



RESEARCH FACTS

RESEARCH & TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY

Beef Science Cluster



Examining Antimicrobial Sprays Applied to Beef Trim

Project Title:

Examining the Decontamination of Beef Trim by Spraying it with Lactic Acid Solution

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Background:

Lactic acid has antibacterial properties, and is naturally found in yogurt and sourdough bread. It is approved by Health Canada for use on beef. Commercial packing plants routinely use 2 to 5% lactic acid to spray or wash beef carcasses and cuts in order to eliminate *E. coli* O157:H7 and other pathogenic *E. coli*. Research has shown that lactic acid can reduce *E. coli* O157:H7 in beef that has been experimentally inoculated with artificially high numbers of bacteria. These results have not been validated in commercial situations where *E. coli* O157:H7 levels are much lower. The effectiveness of lactic acid solutions on generic (non-O157) *E. coli* has been studied in commercial practice, but whether this can also reduce low numbers of *E. coli* O157:H7 is uncertain because *E. coli* O157:H7 is thought to be more acid-resistant than generic *E. coli*. Consequently, the extent to which commercial packers can use lactic acid to control *E. coli* O157:H7 on beef is not clear. Previous studies of lactic acid treatments of beef have also given little or no consideration as to how survival of *E. coli* O157:H7 may be affected by the type of meat surface, the volume of lactic acid used, or the numbers of bacteria on the meat.

Objective:

To determine how effectively different concentrations and volumes of lactic acid can control different levels of generic *E. coli* and *E. coli* O157:H7 contamination on muscle, fat and membrane-covered beef surfaces.

What they did:

An apparatus was constructed to evenly apply controlled volumes of lactic acid to beef trim. Fat, muscle and membrane-covered surfaces were inoculated with acid-adapted *E. coli* O157:H7 or non-acid adapted generic *E. coli* at high (100,000 cells/cm²), medium (10 cells/cm²) or low levels (1 cell/10 cm²). The three different meat samples inoculated with three levels of *E. coli* were then sprayed with water (no lactic acid) or 2% or 5% lactic acid, at volumes of 0.5 ml/cm² or 0.02ml/cm². After treatment, the numbers of surviving injured and surviving uninjured bacteria were counted separately.

What they learned:

Although lactic acid sprays and washes are very beneficial for reducing microbial contamination on dressed carcasses, this study showed that lactic acid sprays had limited benefit on trim.

Although a 99% reduction was attained on fat and muscle surfaces using 5% lactic acid at 0.5 ml/cm², *E. coli* and *E. coli* O157:H7 were not completely eliminated from beef trim, even when surfaces were inoculated with low levels of bacteria. Results also varied with the type of trim. The spray eliminated more *E. coli* from membrane-covered surfaces than from fat or cut muscle surfaces; membranes are smooth, but fat or cut muscle surfaces have tiny cracks that some bacteria can hide in. This means that if there are very few bacteria on the surface to begin with, it will be easier for most of them to hide in the fat and muscle cracks.

Most of the *E. coli* that survived the lactic acid treatment were not injured, and survival was very similar for both *E. coli* O157:H7 and generic *E. coli*. Similarities in survival between the acid-tolerant *E. coli* (O57:H7) and acid-susceptible *E. coli* (generic) suggests that the acid wasn't reaching the *bacteria*. This is probably related to the cracks in the fat and muscle. The *E. coli* that hide in the cracks of the fat or muscle were protected from the lactic acid treatment, and acid can't kill *E. coli* that it doesn't touch.

What it means:

The presence of small cracks in fat and muscle means that there is always a place for some bacteria to be protected from organic acid washes and sprays.

Lactic acid treatment can reduce *E. coli* numbers but cannot completely eliminate it from beef trim, even when *E. coli* levels are extremely low.

Treating beef trim with lactic acid or other antimicrobial solutions will probably have very limited benefits for beef safety. Trim pasteurization, irradiation, or finding other means of reducing the amount of *E. coli* on beef trim would likely provide a greater benefit than antimicrobial sprays applied to beef trim.

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