

The Formulation of Soap Incorporated with Stingless Bee Honey and *Cassia alata* Extract against Skin Pathogenic Bacteria

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Structured Abstract

Background: Skin pathogenic bacteria can cause a wide range of infections, from mild rashes to severe abscesses, particularly in individuals with poor hygiene or compromised immune systems. Due to the rise of antibiotic-resistant bacteria, natural alternatives have gained attention for their potential to inhibit such pathogens. Herbal soaps, which are rich in antibacterial compounds, have long been used to protect and heal the skin. In this study, stingless bee honey (Madu Kelulut) and *Cassia alata* (Daun Gelenggang), both known for their antimicrobial properties, were investigated for their potential to enhance the antibacterial activity of liquid soap. Since liquid soap plays an important role in maintaining hygiene and preventing disease, this study aimed to evaluate the antibacterial effectiveness of soap formulations incorporating stingless bee honey and *C. alata* leaf extract.

Methods: *Cassia alata* leaves were extracted using ethanol, while Madu Kelulut was diluted into various concentrations. The antimicrobial activity of soap formulations containing different concentrations (mg/mL) of both extracts was evaluated using the agar well diffusion assay. The combined efficacy of the extracts was further assessed through the determination of Minimum Inhibitory Concentration (MIC), Minimum Bactericidal Concentration (MBC), and the MBC/MIC ratio. Finally, the Kirby-Bauer disk diffusion method was employed to confirm that the herbal soap formulations retained their antimicrobial properties.

Results: This study demonstrated the successful extraction of Madu Kelulut (honey) and *C. alata* leaves, both of which exhibited antimicrobial activity against skin pathogenic bacteria. The results indicated that *Staphylococcus epidermidis* was the most susceptible to both extracts. Additionally, both extracts showed notable antibacterial effects against methicillin-resistant *Staphylococcus aureus* (MRSA), a multidrug-resistant strain. Most of the tested bacteria exhibited bactericidal activity, with MBC/MIC ratios ranging from 2 to 4. However, MRSA displayed a higher MBC/MIC ratio of 8 when treated with *C. alata*, indicating a weaker bactericidal response. The antimicrobial activity of the soap formulation incorporating both honey and *C. alata* extracts was measured using the agar diffusion method, yielding inhibition zone diameters of 12.33 ± 0.58 mm for *S. aureus*, 11.00 ± 1.00 mm for MRSA, and 11.67 ± 0.58 mm for *S. epidermidis* after 24 hours of incubation.

Conclusion: The findings of this study indicate that formulating herbal soap with Madu Kelulut (honey) and *C. alata* leaf extracts holds promising potential as an alternative antibacterial cleansing agent against skin pathogenic bacteria. This natural formulation may contribute to maintaining a healthy skin barrier in the long term.

Keywords: *Cassia alata*, Stingless bee honey, Antimicrobial activity, Liquid Soap.

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