

Combining Pediocin (ALTA™ 2341) with Irradiation for Control of *Listeria monocytogenes*.

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Summary and Implications

Pediocin (ALTA™ 2341) was studied in combination with irradiation treatments for control of *Listeria monocytogenes* on ready-to-eat (RTE) meat products. Both pediocin and irradiation were effective but the combination was highly effective and synergistic. Therefore, the use of pediocin for RTE meats that are irradiated should permit use of lower irradiation doses and improved product quality because of less irradiation-induced off-odors.

Introduction

Listeria monocytogenes has been identified as a pathogen of major concern for ready-to-eat (RTE) meat products. The organism is difficult to eradicate from meat plant environments and typically contaminates products after cooking and before packaging. Consequently, inhibitory treatments that exert their influence in the package after sealing will have greatest impact on safety from this organism. Irradiation has been clearly shown to be highly effective for inactivating *L. monocytogenes* but often introduces quality changes to RTE meats. Pediocin has been shown to reduce *L. monocytogenes* numbers. Combining pediocin with irradiation may permit use of lower irradiation doses to achieve control of *L. monocytogenes* on RTE meat products and minimize the quality changes often associated with irradiation of these products.

Materials and Methods

Frankfurters for this study were prepared for packaging after manufacturing was complete by placing single, 5- and 10-link groups of frankfurters in flexible pouches. Frankfurters were sprayed with pediocin (ALTA™ 2341) and inoculated with a 5-strain mixture of *L. monocytogenes*. Packages were then sealed under vacuum, irradiated with 0, 1.2, 1.4, 2.3 or 3.5 kGy doses. Packages from each treatment group were then stored at 4°C, 10°C and 25°C. Surviving *L.*

monocytogenes was enumerated periodically during storage for up to 12 weeks. Uninoculated samples were also evaluated for quality effects of the treatments by measuring purge, color, texture, odor and rancidity of the frankfurters during storage.

Results and Discussion

Results of the combined treatments of pediocin and irradiation on survival and growth of *L. monocytogenes* at 10°C are shown in Fig. 1. Pediocin alone reduced *L. monocytogenes* by 1.5-2.0 log CFU/g and suppressed growth of survivors for about two weeks at 10°C. Irradiation with pediocin dramatically reduced *L. monocytogenes* counts by as much as 5.2 log CFU/g. While initial counts were reduced to essentially zero following irradiation, the lowest dose (1.2 kGy) allowed recovery and growth after two weeks. The impact of irradiation was potentiated by the presence of pediocin and a highly significant ($P < 0.001$) interaction between the two treatments was observed, suggesting a synergistic effect of these two treatments on *L. monocytogenes*. The erratic recovery of *L. monocytogenes* in packages receiving doses of 2.3 kGy or greater (Fig. 1) probably reflects injury to the cells followed by partial recovery. Package size (1, 5 or 10 links) did not affect the antilisterial impact of the irradiation treatments as it did for thermal pasteurization in other studies. Product quality was largely unaffected by the low-dose irradiation treatment. Therefore, pediocin combined with low-dose irradiation is a very effective means of controlling *L. monocytogenes* on RTE meat products and is more effective than post-packaging thermal pasteurization.

Acknowledgement

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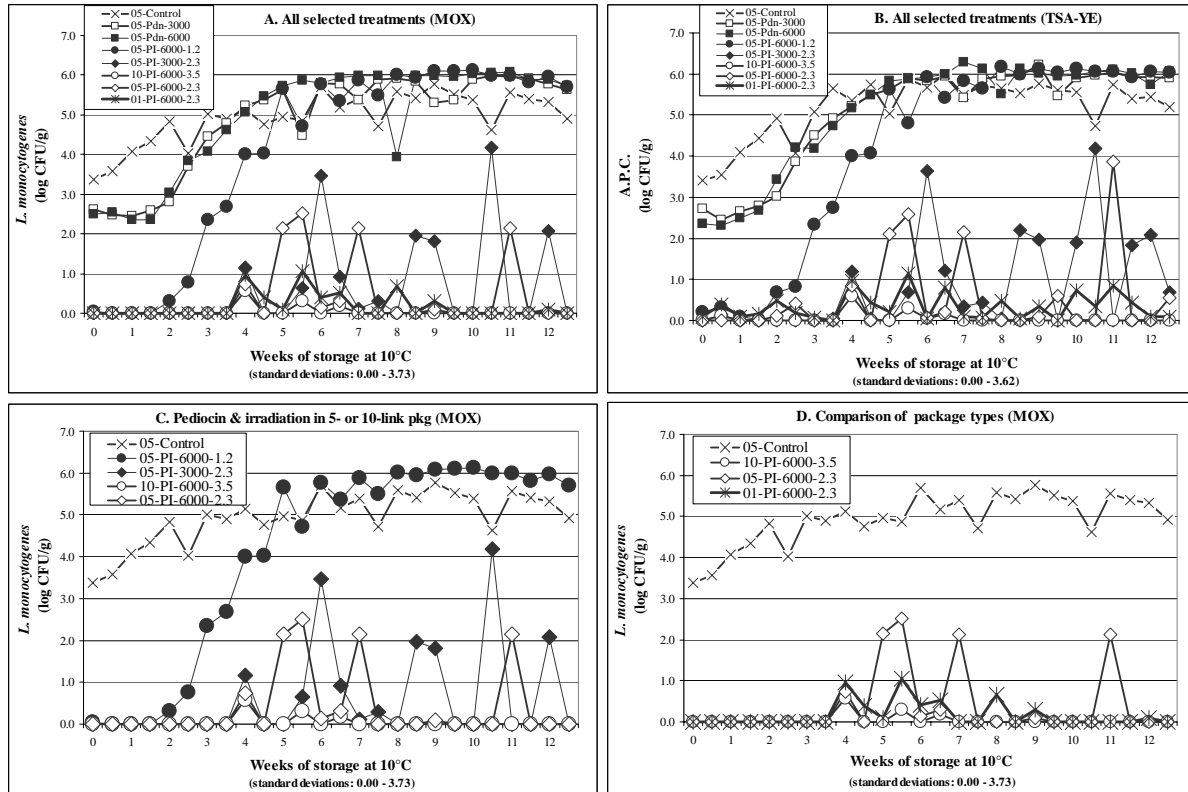


Figure 1. Survival and growth of *Listeria monocytogenes* (3.40 log CFU/g inoculation) and aerobic bacteria on the surface of frankfurters treated with pediocin combined with postpackaging irradiation during storage at 10°C. (A) All selected treatments listed below (*L. monocytogenes* on MOX agar), (B) all selected treatments listed below (aerobic plate counts on TSA-YE agar), (C) treatments for frankfurters treated with Pdn-3000 or Pdn-6000 and irradiated at 1.2, 2.3, or 3.5 kGy in 5-link or 10-link packages. 05-Pdn-3000: frankfurters (5 links per package) treated with 3,000 AU pediocin. 05-Pdn-6000: frankfurters (5 links per packages) treated with 6,000 AU pediocin. 05-PI-6000-1.2: frankfurters (5 links per package) treated with 6,000 AU pediocin and irradiated at 1.2 kGy. 05-PI-3000-2.3: frankfurters (5 links per package) treated with 3,000 AU pediocin and irradiated at 2.3 kGy. 10-PI-6000-3.5: frankfurters (10 links per package) treated with 6,000 AU pediocin and irradiated at 3.5 kGy. 05-PI-6000-2.3: frankfurters (5 links per package) treated with 6,000 AU pediocin and irradiated at 2.3 kGy. 01-PI-6000-2.3: frankfurters (1 link per package) treated with 6,000 AU pediocin and irradiated at 1.2 kGy. 0.00 log CFU/g represents an undetectable number of *L. monocytogenes*.