Investigating Piperine as a Non-Synthetic Efflux Pump Inhibitor, to Restore Antibiotic Sensitivity in Staphylococcus aureus

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The rise of multidrug-resistant (MDR) bacteria presents an escalating challenge to traditional antibiotics, causing the exploration of alternative therapeutic strategies. A key mechanism of bacterial resistance is the activity of efflux pumps, which expel antibiotics from bacterial cells, reducing their efficacy. Efflux pump inhibitors (EPIs) have the potential to block these pumps and restore antibiotic effectiveness. This study investigates the ability of piperine, a plant-derived bioactive compound, to function as a non-synthetic EPI in combination with fluorescently tagged paromomycin against Staphylococcus aureus. To evaluate the effectiveness of piperine, S. aureus cultures were treated with varying concentrations of piperine (0, 16, 24, and 32 µg/mL) alongside paromomycin. After incubation, the cells were washed, lysed, and fluorescence readings were taken from the supernatant to quantify intracellular antibiotic accumulation. According to the standard curve made from the antibiotic, the results indicate that piperine at 24 µg/mL showed the highest inhibition of efflux activity, leading to increased intracellular retention of paromomycin. These findings suggest that piperine enhances antibiotic accumulation by inhibiting efflux pumps, supporting its potential as an EPI. Future studies into plant-derived EPIs could contribute to novel combination therapies against antibiotic-resistant bacteria. This study opens the door for further research of natural products as a safe and viable means to combating antibiotic resistance.

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