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Fate of Escherichia Coli O157:H7, Salmonella Spp. and Listeria Monocytogenes during Curing and Drying of Beef Bresaola

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Objectives

Manufacturing dry-cured, whole muscle meat products without a thermal lethality step is a growing trend for charcuterie companies in the United States. The USDA-FSIS requires that hazards for ready-to-eat meat products be addressed with a scientifically valid HACCP system. Since little literature exists for validation of these “old world” products, an experiment was designed to validate the safety of beef bresaola. The objectives of this study were to validate the safety of dry-cured, beef bresaola and to investigate a bresaola manufacturing process by attempting to achieve a 5 LOG₁₀ (CFU/cm²) reduction of *E. coli* O157:H7, *Salmonella* spp. and *Listeria monocytogenes*.

Materials and Methods

Prior to curing, whole beef eye rounds ($n = 6$) were inoculated with a mixed culture bath containing 3 strains each of *E. coli* O157:H7, *Salmonella* spp. and *Listeria monocytogenes*, allowed to air dry (30 min at 23°C), sprayed with a 2.5% Beefside antimicrobial treatment (lactic and citric acid) on all surfaces and allowed to sit overnight in a walk-in cooler (2 to 4°C). Cure (NaNO₃ and NaNO₂) and salt were applied to the beef surface 24 h after the antimicrobial treatment, and the beef was allowed to cure for 28 d (2 to 4°C). Following curing, a proprietary spice mixture was applied to the surface of the beef, and each piece was stuffed into beef casings (115–130mm).

The stuffed bresaola pieces were hung and allowed to dry for 44 d to a target water activity < 0.92 (13.63 ± 2°C; rH 68% ± 7%). Pathogen populations and aW were analyzed at d 0, 1, 2, and then once a week until d 72 of the study. Individual comparisons using a Generalized Linear Model were used to determine significant differences ($p < 0.05$) of pathogen concentrations between days.

Results

A 5 LOG₁₀ (CFU/cm²) reduction was achieved for all 3 pathogens. A reduction of 5.52 LOG₁₀ (CFU/cm²; $p < 0.0001$) for *E. coli* was achieved on d 44. A reduction of 5.72 LOG₁₀ (CFU/cm²; $p < 0.0001$) for *Salmonella* spp. was achieved on d 44. A reduction of 5.21 LOG₁₀ (CFU/cm²; $p < 0.0001$) for *Listeria monocytogenes* was achieved on d 37. Final reductions of 5.97, 5.98, and 5.44 LOG₁₀ (CFU/cm²; $p < 0.0001$) were achieved on d 65 for *E. coli*, *Salmonella* spp., and *Listeria monocytogenes*, respectively. During the entire curing and drying process, populations of each species never increased by more than 0.5 LOG₁₀ (CFU/cm²).

Conclusion

The critical parameters used to treat, cure (3.5% salt), and dry this product are sufficient to achieve the minimum 5 LOG₁₀ (CFU/cm²) reduction of each pathogen as required by FSIS to validate process safety.