RESEARCH ABSTRACT

PORK SAFETY

Title: Efficacy of interventions to reduce *Salmonella* on fresh pork products to improve food safety **- NPB #17 – 047**

revised

Investigator: Mindy Brashears, Ph.D.

Institution: Texas Tech University,

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Scientific Abstract:

Introduction.

Salmonella is a leading cause of foodborne illness in the United States, and is one of the leading pathogens found on pork products. There is a need to find an effective control for *Salmonella* and other pathogens. Thus, the objectives of this project were (1) Determine the efficacy of various interventions on the reduction of pork head meat and carcass pieces inoculated with *Salmonella* in pathogen processing area. (2) Determine the efficacy of the reduction of surrogate organisms in a pork production facility to validate the reduction on pork carcasses. (3) Determine the impact of intervention treatments on the shelf life of pork trim.

Materials and Methods.

Phase 1: Fresh pork cheek meat and hot pork skin, was inoculated with a 5-strain cocktail of *Salmonella* strains. Interventions tested in this study included: 1)**Titon-**Sulfuric acid and sodium sulfate (pH 1.3), 2)**PAA-**Peracetic acid (350 ppm), 3)**LA-**Lactic acid (3%), 4)**CA-**Citric acid (1.3%), 5)**HBR-**Hypobromous acid (300 ppm), 6)**LAE-**Lauramide arginine ethyl ester (200 ppm), 7)**PAA+Acetic-**Peracetic acid (400 ppm) with 2% acetic acid, 8)**PAA+Titon™** Sulfuric acid and sodium sulfate (pH 1.3) combined with peracetic acid (350 ppm), 9)**Water**, and 10)**Control**-no treatment. A CHAD cabinet was used to apply individual treatments at ambient temperature. *Salmonella* on the pork pieces after inoculation and 24hrs after treatment was enumerated to determine the reduction from each treatment.

Phase 2: Pork carcasses in two different facilities with two different chill systems were utilized and carcasses were inoculated with non-pathogenic *Escherichia coli*. Carcasses in portion one were treated with the following: 1)**Titon™** , 2)**PAA**, 3)**LA**, 4)**CA,** 5)**HBR**, 6)**LAE**,7)**PAA+Acetic**, 8)**PAA+Titon™** . Carcasses in the second portion of phase II, in the large commercial facility with an industrial carcass sprayer and blast chiller, were treated with the following treatments: 1) **control**, 2) **PAA + Acetic**, 3) **PAA + Titon™** , 4) **LA**. Phase II determined aerobic plate count and psychrotrophic bacteria reductions 24hrs after intervention and chilling.

Phase 3: Pork trimmings were divided into 50-lb batches for each individual treatment (n=4 batches). Treatments included, control (no intervention), PAA+Titon™ , PAA+Acetic, and LA. Shelf-life measurements taken included instrumental color (at 0min, 10min, and 20min after package opening), pH, proximate analysis, TBARS, raw product odor acceptability, aerobic plate count and psychrotrophic plate count bacterial enumeration.

Results

On warm pork skin, organic acid applications demonstrated pathogenic *Salmonella* reduction of 1.56 to 2.06 log CFU/cm^2. On pork cheek meat pathogenic *Salmonella* reduction at 24-hours after chilling ranged from 1.37 to 3.98 log CFU/cm^2. In the small-scale facility, with a traditional hot box cooler, intervention treatments showed a 1.74 to 4.91 log CFU/100cm^2 reduction of non-pathogenic *E. coli* on pork carcasses from inoculation to 22hrs post chilling. In the commercial pork facility, with the large sprayer cabinet and a blast chiller, significant reductions of 2.96 to 4.80 log CFU/100cm^2 reduction of *E. coli* was achieved ($p<0.05$). On uninoculated pork carcasses in the commercial pork facility with a blast chiller, aerobic plate counts of bacteria were reduced 2.14 to 3.58 log CFU/100cm^2 by intervention application. Odor acceptability was significantly impacted by day but not by treatment group ($p>0.05$) in the shelf-life study of ground pork. Ground pork color was also minimally impacted by treatment of pork trim.

Conclusions

Overall phase I demonstrated efficacy of selected interventions to address pathogenic *Salmonella* control during the harvest process, prior to pork carcass chilling. Phase II demonstrated effective reduction of *E. coli* inoculated carcasses in a small-scale traditional chilled pork harvest facility, in addition to a large-scale commercial pork facility with a blast chiller. Phase III demonstrated no significant negative organoleptic changes to pork trim when treated with selected organic acid interventions prior to grinding. Additionally, phase III highlighted an opportunity for further work to address the most efficient use of intervention application in pork trim for extended shelf-life and maintained product quality. Across all applications utilized in this study (warm skin pieces, cheek pieces, whole hog carcasses, and pork trim), the intervention treatments found to be most successful were 3% lactic acid, PAA acidified with acetic acid, and PAA acidified with Titon™.