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Validation of Antimicrobial Interventions for Reducing E. Coli Population (Surrogate for Shiga Toxin-Producing Escherichia Coli; Stec) during Goat Slaughter and Carcass Chilling

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Objectives

Population growth of ethnic cultures that readily consume goat meat has led to an increase in demand and consumption in the United States. Although foodborne disease outbreaks associated with meat from small ruminants have been limited, small ruminant animals such as goats are known reservoirs for Shiga toxin-producing *Escherichia coli* (STEC). As goat meat demand increases, it is critical to ensure pathogen reduction strategies for STEC are effective during the slaughter and chilling processes. The objectives of this research were to evaluate 4.5% lactic acid (LA), 400 ppm peroxyacetic acid (PAA), Citrilow (a proprietary blend of hydrochloric and citric acid; CL; pH 1.2), 5% levulinic acid plus 0.5% sodium dodecyl sulfate (LVA+SDS), and a non-treated control (CON) for their ability to reduce STEC surrogates and their effects on carcass color from slaughter through chilling.

Materials and Methods

A total of 15 goat carcasses (28 ± 6 kg) across 3 replications were inoculated with a 5-strain cocktail (ca. 8 log CFU/ml) containing rifampicin-resistant *Escherichia coli* (*E. coli*; BAA-1427, BAA-1428, BAA-1429, BAA-1430, and BAA-1431), surrogates for STEC. The exterior of each carcass was evenly inoculated to achieve 6 log CFU/cm^2. After inoculation, the carcasses were held on the slaughter line for 30 min (25°C) for attachment prior to antimicrobial treatment application. Antimicrobial treatments were randomly assigned to each carcass and applied prerigor and 24 h post chill. Each carcass was sampled at 5 different points during processing 1) after inoculation with a 30-min attachment period, 2) after the standard water wash (55°C), 3) 5 min after the pre-chill carcass antimicrobial spray application, 4) post-24 h chilling, and 5) 5 min after the 24 h post-chill carcass antimicrobial spray application. One of 5 anatomical carcass locations was randomly assigned for sample collection on both sides of each carcass at each time point and then combined for analysis. Objective carcass color was measured below the hipbone on a surface that was not sampled for microbial analysis, at 5 different processing points: 1) pre-treatment (immediately prior to application of inoculum), 2) after pre-chill antimicrobial spray treatment, 3) post-1 h chill, 4) post-24 h chill, and 5) after the post-24 h chill antimicrobial spray application. *E. coli* population (log CFU/cm^2) and color values were analyzed using PROC GLM (SAS V.9.4; SAS Inst. Inc., Cary, NC). *E. coli* population and color values were analyzed for the main effects of antimicrobial treatment, sampling time point, and their interaction. Least squares means were generated and separated using the PDIFF option. Means were considered different at $\alpha \leq 0.05$.

Results

Mean log reductions ($P < 0.05$) achieved after prerigor treatment with CL, LA, LVA+SDS, and PAA were 2.27, 2.00, 1.9, and 1.87 log CFU/cm^2, respectively. Antimicrobial treatment after the 24 h chilling period resulted in subsequent reductions ($P < 0.05$) of surrogate *E. coli* by 1.89, 1.17, 1.03, and 0.47 log CFU/cm^2 for CL, LA, PAA, and LVA+SDS, respectively. Antimicrobial treatments did not have a large impact goat carcass objective color.

Conclusion

The antimicrobials tested in this study were effective at reducing *E. coli* populations on goat carcasses during pre- and post-chill applications without compromising carcass color.

