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Effect of High Pressure Processing and Water Activity on the Survival of Listeria Monocytogenes on Ready-to-Eat Shelf-Stable Turkey-Based Meat Bars

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Objectives

A study was conducted to evaluate the effects of product water activity (a_w) and a post-processing HPP (high pressure processing) treatment on the survival of inoculated *Listeria monocytogenes* populations on shelf-stable vacuum-packaged meat bars stored at 25°C.

Materials and Methods

The study was repeated on separate start days and cooked batches (2 a_w levels: ≤ 0.91, ≤ 0.85) of turkey-based bars for each trial. Ingredients included turkey, fruit, vegetables, seeds, nuts, rice and spices. Following processing, bars of both a_w were surface-inoculated with a mixture of *L. monocytogenes* (LM101, LM108, LM310, V7, Scott A) to a target level of approximately 3 or 6 log CFU/g. Inoculated bars were individually vacuum packaged. Approximately 18 to 20 h post-inoculation, half the bars from each a_w and inoculation level received HPP treatment (586 MPa, 180 s, 5°C) while the remaining half were not HPP treated (control). HPP-treated and control vacuum-packaged bars were stored at 25°C for up to 50 d and analyzed for pathogen counts (PALCAM agar). The study was designed as a 2 × 2 factorial, with factors of a_w (≤ 0.91, ≤ 0.85) and post-processing treatment (control, HPP) for 2 pathogen inoculation levels (3 and 6 log CFU/g). The Mixed Procedures of SAS version 9.4 was used to assess differences between treatments (a = 0.05). Surviving pathogen counts were fitted with the Baranyi and Roberts mathematical model (DMFit version 3.5, ComBase) to assess shoulder periods (the time in days where the levels of the pathogen remain at the level of inoculation) and inactivation rates (log CFU/g/d).

Results

Storage day affected ($P < 0.05$) the *L. monocytogenes* populations recovered from bars inoculated at both levels; populations tended to decrease over time. Additionally, irrespective of inoculation level, a_w (≤ 0.91, ≤ 0.85) and post-processing treatment (control, HPP) significantly affected *L. monocytogenes* populations during storage. For the 6 log CFU/g inoculation level, a_w was a significant effect for shoulder period and inactivation rate of the pathogen in each of the treatment combinations during storage; there were no significant effects observed for bars inoculated at 3 log CFU/g. The HPP treatment didn't affect the survival of *L. monocytogenes*; it only reduced ($P < 0.05$) the initial and/or end of storage counts. Initial pathogen reductions obtained with HPP ranged from 0.2–0.6 log CFU/g (6 log CFU/g inoculation) and 0.5–1.0 log CFU/g (3 log CFU/g inoculation). When inoculated to 6 log CFU/g, bars with $a_w \leq 0.91$ had longer ($P < 0.05$) shoulder periods (6.5 and 8.8 d) compared to bars dried to $a_w \leq 0.85$ (1.9, 1.8 d). Likewise, bars dried to $a_w \leq 0.91$ had slower ($P < 0.05$) pathogen inactivation rates (–0.06, –0.08 log CFU/g/d) compared to bars dried to $a_w \leq 0.85$ (–0.12, –0.10 log CFU/g/d). Regardless of treatment, *L. monocytogenes* populations were still recovered from all bars following 40 or 50 d of storage at 25°C.

Conclusion

High pressure processing of bars with $a_w \leq 0.85$ showed the greatest potential for increased control of *L. monocytogenes* presence starting with 3 log CFU/g of post-processing contamination. The a_w impacted pathogen inactivation and surviving counts on shelf-stable meat bars. Parameters of HPP should be further investigated to better understand the most effective time and temperature to increase inactivation of *L. monocytogenes* on meat bars.

