CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
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Project Number
35227

Project Title
Investigating the Synergism between Polyphenols and Macrolides: A Method to Combat Antibiotic Resistance?

Abstract

Objectives/Goals
The objective is to compare the individual and combination effects of two common macrolide antibiotics (erythromycin and azithromycin) with two plant polyphenols capable of bacterial membrane damage and permeation (resveratrol and quercetin) against Escherichia coli, in order to test for possible synergism.

Methods/Materials
A broth microdilution method was used to find the minimum inhibitory concentration capable of inhibiting 50% of E. coli growth (MIC50) for each polyphenol and macrolide alone. By utilizing the microdilution method, the synergy test was done by combining macrolides and polyphenols in 1 to 1 ratios with regards to their respective MIC50 values. Control tests for solvent toxicity, growth, sterility, and chemical turbidity were performed.

Results
Alone, erythromycin, azithromycin, resveratrol, and quercetin had MIC50's of 0.77 µg/mL, 0.0064 µg/mL, 216 µg/mL, and 162 µg/mL, respectively. In the synergy test, the combinations showed either indifference or antagonism. The resveratrol and erythromycin combination showed no decrease in MIC50, with the inhibitory concentration of erythromycin remaining at 0.77 µg/mL. The resveratrol and azithromycin combination showed antagonism, with the MIC50 of azithromycin increasing to 0.0114 µg/mL compared to 0.0064 µg/mL alone. The quercetin and erythromycin combination showed antagonism, with the MIC50 of erythromycin rising to 1.03 µg/mL. The quercetin and azithromycin combination also showed antagonism, with the MIC50 of azithromycin rising to 0.0114 µg/mL.

Conclusions/Discussion
Alone, the polyphenols resveratrol and quercetin displayed potent antibacterial activity at high concentrations, showing their potential to act as a novel lead in drug development. However, they did not synergize with macrolide antibiotics. Instead, they had an antagonistic effect in most of the combinations, possibly because both the drugs and polyphenols competed for the same site of antibacterial activity. This unforeseen drug interaction suggested that resveratrol and quercetin, common in dietary supplements, should not be taken together with macrolide antibiotics.

Summary Statement
The plant polyphenols resveratrol and quercetin were combined with the macrolide antibiotics erythromycin and azithromycin to test for possible synergistic effects.

Help Received
Research was performed at Universal Biopharma Research Laboratory under the supervision of Dr. Khushoo and Dr. Thusu.