Processing Treatments for Control of *Listeria monocytogenes* on Frankfurters

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Summary and Implications

Frankfurters were surface inoculated with a 5-strain mixture of *Listeria monocytogenes* then treated with a pediocin (ALTA™ 2341), post-packaging pasteurization with heat or post-packaging irradiation. All treatments effectively reduced *L. monocytogenes* numbers but combinations, particularly pediocin with heat or with irradiation were most effective for both reducing *L. monocytogenes* and suppressing growth of survivors. Pediocin and irradiation treatments were synergistic and achieved the greatest control of *L. monocytogenes* of all the treatments studied. These treatments offer meat processors alternatives to improve control of *L. monocytogenes* on processed meats.

Introduction

Several outbreaks of *Listeria* infections have been linked to ready-to-eat (RTE) processed meats such as frankfurters. *L. monocytogenes* is common in the environment and, while easily killed by heat, is very likely to contaminate processed meat products after cooking and before packaging despite the best efforts of meat processors. It has become clear that additional antilisterial measures are necessary to ensure the elimination of this pathogen from RTE meat products. Treatments that are effective post-packaging offer the most potential because no recontamination can occur from the environment after the package is sealed. Therefore, addition of antilisterial compounds such as pediocin, post-packaging pasteurization or post-packaging irradiation should offer significant improvement in the safety of RTE meat products.

Materials and Methods

Frankfurters were packaged as single links, 5 links per package or 10 links per package and inoculated with a 5-strain mixture of *L. monocytogenes*. Before sealing, some of each package type was treated with 3,000 or 6,000 units of pediocin (ALTA™ 2341). After sealing the packages a portion of each package type was submitted to pasteurization in hot water or to irradiation (1.2 or 2.3kGy doses). All product treatments were then divided for storage at 4°C, 10°C and 25°C. *L. monocytogenes* numbers were assessed during storage.

Results and Discussion

Figure 1 shows the effect of pediocin alone on *L. monocytogenes* at 4°C. The number of organisms was reduced initially by pediocin and the survivors grew more slowly than samples without pediocin. The effectiveness of pediocin was highly temperature dependent with survivors growing more rapidly at 10°C and 25°C than at 4°C. Post packaging pasteurization was effectively and, more so, when combined with pediocin (Figure 2). An important consideration for post-packaging heat treatments is the packaging arrangement of frankfurter links because the product surface not in contact with the package film offers protection for *L. monocytogenes.* Thus, 10-link packages resulted in greater survival than 5-link packages. Single-link packages resulted in the greatest reduction of *L. monocytogenes* numbers. Irradiation (Figure 3) was very effective in reducing *L. monocytogenes* on frankfurters, and especially when combined with pediocin. The combination of pediocin with irradiation resulted in complete elimination of *L. monocytogenes* at 4°C.

Acknowledgements

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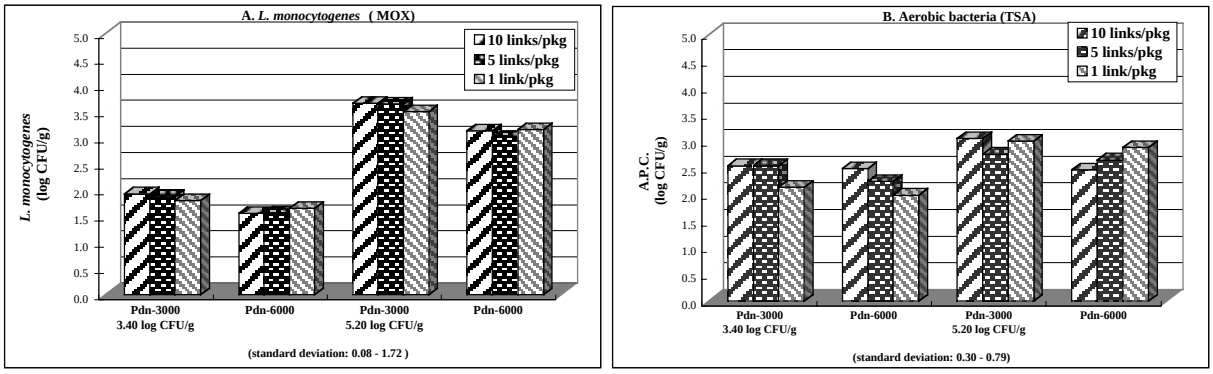
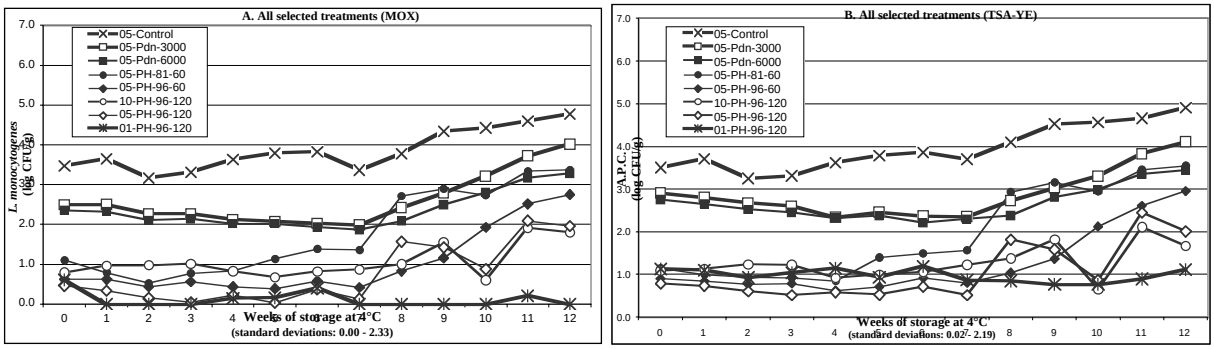
Figure 1. Survival of *Listeria monocytogenes* and aerobic bacteria on the surface of frankfurters treated with pediocin (in ALTA™ 2341) at 3,000 AU or 6,000 AU; A. *L. monocytogenes* counts (3.40 and 5.20 log CFU/g inoculations) on MOX agar; B. Aerobic bacterial counts (A.P.C.) on TSA



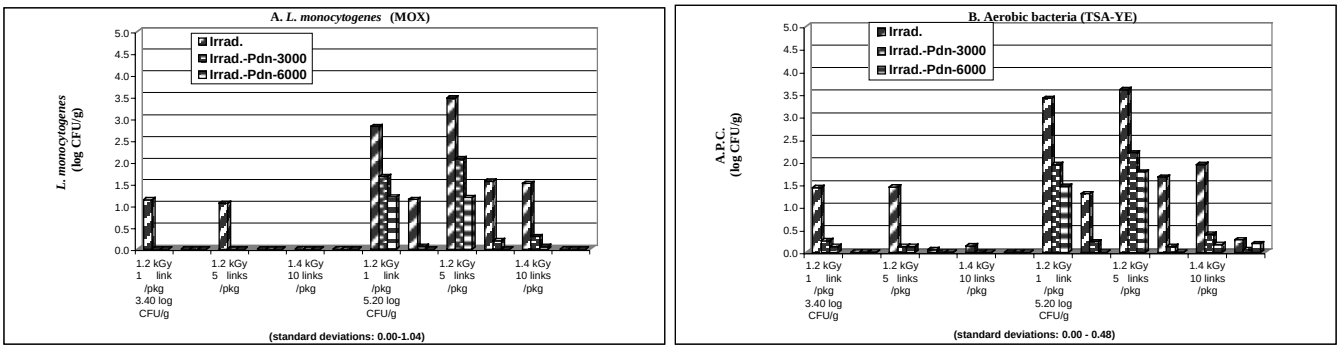
Pdn-3000: Frankfurters (1, 5 & 10 links[s]) treated with 3,000 AU pediocin per link
Pdn-6000: Frankfurters (1, 5 & 10 links[s]) treated with 6,000 AU pediocin per link

Figure 2. Surival and growth of *Listeria monocytogenes* (3.40 log CFU/g inoculation) on the surface of frankfurters treated with pediocin (in ALTA⏐ 2341) combined with post-packaging thermal pasteurization (PPTP) and stored at 4ºC; All selected treatments listed below (*L. monocytogenes* on MOX agar)



05-Pdn-3000: Frankfurters (5 links/pkg) treated with 3,000 AU pediocin
05-Pdn-6000: Frankfurters (5 links/pkg) treated with 6,000 AU pediocin
05-PH-81-60: Frankfurters (5 links/pkg) treated with 6,000 AU pediocin and immersed in hot water at 81ºC for 60s
05-PH-96-60: Frankfurters (5 links/pkg) treated with 6,000 AU pediocin and immersed in hot water at 96ºC for 60s
10-PH-96-60: Frankfurters (10 links/pkg) treated with 6,000 AU pediocin and immersed in hot water at 96ºC for 120s
05-PH-96-60: Frankfurters (5 links/pkg) treated with 6,000 AU pediocin and immersed in hot water at 96ºC for 120s
01-PH-96-120: Frankfurters (1 links/pkg) treated with 6,000 AU pediocin and immersed in hot water at 96ºC for 120s
0.0 log CFU/g represents an undetectable number of *L. monocytogenes.*

Figure 3. Survival of *Listeria monocytogenes* and aerobic microorganisms on the surface of frankfurters treated with pediocin (in ALTA™ 2341) and post-packaging irradiation; A. *L. monocytogenes* counts (3.40 & 5.20 log CFU/g inoculations) on MOX agar, B. Aerobic bacterial counts (A.P.C.) on TSA–YE agar.



Irrad.: Frankfurters (1, 5 and 10 link[s]/pkg) irradiated at 1.2, 1.4, 2.3 and 3.5 kGy
Irrad.-Pdn-3000: Frankfurters (1, 5 and 10 link[s]/pkg) treated with 3,000 AU pediocin and irradiated at 1.2, 1.4, 2.3 and 3.5 kGy
0.0 log CFU/g represents an undetectable number of *L. monocytogenes.*