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Effect of *Aloe vera* Gel Formulation and *Jatropha multifida L* Leaf on the Growth of *Staphylococcus aureus* Bacteria

I Made Putra Pramaditya, Iswari Pauzi, Lalu Srigede, Yunan Jiwintarum
Jurusan Teknologi Laboratorium Medis Poltekkes Kemenkes Mataram Jl. Praburangkasari, Dasan Cermen, Sandubaya, Mataram, Indonesia
* Corresponding author e-mail: dektradektra28@gmail.com

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Abstract
Staphylococcus aureus bacteria is one of the agents of health problems that require special attention. Inappropriate use of antibiotics can cause resistance, so a more effective and safe alternative treatment is needed, one of which is by giving aloe vera gel formulations and tintir castor leaves that can help overcome bacterial infections, such as *Staphylococcus aureus*. Knowing the effect of *aloe vera* gel formulation (*Aloe vera*) and tintir castor leaf (*Jatropha multifida*) on the growth of *Staphylococcus aureus* bacteria. The study was pre-experimental with a cross sectional design. Gel formulations were made with various comparisons between aloe vera gel and tintir castor leaf, then tested against *Staphylococcus aureus* bacteria by observing the inhibition zone as an indicator of antibacterial activity. The results of testing the *Aloe vera* gel formulation and castor leaf filtrate showed that there was no inhibition zone in each of the tested formulation ratios. In the testing using *Aloe vera* gel formulations and *Jatropha multifida* leaf extract, no inhibition zones were observed in the 1:1 and 1:3 ratios, but an inhibition zone was present in the 3:1 ratio, measuring 4–6 mm with an average inhibition zone of 5 mm. This result can be considered sensitive but at a low level for inhibiting bacterial growth. There is an effect of *Aloe vera* gel and jarak tintir leaf formulation on the growth of *Staphylococcus aureus* bacteria.

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INTRODUCTION

Staphylococcus aureus is a gram positive coccus bacterium that is part of the normal flora of the skin and nasopharyngeal mucosa. However, a decrease in immune system function or an increase in bacterial virulence can trigger infection. The clinical manifestations of *Staphylococcus aureus* infection are highly variable, ranging from localized abscesses to systemic infections such as endocarditis, meningitis, pneumonia, and osteomyelitis. Transmission typically occurs through direct contact with infected skin or mucous membranes (Cahyaningrum & Susanti, 2022).

Infections caused by *Staphylococcus aureus* bacteria are a health issue that requires special attention, especially in hospitals. The incidence is estimated to be between 10 and 30 cases per 100,000 person-years (Tong dkk., 2015). The prevalence of MRSA infection in Asia reaches 70%, while the prevalence of MRSA infection in Java and Bali, Indonesia, reaches 3.1%, with 45.3% of skin and soft tissue infections caused by *Staphylococcus aureus*. (Santosaningsih dkk., 2018).

Staphylococcus aureus infections can be very dangerous, leading to death regardless of antimicrobial resistance patterns. *Staphylococcus aureus* remains the most common pathogen causing skin and soft tissue infections and accounts for significant morbidity and mortality, representing the leading bacterial cause of death in 135 countries and contributing to over one

million deaths in 2019 (Linz dkk., 2023). The increasing resistance to antibiotics has made the search for herbal-based treatment alternatives increasingly important. Based on the above background, research into the effectiveness of a gel containing *Aloe vera* and neem leaves as an antibacterial agent could make a significant contribution to the development of safer and more effective new therapies. By leveraging the antibacterial properties of these two natural ingredients, it is hoped that this study will provide insights into the potential use of this gel formulation in the treatment of *Staphylococcus aureus* bacterial infections.

METHOD

The research design used is pre-experimental research, which is a type of research that does not have a control group and still has external variables that affect the dependent variable, with the aim of identifying the symptoms or effects that arise as a result of the treatment. In terms of timing, this study is cross-sectional, meaning that both independent and dependent variables are measured simultaneously. Sample collection and analysis were conducted at the Health Testing and Calibration Laboratory (BLKPK) in Mataram City and the Microbiology Laboratory of the Research and Development Center at the Provincial General Hospital of West Nusa Tenggara (RSUD NTB). The study was conducted from April to June 2025.

RESULTS AND DISCUSSION

Table 4. 1 Data from Sensitivity Test Results of *Aloe vera* Gel Formulation and *Jatropha multifida* Leaf Filtrate (*Jatropha multifida L*) on the Growth of *Staphylococcus Aureus* Bacteria.

Sample code (c)	**Zone of Inhibition (mm)**		
	1:1 ratio	**1:3 ratio**	**3:1 ratio**
S1	-	-	-
S2	-	-	-
S3	-	-	-
S4	-	-	-
S5	-	-	-
S6	-	-	-
S7	-	-	-
S8	-	-	-
S9	-	-	-
control (+)	20		
control (-)	-		
Total			
Average			

Table 4.1 The results show that each comparison is insensitive to bacteria, as evidenced by the absence of inhibition zones formed on the Petri dish. In the positive control, an inhibition zone with a diameter of 20 mm was formed on the Petri dish, indicating that only the positive control is sensitive to *Staphylococcus aureus* bacteria.

Table 4.2 Data from Sensitivity Test Results of *Aloe vera* Gel Formulation and *Jatropha multifida* Leaf Extract (*Jatropha multifida L*) on the Growth of *Staphylococcus Aureus* Bacteria.

Sample code (c)	**Zone of Inhibition (mm)**		
	1:1 ratio	**1:3 ratio**	**1:1 ratio**
S1	-	-	4 mm
S2	-	-	6 mm
Total	-	-	10 mm
Average		5 mm	

Table 4.2 The results show that each 3:1 ratio is sensitive to bacteria, as seen from the inhibition zone formed on the Petri dish at a ratio of 3:1, namely 4 mm in the first repetition and 6 mm in the second repetition, with an average inhibition zone diameter of 5 mm, marked by the absence of bacteria growing in the area around the well containing the extract concentration.

Jarak tintir is a medicinal plant from the Euphorbiaceae family that is widely known in Indonesia as a traditional plant with various benefits. The leaves of this plant are known to contain various bioactive compounds such as flavonoids, saponins, tannins, alkaloids, and terpenoids, which have the potential to provide antibacterial, anti-inflammatory, and antioxidant effects (Aryantini dkk., 2021).

The results of testing the castor leaf extract showed strong antibacterial activity against *Staphylococcus aureus*, marked by the formation of an inhibition zone of 20 mm in the agar diffusion test. This reinforces several previous studies, according to (Ivan dkk., 2019) Water extracts or infusions at high concentrations can produce bacteriostatic or bactericidal effects against *Staphylococcus aureus*. For example, a 75–100% leaf infusion inhibits the growth of these bacteria, and pure castor oil can kill 100% of *Staphylococcus aureus*. Research conducted by (Kinasih dkk., 2021) reported significant antibacterial effects of castor leaf extract, both in the form of sap (natural liquid that comes out of plant tissue) and ethanol extract, against *Streptococcus aureus*, with inhibition zones ranging from 11–17 mm at concentrations of 50–100%.

Aloe vera is a succulent plant from the Liliaceae family that has long been known as a medicinal plant with various health benefits. *Aloe vera* gel is the clear part found inside the leaves and is known to contain various antibacterial compounds such as anthraquinones, saponins, tannins, and flavonoids (Aryani dkk., 2019).

The literature also shows that polar solvent-based *Aloe vera* extracts are capable of exhibiting more significant antibacterial activity. Research conducted by (Wijaya & Masfufatun, 2022) also reported that ethanol extracts of *Aloe vera* leaves and roots have moderate to high activity against Gram-positive and Gram-negative bacteria, including *Staphylococcus aureus*, while the aqueous gel tends to show moderate or weak activity. In addition, research conducted by (Usman dkk., 2020) also found that fresh *Aloe vera* gel can have activity against MDR (Multi-Drug Resistant) *Staphylococcus aureus*, although with relatively high MIC and MBC values, namely 25–50 µg/mL and 50–100 µg/mL.

In the formulation of *Aloe vera* gel and castor leaf filtrate, there is a significant difference in the inhibition zone, indicating that the leaf filtrate does not represent the entire bioactive compound content of the castor leaf. Due to the polar nature of water as a solvent, water-soluble compounds (hydrophilic) such as carbohydrates or proteins dissolve well, but the main antibacterial compounds such as tannins, flavonoids, and alkaloids are only partially soluble in water and more stable in ethanol. Therefore, the filtrate tends to contain active compounds at

low concentrations, while the extract has significantly higher concentrations of active compounds (Badi'ah, 2017).

The *Aloe vera* gel and castor leaf extract formulations were tested in various ratios. The results showed that the 3:1 ratio produced an inhibition zone of approximately 4–6 mm, indicating antibacterial activity, although reduced compared to the pure extract. Meanwhile, the 1:1 and 1:3 ratios did not produce an inhibition zone, indicating that the extract proportion was too low to produce an effect (Arva dkk., 2024). This decrease in effectiveness can be explained by two mechanisms. The first is the dilution of the active compound so that the concentration of the extract does not reach the threshold to inhibit bacteria. The second is the physical effect of the aloe vera gel, which inhibits the diffusion of the extract into the agar medium. Research conducted by (Farid dkk., 2020) also reported that castor leaves have a stronger effect when used as a pure water extract, rather than when formulated in a mixed gel. The presence of a 4–6 mm inhibition zone at a 3:1 ratio indicates that if the extract concentration is sufficiently high, the antibacterial effect can still be maintained even though the formulation contains gel. This implies that *Aloe vera* gel can serve as a carrier medium for the extract, but the extract proportion must be maintained to prevent a drastic decrease in effectiveness (Alifiya, 2022). The absence of activation at lower ratios confirms that the combination of natural ingredients is not always synergistic, but rather depends heavily on the ratio and physical properties of the formulation.

CONCLUSION

The sensitivity testing of the *Aloe vera* gel formulation and *Jatropha multifida L* leaf filtrate indicates that, under the conditions and methods used, the formulation is ineffective in inhibiting the growth of *Staphylococcus aureus*, as no inhibition zone was formed. However, in a repeat test using the *Aloe vera* gel formulation and *Jatropha multifida L* leaf extract, an inhibition zone of 4–6 mm was observed at a 3:1 ratio, with an average inhibition zone of 5 mm. These results can be considered sensitive but at a low level for inhibiting bacterial growth.

RECOMMENDATIONS

Future researchers can continue with other methods, such as KHM and KBM, optimize different extract concentrations in the extraction process, and use other materials as antibacterials.

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