EFFECTS OF PEROXYACETIC ACID AND CITRIC LACTIC ACID BLEND SPRAY ON THE SHELF LIFE OF VACUUM-PACKAGED BEEF

H. Wang[1*] and X. Yang[1],
[1]*Lacombe Research and Development Centre, Agriculture and Agri-Food Canada, Lacombe, Canada*,
*hui.wang@canada.ca

I. OBJECTIVES

Antimicrobial interventions are widely used for reducing enteric pathogens such as *Escherichia coli* O157:H7 on meat. However, information on the efficacy of acid sprays, e.g., peroxyacetic acid (PAA) and citric lactic acid blend (CLA), for spoilage bacteria and their impact on the microbiota during chiller storage is largely lacking. The aim of this work was to examine the effects of PAA and CLA spray on the shelf life of vacuum-packaged beef using a customized spray system and investigate the microbial community dynamics on acid-sprayed beef during chiller storage.

II. MATERIALS AND METHODS

Both sides of beef short plates (400 cm^2/side) were sprayed with water, 400 ppm PAA or 2.5% CLA at 30 PSI for 3 min at 1°C ± 1°C for a coverage of > 0.5 mL/cm^2. Each plate was then equally divided into 4 pieces, which were subsequently vacuum packaged individually. In total, 84 pieces of meat with 28 for each treatment group were stored at 1°C ± 1°C and sampled on days 1, 15, 28, 43, 57, 70 and 86 of storage. An additional 4 pieces of meat not sprayed with any solutions were sampled on day 1 as control. At each sampling time, total aerobes, lactic acid bacteria (LAB), Enterobacteriaceae and *E. coli* were enumerated, and color, odor, and pH of meat were assessed. Tukey test was used to separate least-squares means. The microbiota was profiled using 16S ribosomal RNA gene amplicon sequencing.

III. RESULTS

Mean surface pH values for CLA-sprayed meat were lower ($P < 0.05$) on days 1, 15, and 43, but no differences were noted between PAA and water groups. Off-odor intensity and discoloration increased over time. PAA delayed moderate off-odor by 14 d compared with water, and discoloration (>50%) by 27 days compared with CLA. *E. coli* were only found on 2 of the water-sprayed and control meat samples on day 1. No difference in numbers of aerobes and LAB was noted between water, PAA, and CLA at equivalent times during storage, although PAA and CLA reduced aerobes and LAB by 0.5 and 1.1, and 0.7 and 0.9 log units, compared with water spray on day 1 ($P < 0.05$). PAA reduced 1.1 log units more of Enterobacteriaceae than water on day 1 ($P < 0.05$), but this difference was not maintained during storage. On the other hand, no difference in numbers of Enterobacteriaceae was noted between CLA- and water-sprayed groups for up to 28 d, but the numbers for CLA-sprayed group were 1.4, 1.6, and 2.1 log units lower ($P < 0.05$) on days 43, 70, and 86, respectively. From 16S ribosomal RNA gene amplicon sequencing, LAB dominated the microbiota on the meat from each treatment during storage. *Lactobacillus, Carnobacterium*, and *Yersinia* were the most frequently identified genera across the samples. Spray treatment and storage time affected the microbiota beta diversity ($P < 0.001$).

IV. CONCLUSION

Spraying beef with 400 ppm PAA and 2.5% CLA did not affect the numbers of total aerobes, LAB, and Enterobacteriaceae on meat with extended storage. However, PAA-sprayed meat may have an edge over water- or CLA-sprayed meat with extended storage in their

organoleptic properties, which could be caused by difference in composition, rather in numbers of bacteria growing on meat from different treatment groups.

Keywords: acid spray, antimicrobial intervention, shelf life, spoilage bacteria, vacuum packaged