Effectiveness of Extracts of Garlic (*Allium sativum* L) and Red Ginger (*Zingiber officinale var rubra*) as *Escherichia coli* Control in Broiler Chicken

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Abstract. This study aims to determine the effectiveness of extracts of garlic (Allium sativum L.) and ginger (Zingiber officinale) on the growth of broiler chickens infected with E. coli. The design used in this study was a Completely Randomized Design with 6 treatments and 3 replications. The treatment consisted of P0A = control without infection, P0B = control + E. coli infection, P1 = E. coli infection + 0.05% tetracycline antibiotics, P2 = E. coli infection + 1% garlic (Allium sativum L.) extract , P3 = E. coli infection + 1% ginger (Zingiber officinale) extract and P4 = E. coli infection + garlic (Allium sativum L) extract and 1% ginger (Zingiber officinale). The results showed that the administration of garlic and ginger extract had a significant effect ($P < 0.05$) on the decrease in the number of Escherichia coli bacteria in broiler chicken feces. The combination of extracts of garlic (Allium sativum L.) and red ginger (Zingiber officinale) has the most effective effect compared to garlic and ginger extract alone. It was concluded that the administration of extracts of garlic and ginger could be used as Escherichia coli control in broiler chickens.

1. Introduction

E.Coli is a normal inhabitant of the poultry digestive tract. The presence of E. coli bacteria in drinking water is an indication of fecal contamination. In the normal chicken digestive tract there are 10-15% of pathogenic E. coli bacteria from all E. coli (Barness and Gross, 1997). E. coli bacteria are included in gram negative bacteria, are not acid resistant, and do not form spores. In healthy animals, the composition of the digestive tract microbes is relatively fixed, but if stability is disturbed, pathogenic microorganisms will make colonies and initiate serious infections.

So far, controlling Escherichia coli is only using antibiotics. Antibitic is given as a supplement ingredient for ration which aims for Antibiotic Growth Promoter (AGP). The effect of continuous antibiotic use and unwise use causes resistant microbes. Various efforts have been made to find a substitute for antibiotics as AGP because of the increasing trend in demand for livestock products that are healthy, safe and free of harmful residues. One of them is by utilizing relative natural materials to prevent disease.

Garlic contains essential oils with the main element alliin. Alliin is enzymatically broken down by the enzyme allinase into a typical odorous compound, allicin. Allicin compounds are known to have strong antibacterial power. The content of secondary metabolites found in ginger (Zingiber officinale roscoe) plants are mainly flavonoids, phenols, terpenoids, and essential oils. Secondary metabolite compounds produced by plants of the Zingiberaceae tribe generally can inhibit the growth of pathogenic microorganisms (Nursal, 2006).

Antibiotics are believed to be able to suppress the growth of pathogenic bacteria which results in a soaring population of beneficial bacteria 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 comfortable for the growth of pathogenic bacteria.

2. Materials and Methods

The study was conducted at the Laboratory of Animal Biology, Animal Husbandry Study Program, Faculty of Agriculture, University of North Sumatra, Jl. A. Sofyan No. 3 University of North Sumatra Campus, Medan. This research took place from June to August 2017. The materials used in this study were garlic (Allium sativum), red ginger (Zingiber officinalevar rubra), 96% ethanol solvent, aquades, escherichia coli isolates obtained from the collection of Veterinary and Health Centers. Medan animals, alcohol, broiler chicken feed and broiler chickens as test material challenge E. coli bacteria. The main tools that are used are knives, mills, stirrers, sieves, rotary vacuum evaporators, water baths, thermometers, cages, feed places, drinking places, syringes, faecal shelters, solid media of E. coli bacteria, petri dishes , dropper pipette, incubator, test tube, steel wire and gloves.

This study will use a test method, where researchers will host E. coli bacteria in broiler chickens and be treated so that it can be known the growth and development of E. coli bacteria on the treatment given, whether the treatment given can inhibit the growth of E. coli and affect growth in host or not. The research method used was a Completely Randomized Design (CRD) consisting of 6 treatments and 3 replications. The treatment studied used E. coli with a dose ranging from 106 CFU / ml.

3. Results and Discussion

Based on the results of research that has been carried out it is known that the administration of garlic extract and ginger extract and the combination of both have an effect on the number of E. coli bacteria in boiler chicken stool.

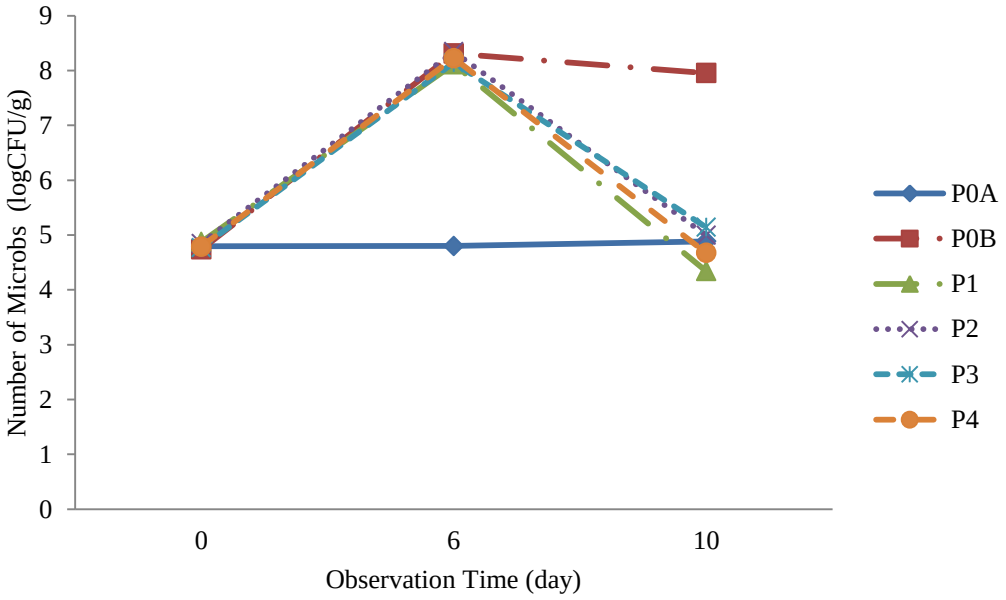
Table 1. Effect of garlic extract and ginger extract and a combination of both on the number of E. Coli bacteria (logCFU / gram) in broiler chicken feces

Treatment			
	Before Infection	Before Medication (5)	After Medication (15)
P0A	4,797[a]	4,799[c]	4,884[c]
P0B	4,738[a]	8,310[a]	7,953[a]
P1	4,873[a]	8,116[b]	4,343[e]
P2	4,846[a]	8,346[a]	4,994b[c]
P3	4,771[a]	8,146[b]	5,141[b]
P4	4,790[a]	8,227[ab]	4,673[d]

Description: Superscripts with different letters in the direction of the column, showed a significant difference (P <0.05) based on the DMRT test
P0A = Control without infection.
P0B = Control + E.coli infection
P1 = E.coli infection + tetracycline antibiotics 0.05%
P2 = 1% E.coli infection + garlic extract
P3 = E.coli infection + 1% red ginger extract
P4 = E.coli infection + 1% Garlic and red ginger extract.

Table 1 shows that before infection, the number of E. coli bacteria in boiler chicken stool ranged from 4.738 to 4.846 CFU / gram or 5.47x104 to 7.46x104 CFU / gram. After being infected with 106 CFU / gram E. coli bacteria, E. coli bacteria in boiler chicken stool increased to 8,146-8,346 CFU / gram or 1,31x108 - 2,2x108 CFU / gram, while in uninfected broilers (treatment control without infection) the number of fixed microbes is 4,799CFU / gram or 6,30x104 CFU / gram. After treatment using

teteracyclin antibiotics (P1), the number of E. coli bacteria in feces decreased to 4.33 logCFU / gram, which decreased by 4.34CFU / gram or around 86.89%. In P2 treatment (treatment with 1% garlic extract) there was a decrease in the number of E. coli bacteria in boiler chicken stool to 4,994 CFU / gram where the decrease occurred as much as 3,352 logCFU / gram or 67,12%.
In P3 treatment (treatment with ginger extract 1%) there was a decrease in the number of bacteria to 5,141 CFU / gram where the decrease occurred as much as 3,00 logCFU / gram or as much as 58%. While in treatment P4 (treatment with a combination of 1% garlic and ginger extract) there was a decrease in the number of E. coli bacteria to 4.67 logCFU / gram where the amount of reduction was 3.55 CFU / gram or 76.05%. While in the uninfected treatment group, the number of bacteria experienced an increase but not significant where the number of E. coli bacteria in faeces increased to 4,884 CFU / gram or increased by 1,817%. The relationship between giving garlic extract, ginger extract and the combination of both to the number of E. coli bacteria in boiler chicken stool can be seen in Figure 1.



Description: Relationship between garlic extract, ginger extract, and a combination of both on the number of E. coli bacteria in broiler chicken feces.

Before infection, the number of E. coli bacteria in chicken feces was 4,738-4,846 CFU / gram. Based on Santoso's research (2005) it was found that the number of E. coli bacteria in normal chicken feces (which were not infected with E. coli) was 227.3x105 CFU / gram. The presence of bacteria in the feces is normal, because under normal conditions E. coli is found in the digestive tract of the chicken. About 10-15 percent of all E. coli found in healthy chicken intestines are classified as pathogenic serotypes. The intestine that contains the most germs are the jejunum, ileum and cecum. Feed, water and litter are known as a source of infection from colibasilosis (Tarmudji, 2003).
In this study, infecting chicken healthy boilers using E. coli 106 bacteria isolates. The results showed that after infection, the number of E. coli bacteria in feces increased to 8,116-8,346 CFU / gram which in healthy chickens (not infected) , the number of E. coli bacteria is 4.799 CFU / gram. The increase that occurred was 3,317-3,547 CFU / gram.
Chickens infected with E. coli showed symptoms of depression, anorection, coarse hair, hanging wings, weakness, and pasta diarrhea (Wibowo, et al., 2008). At the time of infection, there is an increase in the amount of chicken hemoglobin which causes damage to some of the chicken's organs. The body then attempts to increase the supply of oxygen to the tissues and carry oxygen to the lungs (Suryani, et al., 2014).

E. coli infection also causes lymphocyte infiltration, heterophyll, macrophages, pericarditis, and the presence of multi-necrotic focal in several digestive organs. The organs that undergo lymphocyte infiltration are found in the digestive tract, liver, pericardium, and lungs. Lymphocyte infiltration occurs because the digestive tract, liver, and pancreas are early organs in contact with infectious agents (E.coli bacteria) so as a form of body defense response lymphocytes, heterophiles, and macrophages infiltrate into the tissues of the digestive organs (Suryani, et al., 2014).

As for the effect of tetraxicline antibiotics on the decrease in the number of E. Coli bacteria after treatment using teteracyclin antibiotics (P1), the number of E. coli bacteria in feces decreased to 4.34 log CFU / gram, around 86.89%. Tetracycline is an antibiotic that belongs to the group of antibiotics that react by inhibiting bacterial protein synthesis. These antibiotics will interfere with the formation of proteins in the ribosome by binding to 3OS or 5OS ribosomes. This bond to 3OS or 5OS ribosomes causes no functional formation of 7OS ribosomes (Bennet et al., 2012).

The results showed that garlic extract was able to reduce the number of E. coli bacteria in boiler chicken stool by 67.12%. Garlic has the ability to inhibit the growth of E. Coli bacteria. The usual dose used to inhibit pathogenic bacteria is 11.25-360 mg/gram. Prihandani, et al. (2015) showed that garlic effectively inhibited E.coli growth at concentrations of 12.5%, 25%, and 50%. The bacterial inhibitory ability is caused by the content of antimicrobial compounds contained in garlic. Garlic contains at least 33 sulfur compounds, 17 amino acids, several enzymes and minerals. It is this sulfur compound that makes garlic have a distinctive sharp odor and make garlic have a clinical effect (Kemper, 2005).

Effect of ginger extract on the decrease in the number of E. coli bacteria in boiler chicken stool. The results found that ginger extract was able to reduce the number of microbes in chicken stool boilers that had been infected by E. coli by 58%. Ginger extract is able to inhibit the growth of E. coli bacteria because it contains gingerol and shagelol compounds which are identified as more active agents that act as antibacterial and antifungal (Rahmani, et al., 2014).

4. Conclusion

Giving extracts of garlic and or ginger with a concentration of 1% can reduce the number of E. Coli bacteria. The use of garlic and red ginger can reduce bacterial E. coli numbers. Garlic extract can reduce 67.12%, Ginger extract can reduce 58% and a combination of ginger extract can reduce 76.05%. The combination of garlic and red ginger shows the best results as controlling E. coli in broiler chickens.

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