concentration of 1% and 1.5% can increase the amount of protein in the body of chickens so that protein needs can be optimized to increase egg weight. This is thought to be related to the protein content contained in the extract, the protein content contained in *moringa* leaf extract will be higher if extraction is carried out [16].

Egg shell thickness in chickens treated with *moringa* leaf ethanol extract concentrations of 0.5% (T2), 1% (T3), and 1.5% (T4) was significantly ($P < 0.05$) higher than the egg shell thickness in the control treatment (T1). This is thought to be caused by the calcium content found in *Moringa* leaves according

to [17], the extraction of moringa leaves can increase the calcium content to be higher, namely 1,600-2,200 mg. Therefore, the treatment of giving moringa leaf extract concentrations of 0.5% , 1%, and 1.5% is thought to be able to meet calcium needs optimally because calcium obtained in the body is not only sourced from the ration consumed.

Haugh Units are very important for the egg industry and are considered a sign of egg freshness and optimal shelf life [18]. The addition of Moringa leaf ethanol extract with concentrations of 0.5% (T2), 1% (T3), and 1.5% (T4) significantly ($P<0.05$) increased the haugh unit value. This indicates that the content of Moringa oleifera leaf extract can increase the haugh unit (HU) value due to the healthier condition of the chicken by the presence of saponins, flavonoids and tannins. This phenomenon is in accordance with the statement of [19] that Moringa leaf extract has phytochemical compounds in the form of saponins, flavonoids, and tannins that can affect the condition of the small intestine by improving duodenal conditions, increasing the number of Lactobacillus populations in the ileum, and reducing Escherichia coli colonies, so that the immune status of the chicken body increases which has an impact on increasing chicken productivity and maximizing the absorption of nutrients including protein in the chicken intestine [20].

Moringa oleifera leaf ethanol extract at levels of 0.5%, 1.0% and 1.5% in drinking water increased in egg weight, eggshell thickness, albumen index, and yolk color. It is suspected that the increase in eggshell weight and thickness is due to phytochemical compounds that may have the ability to increase calcium storage, uterine function and intestinal secretion, which can improve eggshell and egg quality [21]. The bioactive components of Moringa oleifera leaves appear to improve oviposition and uterine health, thereby enhancing egg quality. The results of this study are in accordance with the report of [14], that M.oleifera supplementation can increase yolk color score compared to the non-supplemented group. The increase in yolk color score can be caused by the high carotene content in Moringa leaves [22]. The results of this study are in accordance with [23] statement that Moringa leaves given to laying hens can improve egg quality. With the addition of moringa leaf ethanol extract, egg quality, which is one of the important criteria in the egg industry, will be improved into healthy eggs and will have an impact on increasing economic profits.

6. Conclusion

Supplementation of Moringa (*Moringa oleifera*) leaves ethanol extract at a dose of 0.5 - 1.5% in drinking water significantly ($P<0.05$) increased egg weight, egg shell thickness, albumen index, Haugh Unit value and yolk color of laying hens, without significant effect ($P>0.05$) on feed consumption, egg production and yolk index. Research can be continued to study the potential of Moringa oleifera extract ethanol leaves to make eggs a functional food.

Ethical approval

This research complies with the code of ethics for experimental animal research based on the statement letter from the Dean of the Faculty of Agriculture, University of Lampung (53A/UN26.14/2023), and all ethical issues for publication have been checked and approved by the author

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