



Research Project Status Report

Project: 07-205

Investigators: Kathy Glass, Jeffrey Sindelar

Organization: University of Wisconsin

Title: Evaluation of anti-Listerial Properties of Natural and/or Organic Ingredients in Ready-to-Eat Meat and Poultry Products

Cost: \$94,526

Timeline: Two years

End Date: March 2010

Description: The objective of this project is to identify ingredients to suppress growth of *Listeria monocytogenes* in ready-to-eat (RTE), deli-style, meat and poultry products that meet “natural” or organic requirements defined by USDA. The study will be conducted in two phases. Phase 1 will screen for effective levels of commercial extracts, flavorings, and microbial fermentation byproducts in cooked uncured turkey breast slurries (25% meat) and in slurries prepared with vegetable powder and a nitrate-reducing starter culture to yield nitrite or a commercially available vegetable powder which has been pre-reduced to yield nitrite. In addition, the effects of the antimicrobials will be screen in slurries to represent traditional cured product (156 ppm sodium nitrite) and uncured product. Slurries will be inoculated with 3-log log CFU/g *L. monocytogenes* and stored at 4°C for 4 weeks. A minimum of 60 treatments will be developed to assess the antilisterial impact the tested ingredients have either individually or in combination.

Pending results for the screening study, small test batches will be prepared using several natural antimicrobials systems (minimum 2-3 systems at two levels) for informal sensory evaluation using experienced panelists. Phase 2 will then evaluate two natural antimicrobial systems with acceptable sensory attributes for each of three low-fat (<5% fat) RTE products: natural boneless ham, whole muscle roast beef, and deli-style turkey breast. Products will be sliced and surface-inoculated with *L. monocytogenes* to provide 5-log CFU per package, stored at 4 or 7°C, and assayed for changes in microbial populations biweekly for up to 12 weeks. In addition, traditionally prepared ham with lactate-diacetate will be inoculated as a negative control.

Status: Three ingredients which prevented growth of *L. monocytogenes* in the 4-week screening study in Phase 1, and which were deemed most acceptable using experienced panelist for sensory analysis, were chosen for further testing in meat products. For Phase 2, 1.5% lemon/cherry/vinegar blend, 2.5% buffered vinegar, and 3.0% cultured cane sugar/vinegar blend, were incorporated into naturally cured ham, uncured roast beef, and uncured deli-style turkey breast. Controls

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included naturally cured ham, uncured roast beef, and uncured deli-style turkey breast without antimicrobials and a traditional nitrite-cured ham with 2.8% lactate/diacetate. Cooked, sliced products were inoculated with 3-log CFU/g of a 5-strain mixture of *L. monocytogenes*, vacuum packaged, and stored at 7 and 4°C. *L. monocytogenes* was enumerated in triplicate samples at 0, 2, 4, 6, 8, and 10 weeks. To date, testing is complete through 10 weeks for the first beef replicate and through 6 weeks for second beef replicate; testing was discontinued after 6 and 8 weeks for the turkey and ham replicates, respectively, due to consistent growth of *L. monocytogenes* for those treatments.

L. monocytogenes increased 2-log CFU/g on both the No-Antimicrobials Control treatments for ham (Figure 1) and turkey (Figure 2) at 2 weeks of storage and at 4 weeks for roast beef (Figure 3). Growth (defined as >1-log increase) in the Traditional Cured Ham with lactate/diacetate was delayed until week 6 storage at 4°C. Each of the three antimicrobials delayed listerial growth compared to the No Antimicrobial Controls for all three meat types. The addition of either 1.5% lemon/cherry/vinegar blend or 3.0% cultured cane sugar/vinegar blend delayed growth for an additional 2 weeks over the ham and turkey no-antimicrobial controls. Whereas, the addition of 2.5% buffered vinegar delayed growth for an additional 4 weeks. The greatest delay was observed in uncured roast beef containing any of the three antimicrobials, with no growth of *L. monocytogenes* detected to date in samples stored at 4°C (through at 6 weeks in Beef 2 replicate and through 10 weeks in Beef 1 replicate; testing still in progress). As expected, microbial growth was more rapid when products were stored at 7°C (data not shown).

In addition to the effect of the antimicrobials, the delay of *L. monocytogenes* growth may also be attributed to differences in product moisture and pH. Ham averaged 70% moisture and a pH of 6.3, turkey averaged 73% moisture and a pH of 6.2, beef averaged 66% moisture and a pH of 5.8. These preliminary data suggest that natural growth inhibitors can enhance the safety of natural and organic RTE meat and poultry products, but their efficacy is enhanced in the presence of nitrite and in products with lower moisture and pH.



