



Lactic acid bacteria protect human intestinal epithelial cells from *Staphylococcus aureus* and *Pseudomonas aeruginosa* infections

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ABSTRACT. *Staphylococcus aureus* and *Pseudomonas aeruginosa* are opportunistic pathogens that cause nosocomial and food-borne infections. They promote intestinal diseases. Gastrointestinal colonization by *S. aureus* and *P. aeruginosa* has rarely been researched. These organisms spread to extra gastrointestinal niches, resulting in increasingly progressive infections. Lactic acid bacteria are Gram-positive bacteria that produce lactic acid as the major end-product of carbohydrate fermentation. These bacteria inhibit pathogen colonization and modulate the host immune response. This study aimed to investigate the effects of *Lactobacillus acidophilus* and *Lactobacillus rhamnosus* on enteric infections caused by the paradigmatic human pathogens *S. aureus* ATCC25923 and *P. aeruginosa* ATCC27853. The effect of whole cells and neutralized cell-free supernatant (CFS) of the lactobacilli on LoVo human carcinoma enterocyte (ATCC CCL-229) infection was analyzed by co-exposure, pre-exposure, and post-exposure studies. Simultaneous application of whole cells and CFS of the lactobacilli significantly eradicated enterocyte infection ($P < 0.05$); however, this effect was not seen when the whole cells and CFS

were added after or prior to the infection ($P > 0.05$). This result could be attributed to interference by extracellular polymeric substances and cell surface hydrophobicity, which resulted in the development of a pathogen that did not form colonies. Furthermore, results of the plate count and LIVE/DEAD BacLight bacterial viability staining attributed this inhibition to a non-bacteriocin-like substance, which acted independently of organic acid and H_2O_2 production. Based on these results, the cell-free supernatant derived from lactobacilli was concluded to restrain the development of *S. aureus* and *P. aeruginosa* enteric infections.

Keywords: Infection; Intestinal epithelial cells; Lactic acid bacteria; *Pseudomonas aeruginosa*; *Staphylococcus aureus*