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# ANTIBACTERIAL OF VIRGIN COCONUT OIL ON THE GROWTH OF *Staphylococcus aureus* BACTERIA

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## ABSTRACT

*Staphylococcus aureus* is a commensal and pathogenic bacteria in humans. *Staphylococcus aureus* infection can cause bacteremia, endocarditis, osteoarticular, acute hematogenous osteomyelitis, skin and soft tissue infections, meningitis, lung infections. Virgin Coconut Oil (VCO) is original coconut oil made from fresh coconut raw materials and processed with controlled heating and without chemicals. As a result of the heating process, coconut oil can produce essential compounds containing lauric acid, so that pure coconut oil has antibacterial properties. VCO has an antibacterial effect that comes from its active compound content. VCO contains medium chain fatty acids whose mechanism of action damages bacterial cell walls, liquefies and shows the effect of killing viruses by damaging the DNA and RNA of viruses coated with lipids. The purpose of this study was to determine the antibacterial
of VCO on the growth of *Staphylococcus aureus* bacteria. The method used in this study was an experimental laboratory. The results of this study indicate that at concentrations of 40%, 60%, 80% and 100% in Virgin Coconut Oil did not have inhibitory power against the growth of *Staphylococcus aureus* bacteria. The conclusion of this study is that Virgin Coconut Oil does not have inhibitory power against the growth of *Staphylococcus aureus* bacteria. The negative control of the antibiotic Ciprofloxacin has an inhibition zone of 33.625 mm, this indicates that the bacteria used in this study are still sensitive to the antibiotic Ciprofloxacin.

## KEYWORDS

Antibacterial, *Staphylococcus aureus,* virgin coconut oil

*Staphylococcus aureus* is a commensal and pathogenic bacterium in humans. Approximately 30% of the human population is colonized by *Staphylococcus aureus*, generally this bacterium is found on the skin, respiratory tract and digestive tract without causing health problems. This bacterium becomes a problem when there is a focus of infection and can spread from one person to another through direct contact or through contaminated objects. Pathogenic of *Staphylococcus aureus* is invasive, that infection can cause bacteremia, endocarditis, osteoarticular, hematogenous acute osteomyelitis, skin and soft tissue infections, meningitis, lung infections and infections associated with medical devices (Jawetz et al., 2014; Lister et al., 2014).

Serious diseases that caused by *Staphylococcus aureus* infection that has reached the inner tissue (Walker et al., 2017). Giving antibiotics to patients with infectious diseases aims to inhibit the growth or kill microorganisms, especially bacteria that cause disease. The use of antibiotics will provide successful therapy if used rationally. However, if not used rationally, the use of antibiotics will result in antibiotic resistance. Antibiotic resistance is a public health problem that needs to be resolved immediately. Antibiotic resistance causes bacteria not to respond to drugs that will kill them. This results in a decrease in the ability of antibiotics to treat infectious diseases in humans. Not only that, this will also increase morbidity and mortality, increase costs and duration of treatment, increase side effects from the use of multiple drugs and high doses (Jabbar et al., 2023).

Because many bacteria are resistant to antibiotics, alternative antibiotics are needed. Indonesia is rich in various types of plants that are widely used as herbal ingredients for medicine, one of which is the coconut plant. The coconut plant is one of the natural products that almost all parts of it can be used, some are produced as food and beverage ingredients, some are processed into virgin coconut oil. Virgin Coconut Oil (VCO) is original coconut oil made from fresh coconut raw materials and processed with controlled heating and without chemicals. As a result of the heating process, coconut oil can produce essential compounds containing lauric acid, so that VCO has antibacterial properties (Komalasari, R., 2023).

VCO has an antibacterial effect that comes from its active compound content. VCO contains medium chain fatty acids, that consist of lauric acid (32.73%), myristic acid (28.55%), palmitic acid (17.16%), caprylic acid (7%), and capric acid (0.187%). Of the several medium chain fatty acids, the strongest effect on inhibiting the growth of pathogenic bacteria is lauric acid. Lauric acid is a medium chain saturated fatty acid (MCFA) that is easily metabolized and has antimicrobial

properties so that it can increase immunity. The antibacterial working mechanism of VCO comes from lauric acid which is broken down into monolaurin. This monolaurin in the body will play an active role in penetrating the cell walls of microorganisms so that the fluid will be sucked out and cell shrinkage occurs which results in the death of microorganisms (Purtamiati et al., 2020).

VCO is reported to have good activity as an antibacterial. Therefore, by conducting this study, it is expected that the activity of the compounds contained in VCO can inhibit and kill *Staphylococcus aureus* bacteria higher and can overcome infectious diseases. This study aims to see how the antibacterial activity of VCO is against *Staphylococcus aureus* bacteria.

## LITERATURE REVIEW

The Indonesian Ministry of Health (2021) said that deaths due to antimicrobial resistance reached 700 thousand people per year worldwide. It is predicted that the largest distribution is in Asia and Africa around 4.7 million and Africa 4.1 million, the rest in Australia, Europe, America. The causes of antimicrobial resistance are reviewed from a health perspective starting from the absence of indications in the use of antimicrobials, inappropriate indications, inappropriate selection of antimicrobials, and inappropriate dosages.

Resistance to antibiotics, phagocytosis and immunocompetent cells are one of the virulence factors of *Staphylococcus aureus* bacteria associated with biofilm formation (Mutmainnah, 2016). This bacteria is included in one of the species that can form biofilms and is a pathogenic microorganism that causes the most infections. Biofilm formation can occur in various media, especially in the use of medical devices that touch or enter the human body (Nuryastuti, 2014). Biofilm as a virulence factor functions to facilitate determination in the host's body, avoiding the host's defense system, causing bacteria to be resistant to antimicrobials at high concentrations. Biofilm bacteria have the ability to be 100-1000 times more resistant than bacterial plankton cells (Munita and Arias, 2016).

Virgin Coconut Oil contains medium chain fatty acids whose working mechanism damages bacterial cell walls, liquefies and shows the effect of killing viruses by damaging the DNA and RNA of viruses coated by lipids. Several previous studies have proven that VCO is an antibacterial in *Enterococcus faecalis* (Tumbel, 2017) and VCO is able to inhibit the growth of *Salmonella typhi* bacteria.

This study used experimental laboratory, that aimed at determining the antibacterial of virgin coconut oil (VCO) against *Staphylococcus aureus* bacteria. This research was conducted at the NTB Provincial Hospital's Research and Development Unit Laboratory.

The population in this study was coconut plants in the Mataram area, and the sample used in this study was Virgin Coconut Oil. This study consisted of 6 groups, including 4 treatment groups and 2 control group. The control group was divided into groups with VCO concentrations of 40%, 60%, 80%, and 100% respectively. Antibacterial activity test was measured using the diffusion method.

The tools needed in this study are sterile cotton swabs, test tubes, Bunsen, petri dishes, inoculation needles, Erlenmeyer flasks, scissors, matches, analytical scales, autoclaves, incubators, hot plates, magnetic stirrers, micro pipettes, test tube racks, beacker glass, aluminum foil, yellow type, stirrer, microscope, aureus, stationery, ose needles. The materials needed in the study are Muller hinton agar (MHA), Virgin coconut oil (VCO), 0.9% NaCl solution, Aquades, absolute ethanol, *Staphylococcus aureus* bacteria isolates, antibiotics, sterile filter paper.

**Sterilization**

The glassware used in this antimicrobial activity study was first sterilized using an autoclave at a temperature of 121 ºC for 15 minutes, the tweezers were burned by burning over direct fire and the media were sterilized in an autoclave at a temperature of 121 ºC for 15 minutes.

**Making VCO concentration**

VCO with a concentration of 100% is diluted by adding ethanol solution, so that VCO concentrations of 40%, 60%, and 80% are obtained.

**Bacterial purification**

*Staphylococcus aureus* bacteria were taken with a sterile loop from the bacterial culture, to be reviewed on each medium in a zigzag manner. Furthermore, incubation using a temperature of 37 ° C for 24 hours, and observations were made whether or not there was colony growth on each medium. The purified *Staphylococcus aureus* bacteria were taken 1 to 2 loops and suspended in a 0.9% NaCl solution until turbidity was obtained with a standard of 0.5 Mc Farland or equivalent to the number of bacteria $10^8$ (CFU / ml).

**Antibacterial test**

To determine the antibacterial of VCO against the growth of Staphylococcus aureus bacteria using the well method. A clinical suspension of bacteria with a turbidity of 0.5 Mc Farland was prepared. Then a sterile cotton swab was dipped into a 0.5 Mc Farland bacterial suspension and the sterile cotton swab was applied to the bacteria on the surface of the MHA media evenly. A well was made using a sterile blue tip placed on the surface of the MHA media, and 50 µl of VCO was added to each well with a concentration of 40%, 60%, 80%, 100%. Ciprofloxacin (positive control) and sterile ethanol (negative control) were also added to the media. Incubated at 37 $^{o}$C for 24 hours. Furthermore, the inhibition zone around the well was measured, the inhibition zone formed was measured with a caliper and expressed in millimeters.

## RESULT AND DISCUSSION

The results of the antibacterial test of Virgin Coconut Oil on the growth of *Staphylococcus aureus* bacteria can be seen in table 1.

Table 1. Antibacterial test of Virgin Coconut Oil on the growth of Staphylococcus aureus bacteria

| Group (Concentration) | Inhibition zone diameter (mm) | | | | Average of inhibition zone diameter (mm) | Category |
|---|---|---|---|---|---|---|
| $P_1$ (40%) | 0 | 0 | 0 | 0 | 0 | None |
| $P_2$ (60%) | 0 | 0 | 0 | 0 | 0 | None |
| $P_3$ (80%) | 0 | 0 | 0 | 0 | 0 | None |
| $P_4$ (100%) | 0 | 0 | 0 | 0 | 0 | None |
| Control (+) Ciprofloxacin | 35,5 | 35 | 31,5 | 32,5 | 33,625 | Very strong |
| Control (-) Ethanol | 0 | 0 | 0 | 0 | 0 | None |

Based on table 1, the antibacterial test on Virgin Coconut Oil at P1, P2, P3, P4 and negative controls did not have an inhibition zone (0 mm) against *Staphylococcus aureus* bacteria, while in

the positive control using the antibiotic Ciprofloxacin, the average inhibition zone was 33.625 mm, this indicates that the bacteria used in this study are still sensitive to the antibiotic Ciprofloxacin.

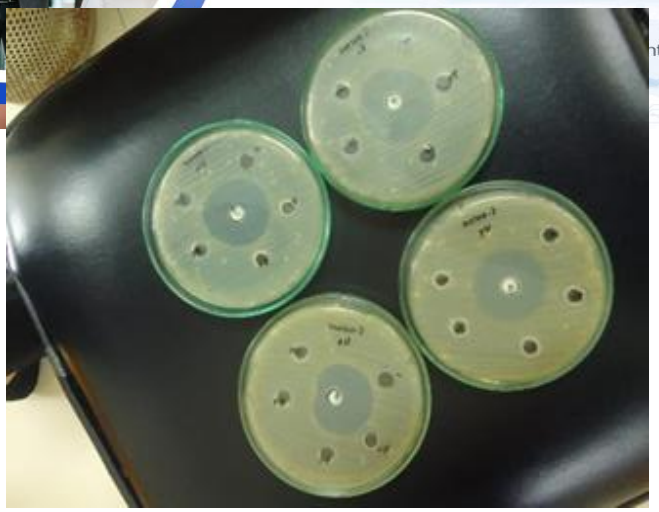

Figure 1. Antibacterial activity test using diffusion method on MHA media

This study used a negative control of ethanol which did not produce inhibitory power and a positive control of ciprofloxacin 5 µg which was able to form a radical zone with an average diameter of 24.67 mm. Ciprofloxacin is a new quinolone antibiotic with a fluorine atom in the quinolone ring. Fluoroquinolones have greater antibacterial power and lower toxicity. Ciprofloxacin will inhibit the topoimerase II enzyme (DNA gyrase) and the topoimerase VI enzyme in bacteria. The topoimerase II enzyme functions to cause relaxation and DNA that experiences positive supercoiling during transcription in the DNA replication process. The topoimerase VI enzyme functions in separating new DNA that is formed after the bacterial DNA replication process is formed (Dima et al., 2016).

The results of this study are not in accordance with the study conducted by Rahma et al.,(2022) which concluded that there was an effect of giving virgin coconut oil and olive oil on the inhibition of *Staphylococcus aureus* bacteria at a concentration of 100%. In this study, the failure to form an inhibition zone was due to several factors such as VCO purchased through an online shop resulting in poor VCO quality, microorganisms that were too resistant, and intervention of environmental factors such as temperature, pH and humidity which affected the formation of an inhibition zone.

The absence of VCO inhibition zone can also be caused by the large molecules of fatty acids contained in VCO, thus slowing down its diffusion in the media. In addition, the solvent used also seems to be less able to dissolve VCO as indicated by the formation of an emulsion. This is because the hydrophilic alcohol does not combine with the hydrophobic fatty acids (Noriko, 2014). In this study, the solvent used was not able to dissolve VCO well. Because VCO is not dissolved well, VCO cannot be dissolved well and cannot diffuse well in the media. The results of this study which did not have inhibitory power can also be caused by lauric acid not being converted into monolaurin which has higher antibacterial power (Tangwatcharin dan Khopaibool, 2012).

## CONCLUSION

Based on the results of the research that has been done, it shows that virgin coconut oil at concentrations of 40%, 60%, 80% and 100% does not have the potential as an antibacterial against the growth of *Staphylococcus aureus* bacteria which is indicated by the absence of an inhibition zone. In the positive control with the antibiotic Ciprofloxacin, an inhibition zone of 33.625 mm was formed, this indicates that the bacteria used in this study are still sensitive to the antibiotic Ciprofloxacin.

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