

ABSTRACT

Charles University of Prague, Faculty of Pharmacy in Hradec Králové

Department of Biological and Medicinal Science

Consultant: RNDr. Klára Konečná, Ph.D.

Author: Iveta Rockenbauerová

Study program: Pharmacy

Title of thesis: Alternative strategies in the fight against antimicrobial resistance

Background: The aim of this review thesis is to clearly present alternative strategies in the fight against antimicrobial resistance. The main focus of the thesis is the possibility of using bacteriophages as natural rivals of bacteria. Among other topics, the structure and replication mechanisms of bacteriophages, as well as historical aspects associated with their discovery, are discussed in the thesis. Attention is also given to phage therapy, which appears to be a very promising alternative to antibiotic treatment, which still dominates as the primary strategy in treating bacterial infections.

Main findings: Bacteriophages, or viruses that attack bacteria, represent a highly promising therapeutic strategy due to their ability to specifically target and destroy bacterial pathogens, particularly in infections caused by multidrug-resistant microorganisms. Current results and findings from clinical studies, in which phage therapy has been applied, demonstrate its significant effectiveness in patients suffering from infections that did not respond to conventional antibiotic treatment. The advantages of this therapeutic approach include particularly its high specificity for pathogenic bacteria and the low risk of side effects. However phage therapy also brings potential disadvantages and challenges associated with its widespread implementation. Currently, the scientific community is dealing with, among other things, the issue of the possibility of bacterial resistance to bacteriophages. In this regard, great importance is attached to the combination of phage preparations with antibiotics, which has proven itself very useful in these situations and has repeatedly demonstrated its impact.

Conclusions: The ever-growing threat of antimicrobial resistance to traditional antibiotics necessitates the introduction of new and effective approaches. Phage therapy represents an innovative and very effective method for treating infections caused by multidrug-resistant agents. Thanks to its specific activity and ability to selectively target pathogenic bacteria, it is becoming an attractive and highly promising alternative to current antibiotic treatment. One of its significant benefits is that phage-based therapy significantly reduces the negative impact on gut microbiome, as it targets only specific bacteria. However there are still certain obstacles, such as regulatory approval processes and standardization of production. Continuing research and ongoing clinical studies are bringing new insights and improvements that will surely help advance the development of phage treatment. The future of phage therapy lies not only in the treatment of severe infections, but it can also serve as a valuable tool in pathogen detection in food industry or contribute to the elimination of pathogenic bacteria in aquaculture and water ecosystem management. Therefore it is safe to say that this approach offers a significant promise not only in human medicine but also in other fields.

Key words: phage therapy, drug repurposing, antivirulence approaches, combination therapy, photosensitizers