The Effect of Using Natural Feed Additive on Egg Production and Quality of Mojosari Duck (*Anas platyrhynchos*)

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Abstract. The aim of this study was to determine the effect of using natural feed additives on egg production and quality of Mojosari Ducks. The animals used were 81-layer period Mojosari ducks 145 days old with an average egg weight 67.55 g and a coefficient diversity 8.98%. Each bird placed in experimental cages 2.25 x 2.25 m. Each plot (experimental unit) placed 3 ducks. The research treatment is adding feed additives (UB Feed) which are composed of natural ingredients, include amino acids, multivitamins, balanced micro minerals, acidifiers, probiotics, and phytobiotics. Research treatment was P1 (100% commercial complete feed), P2 (100% mixed feed), and P3 (100% mixed feed + 0.4% feed additive UB Feed). The research variables were egg production (percentage), cholesterol content (mg/100 mg) and protein content of egg yolk (g/100 g), and protein content of albumin (g/100 g). Based on the research results, the addition of natural feed additives had a very significant effect (P<0.01) on the egg production and quality of Mojosari duck eggs. The addition of natural additive feeds in feed increased egg production, yellow protein content and egg albumin and reduced cholesterol content of egg yolk.

1. Introduction
Various types of natural feed additives such as probiotics, symbiotic, and organic acids have used as alternative feeding strategies to improve performance production of laying hens. Probiotics are natural living microorganisms including bacteria, fungi or mould. Some strains of bacteria such as *Lactobacillus*, *Enterococcus*, *Pediococcus*, and *Bacillus* are commercial probiotics. Prebiotics are feed ingredients that cannot be digested and have benefits to the host by stimulating growth and or control metabolic activities in the intestine [1]. Whereas symbiotic or synbiotic are a combination of probiotics and prebiotics [2].

Based on its composition, probiotic bacteria produced and mixed with a substrate that functions as a protector or feed, increases life ability, and maintains beneficial bacteria in the digestive tract [3]. Interactions between probiotics and prebiotics can support the adaptation of probiotics to prebiotic substrates and have an impact on both. Included inorganic acids are lactate; citrate, formate, and a fumarate are a group of salts known to control harmful microorganisms in the digestive and respiratory tracts of birds [4]. The mechanism of adding organic acids by reducing the pH of the stomach and digestive tract and enhancing the immune system [5].

The addition of probiotics to laying hens known to increase the appearance of production and egg quality. The increase production of ISA-Brown chicken eggs and Leghorn laying hens fed probiotics was reported [6]. Research by Zarei [7] showed that the addition of probiotics had no effect on egg production...
production and egg mass. Supplementation of yeast as probiotics increased the percentage of egg production [8], egg weight and eggshell strength [9], utilization of nutrient [10], and increased intake feed and feed conversion ratio [11].

The positive effect of using prebiotic on eggshell quality has reported. Prebiotics stimulates the availability of minerals. Scholz-Ahrens [12] report that the mechanism of a positive prebiotic effect on the use of minerals can attributed to the high viability minerals due to increased production of short chain fatty acids. Organic acids improve the quality and appearance of egg-laying eggshells and old broiler breeding hen [13]. Influence of giving additive feeds on the production and quality of poultry products is very varied.

This research uses Mojosari Duck objects, which is dual-purpose Indonesian indigenous poultry with relatively low egg production. Some small-scale production units and industrial try to make natural feed additive preparations to make it easier for farmers. In addition to increasing production, the addition of additives feeds made from natural materials thought to improve the quality of livestock products.

2. Materials and methods

2.1. Animal and management

The animals used in this study were 81-layer period Mojosari ducks 145 days old with an average egg weight of 67.55 g and a diversity coefficient of 8.98%. Birds placed randomly on a 2.25 x 2.25 m cage. Each plot (experimental unit) was placed three ducks and fed with treatment. The temperature and humidity of the enclosure recorded daily with a thermometer and hydrometer. Birds were kept for 30 days and fed with a total amount of 175 g/head/day. The feed treated added to water with a ratio of 2:1 to make it easier intake. Drinking water given ad libitum. Egg production recorded every day and calculated using the formula:

\[
\text{Egg production (\%) = \frac{\text{Number of egg}}{\text{Hen population}} \times 100\%}
\]

At the end of birds raising, eggs were collected to analyse the cholesterol content of egg yolk (mg/100 g), egg yolk protein (g/100 g), and albumin protein (g/100 g).

2.2. Feed

The research treatment feed with the addition of UB Feed, commercial feed additive produced by the Faculty of Animal Husbandry, Universitas Brawijaya with composition: amino acid, multivitamins, balanced micro minerals, and acidifiers, probiotics and phytobiotics. Basal feed is a complete commercial feed for laying hens during the production layer of PT. Cargill Indonesia and mixed feed consisting of dried rice, kebi, shrimp meal, commercial layer concentrates, and premix. The composition and chemical composition of the treated feed presented in Table 1.

The research treatments are:
\[\begin{align*}
P_1 &= \text{Commercial Feed} \\
P_2 &= \text{Mixed Feed} \\
P_3 &= \text{Mixed Feed + Feed Additive}
\end{align*}\]

| Ingredients               | \(P_1\) | \(P_2\) | \(P_3\) |
|---------------------------|---------|---------|---------|
| Commercials complete feed | 100%    | -       | -       |
| Concentrate               | -       | 19.9%   | 19.9%   |
| Dried rice                | -       | 19.9%   | 19.9%   |
| Kebi                      | -       | 27.9%   | 27.9%   |
| Shrimp meal               | -       | 4.0%    | 4.0%    |
| Premix                    | -       | 0.4%    | 0.4%    |
Commercials Feed Additive (UB Feed) - - 0.4%

| Total | 100% | 100% | 100.4% |
|-------|------|------|--------|

**Chemical Composition**

| Parameter                | P1    | P2    | P3    |
|--------------------------|-------|-------|-------|
| Dry matter (%)           | 88,00 | 91,12 | 91,50 |
| Crude protein (%)        | 21,00 | 17,84 | 17,97 |
| Extract ether (%)        | 7,00  | 6,99  | 7,02  |
| Crude Fibres (%)         | 7,00  | 7,96  | 7,96  |
| Ash (%)                  | 14,00 | 17,68 | 17,68 |
| Calcium (%)              | 3,00-4,00 | 2,68 | 2,75 |
| Phosphor (%)             | 0,61-1,00 | 0,81 | 0,88 |
| Alfa toxin (ppb)         | 20,00 | -     | -     |
| Gross energy (kcal/kg)   | -     | 3,860,00 | 3,860,00 |
| Metabolize energy (kcal/kg) | -   | 2,702,00 | 2,702,00 |

Note:
1. Chemical analysis of Nutrition and Feed Laboratory, Animal Science Faculty, Universitas Brawijaya (Indonesia)
2. Chemical analysis of Soil Chemical Laboratory Agricultural Faculty, Universitas Brawijaya
3. Gross energy analysis of Nutrition and Feed Laboratory, Animal Science Faculty, Muhammadiyah Malang University (Indonesia)
4. Mathematic equation

The research method was an experiment using a completely randomized design 3 treatments, each treatment consisted of nine replications.

2.3. Data Analyze

The data obtained tabulated and analyzed using Variance Analysis (ANOVA) using the SPSS software version 16.0 tool, if differences found between treatments followed by the Duncan test.

3. Result and Discussion

3.1. Result

The effect of treatment on egg production (percentage), cholesterol content of egg yolk (mg/100 g), protein content of egg yolk (g/100 g), and protein content of albumin (g/100 g) presented in Table 2.

**Table 2.** Effect of treatment on egg production (percentage), cholesterol content of egg yolk (mg/100 g), protein content of egg yolk (g/100 g), and protein content of albumin (g/100 g)

| Treatment | Egg production | Yolk Cholesterol | Yolk Protein | Albumin Protein |
|-----------|----------------|------------------|--------------|-----------------|
| P1        | 67.82±1.04a     | 687.87±26.18b    | 16.94±0.28b  | 11.52±0.28a     |
| P2        | 80.86±0.64b     | 552.97±34.52b    | 17.25±0.19b  | 12.01±0.19b     |
| P3        | 84.03±1.02c     | 492.04±24.11a    | 16.88±1.04a  | 12.16±1.16b     |
| Sig.      | 0.00            | 0.00             | 0.03          | 0.00            |

Note: Superscript in the same column shows significant differences between treatments (P < 0.01)

Based on the results of the research presented in Table 2., the treatment had a significant effect (P < 0.01) on egg production, egg yolk cholesterol content, protein content of duck egg yolks, and egg white protein content.

3.2. Discussion

3.2.1. Egg Production
Factors that influence the productivity of duck are maintenance, feed and seed management. This research focuses on the aspect of feed by utilizing feed additives with complex compositions, namely amino acids, multivitamins, balanced micro minerals, and acidifiers, probiotics, and phytobiotics. The substance has a role to increase the efficiency of the use of food substances, which ultimately increases bird’s productivity. The presence of active substances contained in medicinal plants (phytobiotics) affects the micro biota ecosystem through control of pathogenic bacteria. This increases the absorption capacity of food substances for egg production. The highest egg production was achieved in treatment P3 as much 84.03%.

3.2.2. Egg Quality
The main component of egg yolk produced in the liver in response to estrogenic stimuli. The main material is lipoprotein and phosphoprotein, which come from blood during the parent bird in the phase layer. Most of the poultry feed lipids in the form of fatty acids, triglycerides, and cholesterol, which will be absorbed in the small intestine to degrade into fatty acids and glycerol, are then broken down into chylomicron. Chylomicron along with protein (lipoprotein) which is then absorbed in the blood circulation and transformed into VDL, HDL, LDL, and cholesterol. Small amounts of lipids converted to free fatty acids. Lipid metabolism manifestations are lipids and cholesterol contained in eggs. The results of the research on the use of herbs Andrographis paniculata did not have an effect on the yolk lipid content [14].

Egg yolk lipids are the main energy source for embryo development, with the amount of oxidize material ranging from 840-980 g/kg. This is the reason why the ingredients of the egg yolk did not influenced by the composition of the food contained in the feed. The main component supply of egg yolk runs through a specific mechanism, namely coated vesicles that concentrate on the rapid and continuous transport of molecules through specific membrane organelles. The lipid supply for the formation of the yolk ascertained in number. Only a certain number of constituent components of the yolk that enter the oocytes subsequently develop in the ovarian organs. In line with the research carried out by Vogtmann and Cladomin [15] who found that the lipid content in eggs did not affected by feed lipid intake. Wheter the feed contained high amounts of fat, it did not affect the total content of egg yolk lipids, although sometimes related to the composition of fatty acids that make up triglycerides in feed.

Contrary to lipoprotein contained in egg yolk, a minor lipid component related to the amount contained in the feed. Feeds that are high in cholesterol content will have an impact on the high cholesterol content in blood plasma and egg yolk [16]. Substances such as cholesterol accumulate in oocytes and other components because the uptake mechanism of macro components (macromolecules) is not selective. Pinocytotic coated vesicles involved in uptake of VDL and phosvitin involving a fraction dissolved in water, consequently the concentration of coated vesicle substance depends on the concentration of tissue flow in the space surrounding the oocyte. This depends on the concentration in blood plasma. Based on the results of the statistical analysis shown in Table 2. Using additive feeds has an effect on the cholesterol content of Mojosari duck egg yolk (P<0.01).

Mahdavi et al. [17] state that the important role of microorganisms is lipid recycling. Mahdavi et al. [17] showed that microorganisms such as Bacillus subtilis and Bacillus licheniformis were able to synthesize esterase enzymes together with lipase enzymes, which convert free fatty acids into different esterified forms of triglycerides to become intestinal constituent matter material and ultimately fewer opportunities for absorption triglycerides into the plasma. Genedy and Zeweil [18] reported that total lipid and cholesterol concentrations tended to decrease in the blood of growing Japanese quail groups fed medicinal plants (containing Thyme flowers or Chamomile flowers) compared to the control group. The study is in line with the results of a study that showed a tendency to decrease cholesterol content in egg yolk in treatment P3, which is 492.04 mg/100 g.

The antimicrobial properties contained in herbal plants work through the mechanism of control of pathogenic microorganisms so that food substances become more available to the livestock of the host. In addition, antioxidant compounds in various phytobiotics play a role in protecting feed lipids from damage caused by oxidation reactions. Research using herbal plants containing phenolic compounds.
shown to increase the stability of oxidation reactions of poultry derivative products such as chicken meat and eggs [19]. The study using Noni (*Morinda citrifolia*) herbal plants in broiler chickens strain ISA Brown phase layer has no effect on egg quality and cholesterol levels [20]. This is in line with the research conducted by Zeweil *et al.* [21] with the object of quail research showing that the addition of probiotics and phytobiotics as much as 2 g/kg of feed increased protein digestibility compared to controls. In addition, these treatments reduce the cholesterol and lipid content in blood plasma. Cross *et al.* [22] concluded that the quality and quantity of active substances contained in herbs affect the response of poultry production.

Based on the results of the research presented in Table 2. The addition of probiotic and phytobiotic feed additives gave an increase in egg white protein content (P <0.01), but not the protein content of the yolk. This caused by the feed protein content treated. The protein content of P1 feed is 21% while the protein content of P2 and P3 feed is 17%. The positive effect of the addition of probiotics is due to a decrease in the proliferation of pathogenic bacteria, which causes changes in environmental conditions in the digestive tract thereby increasing digestion of food substances [23]. Probiotics also increase the activity of enzymes in the digestive tract thereby increasing digestion of nutrients [23]. The positive effects of probiotic supplementation also reported by El-Sheikh [24].

Active compounds of herbal plants that have antimicrobial properties affect the balance of the digestive tract micro flora by controlling pathogenic microorganisms. This will increase the availability of food substances for the absorption process. So that the quality and quantity of livestock derivative products, namely Mojosari duck eggs increases. Several factors influence the effectiveness of phytobiotic additive feeds, including: parts of plants and property owned, plant genetic variation, plant age, usage dose, extraction method, harvesting time, and their interaction with other compounds also explain the occurrence of different responses to the appearance of production [25].

4. Conclusion
The use of feed additives made from natural probiotics and phytobiotics has a positive effect on increasing the production and quality of Mojosari duck eggs, namely increasing the yellow and egg white protein content and reducing the cholesterol content of egg yolk.

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