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Effect of the MS Bacteriophage on STEC O157:H7 Populations in Beef

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Objectives

This research was conducted to evaluate the killing efficiency of the Mello-Shebs (MS) O157:H7 bacteriophage against three strains of STEC O157:H7 in vitro and on beef surface under aerobic conditions.

Materials and Methods

Killing efficiency of bacteriophage MS O157:H7 (University of Nevada, Reno– Meat Science library) was tested against three strains including ATCC® 43895 (stx1 and stx2 positive), ATCC® 43894 (stx1 and stx2 positive), and Micreos 128. To determine the efficiency of the phage in vitro, each strain of STEC O157:H7 was incubated at 37°C overnight and then diluted to achieve 1500 CFU/mL. Subsequently, 0.1 mL of this dilution for each strain was plated onto 1.6% LB agar plates. The experimental plates received 0.1 mL of phage solution at 10^8 PFU/ml, in quadruplicate. The plates were incubated at 37°C for 24 h and the resulting colonies were counted and compared to controls to determine killing efficiency of the phage against each STEC strain. To evaluate the effect of bacteriophage application on beef, *m. cutaneous trunci* (rose meat, IMPS 194) were sourced from a USDA inspected facility, fabricated into 100 cm^2 and randomly assigned to either control or treatment groups. Samples acclimated to 7°C were inoculated with a STEC cocktail to result in a contamination level of approximately 3 log CFU/cm^2 on meat surfaces after swabbing. After bacterial attachment for 30 min at 7°C, control samples were treated with sterile buffered peptone water (BPW) and experimental samples were treated with the phage solution at 10^8 PFU/ml. After dwelling for 1 h at 7°C, samples were swabbed and the resulting 1 mL was thoroughly vortexed, serial diluted, and plated onto LB plates. The plates were incubated at 37°C for 24 h and the resulting colonies were counted. Data was analyzed as a completely randomized design in SAS. Means were separated by LSMEANS and differences were indicated by using DIFF functions.

Results

In vitro killing efficiency of bacteriophage MS O157:H7 was determined to be 85%, 98.89%, and 97.16% for ATCC® 43894, ATCC® 43895, and Micreos 128 strains, respectively. On beef, bacteriophage application significantly decreased STEC loads by 0.626 log CFU/cm^2 ($P = 0.0184$, SEM = 0.21).

Conclusion

Bacteriophage MS-O157:H7 applications as an antimicrobial on beef reduces STEC O157:H7 populations on contaminated beef. Commercial applications of this bacteriophage may improve STEC control in meat products, however, having this treatment combined with other interventions such as organic acids or UV light treatment may increase the killing efficiency of STEC populations, warranting further research to determine industry applicability.