Antibacterial effects of organosulfur compounds against gram-negative bacteria

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BACKGROUND

Organosulfur compounds (OSC) contain sulfur and have an extraordinary range of chemical structures and activities, and many of these also have biological activity including pro- or anti-tumorigenic activity.1 Similarly, there are recent reports of antibacterial activity or resistance to antibiotics by OSCs.2 Some may have both anti-cancer and anti-bacterial activity, a classic example is garlic which contains multiple sulfur compounds and is recognized for its antimicrobial effects and cancer preventive properties.3 Organic isothiocyanates and various sulfophenanes are known to have anti-cancer effects in vitro.4 Some compounds are known to be based on nitric oxide- and H2S -signaling with effects on molecular targets in cancer cells and other cell types.

METHODS

Bacterial strains were obtained from Carolina Compounds and were screened for susceptibility to specific organosulfur compounds. Klebsiella pneumoniae, Escherichia coli, and Pseudomonas aeruginosa were examined using positive and negative controls. Chloramphenicol (30 µg discs) and mercuric chloride (1%) were used as positive controls. The organosulfur compounds (obtained from Advanced Biotech, Totowa, NJ) were used as di-furfuryl disulfide (DFFDS), 3-(methylthio) propyl isothiocyanate (3MPITC), and methyl 2-methyl 3-furyl disulfide (M2M3FD) as negative controls. Chloramphenicol (30 µg discs) and mercuric chloride (1%) were used as positive controls. The organosulfur compounds (obtained from Advanced Biotech, Totowa, NJ) were used as di-furfuryl disulfide (DFFDS), 3-(methylthio) propyl isothiocyanate (3MPITC), and methyl 2-methyl 3-furyl disulfide (M2M3FD).

RESULTS

Some OSCs release H2S. Hydrogen sulfide may serve as a signaling molecule. Sulfur hydration of proteins by H2S can modulate protein functions. H2S also exhibit antibacterial effects on the other gram-negative bacteria. 3MPITC (4087) exhibited concentration-dependent antibacterial effects against both E. coli and K. pneumoniae. As the concentration increased, so the bactericidal effect increased as well. DFFDS did not exhibit any zones of inhibition on the agar plates. The top right plate showed a huge ZOI. In the growth curve, unlike the disc diffusion assay, 3MPITC does not exhibit concentration-dependent bactericidal effects. The most effective concentration was 75mM which was not the highest concentration used.

DISCUSSION

• 3MPITC exhibits antibacterial effects against gram-negative bacteria and DFFDS was not effective against gram-negative bacteria examined
• MICs were determined; 3MPITC for E. coli [15 mM], for Klebsiella [38 mM], Pseudomonas [75 mM]
• IC50 of 3MPITC for broth culture of K. pneumoniae was not effective against gram-negative bacteria examined
• Additional studies will be conducted to determine the significance of the results. In addition, the effects of 3MPITC on the growth of E. coli, and Pseudomonas in growth curves will be examined.
• Solubility issues of the compounds have complicated the H2S release in kinetic assays

REFERENCES