The potential of *Phyllanthus niruri* as an antibacterial agent: A systematic review

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ABSTRACT

Introduction: The rise of antimicrobial resistance has prompted the search for alternative therapies, including plant-based antimicrobials. *Phyllanthus niruri* (PN), also known locally as "Dukung Anak," is traditionally used for various ailments and has shown promising antibacterial properties. This systematic review explores the antibacterial potential of PN and its bioactive compounds. **Materials and Methods:** A systematic search was conducted using Medline, PubMed, and Google Scholar databases with keywords related to PN, antibacterial activity, and bioactive compounds. Inclusion criteria focused on in vitro, in vivo, and phytochemical studies assessing PN's antimicrobial effects. Data extraction and reporting followed PRISMA guidelines. **Results:** The database search identified 12,749 titles of potentially relevant articles. Out of these only thirteen studies were included. PN's leaves or whole plant were used in most of the studies. Methanolic extracts of PN consistently demonstrated the highest antibacterial activity, particularly against Gram-positive bacteria such as Staphylococcus aureus and Bacillus cereus, with inhibition zones ranging from 12–15 mm and Minimum Inhibitory Concentration (MIC) values between 6–58 µg/mL. Gram-negative bacteria showed higher resistance. Key bioactive compounds identified include phyllanthin, flavonoids, tannins, alkaloids, and saponins. Nanoparticle formulations using PN extract enhanced antibacterial efficacy, especially at a 5% concentration, confirmed through particle size analysis (PSA) and scanning electron microscopy (SEM). Synergistic effects were observed when PN was combined with Kelulut honey or conventional antibiotics, reducing MIC values and improving bacterial inhibition. Extraction methods significantly influenced efficacy, with methanol and ethanol yielding the most potent results. PN was tested against a wide range of organisms including *E. coli, P. aeruginosa, K. pneumoniae, and Candida albicans,* showing broad-spectrum activity. Some studies also reported antiviral properties against HBV and HIV. **Conclusion:** *Phyllanthus niruri* exhibits strong antibacterial activity, particularly against Gram-positive pathogens, due to its rich phytochemical profile. Its synergistic potential with other natural products and antibiotics highlights its promise as a natural alternative or adjunct in antimicrobial therapy. Further clinical trials are needed to validate its efficacy and safety in human applications.

Keywords: Phyllanthus niruri, antibacterial activity, bioactive compounds, natural antibiotics, antimicrobial resistance