Impact of Amygdalin and Lactic Acid on Biofilm Formation of Typhoidal and Nontyphoidal *Salmonella* Serovars in Abiotic Environment

Introduction: As high as 80% of bacterial infections could be linked to sessile microbial cells and biofilms. Various serovars of typhoidal and nontyphoidal *Salmonella* could form biofilm on biotic and abiotic surfaces.

Purpose: The current study compared biofilm formation of typhoidal and nontyphoidal *Salmonella* serovars for up to two weeks and investigated the sensitivity of planktonic and sessile cells of the pathogen to amygdalin and lactic acid.

Methods: Four-strain mixtures of typhoidal and nontyphoidal *Salmonella* serovars were spot-inoculated on surface of stainless-steel coupons (type 304, 2b finish) and were half-submerged in sterilized milk (3% fat) at 25 °C for up to two weeks for biofilm formation. After removal of loosely attached cells, the coupons were then treated with distilled water (control), 20% amygdalin, and 20% lactic acid (immersion for 90 seconds) to evaluate the sensitivity of the planktonic and sessile cells to the antimicrobials. Sessile cells were recovered from coupons using glass beads and sonication. Results of the trials were statistically analyzed using Tukey and Dunnett's-adjusted ANOVA at type I error level of 5%.

Results: During the two-week aerobic storage at 25°C, both typhoidal and nontyphoidal serovars of the pathogen illustrated comparable ($P \geq 0.05$) biofilm formation and sensitivity to amygdalin and lactic acid. While treatment with amygdalin resulted in modest reductions of <1 log CFU/cm2 of the pathogen, treatments with 20% lactic acid resulted in microbiologically significant reductions ($P < 0.05$) of more than 99.9% of the inoculated pathogen.

Significance: Under the conditions of our experiments we observed that typhoidal and nontyphoidal *Salmonella* serovars have comparable biofilm formation and sensitivity to selected antimicrobials. Thus, an antimicrobial treatment validated against nontyphoidal *Salmonella* could almost certainly be equally effective against typhoidal serovars as well. This could be of importance in preparation of Sanitation Standard Operating Procedures, as prerequisite programs of HACCP and FSMA-based food safety management systems.