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By Yunita et al

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Antibacterial Activity Lemongrass Leaves (*Cymbopogon nardus*) of *Staphylococcus aureus* Inhibition one

Yunita*, Fitria Lestari, Yuli Febrianti

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ABSTRAK

S. aureus is a nosocominal problem that can cause skin infections. Treatment of skin infections can be done by using citronella (*C. nardus*) which is antibacterial because it contains compounds such as flavonoids, steroids, terpenoids, saponins, and essential oils. This study aims to determine the antibacterial pow of *C. nardus* leaf starch essence against *S. 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 *C. nardus* leaves with a concentration of 5%, 10%, 15%, and 20% with a positive control of ampicillin had different inhibitory power against *S. aureus* bacteria. The conclusion is that the concentration of *C. nardus* leaf starch is the most effective and forms an inhibition zone with the largest average (16.28), namely a concentration of 20%.

INTRODUCTION

Skin infection is one of the health problems of the external body and disturbs comfort and if ignored in the long term can reduce the quality of life of sufferers (Agustina, et al. 2016: 2). Skin disease is caused by bacterial activity that has undergone resistance. One type of bacteria that can cause skin infections is S. aureus which is a group of Gram-positive bacteria in the form of cocci, clustered like grapes, is facultative anaerobic, has no spores, grows at a temperature of 6.5 - 46 °C at pH 4.2-9, 3 spherical with a diameter of 0.7 - 1ηm arranged in irregular groups (Karimela, et al. 2012: 193).

S. aureus is a nosocominal infection problem and can cause minor skin infections to serious life-threatening infections (Lutpiatina 2017: 62). *S. aureus* can through the injured skin then invade and multiply in hair follicles in the subcuntant tissue and can spread to other parts of the body through lymph vessels (Razak, et al. 2013: 5). *S. aureus* has a thick peptidoglycan layer containing polycasarida and antigenic protein in the form of rigid endoskeleton subunits on the cell wall so that it is pathogenetic to infection (Ekawati et al., 2018: 140). *S. 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: 1).

S aureus is a pathogen that causes skin infections with varying degrees of severity in the form of impetigo, furunculosis, vesicobulosic dermatosis, and Staphlococcal Scaled Skin Syndrome (Septiani, et al., 2017: 2). Symptoms caused by *S. aureus* infection include itching, inflammation, swelling, and festering sores. Infection caused by S. aureus can cause damage to the skin or injury to the infected organs (Bota, et al. 2015: 3). Treatment of skin infections caused by S. aureus infection can be done by using citronella (*C. nardus*).) as an alternative to traditional medicine.

The *C. 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, 2017: 25). *C. nardus* plants have high effectiveness in inhibiting the growth of Gram-positive bacteria (Sulaswatty, 2019: 115). In addition, the high content of citronellal, geraniol, and citronellal in *C. nardus* essential oil can inhibit bacterial growth activity and can cause bacterial cell death (Astuti, 2015: 290). Based on these problems, this study was conducted to solve the problem of skin infections caused by *S. aureus* by using an alternative to the traditional treatment of *C. nardus* leaf starch as an antibacterial agent. The purpose of this study was to determine the inhibitory power of *C. nardus* citronella starch to the inhibition zone of *S. aureus*.

METHODS

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, et al. 2018: 25). The parameters measured in this study were the antibacterial power against *S. aureus* using the disc paper method and measured using a caliper (Rahmawati, et al. 2017: 14).

Instruments

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, *C. nardus* plants, culture of S. aureus, 70% alcohol, distilled water, Nutrient Agar (Na), aluminum foil, masks, gloves, cotton buds, tissue, gauze, spritus and discs paper.

Procedure

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, et al. (2013: 16). Tools and materials are sterilized through a double sterilization resistant with the aim of more aseptic processing to avoid contamination.

Making Na Procces

Mix Na and distilled water until homogeneous for 30 minutes with a temperature of 120^{o}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, et al. 2019: 54).

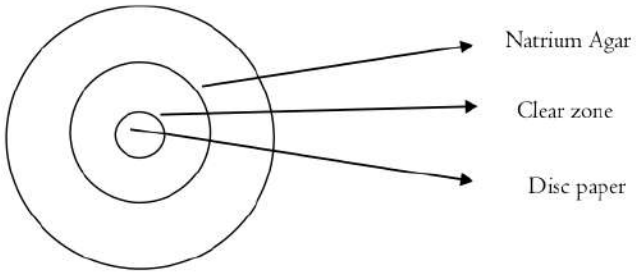
Pengujian aktivitas antibakteri

Antibacterial testing was done by streaking *S. 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 S. 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 *C. nardus* leaf starch. Positive control disc paper placed

in the middle. The next step was 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.

Analysis Technuique

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, et al., (2016: 1) and will be calculated manually using the drag zone calculation formula in Figure 1 (Hidayat, 2013: 17).



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 power are presented in Table 1.

Tabel 1. Inhibition zone response criteria for bacterial growth

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

(Lauma, et all., 2015:12)

RESULT

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

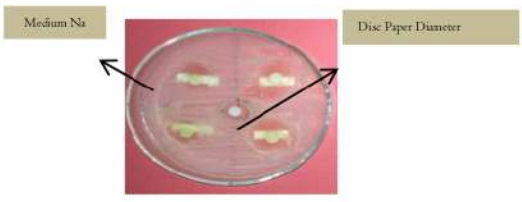


Figure 2. Formed Clear Zone

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

Tabel 2. Inhibition Zone Result

Konsentrasi	Inhibition Zone (mm)					X ± SD	Inhibition zone Response
	P1	P2	P3	P4	P5		
A0 (+)	5,6	7,1	12,8	4,3	9	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	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 *C. nardus* leaf starch against the S. aureus inhibition zone found that *C. 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 C. nardus* leaves has an inhibitory power against the growth of *S. aureus*. The inhibitory power in this study has a hypothesis with H1 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 *S. aureus* in this study was obtained by measuring the inhibition zone of *S. aureus* against each concentration of *C. 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 *C. nardus* leaf extract which has been done with five repetitions, the results obtained at a concentration of 5% the average diameter formed is 9.84 mm with the category of having moderate antibacterial power, 10% of the average diameter is , 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 of 7.76 with the category of having moderate antibacterial power according to the established general standards of the inhibition zone (Lauma, et al. 2015: 12).

DISSCUSION

The starch extract of *C. nardus* leaves with a concentration of 5%, 10% 15%, and 20% can inhibit the growth of S. aureus. This is in accordance with the research of Winato, et al. (2019) who showed that *C. nardus* leaves are antibacterial. The ability of *C. nardus* leaf starch extract to inhibit bacteria is because *C. 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: 26). Winato, et al. (2019: 52) stated that the secondary metabolite compounds found in *C. nardus* leaves are flavonoids, polyphenols,

saponins, terpenoids, steroids, and essential oils. The essential oil content of *C. nardus* has active compounds in the form of chemiasitronellal particles of 34.5%, geraniol of 23.17% and citronellol of 12.09% (Bota, et al. 2015: 2). The results of the identification of active compounds based on phytochemical tests on the crude extract of methanol and acetate fraction of *C. nardus* were positive containing flavonoids, phenolics, and steroids which contained many –OH groups so that *C. nardus* leaves had antibacterial power (Hendrik, et al., 2013: 78) .

The content of essential oils which contain phenolic compounds in the form of polyphenols consisting of active compounds such as citronellal, geraniol, and citronellal are able to 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, et al. 2017: 7). 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, et al. 2014: 34).

Saponin compounds work by disrupting the surface tension of the bacterial cell walls (Rastiana, et al. 2015: 185). 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 (Kaseng, et al. 2016: 2). 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, *C. 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 *C. nardus* leaves are more complex than the content of Ampicillin where all the components of the compounds contained in the starch of *C. 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, 2017: 1358). The components of Ampicillin consist of Penicillin, Augmentin, Surpas, 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: 32).

The use of antibiotic drugs such as Ampicillin can cause several side effects to decrease the function of vital organs (Negara, 2014: 43). 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 , 2010: 2). 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: 15).

CONCLUCION

Berdasarkan hasil penelitian yang dilakukan, maka dapat diambil kesimpulan sari pati daun *C. nardus* memiliki aktivitas antibakteri terhadap *S. aureus*. Pada konsentrasi 5% memiliki diameter zona hambat 9,84 mm, konsentrasi 10% memiliki diameter zona hambat 11,02 mm, konsentrasi 15% memiliki diameter zona hambat 12,38 mm, konsentrasi 20% memiliki diameter zona hambat 16,28 mm, dan kontrol (+) Ampicillin memiliki diameter zona hambat 7,76 mm dimana semakin tinggi konsentrasi

maka zona hambat yang terbentuk semakin besar, dan tumbuhan *C. nardus* memiliki zona hambat lebih besar dari pada ampicillin.

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