Effect of Meniran Extract (*Phyllanthus niruri* Linn.) to Alternate Antibiotic Growth Promoter (AGP) on Egg Quality and Economics Analysis of Layers Infected by *Escherichia coli*

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Abstract: The purpose of this study was to know the economics analysis in layers infected by *Escherichia coli*, which used Meniran Extract (*Phyllanthus niruri Linn.*) as alternate Antibiotic Growth Promoter (AGP) to egg quality. About 50 layers at 20 weeks of age were completely randomized into five treatments with two factors, each treatment consisted of five replications with non-infectious factor and infectious factor. The treatments were T0, T0+, T1, T2, and T3 containing standard feed, standard feed with 0,01 gram AGP/kg feed, standard feed with 10% Meniran Extract/kg feed, standard feed with 20% Meniran Extract/kg feed, and standard feed with 30% Meniran Extract/kg. The infection consisted of *Escherichia coli* 10^8 CFU/gram given to each layer about 1 ml/kg of weight. The results in two ways *Analysis of Variance* (ANOVA) 5% showed that there were insignificant differences among the treatments ($P<0.05$) and factors ($P<0.05$). In both factors, the lowest egg quality was T3 which has 55.7 grams of weight, 76.24 of Haugh Unit Index, 0.36 of Yolk Index, 0.09 of Albumen Index, and Yolk colour about 8.20. The highest egg quality was T2 which has 63.21 grams of weight, 90.59 of Haugh Unit Index, 0.41 of Yolk Index, 0.11 of Albumen Index, and Yolk colour about 9.60. All treatments showed good economics analysis, which had the best result in Benefit Cost Ratio, which has a score about 1.51-1.60. It can be concluded that we can give 20% Meniran Extract/kg feed to get the best egg quality and profit that can replace AGP.

1 INTRODUCTION

Eggs are a livestock product that contributes greatly to the achievement of the nutritional adequacy of the community. The price is relatively cheap compared to other sources of animal protein and easily obtained because the eggs have become public goods. Eggs are one of the animal products derived from poultry and are known as a food source of high quality protein (Djaelani, 2016). Egg quality is a factor to be considered, so that consumers get the nutritional content of eggs intact. Combination of high ration protein and linoleat content can produce eggs of excellent quality. Quality of eggs will be guaranteed if the quality of feed provided is sufficient according to age and maintenance management (Djaelani, 2016).

Breeders generally use antibiotics to improve quality and efficiency for feeding, as well as livestock being healthier and more productive. Nowadays, the use of antibiotics causes consumers anxiety about the risk of antibiotic residues and they tend to avoid livestock products containing residues.

Feed additives such as hormones and antibiotics (Antibiotic Growth Promoter or AGP) are strictly banned in developed countries including Indonesia (Kompiang, 2006), related to the current global issue of poultry farming, namely the safety of animal foods

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from contaminants and residues that are harmful to consumers, certain bacterial resistance and environmental issues (Akhadiarto, 2010). Feed additives in poultry consist of vitamins, minerals, antibiotics, and other factors such as growth hormone used to improve poultry performance and improve the nutrition of local raw materials used.

Khusnan (2012) states that feed additives have the purpose of improving efficiency in breeding, by accelerating the increase in body weight or increasing livestock production so that maintenance costs can be suppressed and profits can be obtained maximally. Small doses of antibiotics in the diet to spur the growth of livestock were used more than half a century ago. The facts show that antibiotics in very small doses can accelerate the growth of livestock, thus causing leeway in obtaining antibiotics for use in the field of livestock.

Some antibiotics that are widely used as AGP, among others, include tetracyclin, penicillin, macrolide, lincomysin and virginiamycin.

The activity of AGP as a growth promoter is affected by antibiotic effects. There are several theories that explain the mechanism of action of AGP. These include antibiotics can help increase the absorption of nutrients by making the wall barrier of the small intestine become thin. Antibiotics can reduce the production of toxins from the bacterial gastrointestinal tract and reduce the incidence of subclinical gastrointestinal infections (Feihgner and Dashkevics, 1987 in Noor and Poeloengan, 2005). The risk is of residual antibiotics becoming toxic to consumers, as antibiotics can create resistant microorganisms in the human body or livestock especially pathogenic bacteria such as *Salmonella*, *Escherichia coli* and *Clostridium perfringens* (Sarwono, Yudiarti, and Suprijatna, 2012).

Escherichia coli belongs to gram negative bacteria, facultative anaerob, rod-shaped, not spore-forming, not acid-resistant and size 2-3 x 0.6 µm (Gordon and Jordan, 1982). These bacteria live in the animal's digestive tract. Physiological tests show a positive reaction to indol and methyl red, negative to Vogues-Proskauer, and do not use citrate as the only carbon source (Krieg and Holt, 1984).

Innovation needs to be implemented in order to find solutions to the problem and that is by providing natural ingredients in the feed that can replace the function of AGP. According to Bagalkotkar, Sagineedu, Saad, and Stanslas (2006) in meniran leaves there are various kinds of secondary metabolites, including flavonoids, alkaloids, lignans, tannins, and saponins. Almost all parts of the meniran plant are medicinal.

Meniran plants (*Phyllanthus niruri Linn*.) grow in tropical regions such as Indonesia. These plants are often found growing wild in forests, in fields, and in places where the soil is moist, sandy, by the river, on the beach, and they even grow wild around the yard of the house. Meniran can grow at an altitude of up to 1,000 meters above sea level (Ekasari, 2011). Meniran herbal extract contains alkaloids, flavonoin, saponin, steroid, tannin, and phenolic compounds (Rivai, Septika, and Boestari, 2013).

The results suggest that meniran has immunomodulatory activity that plays a role in making the immune system more active in performing its functions, strengthens the body's immune system (immunostimulator) or suppresses the immune system's excessive reaction (immunosuppressant).

With the addition of meniran extract it is expected to increase egg quality, thus reducing the production cost in laying hens. Through business analysis with total cost parameters, revenue, profit and loss, Benefit Cost Ratio, will be analyzed regardingwhether the provision of meniran extract on laying chicken feed is more profitable or not. This study aims to determine the financial analysis of infected chicken farms (*Escherichia coli*) using meniran extract as a substitute for Antibiotic Growth Promoter on the quality of egg laying hens.

2 MATERIAL AND METHOD

2.1 Materials

The type of chicken used in this study was 50 egg laying hens ISA-BROWN 20 weeks old with a battery cage system length x wide x height front, rear height = 40 cm x 40 cm x 37 cm, 30 cm.

Egg quality checking tools used: Egg yolk separator used to separate egg yolks and egg whites, yolk color Roche branded fans with 1-15 precision as yolk color index (yolk index), glass as base with the width of 20 cm and the length of 15 cm is used as the base for measuring the egg white diameter, egg yolk and its thickness, the sliding term is used to measure the diameter of egg whites and egg yolk, the spherometer is used to measure the thickness of the egg white and the yolk, made of stainless steel, digital scales Nakami weighing scales with gram scale with a maximum limit of 5000 g to calculate egg weight.

2.2 Method

The study was conducted in April 2018 in Ngrejo village, Blitar regency, East Java. The day before the research 20 weeks old chickens were taken and separated in different cages. Chickens were adapted for 5 days, fed commercial phase without antibiotics layer and fed ad libitum. Chicken adapted and weighed and weighed chicken feed for chicken needs for 1 week. Data collection for egg quality was performed in the last 1 week. On day 6 at the age of 21 weeks the chickens were infected with *Escherichia coli* bacteria intramuscularly with concentration of 108 cells/kg weight as much as 1 ml then observed clinical symptoms for 3 days. The meniran extract was administered starting on the 9th day mixed in the feed with different doses of each treatment group in concentrations of 10%, 20%, and 30%.

2.3 The concentration of meniran extract and AGP in the feed

2.3.1 Research on laying hens that are not infected by *Escherichia coli*

Laying chickens were randomized into five treatments, as follows:

o T0: Non-infected chickens *Escherichia coli* are fed commercially

o T0 +: Non-infected chicken *Escherichia coli* fed commercial with addition of 1% AGP

o T1: Non-infected chicken *Escherichia coli* fed commercial with the addition of 10% concentrated meniran extract of 1 ml / kgBW

o T2: Non-infected chicken *Escherichia coli* was fed commercial with the addition of 20% concentrated meniran extract of 1 ml / kgBW

o T3: Non-infected chicken *Escherichia coli* was fed commercial with the addition of 30% concentrated meniran extract of 1 ml / kgBW

2.3.2 Research on laying hens infected with *Escherichia coli*

Laying chickens were randomized into five treatments, as follows:

o T0: laying hens infected *Escherichia coli* 10^8 CFU / ml of 1 ml fed commercial

o T0 +: laying hens infected *Escherichia coli* 10^8 CFU / ml of 1 ml fed commercial with addition of 1% AGP

o T1: laying hens infected with *Escherichia coli* 10^8 CFU / ml as much as 1 ml were fed with the addition of 10% extract of meniran concentration of 1 ml / kgBW

o T2: laying hens infected *Escherichia coli* 10^8 CFU / ml as much as 1 ml fed with the addition of extract of meniran concentration of 20% by 1 ml / kgBW

o T3: laying hens infected *Escherichia coli* 10^8 CFU / ml of 1 ml fed with the addition of 30% extract of meniran concentration of 1 ml / kgBW

2.4 Egg Quality

Looking at egg quality is done by breaking the egg and spilling its contents on flat and smooth glass, then measuring yolk index, egg white index, and Haugh Unit. The Yellow Egg Index (IKT) is the high ratio of egg yolk to the yolk center line (Koswara, 2009). The standard for the yolk index is as follows: 0.22 = ugly; 0.39 = average, and 0.45 = high.

Egg White Index is a high ratio of egg white (albumin) thick with an average diameter. Measurements are performed after the egg yolks are carefully separated. The new egg has an Egg White Index between 0.050 - 0.174, but usually ranges between 0.090 and 0.120. The Egg White Index decreases during storage, due to the breakdown of ovomucin that is accelerated by the rising pH.

Referring to the Badan Standardisasi Nasional (2008) on SNI 3926: 2008, it is said that the egg white index is a comparison between egg white height with an average diameter of viscous egg white. Fresh egg white index ranges between 0.050-0.174. The yolk index is a comparison between the height of the egg yolk and the yolk diameter. According to the Badan Standardisasi Nasional (2008) on SNI 3926: 2008 the index of fresh egg yolks ranged from 0.33 to 0.52.

Haugh unit was calculated using the formula (Card and Nesheim, 1972), *Haugh Units (%): 100 x log(H+7.57 – 1.7W$^{0.37}$)*, where H is the height of albumen and W is the weight of the egg. Eggs with good quality have a minimum HU of 72. Eggs that are not worth consuming have less than 30 HU (Koswara, 2009).

a. Data Analysis

The experimental data of addition of meniran extract on egg quality can be analyzed statistically using analysis of variance (ANOVA) to know whether there is real difference from treatment given. If different or very different results are obtained then it is continued with a Duncan Multiple Range Test. Statistical analysis uses SPSS for Windows 21.0 program.

2.5 Business analysis

Production costs are all company expenditures to obtain the factors of production that will be used to produce goods produced by the company. Production cost consists of two main parts, namely fixed cost and variable cost.

2.5.1 Benefit Cost Ratio

Soepranianondo et al. (2013) states that the ratio between the present value of the cash inflows and the total present value of the outflow cash stream is called the Benefit Cost Ratio (B / C), with the following formula,

$$B/C = \frac{\text{Sales Results}}{\text{Production Fund}}$$

There are three possibilities: B / C> 1, B / C = 1, B / C <1.

Criteria:
B / C Ratio > 1 means the business is feasible
B / C Ratio <1 means the business is not feasible
B / C Ratio = 1 means the business is break even (BEP)

3. RESULTS

3.1 Egg Quality

3.1.1 Egg Yolk Index

The mean value of the egg yolk index can be seen in Table 1.

Table 1. The mean value and standard deviation of egg yolk index.

FACTOR	GROUP	Mean	Std. Deviation
NON INFECTED	T0	0.3740	0.07092
	T0+	0.3780	0.03421
	T1	0.4120	0.02168
	T2	0.4100	0.02000
	T3	0.4060	0.00894
INFECTED	T0	0.3580	0.05167
	T0+	0.4020	0.07950
	T1	0.3900	0.02915
	T2	0.4180	0.03347
	T3	0.3180	0.17824

The results showed that among the treatments that did not show any significant difference ($p < 0.05$), between the treatment of T0, T0 +, T1, T2 and T3 in both factors there was no difference. The high yolk egg index was found in T1 in uninfected and T2 factor in infected factor of 0.412 and 0.418, respectively, while the low egg yolk index was found in T0 in uninfected and T3 factor in the infected factor, respectively - range by 0.374 and 0.318.

The value of yolk index of each treatment showed a moderate value, ranging from 0.31 to 0.41, in accordance with the SNI 2008 stating the egg yolk index ranged from 0.33 to 0.52.

3.1.2 Egg White Index

The mean value of the egg white index can be seen in Table 2.

The results showed that among the treatments that did not show any significant difference ($p < 0.05$), between the treatment of T0, T0 +, T1, T2 and T3 in both factors there was no difference. The high egg white index found in T2 in both factors is 0.118 and 0.116 respectively, while the low egg white index was present in T0 in both factors respectively 0.092 and 0.078.

The egg white index value of each treatment showed a moderate value, ranging from 0.07 - 0.11, i.e. in accordance with SNI 2008 which states the egg white index ranged from 0.05 - 0.174.

Table 2. The mean value and standard deviation of egg white index

FACTOR	GROUP	Mean	Std. Deviation
NON INFECTED	T0	0.0920	0.02702
	T0+	0.1140	0.03050
	T1	0.1140	0.01517
	T2	0.1180	0.03347
	T3	0.0940	0.03130
INFECTED	T0	0.0780	0.01095
	T0+	0.1080	0.03114
	T1	0.1000	0.03742
	T2	0.1160	0.04219

	T3	0.0880	0.05805

3.1.3 Haugh Unit Index

The mean value of the Haugh Unit index can be seen in Table 3.

Table 3. The mean value and standard deviation of the Haugh Unit Index.

FACTOR	GROUP	Mean	Std. Deviation
NON INFECTED	T0	92.4020	8.53913
	T0+	90.8980	9.98262
	T1	92.8680	3.75411
	T2	92.4120	10.01690
	T3	82.2720	12.36696
INFECTED	T0	76.4020	7.58204
	T0+	87.6860	11.07991
	T1	79.7720	26.55888
	T2	88.7840	13.58453
	T3	70.2120	40.49375

The results showed that among the treatments that did not show any significant difference ($p < 0.05$), between the treatment of T0, T0 +, T1, T2 and T3 in both factors there was no difference. The high Haugh Unit index was found in T1 in uninfected and T2 factors in the infected factor of 92.868 and 88.784 respectively, while the low Haugh Unit index was in T3 in both factors respectively 82.272 and 70.212.

Haugh Unit index value of each treatment shows the value of the worst to the best, which ranges from 70 to 92, that is in accordance with Koswara (2009) stating that the value of Haugh Unit has a minimum value of 72.

With egg quality values that showed no significant difference in treatment of addition of meniran extract between control treatment and treatment with addition of AGP it showed that feeding innovation plus meniran extract could replace AGP in feed.

3.2 Business Analysis

Detailed calculation of business analysis can be seen in Table 4.

Fixed costs are calculated from the multiplication of fixed costs by the number of units. Fixed costs consist of the cost of cage depreciation and equipment, and employee salary. Fixed costs have the same amount between treatments that is Rp 21,900.00 for 50 heads during 1 phase of production.

The variable cost is calculated from the multiplication of variable costs by the number of units. Variable costs consist of seeds, transportation, feed and feed additive. Feed cost is calculated from the average amount of feed consumption per treatment.

Revenue is the selling price per unit of production multiplied by the number of products sold.

Of the five treatments they showed no large differences, each treatment shows the value of B / C> 1 which means the business is feasible. With the provision of meniran extract on the diet it proved a feasible effort to continue as a substitute AGP on feed.

Table 4. Detailed calculation of business analysis (in Rupiah).

Description	T0	T0+	T1	T2	T3
Fixed Cost					
Cage Depreciation	8000	8000	8000	8000	8000
Employee Salary	13500	13500	13500	13500	13500
Equipment Depreciation	400	400	400	400	400
Total Fixed Cost	21900	21900	21900	21900	21900
Variable Cost					
Seeds	700000	700000	700000	700000	700000
Feed	1459213,34	1498751	1408170	1474958	1389095

Feed Additive	0	1924,56	2585,789	2708,43	2550,762
Transport	102939,4286	98912,57	99745,71	101597,1	99792
Total Variable Cost	2262152,768	2299588	2210502	2279263	2191438
Total Cost	2284052,768	2321488	2232402	2301163	2213338
Receipts					
Egg	3088182,857	2967377	2992371	3047914	2993760
Chicken rejects	550000	550000	550000	550000	550000
Feces	2999,5	2999,5	2999,5	2999,5	2999,5
Total Receipts	3641182,357	3520377	3545371	3600914	3546760
Profit	1357129,589	1198888	1312969	1299750	1333422
Financial Analysis					
BEP Price	13312,99075	14082,06	13428,56	13589,93	13307,71
B/C	1,59417611	1,516431	1,588142	1,564823	1,602448

4. CONCLUSION

The provision of meniran extract on feed proved able to replace AGP function in the feed, with the best result of egg quality at T2. With the calculation of Benefit Cost Ratio each treatment also shows that the meniran extract can replace AGP function in the feed because it shows the result of feasible effort to be continued.

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