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Editorial

Bacteriophages as Future Prophylactic and Therapeutic Agents against Foodborne Bacterial Pathogens

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Foodborne bacterial pathogens have been a global health concern due to their geographic and physiological diversity. They can be found in every part of the world regardless of geographical location and climate. Moreover, some of them have ability to tolerate harsh conditions such as high or low temperature and can produce heat stable toxins. Even worse, foods that are contaminated with these bacteria may not look, taste or smell any different from foods that are safe to eat. The diseases associated with foodborne bacterial pathogens affect not only individual health but also nations' budgets. Both industrialized and developing countries have spent large amount of money to prevent and treat the diseases annually. Although many national and international organizations responsible for surveillance and prevention of foodborne diseases work harder every year, the disease outbreaks still occur. Furthermore, use of antibiotics that is the most common therapeutic approach for foodborne diseases has been questionable. The major concern on antibiotics is that their use can lead to the development of drug resistance in pathogenic bacteria that may transfer to environmental and other pathogenic bacteria. To alleviate such problems, many attempts have been recently exercised to look for safe effective alternative approaches to control foodborne bacterial infection.One of the promising candidates is bacteriophage therapy that is the use of bacteriophages, bacterial viruses, as antimicrobial agents to inhibit bacterial growth or to kill bacteria.

Since the discovery by Twort in 1915 and by d'Hérelle in 1917 [1], bacteriophages have been used for treatment and prophylaxis of various bacterial infectious diseases until the advent of antibiotics in 1940s.

Another major factor causing the abandon of bacteriophage therapy back in those days is the inconsistency of the approach due to lacks of sophisticated technology to study bacteriophages in depth. However, abuse of antibiotics over the past years has generated a number of problems, especially the emergence of many new drug resistant bacteria. Therefore, the regulated use of antibiotics has been recently advised. Does the "antibiotics era" nearly come to an end? Or Does the world is about to switch back to "pre-antibiotic era" when bacteriophages were used as antibacterial agents? In the modern day when sophisticated technology required for the investigation of bacteriophages in depth is available, bacteriophages may have advantages over antibiotics in many aspects such as

- They have high specificity to their host, leaving untouched the normal flora. This property makes bacteriophages cause less side effects than antibiotics
- They have self-replicating and self-limiting ability, meaning that bacteriophages can multiply when host bacteria are present and fade out when host bacteria are absent.
- They have ability to continuously adapt to bacteria that develop bacteriophage resistance; thereby, the development of bacteriophage resistant bacteria is less probable.
- They have low inherent toxicity because they consist mostly of nucleic acids and proteins.
- The development of therapeutic bacteriophages is less time consuming and less costly than that of antibiotics.

Bacteriophages can be used as prophylactic and therapeutic agents against foodborne pathogenic bacteria. Additionally, they can be used individually or as bacteriophage cocktails (combinations of more than one bacteriophages) to inhibit target bacteria [2]. They have been reported to successfully inhibit several foodborne pathogenic bacteria such as *Escherichia coli* O157:H7, *Salmonella enterica, Campylobacter jejuni, Listeria monocytogenes, Staphylococcus aureus, Cronobactersakazakii* and *Vibrio* spp [3-5]. Their safety and effectiveness in controlling foodborne bacterial pathogens has led to the development of different bacteriophage products already approved by United State Food and Drug Administration (USFDA). Examples of bacterio phage products approved to have generally recognized as safe(GRAS) status are List Shield produced by Intralytix to kill *L. monocytogenes* (approved in 2006), LISTEX produced by Micreos to kill *L. monocytogenes* (approved in

2006) and Eco Shield produced by Intralytix to kill *E. coli* O157:H7 (approved in 2011) [6]. In the near future, bacteriophages will play a major role in prevention and treatment of foodborne bacterial infections.

Conflict of Interest

None.

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