CRAB vs Pepper: The Effect of Bioenhancers on Ampicillin-Sulbactam as a Treatment Against A. baumannii

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As more and more bacteria develop antibiotic resistance, bioenhancers (substances that enhance antibiotic performance) are emerging as potential solutions. We hypothesized that the bioenhancer piperine (which is derived from black pepper) combined with ampicillin-sulbactam, would improve the drug's treatment of Acinetobacter baumannii, a more resistant bacterium. The first phase involved using broth dilution to find the minimum inhibitory concentration of drug needed to inhibit three different strains of A. baumannii, with Escherichia coli as a control. We then exposed the strains to varying concentrations of ampicillin-sulbactam, piperine, both ampicillin-sulbactam and piperine, and a control of just bacteria to measure the synergistic ability of piperine with ampicillin-sulbactam. These four treatments were also used on mice immune cells to replicate this in an in-vitro setting. For all three strains of A. baumannii, combining piperine with ampicillin-sulbactam at a concentration of 64 mg/L led to significantly less bacterial growth for two strains ($p < 0.0001$, $p = 0.0005$) compared to treating the bacteria with ampicillin-sulbactam or piperine alone. At a drug concentration of 32 mg/L, this difference was also insignificant for the same strain but significant ($p = 0.0171$, $p = 0.0002$) for the other strains. At a drug concentration of 16 mg/L, this difference was significant for all strains ($p = 0.0003$, $p < 0.0001$, $p < 0.0001$). Piperine therefore enhances ampicillin-sulbactam and inhibits the growth of A. baumannii effectively. Piperine's addition decreases the necessary drug concentration, so less resistance develops and less dosage is needed to treat patients.

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