

Antibacterial Effectiveness Test of Ethanol Extract of Gadung Mango Leaves Against *Staphylococcus aureus* and *Escherichia coli* Bacteria

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Abstract: Infection is a disease that often occurs in Indonesia. This disease is caused by pathogenic microbes, one of which is bacteria. *Staphylococcus aureus* and *Escherichia coli* are bacteria that cause infection. Pharmacological therapy for bacterial infections used to use antibiotics, currently tends to use drugs that come from nature. One of the plants that has the potential as an antibacterial is gadung mango leaves. This study aims to determine the effectiveness of mango leaf ethanol extract against *S.aureus* and *E.coli* bacteria. The method used was well diffusion with concentrations of ethanol extract of mango leaves 0.5% (S1), 0.75% (S2), 1% (S3), streptomycin (K+), and ethanol (K-), respectively treatment was repeated 5 times. Data that can be analyzed using One Way ANOVA with a significant level of 0.05. Based on the results of the antibacterial extract of ethanol extract of mango gadung leaves, it has the potential to be better on *E. coli* bacteria, namely at a concentration of 1% (S3) of 16.05 mm, whereas on *S.aureus* K+ bacteria (Streptomycin) it is better on control + of 15.9 mm.

Keyword: *S. aureus*, *E. coli*, gadung Leaves

1. INTRODUCTION

Infections caused by bacteria are usually carried out pharmacological therapy using antibiotics, but now the tendency of treatment is back to nature by using plants as medicine (*back to nature*).

Antibacterial is a substance that can inhibit the growth and kill pathogenic bacteria (Paju et al., 2013). Testing was carried out to determine the minimum inhibitory concentration value to increase the effectiveness of the antibacterial compound as well as prevent the emergence of bacterial resistance problems because the administration of antibacterials in excessive amounts and continuously will cause bacterial cells to become resistant (Kuspradini et al., 2016). Antibacterial activity is influenced by several factors, including extract concentration, antibacterial compound content, extract diffusion

power, and the type of bacteria being inhibited (Marselia et al., 2015).

Mangifera indica L. is a plant that has benefits as a medicinal plant (Djarot et al., 2020). Mango leaf extract contains alkaloids, tannins, phenols, flavonoids, saponins, phytosterols, and mangiferans (Djarot et al., 2020).

Staphylococcus aureus is a gram-positive bacterium that can cause meningitis, boils, acne, and infections (Purnamasari et al., 2018), and *S. aureus* is a pathogenic bacteria found in the respiratory tract, mouth, nose, skin, and urinary tract (Lake et al., 2019).

Escherichia coli is a gram-negative bacterium that causes diarrhea, urinary tract infections, neonatal meningitis, gastroenteritis, and hemolytic uremic syndrome (Hanum et al., 2022).

Research by [Rukmana \(2021\)](#) shows that 70% ethanol extract from golek mango leaves can inhibit the growth of *S. aureus* and *E. coli* bacteria at a concentration of 100 mg/ml. In research conducted by [Widiastuti et al. \(2023\)](#), a combination of ethanol extract from guava leaves and arumanis mango leaves with a concentration of 25% can inhibit the growth of *S. aureus* by 12.3 mm. Based on several studies that have been carried out, researchers conducted research on the effectiveness of Gadung mango leaf ethanol extract on the growth of *S. aureus* and *E. coli* bacteria.

2. RESEARCH METHODS

Research Materials and Tools

The materials used in this study include wild mango leaves, ethanol, *E. coli* bacteria, *S. aureus* bacteria, NA media, Bess layer media, seat layer media, and aquades.

Tools used in this study include *Laminar Air Flow*, autoclave, petri dish, erlenmeyer, gobbleglass, incubator, analytical scale, *hot plate*, and stirrer.

Research Design

This study used a Complete Randomized Design with concentration treatment of ethanol extract of gadung mango leaves consisting of S1 (0.5%), S2 (0.75%), S3 (1%), control (-) (ethanol) and control (+) (Septromycin). Each treatment is repeated 5 times.

Research Procedure

Making Ethanol Extract of Gadung Mango Leaves

300 g of mango leaf powder was macerated using 70% ethanol solvent for 24 hours. Next, strain and separate between the pulp and filtrate. The pulp obtained is given ethanol solvent, the activity is carried out up to 3 x 24 hours. The phytrate obtained is then upped until it becomes thick.

Sample generation

The ethanol extract obtained was then made in a concentration of 0.5%; 0.75% and 1% w/v. For a concentration of 0.5%, weigh 0.05 gr of ethanol extract of mango leaves, then dissolve it in 10 ml of solvent (70% ethanol), 0.75% concentration, weigh 0.75 gr of extract and

dissolve it in 10 ml of solvent. For a concentration of 1% weigh 1 gr of extract and dissolve in 10 ml of solvent.

Activity test on mango leaf extract samples

1. Preparing the inoculum of *S. aureus* and *E. coli* bacteria by measuring transmittance on a spectrophotometer at a wavelength of 580 nm until it gets 25% trasmitant.
2. Make a bess layer and seat layer media from nutrient media so that then sterilize at 121°C for 30 minutes.
3. Take enough samples of mango leaf ethanol extract and add 500 µl ethanol, stirring until it forms a thick solution so that it can be pipetized.
4. Pour media bess layer on petri .
5. After the media cools and solidifies, pour the seat layer media to which 10 µl of inoculum solution has been added.
6. Make 5 sumurans/holes, then the sample is inserted into a well of 50 µl (3 times replication) of the extract sample.
7. A standard solution of 50 ppm Septromycin of 50 µl in one well as positive control, and drip sterile ethanol in one well as negative control.
8. Then incubate in the incubator at a temperature of 32.5°C for 24 hours.
9. After the incubation period, measure the size of the tang zone formed using a caliper

3. RESULTS AND DISCUSSION

Research Results

The effectiveness of ethanol extract of gadung mango leaves as an antibacterial of *Staphylococcus aureus*.

The results of research on giving ethanol extract of gadung mango leaves as an antibacterial *S. Aureus* are presented in figure 1.

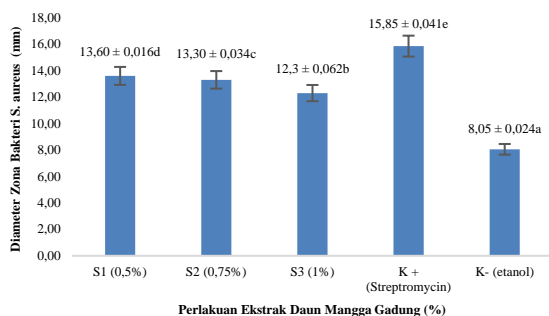


Figure 1. The average diameter of the *S. aureus* bacterial zone after administration of ethanol extract of wild mango leaves.

Figure 1 shows that the growth of *S. aureus* bacteria given ethanol extract of gadung mango leaves showed significant results ($P < 0.05$). The average diameter of the clear zone of growth of *S. aureus* bacteria from smallest to largest after ethanol extract of wild mango leaves was K (-) 8.05 mm, S3 (1%) 12.3 mm, S2 (0.75%) 13.30 mm, S1 (0.5%) 13.60 mm and K (+) 15.85 mm.

Effectiveness of Ethanol Extract of Gadung Mango Leaves as an Antibacterial *Escherichia coli*

The results of research on giving ethanol extract of gadung mango leaves as an antibacterial *E. coli* are presented in figure 2.

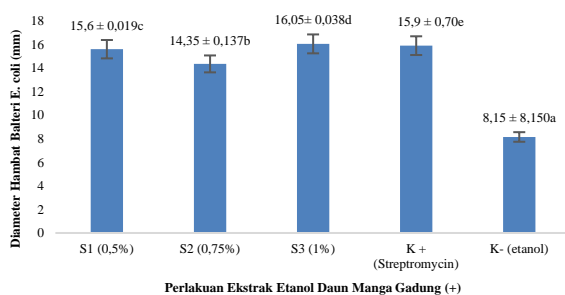


Figure 2. The average diameter of the *E. coli* bacterial zone after administration of ethanol extract of wild mango leaves.

Figure 2 shows that the growth of *E. coli* bacteria given ethanol extract of wild mango leaves showed significant results ($P < 0.05$). The average diameter of the clear zone of growth of *E. coli* bacteria from largest to smallest after ethanol extract of wild mango leaves was S3 (1%) 16.05 mm, control + (Streptomycin) 15.9 mm, S1

(0.5%) 15.6 mm, S2 (0.75%) 14.35 mm, and K - (ethanol) 8.15mm.

Discussion

Based on the research results, it shows that mango leaf extract can inhibit the growth of *S. aureus* and *E. coli* bacteria. According to [Somkuwar and Kamble \(2013\)](#), mango leaf extract contains alkaloids, tannins, phenols, flavonoids, phytosterol saponins, resins, and xanthone compounds, namely mangiferin.

Alkaloid and tannin compounds can inhibit the growth of *S. aureus* and *E. coli* bacteria because they interfere with the formation of peptidoglycan so that the bacteria will lyse and inhibit protein formation. Inhibition of protein synthesis causes bacteria to misread the m-RNA code ([Sandhya et al., 2022](#); [Prasetyorini et al., 2020](#)).

The mechanism of phenolic compounds as antibacterial substances is to stop the metabolic activity of bacterial cells by denaturing proteins, and phenolic compounds can precipitate proteins by penetrating bacterial cell walls ([Muharni et al., 2017](#)). According to [Novita \(2016\)](#), phenol will inactivate proteins with hydrogen bonds, which will cause the protein structure to be damaged. There will be instability in the cell walls and membranes of the bacterial cytoplasm, which will cause the function of the active transport process, selective permeability, and control of the protein structure to be disrupted so that the bacteria lose form that will undergo lysis.

Flavonoid compounds are a group of polar phenols—the hydroxyl groups contained in the flavonoid structure cause toxic effects on bacteria. Flavonoids will damage the cell walls so that these compounds enter the bacterial cell nucleus and damage bacterial DNA so the bacteria will lyse and die ([Kumar & Pandey, 2013](#)). According to [Pasril and Yuliasanti \(2014\)](#), flavonoids have bacteriostatic properties that inhibit the growth and development of bacteria by damaging the fat-soluble bacterial cell membranes.

Saponin compounds can affect the surface tension of cell walls by reducing this tension so that the cell walls will experience lysis and will cause antibacterial substances to enter the cells ([Kumalasari et al., 2020](#)).

E. coli bacteria are gram-negative bacteria, and *S. aureus* bacteria are gram-positive bacteria. The composition of the cell walls of the two bacteria is different, so the response of the ethanol extract of Gadung mango leaves in inhibiting the growth of the two bacteria is different. *E. coli* bacteria have three layers of cell walls, namely lipoproteins, lipopolysaccharides, and phospholipids, with the outer layer being thin peptidoglycan. In contrast, the *S. aureus* bacteria cell wall structure consists of cytoplasm, peptidoglycan, which contains lipids and polysaccharides, with the outermost part of the peptidoglycan containing teichoic acid. The thin peptidoglycan layer in *E. coli* makes Gram-negative bacteria, namely *E. coli*, more susceptible to the antibacterial properties of the extract ([Amalia et al., 2014](#); [Eni et al., 2017](#)).

4. CONCLUSION

The most potential mango ethanol extract as an antibacterial *E. coli* is S3 treatment, which is 1% at 16.05 mm, while *S. aureus* bacteria is K+ (*Streptomycin*) at 15.9 mm.

5. ACKNOWLEDGMENTS

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