Boosting Antibiotic Activity Against *Staphylococcus Aureus* Methicillin Resistant And Susceptible Strains By Photodynamic Inactivation

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Abstract

Background: Bacterial infections are becoming increasingly resistant to conventional antibiotic treatments. One promising avenue to rescue antibiotic activity is through its combination with adjuvant agents, where plant-based compounds, *i.e.* phytochemicals, stand out. Added to the enhancer properties, some of these compounds, such as berberine (Ber), have photodynamic properties that make them very useful for antimicrobial photodynamic inactivation (aPDI). The present study focused on evaluating the antimicrobial efficacy of photoactivated Ber-antibiotic (BA) combinations against the life-threatening pathogen *Staphylococcus aureus*.

Materials: The efficacy of blue light (420 nm, 30 mW/cm^2, 10 min) to photoactivate Ber and thus promote its antimicrobial activity against two clinical strains of *S. aureus* (CECT 976: methicillin-susceptible strain (MSSA) and MJMC568-B: methicillin-resistant (MRSA)) was investigated. In addition, the effect of Ber photodynamic properties on the improvement of less effective antibiotics (mupirocin-Mup, gentamycin-Gen, and tobramycin-Tob) was explored.

Results: The photoactivation of Ber leads to an 8- and 80-fold reduction in its minimum bactericidal concentration against MSSA and MRSA, respectively. All photoactivated BA combinations tested resulted in complete photoinactivation of both *S. aureus* strains (about 9 log reduction in colony forming units).

Conclusion: Photoactivated BA combinations demonstrated for the first time a great antimicrobial potential for the treatment of *S. aureus* infections.

Keywords

Antibiotic Combinations, Antibiotic Resistance, Antimicrobial Photodynamic Inactivation, Berberine, Phytochemicals, Photosensitizers, *S. aureus* infections.

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