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Antibacterial activity lemongrass leaves of Staphylococcus aureus inhibition one

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ABSTRACT

Staphylococcus aureus is a nosocomial problem that can cause skin infections. Treatment of skin infections can be done by using citronella (*Cymbopogon nardus*) which is antibacterial because it contains compounds such as flavonoids, steroids, terpenoids, saponins, and essential oils. This study aims to determine the antibacterial power of *Cymbopogon nardus* leaf starch essence against *Staphylococcus aureus* inhibition zone. This type of research is a laboratory experiment using a post-test only control group design. The results showed that the extract of *Cymbopogon nardus* leaves with a concentration of 5%, 10%, 15%, and 20% with positive control of ampicillin had different inhibitory zona against *Staphylococcus aureus* bacteria. The conclusion is that the concentration of *Cymbopogon nardus* leaf starch is the most effective and forms an inhibition zone with the largest average (16.28), namely a concentration of 20%.

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INTRODUCTION

Skin infection is one of the health problems of the external body and disturbs the comfort and if ignored in the long term can reduce the quality of life of sufferers (Agustina, Mustafidah, & Purbowati, 2016). Skin disease is caused by bacterial activity that has undergone resistance. One type of bacteria that can cause skin infections is *Staphylococcus aureus* which is a group of Gram-positive bacteria in the form of cocci, clustered like grapes, is facultatively anaerobic, has no spores, grows at a temperature of 6.5 - 46 ^{0}C at pH 4.2-9.3 spherical with a diameter of 0.7 - 1ηη arranged in irregular groups (Karimela, Ijong, & Dien, 2017).

Staphylococcus aureus is a nosocomial infection problem and can cause minor skin infections to serious life-threatening infections (Lutpiatina, 2017). *Staphylococcus aureus* can through the

injured skin then invade and multiply in hair follicles in the subcontract tissue and can spread to other parts of the body through lymph vessels (Razak, Djamal, & Revilla, 2018). *Staphylococcus aureus* has a thick peptidoglycan layer containing the polycasarida and antigenic protein in the form of rigid endoskeleton subunits on the cell wall so that it is pathogenetic to infection (Ekawati, Husnul, & Herawati, 2018). *Staphylococcus aureus* releases a toxin in the form of Microbial Surface Components Recognizing Adhesive Matrix of Molecules (MSCRAMMs). MSCRAMMs molecules will bind to collagen molecules and act as pathogens that can infect the body by entering healthy body cells through injured skin (Husna, 2018).

Staphylococcus aureus is a pathogen that causes skin infections with varying degrees of severity in the form of impetigo, furunculosis, vesicobulosic dermatosis, and Staphylococcal Scaled Skin Syndrome (Septiani, Dewi, & Wijayanti, 2017). Symptoms caused by *Staphylococcus aureus* infection include itching, inflammation, swelling, and festering sores. Infection caused by Staphylococcus aureus can cause damage to the skin or injury to the infected organs (Bota, Martusupono, & Rondonuwu, 2015). Treatment of skin infections caused by Staphylococcus aureus infection can be done by using citronella (*Cymbopogon nardus*) as an alternative to traditional medicine.

The *Cymbopogon nardus* plant contains antibacterial compounds such as flavonoids, steroids, terpenoids, saponins, and essential oils consisting of active phenolic compounds in the form of citronellal, geraniol, and citronellol (Dacosta, Sudirga, & Muksin, 2017). *Cymbopogon nardus* plants have high effectiveness in inhibiting the growth of Gram-positive bacteria (Sulaswatty, Rusli, Abimanyu, & Tursiloadi, 2019). Besides, the high content of citronellal, geraniol, and citronellal in *Cymbopogon nardus* essential oil can inhibit bacterial growth activity and can cause bacterial cell death (Astuti, 2015). Based on these problems, this study was conducted to solve the problem of skin infections caused by *Staphylococcus aureus* by using an alternative to the traditional treatment of *Cymbopogon nardus* leaf starch as an antibacterial agent. The purpose of this study was to determine the inhibitory zona of *Cymbopogon nardus* citronella starch to the inhibition zone of *Staphylococcus aureus*.

RESEARCH METHODS

Research Design

The design in this study is a post-test only control group design where there are 5 treatments with the use of concentrations divided into four parts, namely Ampicillin (Positive Control), 5%, 10%, 15%, and 20% (Novaryatiin, Handayani, & Chairunnisa, 2018). The parameters measured in this study were the antibacterial power against *Staphylococcus aureus* using the disc paper method and measured using a caliper (Rahmawati, Bintang, & Artika, 2017).

Instrument

The tools and materials used in this research are: petri dishes, bunsen, mortal, tweezers, oven, hot plate, measuring cup, erlynmeyer, magnetic stirrer, electric scales, aluminum buckets, lighters, and perforators, *Cymbopogon nardus* plants, culture of Staphylococcus aureus, 70% alcohol, distilled water, Nutrient Agar (Na), aluminum foil, masks, gloves, cotton buds, tissue, gauze, spritus and discs paper.

Procedures

The research procedure started from the sterilization of tools, making NA, and testing for antibacterial activity. Sterilization in this study was carried out in 2 ways, namely boiling and dry heat sterilization by heating the oven and modified bunsen from Hidayat, Hifiza, & Asmar,

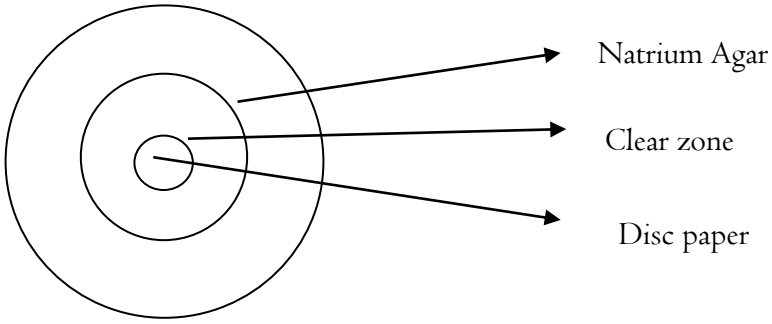
(2013). Tools and materials are sterilized through double sterilization resistance with the aim of more aseptic processing to avoid contamination.

Mix Na and distilled water until homogeneous for 30 minutes with a temperature of 120^{0}C then wait for it to dissolve completely. After that, pour Na into a petri dish that has been sterilized using boiling and drying methods and 70% alcohol and has been passed over the bunsen for 5 minutes. Then Na was incubated for 1x24 hours at room temperature (Winato, Sanjaya, & Siregar, 2019).

Antibacterial testing was done by streaking *Staphylococcus aureus* on a petri dish containing sterile Na. Then dividing the petri dish into 4 quadrants then heating the lips of the petri dish with bunsen for 30 seconds. After that, culture Staphylococcus aureus with a sterilized cotton swab and then press it on the tube wall so that the cotton bud is not too wet then rubbing the cotton bud on the Na surface until it is even. Then insert 5 pieces of paper discs that have been shaped using a perforator with a diameter of 5.5 mm for each petri dish with a concentration of 5%, 10%, 15%, 20% of *Cymbopogon nardus* leaf starch. Positive control disc paper placed in the middle. The next step was to incubating the scratches that had been treated for 1 x 24. The clear zone formed was calculated using a slide caliper with an accuracy of 0.05 mm.

Data Analysis

The analysis technique used in this research is quantitative descriptive obtained from the data obtained through the measurement of the inhibition zone around the disc paper. The data obtained will be tabulated and analyzed descriptively by Lingga, Pato, & Rossi, (2016) and will be calculated manually using the drag zone calculation formula in Figure 1 (Hidayat et al., 2013).



Inhibition zone diameter = Clear zone diameter – disc paper diameter

Figure 1. Inhibition zone diameter measurement

The calculated data will be calculated statistically using the drag zone diameter calculation formula, then the calculation results and decision making with the general standard of inhibition zona are presented in Table 1 (Lauma, Pangemanan, & Hutagulung, 2015).

Table 1. Inhibition zone response criteria for bacterial growth

No.	Drag Zone	Inhibition Zona
1	>20 mm	Very High
2	10-20 mm	High
3	5-10 mm	Normal
4	< 5 mm	Low
5	No Inhibition Zone	

RESULTS

Based on the research that has been done, it is found that the clear zone is formed due to the antibacterial activity of *Cymbopogon nardus* leaf extract against *Staphylococcus aureus* which can be seen in Figure 1.

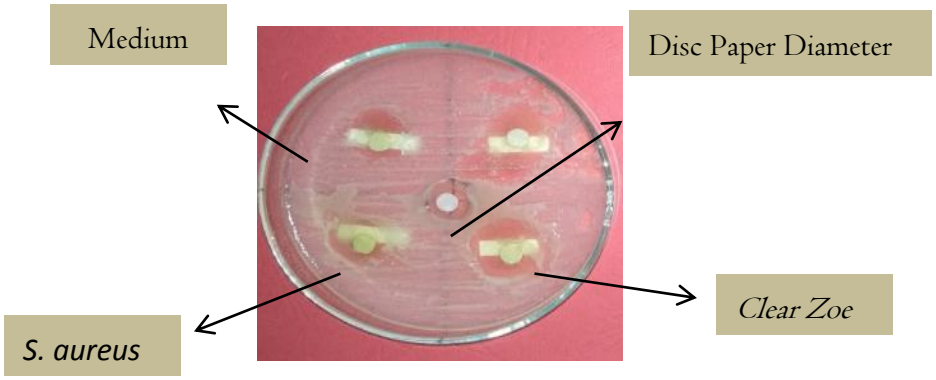


Figure 2. Formed Clear Zone

Based on the results obtained by measuring the clear zone in *Staphylococcus aureus* cultures that have been given concentration treatment with five repetitions, the results of the inhibition zone calculation are presented in Table 2.

Table 2. Inhibition zone result

Konsentrasi	Inhibition Zone (mm)					X ± SD	Inhibition zone Response
	PI	P2	P3	P4	P5		
A0 (+)	5.6	7.1	12.8	4.3	9.0	7.76±3.32	Normal
A1 5%	10.8	9.9	10.2	9.7	8.6	9.84±0.81	Normal
A2 10%	12.2	11.0	11.6	10.7	9.6	11.02±0.98	High
A3 15%	12.9	12.5	13.2	12.8	10.6	12.38±1.04	High
A4 20%	20.6	15.5	15.7	15.2	14.4	16.28±2.47	High

Research on the test for the antibacterial power of *Cymbopogon nardus* leaf starch against the Staphylococcus aureus inhibition zone found that *Cymbopogon nardus* leaf starch had antibacterial activity as evidenced by the formation of an inhibition zone around the disc paper on the treated medium. This indicates that the extract *of Cymbopogon nardus* leaves has an inhibitory zona against the growth of *Staphylococcus aureus*. The inhibitory zona in this study has a hypothesis with HI accepted, which shows the difference in the average diameter of the inhibition zone in each treatment that has been calculated and tabulated in Table 2. Inhibition of *Staphylococcus aureus* in this study was obtained by measuring the inhibition zone of *Staphylococcus aureus* against each concentration of *Cymbopogon nardus* leaf starch. The diameter of the inhibition zone can be obtained by measuring the diameter of the clear zone and the diameter of the disc paper on each treated bacterial culture medium. Then the diameter of the inhibition zone can be calculated by measuring the diameter of the clear zone then subtracting the diameter of the disc paper. Based on the results of measurements of the diameter of the inhibition zone of *Cymbopogon nardus* leaf extract which has been done with five repetitions, the results obtained at a concentration of 5% the average diameter formed was 9.84 mm with the category of having moderate antibacterial power, 10% of the average diameter was 11.02 mm, a concentration

of 15% the average diameter formed was 12.38 mm and 20% the average diameter formed was 16.28 mm with the category of having a strong antibacterial power. Whereas ampicillin has an average diameter was 7.76 with the category of having moderate antibacterial power according to the established general standards of the inhibition zone.

DISCUSSION

The starch extract of *Cymbopogon nardus* leaves with a concentration of 5%, 10% 15%, and 20% can inhibit the growth of *Staphylococcus aureus*. This is by the research of Winato et al. (2019) who showed that *Cymbopogon nardus* leaves are antibacterial. The ability of *Cymbopogon nardus* leaf starch extract to inhibit bacteria is because *Cymbopogon nardus* leaves contain substances that act as antibacterials such as flavonoids, saponins, terpenoids, steroids, and essential oils with active compounds in the form of polyphenols consisting of citronellal, geraniol, and citronellol (Sulaswatty et al., 2019). Winato et al. (2019) stated that the secondary metabolite compounds found in *Cymbopogon nardus* leaves are flavonoids, polyphenols, saponins, terpenoids, steroids, and essential oils. The essential oil content of *Cymbopogon nardus* has active compounds in the form of chemiasitronellal particles was 34.5%, geraniol was 23.17% and citronellol was 12.09% (Bota et al., 2015). The results of the identification of active compounds based on phytochemical tests on the crude extract of methanol and acetate fraction of *Cymbopogon nardus* were positive containing flavonoids, phenolics, and steroids which contained many –OH groups so that *Cymbopogon nardus* leaves had antibacterial power (Hendrik, Erwin, & Panggabean, 2013).

The content of essential oils which contain phenolic compounds in the form of polyphenols consisting of active compounds such as citronellal, geraniol, and citronellal can denature and activate proteins on the surface of the bacterial cell walls so that they can cause damage and disrupt the metabolism of the transport of organic io-ion substances into the body's cells bacteria (Kawengian, Wuisan, & Leman, 2017). The terpenoid and steroid compounds work by penetrating the peptidoglycan layer of the bacterial cell wall and destroying the structure and strength of the protein in the cytoplasmic membrane, causing the cytoplasm to break and the cytosolic fluid to come out of the bacterial cell membrane (Noviyanti, Pasaribu, & Tarigan, 2014).

Saponin compounds work by disrupting the surface tension of the bacterial cell walls (Rizkita, 2017). When the surface tension of the bacterial cell wall is disturbed, flavonoid compounds will enter and cause coagulation or clumping of cell membrane proteins which denature the membrane proteins so that the enzyme work process is disrupted where when the enzyme work is inhibited the replication process in DNA stops so that it can stop the growth rate and death. bacterial cells. Antibacterial compounds work by damaging the bacterial cell structure which can disrupt the metabolic system in the bacterial body. This can cause damage to cell parts and can result in the death of bacterial cells.

Based on the research results, *Cymbopogon nardus* leaf starch was more effective than Ampicillin as seen from the large diameter of the inhibition zone formed. This is because several things such as the content of compounds in *Cymbopogon nardus* leaves are more complex than the content of Ampicillin where all the components of the compounds contained in the starch of *Cymbopogon nardus* leaves can kill bacteria by inhibiting and stopping the metabolic process of bacterial cells by attacking various components of bacterial cells. which includes, proteins, lipids, and bacterial cell membranes so that bacteria experience death (Septiani et al., 2017). The components of Ampicillin consist of Penicillin, Augmentin, Surpass, Bactrim, and Septrim as well as synthetic phenolic compounds which can only inhibit the protein transport reaction process of bacterial cell walls so that most bacteria that are strong against antibiotic use can experience resistance (Fatisa, 2013).

The use of antibiotic drugs such as Ampicillin can cause several side effects to decrease the function of vital organs (Negara, 2014). The amount of inappropriate use in the long term can attack vital organs in the body including decreased kidney function, muscle weakness, damage to the liver so that it is no longer able to help the body's metabolism in toxic mentoxin, and can reduce the body's immune system (Nursanty & Zumaidar, 2010). The use of plants as an alternative to traditional medicine is the most effective and proven way to be healthier than synthetic drugs. Using medicinal plants in medicine has more properties and benefits with less risk of side effects and does not require expensive costs (Lestari & Susanti, 2019).

CONCLUSION

Based on the results of the research, it can be concluded that *Cymbopogon nardus* leaf starch has antibacterial activity against *Staphylococcus aureus*. A concentration of 5% has an inhibition zone diameter was 9.84 mm, a concentration of 10% has an inhibition zone diameter was 11.02 mm, a concentration of 15% has an inhibition zone diameter was 12.38 mm, a concentration of 20% has an inhibition diameter was 16.28 mm, and control (+) Ampicillin has an inhibition zone diameter was 7.76 mm, where the higher the concentration, the larger the inhibition zone formed, and *Cymbopogon nardus* plants have a larger inhibition zone than ampicillin.

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