Packaging Systems and Storage Times Serve as Post-Lethality Treatments for *Listeria monocytogenes* on Whole Muscle Beef Jerky

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Introduction

Following several outbreaks involving *Listeria monocytogenes* in ready-to-eat meat and poultry products, the United States Department of Agriculture Food Safety and Inspection Service required that processors of these products implement post-processing intervention strategies for controlling *L. monocytogenes*. The USDA defines a post-lethality treatment as a process that reduces *L. monocytogenes* by at least 1 log. Research has shown that packaging can generate a 1 log *L. monocytogenes* reduction following 1 or more weeks of storage at room temperature. The objective of our study was to determine the effect of packaging system and storage time on reducing *L. monocytogenes* on shelf-stable whole muscle jerky.

Experimental Procedures

Whole muscle beef jerky was cut into 1.6 × 1.6 inch pieces, dipped into a five-strain *L. monocytogenes* cocktail, and dried at room temperature for 1 to 2 hours to allow water activity to reach its original level prior to inoculation. Inoculated pieces of jerky were then packaged in one of four packaging systems: heat sealed, heat sealed with oxygen scavenger, nitrogen flushed with oxygen scavenger, and vacuum. Packages were then stored at room temperature for 24, 48, and 72 hours and 30 days to determine whether storage time and packaging system had any effect on reduction of *L. monocytogenes*.

Packaged jerky was sampled at 0, 24, 48, and 72 hours after packaging and after 30 days of ambient temperature storage to determine *L. monocytogenes* population reductions. Prior to microbiological sampling, the atmosphere of each packaging treatment was measured to determine the oxygen concentration. Three replications were conducted for this study, and each replication consisted of duplicate samples.

Results and Discussion

Following 24 hours of storage, the heat sealed with oxygen scavenger and vacuum packaging treatments both achieved a 1 log reduction of *L. monocytogenes* (Figure 1). The heat sealed and nitrogen flushed with oxygen scavenger packaging treatments did not achieve the 1 log reduction until 48 hours after packaging. At 72 hours post-packaging, the nitrogen flushed with oxygen scavenger treatment was less effective than the other packaging treatments, but it still achieved the required 1 log reduction of *L. monocytogenes*. After 30 days of room temperature storage, *L. monocytogenes* was reduced by more than 3.5 log CFU/0.39 in.^{2} for all packaging treatments. At all times, oxygen content was less than 0.01% for the heat sealed with oxygen scavenger, vacuum, and nitrogen flushed with oxygen scavenger packaging treatments.

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Implications

Using the heat sealed with oxygen scavenger and vacuum packaging treatments in conjunction with a 24-hour storage time prior to shipping reduced *L. monocytogenes* populations by 1 log, and all packaging treatments reduced *L. monocytogenes* populations by at least 1 log after 48 hours of storage. Small and large beef jerky processing facilities can use any of these packaging systems in conjunction with a storage time of at least 48 hours as *L. monocytogenes* post-lethality control treatments.

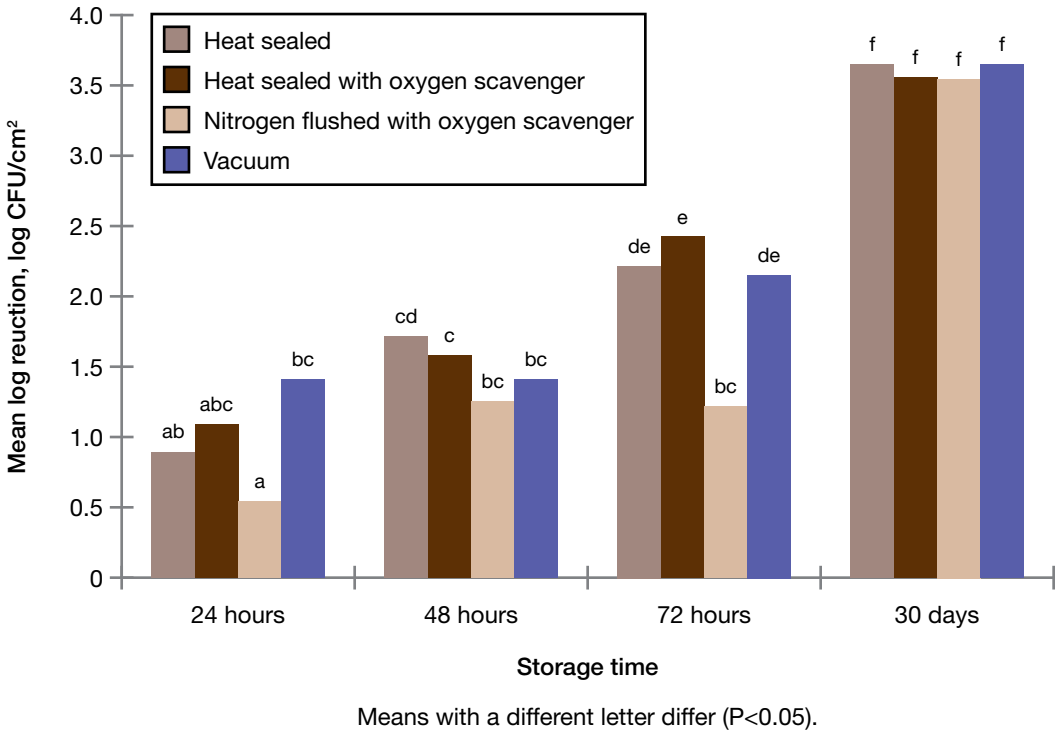

Figure 1. Mean log reduction of *Listeria monocytogenes* on beef jerky packaged in different packaging systems and stored at room temperature.