Potential impact of the resistance to quaternary ammonium disinfectants on the persistence of *Listeria monocytogenes* in food processing environments

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Abstract

The persistence of certain strains of *Listeria monocytogenes*, even after the food processing environment has been cleaned and disinfected, suggests that this may be related to phenomena that reduce the concentration of the disinfectants to subinhibitory levels. This includes (i) the existence of environmental niches or reservoirs that are difficult for disinfectants to reach, (ii) microorganisms that form biofilms and create microenvironments in which adequate concentrations of disinfectants cannot be attained, and (iii) the acquisition of resistance mechanisms in *L. monocytogenes*, including those that lead to a reduction in the intracellular concentration of the disinfectants. The only available data with regard to the resistance of *L. monocytogenes* to disinfectants applied in food production environments refer to genotypic resistance to quaternary ammonium compounds (QACs). Although there are several well-characterized efflux pumps that confer resistance to QACs, it is a low-level resistance that does not generate resistance to QACs at the concentrations applied in the food industry. However, dilution in the environment and biodegradation result in QAC concentration gradients. As a result, the microorganisms are frequently exposed to subinhibitory concentrations of QACs. Therefore, the low-level resistance to QACs in *L. monocytogenes* may contribute to its environmental adaptation and persistence. In fact, in certain cases, the relationship between low-level resistance and the environmental persistence of *L. monocytogenes* in different food production chains has been previously established. The resistant strains would have survival advantages in these environments over sensitive strains, such as the ability to form biofilms in the presence of increased biocide concentrations.