

Chapter 8

Bacterial Pathogens in Food and Their Control by Bacteriophages

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ABSTRACT

Food safety ensures reduced food losses and therefore contributes to food security. The factors causing the contamination of the food may threaten the safe consumption and make the foods harmful. For this reason, it is necessary to utilize various resources to prevent the food from being contaminated in all stages of the food chain. Purified high titer phage lysates have been used for the species-specific control of bacteria during the pre and postharvest phases of food production and storage. This chapter presents recent advances in bacteriophage research and their application in the area of food safety. Some of the components of this chapter are general facts on phage biology that are relevant to their application for control and detection of bacterial

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pathogens in food and environmental samples, application of bacteriophages to control growth of bacterial pathogens and spoilage organisms in food and food processing environment, detection and identification of bacterial pathogens, and advantages of bacteriophage-based methods and their shortcomings.

1. INTRODUCTION AND HISTORY

Food Borne diseases are a major problem of these days and increasing day by day. These diseases are caused by various types of pathogens and most of these illnesses are caused due to bacteria (Farooq *et al.*, 2019). These foods borne diseases are affecting health and working efficiency of people and increasing burden on health system along with major economic losses of many countries. World Health Organization has reported that only diarrheal disease caused approximately 1.9 million death of children every year in the world. Pathogens can infect food products at any point in the food supply chain, including during cultivation, harvesting, killing, milking, processing, and, ultimately, eating (Garcia *et al.*, 2008).

Even at the expense of food quality, significant efforts have been taken to battle germs in order to avoid food-borne illnesses. However, these methods are unreliable and alter the organoleptic qualities of food commodities. Examples of these approaches include the use of heat, chemicals, or UV light. Additionally, there are some restrictions on the application of these methods, such as the inability to apply certain chemicals directly on fresh produce or food that is ready to eat. Furthermore, prolonged exposure to antimicrobial substances may cause germs to become resistant (Ryan *et al.*, 2011). Therefore, it is imperative to apply novel techniques or approaches to guarantee food safety and quality and avoid food-borne illnesses. Utilizing natural enemies of bacteria is one strategy to avoid bacterial contamination in food, which can reduce the negative effects of the processing and preservation techniques now in use to guarantee food safety and quality (Ryan *et al.*, 2011).

A class of viruses known as “bacteriophages” (derived from the Greek word “phagein,” which means “to eat”) infect and multiply within bacteria but do not pose a threat to human health (Chanishvili, 2012). Bacteriophages are found everywhere in the earth in different ecosystem like sahara desert, cold and hot springs (Sharma *et al.*, 2017). It is estimated that there are approximately 10^{31} particles with different size, structure and genome organization. So, in contrast to different antimicrobial approaches bacteriophages is an effective approach to combat bacterial pathogens due to their unique properties. Furthermore, the sensory qualities of food are unaffected by Phage treatments, and issues with bacterial resistance to certain chemicals may be readily resolved (Ishaq *et al.*, 2020; Thung *et al.*, 2019; Li *et al.*, 2022). Additionally,

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