Mini Review

How Bacteriophages are Revolutionizing the Fight Against *L. monocytogenes* in the Food Industry

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ABSTRACT

Bacteriophages, also known as phages, are viruses that infect and replicate within bacteria. These viruses are widely present in nature and are considered to be the most abundant biological entities on the planet. In recent years, bacteriophages have emerged as a promising alternative to antibiotics for the control of bacterial infections. Among the bacterial infections that bacteriophages can target is *Listeria monocytogenes* , a pathogenic bacterium that can cause serious foodborne illness in humans.

Listeria monocytogenes is a gram-positive bacterium that is commonly found in soil, water, and food. It is a facultative intracellular pathogen, which means that it is capable of invading and replicating within host cells. Listeriosis, the disease caused by *Listeria monocytogenes* , can range from a mild flu-like illness to a severe invasive disease that can lead to sepsis, meningitis, and even death, particularly in vulnerable populations such as pregnant women, the elderly, and immunocompromised individuals.

Keywords: Bacteriophages; Control measure; *Listeria monocytogenes* ; Antibiotic resistance; Biofilms

Introduction

Listeria monocytogenes is a foodborne pathogen that can cause serious illness and even death in susceptible individuals. It is a significant public health concern, and efforts to control its spread and growth in food processing environments are critical for preventing foodborne illness. The use of bacteriophages as a control measure against *Listeria monocytogenes* is gaining increasing attention as a promising alternative to traditional antibiotics.

Bacteriophages are naturally occurring viruses that infect and replicate within bacteria, leading to their destruction [1]. They are highly specific in their action, targeting only the specific strain of bacteria they are designed for, and have the ability to penetrate biofilms, making them a potential solution for controlling *Listeria monocytogenes* in food processing environments.

The use of bacteriophages as a control measure against *Listeria monocytogenes* has several advantages, including specificity, targeting of biofilms, reduced risk of antibiotic resistance, environmental friendliness, cost-effectiveness, and reduced risk of collateral damage. However, there are also some potential disadvantages, including limited spectrum of activity, stability and storage issues, regulatory issues, cost and availability, potential for bacterial resistance, and lack of knowledge and awareness [2].

Overall, the use of bacteriophages as a control measure against *Listeria monocytogenes* has shown promise and is an area of active research. However, more studies are needed to fully understand their efficacy, safety, and long-term effects on bacterial populations and the environment.

Usage

The use of bacteriophages to control *Listeria monocytogenes* has been investigated in various settings, including food processing environments, hospitals, and farms. Bacteriophages can be isolated from various sources, such as sewage, soil, and food, and can be selected based on their ability to infect and lyse the target bacteria. Once identified, these phages can be formulated into products that can be applied to surfaces, foods, or used in animal feed to reduce the prevalence of *Listeria monocytogenes*.

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Bacteriophages are viruses that can infect and replicate within bacteria. They are considered to be the most abundant biological entities on Earth and have recently emerged as a potential alternative to antibiotics for controlling bacterial infections. One bacterium that bacteriophages can target is *Listeria monocytogenes*, a pathogenic bacterium that can cause severe foodborne illness in humans.

Listeria monocytogenes is a gram-positive bacterium that is commonly found in soil, water, and food. It is a facultative intracellular pathogen, which means that it is capable of invading and replicating within host cells. Listeriosis, the disease caused by *Listeria monocytogenes* , can range from a mild flu-like illness to a severe invasive disease that can lead to sepsis, meningitis, and even death, particularly in vulnerable populations such as pregnant women, the elderly, and immunocompromised individuals.

Bacteriophages can be isolated from various sources, such as sewage, soil, and food, and can be selected based on their ability to infect and lyse the target bacteria [3]. Once identified, these phages can be formulated into products that can be applied to surfaces, foods, or used in animal feed to reduce the prevalence of *Listeria monocytogenes* .

The use of bacteriophages against *Listeria monocytogenes* has been investigated in various settings, including food processing environments, hospitals, and farms. In one study, a cocktail of bacteriophages was applied to the surface of raw chicken and was able to reduce the number of *Listeria monocytogenes* by more than 90%. In another study, the application of bacteriophages to food contact surfaces in a food processing plant was able to significantly reduce the prevalence of *Listeria monocytogenes* .

Despite the promising results of using bacteriophages against *Listeria monocytogenes* , there are still some challenges that need to be addressed. One of the challenges is the potential for the development of phage-resistant bacteria. Like antibiotics, the use of bacteriophages can exert selective pressure on the bacterial population, favoring the emergence of phage-resistant mutants. To mitigate this risk, a cocktail of phages that target different receptors on the bacterial surface can be used.

Advantages

One of the advantages of using bacteriophages as a control measure against *Listeria monocytogenes* is their specificity. Unlike antibiotics, which can also affect beneficial bacteria, bacteriophages only target the specific bacterial strain they are designed to infect. This means that the use of bacteriophages can help preserve the natural microbiota and reduce the risk of antibiotic resistance.

Another advantage of using bacteriophages against *Listeria monocytogenes* is their ability to penetrate biofilms. Biofilms are complex structures formed by bacteria that attach to surfaces, such as food processing equipment, and can protect the bacteria from disinfectants and antibiotics. Bacteriophages have been shown to penetrate biofilms and effectively reduce the number of bacteria within them, making them a potentially effective tool for controlling *Listeria monocytogenes* in food processing environments.

There are several advantages of using bacteriophages as a control measure against *Listeria monocytogenes* :

Specificity: Bacteriophages are highly specific in their action and only infect and kill the targeted bacterial strain. This specificity means that the use of bacteriophages to control *Listeria monocytogenes* does not affect the beneficial bacteria in the environment, thereby preserving the natural microbiota.

Targeting Biofilms: Bacteriophages have the ability to penetrate and disrupt biofilms formed by *Listeria monocytogenes* , which are often resistant to antibiotics and disinfectants. The ability of bacteriophages to target biofilms can lead to better control of *Listeria monocytogenes* in food processing environments.

Reducing the risk of antibiotic resistance: The overuse of antibiotics can lead to the development of antibiotic-resistant bacteria, which pose a significant threat to human health. The use of bacteriophages as an alternative to antibiotics can help reduce the risk of antibiotic resistance.

Environmental friendliness: Bacteriophages are naturally occurring viruses that are found in soil, water, and food, and their use as a control measure against *Listeria monocytogenes* is considered environmentally friendly.

Cost-effectiveness: The cost of developing and producing bacteriophage-based products is often lower than that of traditional antibiotics. Additionally, bacteriophages can be produced on an industrial scale, making them a cost-effective solution for controlling *Listeria monocytogenes* .

Reduced risk of collateral damage: The use of bacteriophages to control *Listeria monocytogenes* does not harm other organisms in the environment, as it is highly specific to the targeted bacteria. This reduces the risk of collateral damage to non-targeted organisms, making it a safe and effective control measure.

In conclusion, the use of bacteriophages as a control measure against *Listeria monocytogenes* has several advantages, including specificity, targeting of biofilms, reduced risk of antibiotic resistance, environmental friendliness, cost-effectiveness, and reduced risk of collateral damage [4]. These advantages make bacteriophages a promising alternative to traditional antibiotics for controlling *Listeria monocytogenes* in food processing environments and other settings.

Disadvantages

While there are several advantages of using bacteriophages as a control measure against *Listeria monocytogenes* , there are also some potential disadvantages:

Limited spectrum of activity: Bacteriophages are highly specific in their action and only infect and kill the targeted bacterial strain. This means that a cocktail of multiple bacteriophages may be needed to target different strains of *Listeria monocytogenes* , and new bacteriophages may need to be developed as *Listeria monocytogenes* strains evolve.

Stability and storage: Bacteriophages are sensitive to environmental factors such as pH, temperature, and UV radiation, which can reduce their stability and shelf life. This requires special storage conditions and handling procedures to ensure their effectiveness.

Regulatory issues: The use of bacteriophages as a control measure against *Listeria monocytogenes* in food production and processing environments may be subject to regulatory approval and may require additional testing and validation.

Cost and availability: The cost of developing and producing bacteriophage-based products can be higher than traditional antibiotics, and there may be limitations in the availability and accessibility of bacteriophages in some regions.

Potential for bacterial resistance: Although bacteriophages have not been shown to induce antibiotic resistance, there is a theoretical risk that bacteria may develop resistance to bacteriophages over time, particularly if they are used inappropriately.

Lack of knowledge and awareness: There may be a lack of awareness among food producers and processors about the use and effectiveness of bacteriophages as a control measure against *Listeria monocytogenes* , which may limit their adoption.

In conclusion, while the use of bacteriophages as a control measure against *Listeria monocytogenes* has several advantages, there are also some potential disadvantages, including limited spectrum of activity, stability and storage issues, regulatory issues, cost and availability, potential for bacterial resistance, and lack of knowledge and awareness [5]. These factors need to be carefully considered when assessing the suitability of bacteriophages as a control measure against *Listeria monocytogenes* .

Conclusion

Despite the promising results of using bacteriophages against *Listeria monocytogenes* , there are still some challenges that need to be addressed. One of the challenges is the potential for the development of phage-resistant bacteria. Like antibiotics, the use of bacteriophages can exert selective pressure on the bacterial population, favoring the emergence of phage-resistant mutants. To mitigate this risk, a cocktail of phages that target different receptors on the bacterial surface can be used.

In conclusion, bacteriophages have shown great potential as a tool for controlling *Listeria monocytogenes* , a pathogenic bacterium that can cause serious foodborne illness. The specificity and ability of bacteriophages to penetrate biofilms make them a promising alternative to antibiotics in the fight against bacterial infections. However, further research is needed to fully understand the potential risks and benefits of using bacteriophages in various settings and to develop effective strategies for their deployment.

References

1. Rollin H, William A. Hudson Bronchial Obstruction: Its Diagnosis and Treatment. *Radiology 22*, (1934).
2. World Health Organization. Global Surveillance, Prevention and Control of Chronic Respiratory Diseases: A Comprehensive Approach. Geneva, Switzerland: *World Health Organ*, 1-147 (2007).
3. Murray CJ, Lopez AD, Mathers CD, et al. The Global Burden of Disease 2000 project: Aims, *Methods Data Sources 36*, 1-57 (2001).
4. Devine, JF. Chronic obstructive pulmonary disease: an overview. *Am Health Drug Benefits 1*, 34-42 (2008).
5. Martinez, Jose Antonio Baddini. "Not all that wheezes is asthma!" Jornal brasileiro de pneumologia: *publicacao of Soc Bras Pneumol Tisilogia 39*, 518-520 (2013).