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BIOACTIVE HYBRID MOLECULES: THE NEXT FRONTIER IN THE FIGHT AGAINST SUPERBUGS

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INTRODUCTION

Infections caused by superbugs, microorganisms resistant to conventional antibiotics, are one of the greatest threats to global health, with significant impacts. Given the urgency of antimicrobial resistance, exploring bioactive hybrid molecules as new therapeutic strategies is crucial to overcoming the limitations of current treatments.

MATERIAL AND METHODS

This literature review used the ScieLO, PubMed, and Google Scholar databases to identify studies from the last six years on the antimicrobial activity of bioactive hybrid molecules against superbugs. The search included in vitro and in vivo studies, as well as clinical trials in Portuguese, English, or Spanish, while excluding reviews, editorials, and studies with inadequate methodology. The four most relevant articles were selected, with duplicates removed before screening.

RESULTS

Genome sequencing of *Streptomyces sp.* strain 196 revealed biosynthetic gene clusters linked to bioactive metabolites. Quinoline hybrids showed superior activity against Methicillin-resistant Staphylococcus aureus, with three compounds inhibiting *S. aureus* DNA gyrase at levels comparable to novobiocin. Nanocarriers have improved drug absorption, and cefiderocol, by exploiting membrane transporters, has shown efficacy against resistant urinary infections. Non-antibiotic approaches like monoclonal antibodies, bacteriophages, and microbiome modulation are promising. Hybridizing oxazolidinones with pharmacophores enhances antimicrobial activity. And finally, since development of new antibiotic classes to combat antimicrobial resistance seem unlikely, hybridizing oxazolidinone antibiotics with pharmacophores and drugs with distinct antimicrobial mechanisms may offer a strategy against superbugs.

CONCLUSIONS

Bioactive hybrid molecules offer a promising strategy to combat antimicrobial resistance. Advances in genome mining, hybrid synthesis, and nanotechnology-based therapies provide innovative treatment alternatives. While challenges in clinical validation remain, these innovative approaches may contribute significantly to the fight against superbugs, provided further validation.

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