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EFFECTIVENESS OF ANTISEPTIC BASED ON GANDARIA LEAVES (*Bouea macrophylla* Griff) ON THE GROWTH OF *Staphylococcus aureus* AND *Escherichia coli*

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ABSTRACT

Gandaria leaves (*Boea macrophylla* Griff) have potential as antibacterial. The ability to inhibit bacterial growth is inseparable from the role of active compounds, namely flavonoids, tannins, quinones and triterpenoids. Growth by microbes needs to be controlled, namely by inhibiting microorganisms, one way is by using chemicals, namely antiseptics. This study aims to determine the effectiveness of antiseptics made from gandaria leaves against the growth of *S. aureus* and *E. coli* bacteria. The concentrations of the ethanol extract of gandaria leaves used were 5%, 15% and 25% and betadine (+) and aquades (-) were used as controls. Antiseptic effectiveness test against *S. aureus* and *E. coli bacteria* using disc diffusion method. The test results showed that the antiseptic based on gandaria leaves had the ability to inhibit the growth of *S. aureus* with a concentration of 15% at 2.00 mm and 25% at 4.00 mm. Meanwhile, for *E. coli* bacteria, antiseptic made from gandaria leaves has an inhibition zone at a concentration of 15% at 1.00 mm. In accordance with the criteria for antiseptic power according to Davis Stout, gandaria leaves which are used as basic ingredients for antiseptics are included in the criteria for very weak antiseptic power (≤5). Therefore, the antiseptic based on gandaria leaves in this study was less effective in inhibiting the growth of *S. aureus* and *E. coli* bacteria.

Keywords: *gandaria, antiseptic, effectiveness*

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INTRODUCTION

Indonesia is famous for its natural wealth, where around 30,000 types of plants are found in Indonesia. Around 7,000 types of them are estimated to have properties as medicinal plants, and around 2,500 types of them have been confirmed to be medicinal plants. There are approximately 31 types of medicinal plants in Indonesia which are starting to be developed as raw materials for the traditional medicine industry. Since ancient times, the use of plants as medicinal ingredients has been widely used. However, until now not all plants have been known to have potential as medicinal plants. One of the plants whose benefits as a medicinal plant are currently unknown is the gandaria plant (Bouea macrophylla Griff) (Roni et al., 2019). Gandaria is a very specific Maluku tropical fruit plant and is known as an exotic fruit (Rehatta, 2005). In Maluku, this plant is generally spread on the islands of Ambon and Saparua. Especially in Ambon, it usually grows in areas near settlements in both lowland and highland areas (Papilaya, 2007). People use gandaria

from the stems, fruit, to leaves to make agricultural tools. The fruit can be eaten directly, while the young leaves are used as fresh vegetables.

Gandaria leaves are often consumed as a vegetable by the public (Harsono, 2017). Among the people of Maluku, especially on Ambon Island, the part of the Gandaria plant that is often consumed and used is only the fruit because it has a sweet taste and is thought to contain carbohydrates consisting of simple sugars, flour, glucose, fructose and sucrose. This sugar provides a sweet taste and energy that can be used by the body so it is used as fresh fruit, syrup, sweets and pickles. Meanwhile, Gandaria leaves have many health benefits because they contain the largest secondary metabolite compounds found in Gandaria leaves, namely flavonoids, tannins, quinones and triterpenoids. Leaf extracts have bacteriostatic properties, namely they are only able to inhibit the growth of bacteria against E. coli bacteria and all extracts have bacteriostatic properties, namely they are only able to inhibit the growth of bacteria against S. aereus bacteria (Roni et al., 2019). E. coli is a bacteria that causes digestive tract infections. E. coli can cause infections of the urinary tract, and can also cause meningitis in premature babies and neonates. Transmission of E. coli bacteria through unclean environmental factors, contact with someone who forgets to wash their hands after defecating, as well as poor quality drinking water or dirty water below standard will have an impact on health and serving food that does not meet the requirements can be contaminated. E. coli bacteria (Selvi et al., 2021). S. aureus is a commensal and pathogenic bacteria in humans, around 30% of the human population is colonized by S. aureus bacteria (Tong et al., 2015). S. aureus also causes diseases such as: bacteremia, pneumonia and surgical wound infections, boils, acne, impetigo, and wound infections.

Bacteria is a normal flora in the skin, respiratory tract and digestive tract in humans (Rieuwpassa, 2012). S. aureus bacteria are transmitted through infections of unclean skin and open wounds. Open wounds that have become infected can become alcus where bacteria can grow (Selvi et al., 2021). Therefore, growth and contamination by microbes needs to be controlled, namely by inhibiting, eradicating or getting rid of microorganisms, one way is by using chemicals including antiseptics (Pelczar, 2008). Antiseptics are chemical compounds that are used to inhibit or kill microorganisms in living tissue, which have the effect of limiting and preventing infections from becoming serious. Like alcohol, which acts as a bactericide, by damaging the cell membrane of bacteria, so that intracellular components come out. Alcohol also works by denaturing proteins in cells, so that the performance of bacterial enzymes will be hampered, resulting in disrupted metabolic processes (Djide, 2008). This research aims to determine the effectiveness of antiseptics made from gandaria leaves against the growth of S. aureus and E. coli bacteria.

METHOD

This research was conducted from March 29 to April 28 2022 at the Basic Biology Laboratory Pattimura University. The tools and materials used in this research were equipment from the Laboratory and of course along with gandaria leaves from Hative Besar Village. The way this research works uses the disk diffusion method on Nutrient Agar (NA) media and the resistance test by measuring the clear zone formed using a Vernier Caliper.

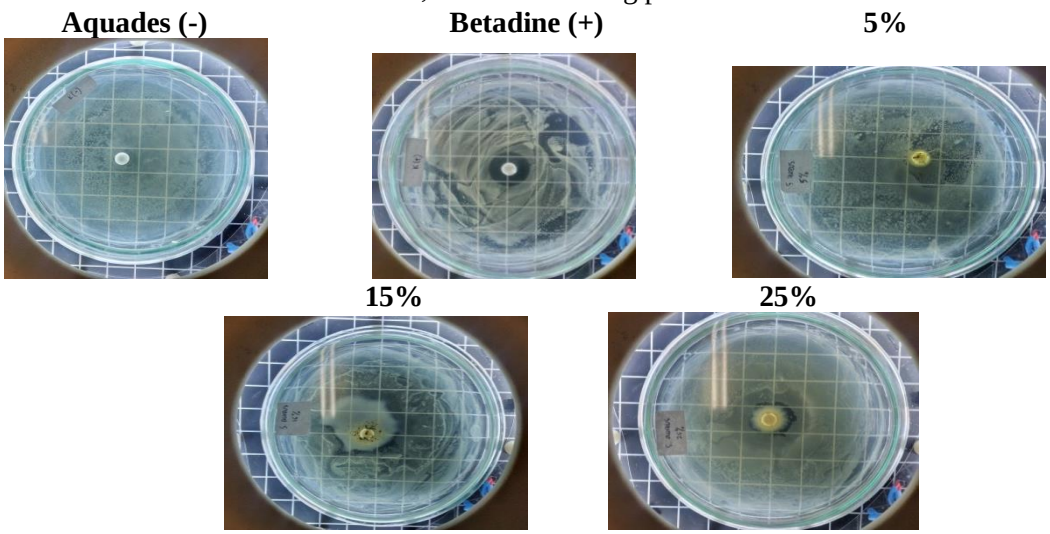
DISCUSSION RESULT

The results of the effectiveness test of antiseptics made from gandaria leaves on S. aureus and E. coli bacteria can be seen in Table and picture.

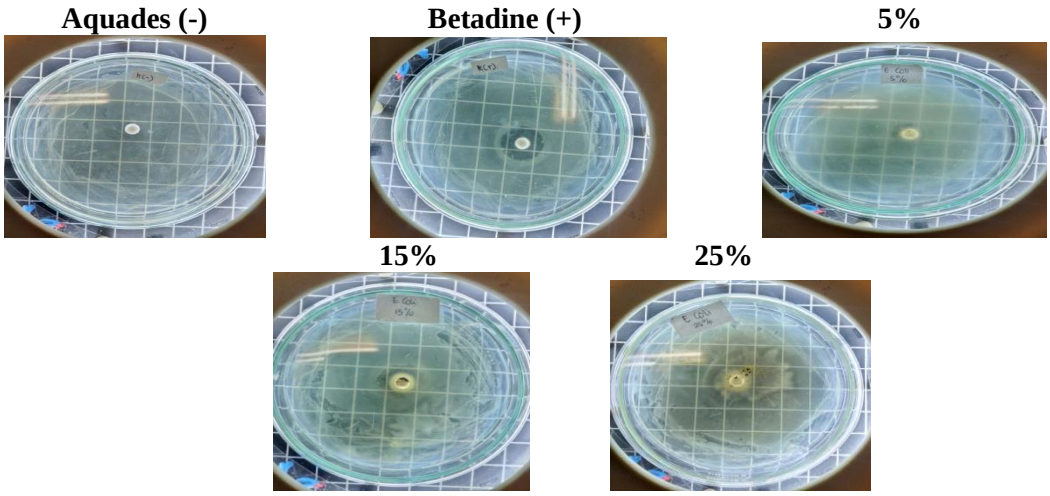
Table 1. Results of measuring the diameter of the inhibition zone of Gandaria leaves (Bouea macrophylla Griff) against S. aureus bacteria.

Gandaria Leaf Inhibition Zone (*Bouea macrophylla* Griff) (mm)		
Consentration	*S. aureus*	*E. coli*
5%	0	0
15%	2,00	1,00
25%	4,00	0
Control (-)	0	0
Control (+)	11,00	11,00

Based on the results of Table 1, it shows that the effect of antiseptics made from gandaria leaves on the growth of S. aureus. Inhibitory zones were formed at research concentrations, namely, 15% and 25%. Based on the Davis Stout criteria, the concentration of 5% and the negative control have no antiseptic power, the 15% concentration of 2.00 mm and 25% of 4.00 mm have weak antiseptic power. Meanwhile, in the growth of E. coli bacteria, an inhibitory zone was formed at a research concentration of 15%. Based on the Davis Stout criteria, concentrations of 5%, 25% and the negative control do not have antiseptic power and a concentration of 15% of 1.00 mm has weak antiseptic power. Positive control (betadine) and negative control (aquades) to compare the treatment of gandaria leaf extract with an antiseptic containing povidone iodine which is widely circulated in the community. The positive control formed the same inhibition zone for S. aureus and E. coli bacteria of 11.00 mm. This strong inhibitory power is partly due to the fact that povidone iodine is a pure, stable antiseptic compound. So the antiseptic made from gandaria leaves produces a good inhibition zone for S. aureus and E. coli bacteria, to see the inhibition zone due to administration of Gandaria leaf extract, see the following picture.



A. Measurement of the diameter of the inhibitory zone of antiseptics made from gandaria leaves against S. aureus bacteria.



B. Measurement of the diameter of the inhibitory zone of antiseptics made from gandaria leaves against E.coli bacteria.

Figure A & B. Measurement of the diameter of the inhibitory zone of antiseptics made from gandaria leaves S. aureus and E.coli

Phytochemical screening tests conducted by Roni et al. (2019) in their research, Gandaria leaf extract contains flavonoids, tannins, quinones and triterpenoids which have the ability to act as antibacterial compounds. These active secondary metabolite compounds can cause interference with bacterial growth so that bacterial growth is inhibited and can be examined in the form of an inhibition zone. Flavonoid compounds are one of the groups of secondary metabolite compounds that are most commonly found in plant tissues and have a low molecular weight. Flavonoids are included in the group of phenolic compounds which have one or more hydroxyl groups because they have C15 or 15 carbon atoms with the chemical structure C_6-C_3-C_6 so Flavonoids are compounds that are polar because they contain oxygen bound to hydrogen (-OH) so they penetrate the peptidoglycan layer which is polar more easily than the lipid layer which is non-polar. Flavonoids are used as antimicrobials and medicines for infections in wounds to inhibit bacterial growth starting from cell membranes, cell walls and cell components because they are lipophilic so they can damage bacterial cell membranes. Flavonoids can form complex compounds with extra cellular and dissolved proteins, thereby damaging cell membranes and causing the release of intracellular compounds (Nuria et al., 2009).

Tannin is a polyphenolic compound that has a large molecular weight consisting of hydroxy and carboxyl groups. Tannin compounds have a very large molecular weight, namely more than 1000 g/mol. Tannin compounds have 2 benzene rings linked by 3 carbon atoms. Tannins have the ability to inactivate microbial cell adhesins and inactivate enzymes, as well as disrupt protein transport in the inner layers of cells. Tannins target cell wall polypeptides so that the formation of bacterial cell walls is less than perfect. This causes bacterial cells to lyse due to osmotic and physical pressure so that bacterial cells will die (Napanggala et al., 2014). The antiseptic ability made from gandaria leaves on S. aureus bacteria has a large inhibitory zone at a concentration of 25% of 4.00 mm, while for E. coli bacteria it has an inhibitory zone at a concentration of 15% of 1.00 mm, then at a concentration of 25% it has no obstacles zone. According to Dewi (2010), the diameter of the inhibitory power does not always increase in proportion to the increase in antibacterial concentration, this is likely due to differences in the diffusion speed of active compounds in the agar medium and different types and concentrations of active compounds also provide different diameters of the inhibitory zone.

Another factor that supports the difference in inhibition zone diameter in this study is the type of bacteria used. In this study the bacteria used were S. aureus and E. coli. S. aureus is a gram-positive (+) bacterium which has a relatively simple cell wall because its structure is one layer and is composed of relatively more peptidoglycan, making it easier for compounds in gandaria leaves to enter the cells. Meanwhile, E. coli is a gram-negative (-) bacteria that is resistant to several antibacterials, this is because gram (-) bacteria have three layers of cell walls, namely the outer membrane, peptidoglycan layer and inner membrane. The outer membrane consists of lipids, liposaccharides (endotoxins) and proteins. This situation causes some compounds to be unable to damage the cell wall of the E. coli bacteria. Gram (-) bacteria contain more lipids, less peptidoglycan, a bilayer outer membrane (functions as a selective defense for compounds that leave or enter the cell and cause toxic effects). The outer wall of the E. coli bacteria has high permeability, so that the active substances in the gandaria leaf extract cannot enter optimally into the bacterial cells, which results in the extract being less than optimal in inhibiting bacterial growth. Bacterial walls also consist of lipoproteins which contain protein molecules, namely porins and lipopolysaccharides. Porins are hydrophilic and contain a nonpolar lipid layer. while the extract is polar. This difference in properties makes it more difficult for the extract component molecules to enter the bacteria. Therefore, this can affect the work activity of the gandaria leaf extract in inhibiting the growth of E. coli, causing the inhibitory activity on gram (-) bacteria to be very weak (Octaviani & Syafrina, 2018).

CONCLUSION

Gandaria leaf-based antiseptic produces a wider inhibition zone against S. aureus bacteria at a 25% concentration of 4.00 mm compared to E. coli bacteria at a 15% concentration of 1.00 mm. In accordance with the criteria for antiseptic power, gandaria leaves which are used as a basic ingredient for antiseptics

are included in the criteria for very weak antiseptic power (≤5). Therefore, the antiseptic made from gandaria leaves in this study was less effective in inhibiting the growth of S. aureus and E. coli bacteria.

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