

Antimicrobial Effects of Gold Nanoparticles Against Gram Positive Coccus spp. and Its Interaction With Bacitracin, Polymyxin B, Gentamicin, Clindamycin and Erythromycin

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Abstract

Introduction: Antibiotic resistance in one of the biggest threats to global health, food security and development today and it has emerged as a medical catastrophe. Antibiotic resistance is also rising to dangerously high levels in all parts of the world. Nanotechnology provides a chance to overcome antibiotic resistance by multiple antibiotic mechanisms. The aim of this study was to examine antibacterial effects of the colloidal gold nanoparticles (GNP) against *Staphylococcus aureus*, *Staphylococcus saprophyticus*, *Staphylococcus epidermidis*, *Enterococcus faecalis*, and *Enterococcus faecium* and also the GNP synergistic effects with three antibiotics including Bacitracin, Polymyxin B, Gentamicin, Erythromycin and Clindamycin.

Methods and Results: Standard agar diffusion method was used to determine the zone of inhibition of each antimicrobial compound and GNP. Standard broth microdilution method was also used to determine the minimum inhibitory concentration (MIC). The different ratios of each antibiotic and GNPs were then prepared and the antibacterial activities of antibiotic/GNP mixture was assessed one by one. Finally, the results of triplicate examinations were analyzed statistically. the results showed that the combination of gold nanoparticles with the most of the antibiotics with the ratio of 25%-75% had the increased antibacterial effect against the majority of strains with considerable MIC compared with all other antibiotic/GNPs ratio. Therefore, the gold nanoparticles in combination with antibiotics in specific concentrations can increase the antibacterial effects of the antibiotics.

Conclusions: bacterial resistance to available antibiotics is an increasing problem and improved methods to identify and treat pathogenic bacterial strains quickly would be of enormous benefit to public health. Our findings indicated that a combination of antibiotics and gold nanoparticles has considerable efficiency against some gram positive bacteria. The alteration of normal mode of metabolite pathway and the release mechanism could involve in antimicrobial process.

Key words: gold nanoparticle, gram positive cocci, antibiotic, antibiotic resistance