



Efficacy of Bacteriophage-Derived Endolysins Against Gram-Negative Bacteria: A Systematic Review

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ABSTRACT

Introduction: Increased bacteria resistance to antibiotics is prompting scientists to search for potential alternatives. As new antibiotics are developed, researchers are exploring alternative therapeutic agents, such as bacteriophage-derived endolysins. Endolysins are less effective against Gram-negative bacteria due to the presence of an outer membrane that protects their peptidoglycan layer. In this study, we aimed to evaluate the effects of endolysins on Gram-positive bacteria.

Search Strategy: This systematic review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement. The authors conducted searches using combinations of keywords related to endolysin, Gram-negative bacteria, and antibiotic resistance based on MESH terms in the PubMed, Web of Science, Scopus, and Google Scholar databases, covering the period from 1 January 2014 until 16 May 2024. The following keywords was also used: (lysin OR endolysin) AND (Gram-positive bacteria OR bacteria) along with relevant terms. After screening the literature for titles and abstracts, full-text reviews were conducted based on established inclusion and exclusion criteria. Any disagreement was resolved through discussions among the three authors.

Results: From 2014 to 2024, 21 articles met the inclusion criteria for the study. The review of the data indicated that endolysins hold significant potential in combating drug-resistant bacteria and effectively reducing bacterial load. Also, endolysins are effective against a broad spectrum of both Gram-negative and Gram-positive bacteria. They demonstrate functionality in various environments, including milk, blood, and serum, by degrading the bacterial peptidoglycan wall and showing resilience under diverse conditions. Moreover, only a tiny quantity of endolysin is required to achieve bactericidal effects within a short timeframe.

Conclusion and Discussion: Endolysins represent a promising alternative to antibiotics, with current research indicating significant potential. Notably, there have been no documented cases of resistance to endolysins to date. However, a major limitation of endolysins is their inability to penetrate and lyse the outer membrane of Gram-negative bacteria. To address this challenge, endolysins are often used synergistically with various drugs and compounds. Additionally, ongoing research efforts aim to identify endolysins that can directly traversing the bacterial outer membrane.

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