REVERSING β-LACTAM ANTIBIOTIC RESISTANCE WITH SOME FLAVONOIDS IN GRAM-POSITIVE BACTERIA

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Abstract

The antibacterial action of naturally occurring flavonoids was investigated. When combined amoxicillin with galangin 12.5 µg/ml, minimum inhibitory concentrations (MICs) of amoxicillin against twelve clinical isolates of resistant Staphylococcus aureus (S. aureus) and four isolates of methicillin-resistant S. aureus (MRSA) were reduced from an initial range of 2–250 µg/ml and 32–250 µg/ml to a range of <0.25–2 µg/ml and <0.25 µg/ml, respectively. Furthermore, six clinical isolates of ceftazidime-resistant S. aureus with MICs 32-250 µg/ml had their resistance to ceftazidime reversed by galangin 25 µg/ml to MICs of <0.25 µg/ml. Viable counts showed that the killing of penicillin-resistant S. aureus cells by 10 and 50 µg/ml benzylpenicillin was potentiated by 25 µg/ml baicalin. Electronmicroscopy clearly showed that the combination of 25 µg/ml benzylpenicillin with 25 µg/ml galangin caused damage to the ultrastructures of MRSA cells. Enzymes assays indicated that galangin, tectochrysin and 6-chloro-7-methyllavone had inhibitory activity against β-lactamase from Bacillus cereus. Apigenin showed marked inhibitory activity against penicillinase type IV from Enterobacter cloacae. It was concluded that galangin, baicalin and tested flavonoids exhibited the potential to reverse bacterial resistance to β-lactam antibiotics against MRSA and other strains of β-lactam-resistant S. aureus.

Keywords: Methicillin-resistant S. aureus, traditional herbal remedies, antibacterial agents, reverse bacterial resistance, minimum inhibitory concentrations