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Short communication

Use of Bacteriophage to Control Enter hemorrhagic Escherichia coli on Green Bell Peppers and *Baby Spinach* Leaves

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Introduction

Produce consumption has been increasing among American consumers and is often associated with many health benefits (1). In contrast to the nutritional benefits, fresh produce has also been associated with several notable outbreaks of food borne pathogens. By definition, fresh produce is exposed to minimal processing which renders the elimination of potential contaminants challenging. Conventional methods for food preservation such as heat treatments, drying, or the addition of some antimicrobials are not viable options. Moreover, fresh produce is often consumed raw which means that, unlike other food items such as meat, the preparation of produce by the consumer does not include a final heat treatment to eliminate pathogenic microorganisms. As a result, fresh produce safety is perhaps one of the most researched areas in food microbiology, requiring novel technologies to effectively prevent outbreaks of pathogens. The effects of food borne disease include not only health risks for the consumer, but pose an economic burden as well. A 2011-study estimates the cost of food borne illness to be $152 million annually (9). Similarly, the Center for Disease Control (2) estimates that there is an annual 76 million cases of food borne disease which result in 325,000 hospitalizations and 5,000 deaths (8). Escherichia coli O157:H7 is a major contributor to these totals. Although the exact numbers are difficult to tabulate since many illnesses are not reported, the CDC estimates that there are 265,000 cases of illnesses resulting from Shiga toxin-producing E. coli (STEC) every year. Of those cases, approximately 36% are attributed to the strain E. coli O157:H7 (3).

Escherichia coli O157:H7 was determined to be one of the top five pathogens contributing to domestically acquired food borne illnesses that resulted in hospitalization for 2011 (8). Bacteriophage treatment may be an effective form of biocontrol for pathogens such as *E.coli* O157:H7 on produce. Previously, researchers isolated phages from the environment and evaluated their potential for biocontrol of E. coli O157 in liquid culture based on the receptor specificity of the phages for the O157 antigen (5). O'Flynn et al., have published preliminary work showing that a cocktail of three phages isolated against E. coli O157:H7 was effective at controlling E. coli on the surface of beef steaks, reducing the E. coli population below detectable limits (7). The efficacy of phage treatment has also been evaluated on fresh-cut produce for the control of Salmonella by Leverentz et al (6). Reduction of Salmonella ranged from 2.5-3.5 logs CFU/g of cut melon, depending on the storage temperature, while virtually no reduction was observed on cut apple slices. The ineffectiveness of phage treatment on apple slices was attributed to low pH, a limiting factor for many phage applications (6). While many fruits have an acidity level that may render phage treatment ineffective, fresh vegetables' pH is often more suitable for bacteriophage. Additionally, the non-destructive nature of phage treatment also lends itself to application within the fresh vegetable industry. The objective of this study was to evaluate the efficacy of a phage lysate dip to control E. coli O157:H7 on fresh green peppers and baby spinach leaves.

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