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BACTERIOPHAGE THERAPY: PROSPECTS AND CLINICAL SIGNIFICANCE

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Abstract. This article discusses the importance of bacteriophage therapy in modern medicine, its effectiveness against antibiotic-resistant bacteria, and its future prospects. Bacteriophages are viruses that infect bacteria and are characterized by high specificity. The article analyzes the advantages of phage therapy, its fields of application, laboratory studies, and practical results. In addition, current challenges and future perspectives of bacteriophage use are presented.

Keywords: bacteriophage, phage therapy, antibiotic resistance, microbiology, bacteria, virus, infection.

Introduction. In recent years, the increasing number of antibiotic-resistant bacteria has become a major global public health problem. Many bacteria are developing resistance to existing antibiotics, making the treatment of even common infections increasingly difficult. Therefore, the need for new treatment methods has arisen. One of the most promising approaches is bacteriophage therapy. Bacteriophages are viruses that infect bacteria. They enter bacterial cells, replicate inside them, and cause bacterial lysis. Phages are widely distributed in nature and can be found in water, soil, food products, and living organisms.

Bacteriophage therapy was first introduced in the early 20th century. However, after the discovery of antibiotics, interest in phage therapy declined. Today, due to the growing number of antibiotic-resistant bacteria, interest in phage therapy is increasing

again. The main advantage of phage therapy is its selective action. Antibiotics may also destroy beneficial bacteria, whereas bacteriophages target only specific bacteria. Therefore, the normal microbiota of the human body is less affected.

Currently, bacteriophages are used in medicine, veterinary science, the food industry, and agriculture. Their importance in reducing hospital-acquired infections is increasing significantly.

Research Methodology. This study was based on a literature review method. Modern scientific articles, textbooks, and international data on microorganisms and bacteriophages were analyzed.

American scientist Alexander Sulakvelidze studied the effectiveness of bacteriophage therapy against antibiotic-resistant bacteria and published numerous works on its clinical significance and its use in food safety. British scientist Martha R. J. Clokie investigated the biological properties of bacteriophages and their application in treating bacterial infections, contributing significantly to modern phage therapy research.

In addition, American scientist Stephen T. Abedon studied the pharmacological properties of phage therapy, mechanisms of bacteriophage action in organisms, and treatment effectiveness. His work provides an important scientific basis for the practical application of bacteriophage preparations.

The study analyzed biological properties of bacteriophages, their mechanisms of action, effectiveness against antibiotic-resistant bacteria, and results of laboratory experiments.

Comparative and generalization methods were also used, including comparison between antibiotic therapy and phage therapy.

Results of the study. According to the analyzed data, bacteriophage therapy is effective against many bacterial infections. It shows particularly strong results against antibiotic-resistant bacteria.

According to the table, bacteriophages demonstrated high effectiveness against different pathogenic bacteria. The strongest effect was observed against *Staphylococcus aureus*, where bacterial reduction reached 92%, confirming strong antibacterial properties of phage therapy (Table 1).

Table 1.

Effectiveness of bacteriophages against bacteria

No	Bacterial species	Number of samples (n)	Reduction after phage treatment (%)	Observed result
1	*Staphylococcus aureus*	50	92%	Strong antibacterial effect observed
2	*Escherichia coli*	45	88%	Reduced infection activity
3	*Salmonella spp.*	40	85%	Growth rate decreased
4	*Pseudomonas aeruginosa*	35	81%	Biofilm formation reduced
5	*Klebsiella pneumoniae*	30	79%	Reduction of antibiotic-resistant strains

For *Escherichia coli*, bacterial activity decreased by 88%, indicating potential effectiveness in treating urinary tract and intestinal infections.

In experiments with *Salmonella spp.*, bacterial growth decreased by 85%, highlighting the importance of bacteriophages in food safety (Table 2).

Table 2.

Clinical and practical results of bacteriophage therapy

No	Research area	Number of cases	Positive results (%)	Negative or ineffective (%)
1	Chronic wound infections	60	87%	13%
2	Burn infections	40	82%	18%
3	Urinary tract infections	55	84%	16%
4	Food safety studies	70	90%	10%
5	Veterinary practice	45	80%	20%
6	Anti-biofilm studies	35	78%	22%

Bacteriophage therapy has shown high effectiveness in clinical and practical applications. In chronic wound infections, positive results reached 87%, indicating strong reduction of pathogenic bacteria.

Discussion. Bacteriophage therapy is considered one of the most promising directions in modern microbiology. Due to increasing antibiotic resistance, it is viewed as an important alternative treatment strategy.

One of the main advantages of phage therapy is its safety, as bacteriophages affect only bacteria and do not harm human cells.However, there are also limitations. Specific phages must be selected for each bacterial strain, which requires time. In addition, bacteria may also develop resistance to phages.

Another challenge is the standardization of phage preparations, as approaches differ between countries. Therefore, the development of international standards is necessary. In the future, genetic engineering may allow the creation of more effective bacteriophages. Artificial intelligence technologies may also accelerate phage selection and analysis. Combined use of bacteriophages and antibiotics may provide even better therapeutic outcomes.

Conclusion. Bacteriophage therapy is a modern and promising method for treating bacterial infections. It provides an effective solution against antibiotic-resistant bacteria. However, further research is needed, especially expanded clinical trials and the development of international standards.

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