

Antibacterial and Antibiofilm Activities of *Carica Papaya* Leaf Extract Against Pathogenic Bacteria

Muhammad Aqil Abbasy Pudzi^a & Mohd Taufiq Mat Jalil^{a*}

Structured Abstract

Background: The emergence of multidrug-resistant (MDR) organisms poses a significant global health threat due to the declining effectiveness of current antibiotics. One major contributing factor is the development of biofilms, which enhance bacterial resistance and hinder treatment efficacy. As a result, attention has shifted toward natural alternatives, particularly plant-derived compounds. *Carica papaya* leaves have shown promise due to their potential antibacterial and antibiofilm properties. This study aims to identify the phytochemicals present in *C. papaya* leaves and evaluate their effectiveness against pathogenic bacteria and their ability to inhibit biofilm formation. Gaining insight into the bioactivity of these compounds may offer alternative or complementary strategies for addressing antibiotic resistance and biofilm-associated infections.

Methods: The study utilized an ethanol-hexane extraction method to obtain crude extracts from *C. papaya* leaves, yielding 73.78 g of extract. Phytochemical screening was conducted to identify bioactive compounds. Antibacterial activity was assessed by measuring inhibition zones and further evaluated by determining the minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC). Biofilm inhibition was analyzed using both microplate and glass slide assays. The inhibitory effects of the extract on biofilm formation were quantified at varying concentrations against *Staphylococcus epidermidis* and *Salmonella typhi*.

Results: Phytochemical analysis confirmed the presence of saponins, alkaloids, flavonoids, tannins, terpenoids, and phenols. Antibacterial assays showed strong activity against Gram-positive bacteria, especially MRSA and *Staphylococcus epidermidis*, with an inhibition zone up to 20mm, while Gram-negative bacteria showed lower sensitivity. MIC values ranged from 15.6 to 31.3 mg/mL, indicating good antibacterial potential. MBC tests confirmed bactericidal activity against all other tested organisms, except against *Bacillus cereus*. Biofilm assays revealed significant inhibition of biofilm formation, with reductions of 67.23% for *S. epidermidis* and 48.34% for *S. typhi*, and visible reductions in biofilm on glass slides at higher extract concentrations.

Conclusion: *Carica papaya* leaf extract contains multiple bioactive compounds with notable antibacterial and antibiofilm activities. It exhibited strong inhibitory effects against multidrug-resistant (MDR) pathogens and effectively disrupted biofilm formation. These findings highlight its potential as a natural antimicrobial agent, particularly against Gram-positive bacteria and for treating biofilm-associated infections.

Keywords: *Carica papaya*, antibacterial, biofilm inhibition, multidrug resistance, phytochemicals

*Correspondence: taufiqjalil@uitm.edu.my

^a School of Biology, Faculty of Applied Sciences, Universiti Teknologi MARA, Shah Alam, Malaysia