

**Title** Growth and bacteriocin production by lactic acid bacteria in vegetable broth and their effectiveness at reducing *Listeria monocytogenes* in vitro and in fresh-cut lettuce

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### Abstract

The fresh-cut fruit and vegetable industry is searching for alternatives to replace chemical treatments with biopreservative approaches that ensure the safety of the product and fulfil consumer preferences for minimally processed foods. In this study, the use of bacteriocins produced by lactic acid bacteria has been tested as a substitute for chemical disinfection of fresh-cut iceberg lettuce. First, the ability of several non-plant origin bacteriocinogenic strains (nisin Z<sup>+</sup>, plantaricin C<sup>+</sup>, lacticin 481<sup>+</sup>, coagulin<sup>+</sup> or pediocin PA-1<sup>+</sup>) to grow in a lettuce extract at 4 °C, 10 °C and 32 °C was tested. All strains were able to grow, but bacteriocin production was predominantly detected at 32 °C. Addition of bacteriocinogenic supernatants (nisin<sup>+</sup>, coagulin<sup>+</sup> and a nisin-coagulin<sup>+</sup> cocktail) to tryptic-soy agar plates inoculated with *Listeria monocytogenes* reduced *Listeria* counts by approximately 1–1.5 log units compared with the control plates without bacteriocin, after 48 h of storage at 4 °C. The effect of washing with bacteriocin-containing solutions on survival and proliferation of *Listeria monocytogenes* was also evaluated in fresh-cut lettuce packaged in macro-perforated polypropylene bags and stored for 7 days at 4 °C. Washing fresh-cut lettuce with these solutions decreased the viability of *Listeria monocytogenes* by 1.2–1.6 log units immediately after treatment, but, during storage at 4 °C, bacteriocin treatments only exerted minimal control over the growth of the pathogen. Natural microbiota were little affected by bacteriocins during storage.