Thymoquinone Derived From Black Seed: Cytotoxicity and Inhibitory Effect Against MRSA and MSSA Infections

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ABSTRACT

Staphylococcus aureus (S. aureus) is known for its ability to colonize human body, with approximately 30% of individuals harbouring it asymptomatically. While it can cause benign skin infections, S. aureus can lead to severe diseases such as hospital-acquired pneumonia (HAP) and bacteremia, especially when methicillin-resistant strains (MRSA) are involved. MRSA has become a major challenge in healthcare setting due to its virulence and extensive antibiotic resistance, complicating treatment options and increasing patient morbidity and mortality. The mecA gene, which encodes for PBP2a, contributes to this resistance, leading to poor efficacy of most beta-lactam antibiotics. This phenomenon has created an urgent need for alternative therapies to combat resistant strains. Drug repositioning has emerged as a promising strategy, utilizing existing compounds for novel therapeutic applications. Thymoquinone (TQ), a bioactive compound derived from Nigella sativa (black seed), displays antimicrobial properties against various pathogens, potentially including MRSA. This study aims for the first time to investigate the differential effects of TQ on MRSA and methicillin-sensitive S. aureus (MSSA), focusing on its antibacterial activity, resistance profiles, and toxicity. A total of 40 isolates (20 MRSA and 20 MSSA) were analyzed using standardized methods. Preliminary results indicate a statistically significant (p value 0.0002) difference in MIC values between MRSA and MSSA, with MRSA exhibiting higher resistance. The cytotoxicity of TQ, evaluated with human breast cancer cells, demonstrates a direct correlation with TQ concentration. Overall, the findings of this study provided insights into TQ's therapeutic potential, establishing a foundation for developing effective strategies against MRSA and contributing to the ongoing fight against antibiotic resistance.

Keywords: Thymoquinone , AMR, MRSA, MSSA, Hospital-acquired pneumonia

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