The Utilization of Garlic (*Allium sativum Linn*) and Red Ginger (*Zingiber officinale var rubra*) Extract on The Growth of Broiler were Infected by *Escherichia coli*

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Abstract . This study aims to examine the effect of garlic (Allium sativum Linn) and red ginger (Zingiber officinale var rubra) extract on the growth of broiler chickens were infected by Escherichia coli. The design used in this study was a complete randomized design (CRD) with 6 treatments and 3 replications. Treatment consists of P0A = Control without infection; P0B = Control + E. coli infection; P1 = Infection E. coli + tetracycline antibiotics 0.05%; P2 = Infection E. coli + garlic extract (Allium sativum Linn) (1%); P3 = Infection E. coli + red ginger extract (Zingiber officinale var rubra) (1%); P4 = Infection E. coli + garlic (Allium sativum Linn) and red ginger (Zingiber officinale var rubra) extract (1%).
The results showed that the effect of garlic and red ginger gave significant influence (P <0,05) to growth of broiler were infected by Escherichia coli. The combination of garlic (Allium sativum Linn) and red ginger (Zingiber officinale var rubra) extract has the highest influence of other activities. It was concluded that giving of garlic and red ginger extract give influence to growth of broiler were infected by Escherichia coli and can be used as alternative antibiotic.

1. Introduction

Broiler chickens are the most economical livestock when compared with other livestock, the advantages possessed is the speed of growth / meat production in a relatively quick and short time or about 4-5 weeks of meat production can be marketed or consumed.

The increasing public demand for livestock products causes the use of medicines for the prevention and treatment of livestock diseases is becoming increasingly important for meat, eggs and milk to be produced efficiently. However, most people refuse to buy livestock products that they know to use antibiotics or chemicals in the process. Because of the lack of attention to the rules of its use has been shown to result in the presence of antibiotic residues in livestock products and the development of resistant microbes in the body of cattle and the human body that consume them.

One of the diseases that often encounter livestock in Indonesia is Kolibasilosis. The disease is often seen even as if it has become a "must" disease in chicken farms. Kolibasilosis is directly related to drinking water sources in the field, because the presence of *Escherichia coli* bacteria causes Kolibasilosis in water and soil is normal flora, so it is not surprising that the results of laboratory tests on water samples at farm sites almost all showed positive bacteria *Escherichia coli.*

Antibiotics are believed to suppress the growth of pathogenic bacteria resulting in soaring beneficial bacterial populations in the digestive tract. The high beneficial microflora can stimulate the formation of antimicrobial compounds, free fatty acids and acidic substances so that the creation of the

environment is less convenient for the growth of pathogenic bacteria. Various alternatives are being developed to look for additional safer feed ingredients, among others through the use of enzymes, probiotics, prebiotics, organic acids, spices and medicinal plant extracts.
Garlic contains essential oils with the main ingredient of allicin. Allicin enzymatically will be broken down by allinase enzyme into a distinctive smelling compound that is allicin. Allicin compounds are known to have strong antibacterial properties. With this allicin then the growth of germs can be inhibited and the subsequent process leads to the occurrence of pathogenic pathogens.

2. Materials and Methods

The research was conducted at Animal Husbandry Laboratory of Animal Husbandry Study Program, Faculty of Agriculture, University of Sumatera Utara, Jl. A. Sofyan No. 3 Campus of Universitas Sumatera Utara, Medan. The study lasted for 2 months from June to August 2017.
Materials used in the study among other broiler chickens as much as 90 DOC Strain Cobb 500 from PT. Charoen Pokphand Jaya Farm, KMnO4, rodalon, vitachick, ND vaccine, Gumboro vaccine, commercial feed, garlic (*Allium sativum Linn*), red ginger (*Zingiber officinale var rubra),* 96% ethanol, aquades, tetracycline antibiotics, bacterial isolates *Escherichia coli* obtained from the collection of Veterinary and Animal Health Center Medan.
The research method used is Completely Randomized Design (RAL) consisting of 6 treatments and 3 replications. The treatments were *Escherichia coli* with a dose of 10^6 CFU / ml. The treatment given is:

P0A : Control without infection
P0B : Control + infection of *Escherichia coli*
P1 : Infection of *Escherichia coli* + tetracycline antibiotics 0.05%
P2 : Infection of *Escherichia coli* + garlic extract (*Allium sativum Linn*) (1%)
P3 : Infection of *Escherichia coli* + red ginger extract (*Zingiber officinale var rubra*) (1%)
P4 : Infection of *Escherichia coli* + garlic extract (*Allium sativum Linn*) and red ginger (*Zingiber officinale var rubra*) (1%)

Parameter were feed consumption, increase of body weight, feed conversion and mortality.

2.1. Feed Consumption

Feed consumption is calculated every day based on the difference between the amount of rations given by the amount of residual rations. Feed consumption can be calculated by the formula:

Feed consumption = Feed given - Feed remaining

2.2. Increase of Body Weight

Growth is a process of increasing the size of bones, muscles, internal organs and tissues of other body parts.
The weight gain (PBB) is calculated based on the difference between the final weight weighing and the previous weight. The weight gain (PBB) can be calculated by the formula:

$$\text{PBB} = \frac{\text{Last weights - Previous weights (g / head / week)}}{\text{Duration of maintenance}}$$

2.3. Feed Conversion

Conversion of feed is one of the production standards to assess the efficiency of feed consumed livestock into meat or as a benchmark level of chicken productivity. The value of feed conversion is caused by an increasing or greater difference in the ratio of feed consumption and body weight gain. Feed conversion can be calculated by the formula:

$$\text{Conversion of feed} = \frac{\text{Feed consumption}}{\text{PBB}}$$

2.4. Mortality

Mortality is the number of deaths from the initial number of chickens maintained. Factors that affect mortality include body weight, nation, chicken type, climate, environmental hygiene, sanitary equipment cage, the presence of disease.

$$\text{Mortality} = \frac{\text{Number of dead chickens}}{\text{Number of chickens enter}}$$

3. Results and discussion

3.1. Feed Consumption

The results of research that has been obtained the average consumption of broiler chicken feed during the study can be seen in Table 1 as follows:

Table 1. Average Broiler Chicken Feed Consumption (g / head / week)

Week	Treatment					
	P0A	P0B	P1	P2	P3	P4
Before infection (0-1 weeks)	181,75 ^{ab}	175,24 ^{b}	181,79 ^{ab}	177,08 ^{ab}	185,11 ^{ab}	185,67 ^{a}
After infection						
Week-2	343,25 ^{ab}	323,22 ^{b}	330,80 ^{ab}	326,13 ^{ab}	348,22 ^{a}	320,01 ^{b}
Week-3	614,23 ^{a}	603,44 ^{c}	612,75 ^{ab}	611,17 ^{ab}	608,45 ^{b}	608,71 ^{b}
Week-4	820,75 ^{a}	802,66 ^{d}	815,30 ^{ab}	811,58 ^{bc}	805,62 ^{cd}	808,47 ^{bcd}
Week-5	1044,13 ^{a}	1009,84 ^{b}	1041,41 ^{a}	1039,31 ^{a}	1010,73 ^{b}	1043,19 ^{a}
Week-6	1159,77 ^{a}	1104,61 ^{d}	1142,54 ^{b}	1128,97 ^{c}	1120,94 ^{c}	1131,74 ^{cb}
Average	796,43 ^{a}	768,75 ^{d}	788,56 ^{b}	783,43 ^{cb}	778,79 ^{c}	782,42 ^{cb}

Description: superscript with different letters in the direction of rows shows a real difference (P <0,05)

In table 1 the average consumption of broiler chicken feed before infected showed significantly different, while the highest average feed consumption was found in P4 treatment of 185.67 g / head and the lowest in treatment P0B of 175.24 g / tail. This is due to several factors that may affect feed consumption, such as palatability, livestock activities and livestock health. This is consistent with Anggorodi's (1990) statement, which states that feed consumption is influenced by animal health, palatability, ration quality and granting procedures [1].

Table 1 above shows that feed consumption at week 2 shows significant differences. Where the highest average feed intake was in treatment P3 of 348,22 g / tail and lowest at treatment P6 equal to 320,01 g / tail. This means the consumption of feed on broiler chickens that have been infected Escherichia coli able to influence feed consumption in each livestock. This is in accordance with the statement of Lee (1998), which states that the infection of Escherichia coli in broiler chickens lower consumption of rations. Escherichia coli infections in broiler age 4-8 weeks can eliminate appetite, lazy to move and sleepy [2].

From table 1 it can be seen that at week 3 after being infected and treated with tetracycline and extract showed better rate than none. Where the highest average is in P0A treatment of 614.23 g / tail and followed by P3, P4, P6, P5 and the lowest at P0B treatment of 603.44 g / tail. This is because infection of Escherichia coli in broiler chickens lower consumption of ration.

3.2. Increase of Body Weight

In table 2 the average of body weight gain of broiler chickens before infected showed no significant difference in treatment of P0A, P0B, P1, P2, P3 and P4, while the highest average body weight gain was found in P0A treatment of 174.68 g / at P4 treatment of 166,43 g / tail. This is because the feed consumption is given as well so that the rate of chicken body weight increase is equal and one of the factors that influence the rate of body weight gain is feed consumption. This is in accordance with the statement Kartadisastra (1994), which states that the weight of chicken will be determined by the amount of feed consumption, the greater the chicken body weight the more the amount of feed consumption [3].

The result of research that has been done to get the average of body weight of broiler chicken during the research can be seen in Table 2 as follows:

Table 2. Mean of Added Body Weight of Broiler Chickens

Week	Treatment					
	P0A	P0B	P1	P2	P3	P4
Before infection (0-1 weeks)	174,68 [a]	171,46 [a]	171,10 [a]	170,17 [a]	170,39 [a]	166,43 [a]
After infection						
Week-2	213,17 [a]	188,05 [b]	208,94 [ab]	201,03 [ab]	204,82 [ab]	200,89 [ab]
Week-3	300,57 [ab]	281,34 [b]	308,59 [a]	304,82 [a]	303,92 [a]	308,09 [a]
Week-4	307,40 [ab]	293,94 [b]	297,92 [ab]	305,68 [ab]	298,80 [ab]	311,99 [a]
Week-5	488,11 [a]	456,85 [b]	475,57 [ab]	476,71 [ab]	472,38 [ab]	474,17 [ab]
Week-6	470,82 [b]	478,48 [ab]	481,66 [ab]	490,55 [ab]	495,74 [a]	492,32 [ab]
Average	356,01 [a]	339,73 [b]	354,53 [a]	355,76 [a]	355,13 [a]	357,49 [a]

Description: superscript with different letters in the direction of rows shows a real difference (P <0,05)

Table 2 above shows that body weight gain at week 2 shows significant differences. Where the highest body weight gain was found in the P0A treatment of 213.17 g / head and the lowest in the P0B treatment of 188.05 g / head. This means that infected chickens with Escherichia coli bacteria can provide an impact on the body weight increase of broiler chickens.

In the 3rd week after chickens were infected, the results showed that garlic extract and red ginger (P2, P3, P4) treatment were able to give the same effect as tetracycline antibiotic treatment (P1 treatment) and comparable to unadjusted broiler chicken (P0A), then broiler chickens infected Escherichia coli without being treated (treatment P0B) in the form of extracts or antibiotics show the lowest average rate. This is because garlic has an allicin substance that is able to inhibit bacterial growth. This is in accordance with the statement of Suharti (2005), which states that the bioactive components present in garlic (alisin) have extensive pharmacological effects . The ability of garlic in inhibiting the growth of bacteria causes the bacterial population contained in the intestinal tract can be suppressed so as to reduce the utilization of food by bacteria and increase the absorption of nutrients in the intestine [4]. While red ginger has an enzyme that is able to optimize the digestive tract. This is consistent with Setyanto et al. (2012), which states that ginger solution can stimulate the gallbladder wall, secrete bile and stimulate the release of pancreatic sap containing amylase, lipase and protase. These enzymes can improve the work of the digestive system. In addition, the role of antibiotics contained in the solution of ginger (gingerol), so that the control of bacteria or disease germs more efficient [5].

3.3. Feed Conversion

In table 3 the average conversion of broiler feed before infected showed no significant difference and the average rate of feed conversion is very good (below 2), meaning that all treatments can stimulate the feed into meat. This is because chickens that have not been infected Escherichia coli is still in good health so that digestion is able to stimulate the feed well. This is consistent with Conley's (1997)

statement, which states that when the conversion process of feed into meat goes well, then the growth rate (weight gain) will be better.
The result of the research has been found the average of broiler feed conversion during the research can be seen in Table 3 as follows:

Table 3. Mean Conversion of Broiler Chick Feed

Week	Treatment					
	P0A	P0B	P1	P2	P3	P4
Before infection (0-1 weeks)	1,04 [a]	1,02 [a]	1,06 [a]	1,04 [a]	1,08 [a]	1,12 [a]
After infection						
Week-2	1,60 [a]	1,72 [a]	1,58 [a]	1,62 [a]	1,71 [a]	1,59 [a]
Week-3	2,04 [ab]	2,15 [a]	1,98 [b]	2,00 [ab]	2,01 [ab]	1,97 [b]
Week-4	2,67 [a]	2,73 [a]	2,74 [a]	2,65 [a]	2,69 [a]	2,59 [a]
Week-5	2,14 [a]	2,21 [a]	2,19 [a]	2,18 [a]	2,14 [a]	2,20 [a]
Week-6	2,46 [a]	2,31 [b]	2,37 [ab]	2,30 [b]	2,26 [b]	2,30 [b]
Average	2,18 [b]	2,22 [a]	2,17 [bc]	2,15 [cd]	2,16 [bc]	2,13 [d]

Description: superscript with different letters in the direction of rows shows a real difference (P <0,05)

From table 3 it was found that the average of feed conversion at 2 weeks was not significantly different from the treatment of P0A, P0B, P1, P2, P3 and P4, this was because at week 2 the chickens were infected with Escherichia coli, so the rate of feed conversion did not differ greatly. While at week 3 the highest average was found in P0B treatment of 2.15 and followed by treatment of P0A, P3, P2, P1 and P4. Conversion of rations showing a ration efficiency feature showed that treatment P4 was the most efficient treatment with a conversion value of 2.13 compared with other treatment conversion values. This is in accordance with the statement Suharti (2005), which states that garlic allegedly also can optimize the function of food metabolism so as to improve the efficiency of feed use. Provision of garlic solution causes less yarg ration consumed, but its absorption increases then produce a high body weight.

3.4. Mortality

The mortality rate is obtained from the ratio of the number of dead chickens to the number of chickens maintained. Broiler breeding is successful if the overall mortality rate is less than 5%.

The results showed that the phases before infecting Escherichia coli had no mortality. This proves that before infection, broiler chicken body resilience condition is good. In the post-infection phase of mortality P0B has the highest mortality, ie 2 tails. The results also indicate that the maintenance of broiler infected with Escherichia coli can still be said to be successful because mortality is less than 5% overall, ie only reached 2.23%. This is in accordance with the statement of North et al., (1990), which states that broiler maintenance is successful if the overall mortality rate is less than 5%.

4. Conclusions

Giving garlic extract and red ginger can affect performance (feed consumption, body weight gain and feed conversion) broiler chickens infected with Escherichia coli bacteria. Giving garlic extract and red ginger can replace the use of commercial antibiotics (tetracycline) in broiler chickens.

References :

[1] Anggorodi, R. 1990. *Ilmu Makanan Ternak Umum*. PT. Gramedia. Jakarta

[2] Lee, M.D. dan H.A. Lawrence. 1998. Colibacillosis. *In A Laboratory Manual For the isolation an identification of avian pathogen*. American Association of Avian Pathologist. Fourth Ed. Pennsylvania: pp: 14−16

[3] Ganiswara, S. G. 1995.*Farmakologi dan Terapi*. Gaya Baru. . Jakarta

[4] Retno, F. D. 1998. *Penyakit-Penyakit Penting Pada Ayam*. Edisi ke-4. Bandung

[5] Mulyani, S. 2010. *Komponen dan Antibakteri dari fraksi kristal minyak Zingiber zerumbet*. Majalah Farmasi Indonesia, 21(3): 178-184