Junior Science Communications Faculty of Applied Sciences, UiTM Shah Alam
https://journal.uitm.edu.my/ojs/index.php/JSC

E-ISSN 2637-0689
Vol 48 2025

Colloquium on Applied Sciences 2 2024
8-14 July 2024, Faculty of Applied Sciences, UiTM Shah Alam, Malaysia

Elucidating the Effects of Sulphide Donours on the Growth of *Staphylococcus aureus* and *Propionibacterium acnes*

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Structured Abstract

Background: The outermost layer of skin acts as the primary barrier to external threats and is crucial for overall health. It is comprised of three layers, epidermis, dermis, and hypodermis, each of these contributes to protection, sensibility and control. The skin microbiome, in particular *Propionibacterium acnes* and *Staphylococcus aureus*, is essential for dermatological health. *P. acnes* contribute to acne vulgaris, whereas *S. aureus* produces impetigo and boils. This study investigates the effects of reactive sulphur species (RSS) and reactive oxygen species (ROS) on these skin microbes, with the aim of better understanding the impacts of sulphur compounds on skin health.

Methods: *S. aureus* and *P. acnes* were sub-cultured on tryptone soy agar and blood agar, respectively. Inoculum were prepared in tryptone soy broth and Mueller-Hinton broth, adjusted to 1.0 x 10^8 CFU/ml and incubated for 24 hours and 72 hours respectively. Clindamycin and sulphide donours (CysSH, GSH, Met, NaHS, Na_2S_2) were examined in TSB and MHB using microdilution. MIC and MBC were measured visually and by a microplate reader. H_2O_2 solutions containing NaHS, Met and GSH were analysed for MIC and MBC with microplate reader and vision observation. By using one-way ANOVA ($p < 0.05$), the results of MIC were analysed.

Results: The findings showed that while Met protects *P. acnes* from H_2O_2-induced cytotoxity, NaHS slightly decreases it, and GSH and Na_2S_2 enhance *S. aureus* growth. The interaction between H_2O_2 and RSS differs with GSH exhibiting strong synergistic inhibitory effects on *S. aureus* at higher doses. Despite these interactions, none of the sulphide donours significantly reduced *S. aureus* growth, implying that they are less effective than clindamycin. Met and GSH were found to be significantly better for bacterial survival than other sulphide donours.

Conclusion: In conclusion, by highlighting the complex relationships between ROS and RSS that affect the development of *S. aureus* and *P. acnes*, the study discovered that while some sulphides can encourage the growth of these bacteria, others can either boost or restrict bacterial proliferation by interacting with ROS. This implies possible treatment approaches that target the combined effects of ROS and RSS on bacterial development to manage skin diseases

Keywords: *Staphylococcus aureus*, *Propionibacterium acnes*, Reactive Sulphur Species, Reactive Oxygen Species

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