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Antibiotic Efficacy Against *Pseudomonas aeruginosa* Biofilms: Synergistic Role of Allicin in Chronic Respiratory Infections

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Infections associated with bacterial biofilm formation caused by *Pseudomonas aeruginosa* present a therapeutic challenge, particularly in patients suffering from chronic respiratory conditions like cystic fibrosis. Biofilms promote the survival of bacterial populations by limiting the penetration and efficacy of antimicrobials, which contributes to increased resistance and complicates eradication. This tolerance allows the pathogen to persist at sites of infection despite ongoing treatment. As resistance to conventional antibiotics increases, there is a growing demand for combination strategies that can improve treatment outcomes and reduce the selective pressure for resistance development. Allicin, a natural compound derived from garlic, has demonstrated antimicrobial properties and the potential to enhance the activity of antibiotics. In this study, we investigate the effect of allicin in combination with selected antibiotics, namely kanamycin and polymyxin B, on inhibiting *P. aeruginosa* biofilm formation. The antimicrobial efficacy of individual and combined treatments was evaluated by monitoring bacterial growth dynamics and assessing biofilm viability after treatment using standard colorimetric and kinetic assays. This approach enabled observation of not only the overall antimicrobial effect but also potential synergistic interactions between tested compounds. Alongside standard *in vitro* conditions, preliminary experiments included structural modifications designed to approximate characteristics of the pulmonary environment, such as increased viscosity. These elements were incorporated to explore whether more physiologically relevant conditions might influence treatment outcomes. Although this aspect of the study is still being developed, it represents a significant step toward a better understanding of therapeutic performance in environments that mimic chronic lung infections.

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