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Evaluating ginger extract, wild blueberry extract, and polysorbates (PS20, PS80) on *Pseudomonas aeruginosa* biofilm formation

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Abstract

Introduction: *Pseudomonas aeruginosa* is a biofilm forming pathogen that challenges clinical and industrial settings. Many natural products and surfactants have been screened and valued for their anti-biofilm capacity. In this study we assessed the inhibitory effect and molecular mechanism of action of ginger extract (*Zingiber officinale Rosc*.), wild blueberry extract (*Vaccinium angustifolium*), and polysorbates (PS20/PS80) on biofilm formation.

Methodology: Ginger and wild blueberry extractions were done using ethanol and distilled water, respectively. Hexane and methanol were used for extracts' liquid-liquid portioning. LC-HRMS was performed to obtain extract fractions. Efficacy of the crude extracts, fractions, and polysorbates was assessed on *P. aeruginosa* PAN14 growth and biofilm. Transcription levels of biofilm encoding genes *ndvB*, *pelC*, *algC* and quorum sensing genes *lasI*, *lasR*, *rhlI*, *rhlR* were evaluated by RT-qPCR.

Results: Extracts and polysorbates concentrations did not affect *P. aeruginosa* growth. Biofilm assay showed a reduction in biofilm when 5% ginger, 25% wild blueberry extracts, 0.2% PS20, and 0.25% PS80 were added. LC-HRMS analysis of ginger extract showed abundant gingerol in the hexane layer. Wild blueberry chromatograms showed various constituents differing between their peel and pulp, and pulp extracts. RT-qPCR showed decreased transcription levels of exopolysaccharide and quorum sensing genes with a 363.6 folds reduction in *ndvB* upon treatment with 25% wild blueberry peel and pulp extract.

Conclusion: These results shed light on the mechanism of action of ginger and wild blueberry constituents as well as PS20/80 on *P. aeruginosa* biofilm formation. Future mouse model experiments are useful to test biofilm inhibition *in-vivo*.

Key words: biofilm; ginger; blueberry; polysorbate; *Pseudomonas*.

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