

Evaluating whether trimming chilled beef during fabrication will control *Escherichia coli* O157:H7

B. A. Laster, K. B. Harris, A. N. Haneklaus*, L. M. Lucia, A. Castillo, and J. W. Savell

Center for Food Safety, Meat Science Section, Department of Animal Science, Texas AgriLife Research, 2471 TAMU, Texas A&M University, College Station, TX 77843-2471

Keywords: beef, *Escherichia coli* O157:H7, fabrication, subprimals, trimming

Introduction

- One area of current concern relates to *E. coli* O157:H7 contamination of beef subprimals intended for the production of non-intact products. Pathogens may be introduced below the surface of these products as a result of non-intact processes.
- No research has evaluated the trimming of exterior carcass surfaces during normal fabrication processes on bacterial levels of subsequent subprimals.

Objective

- To determine if trimming during the fabrication process would reduce or eliminate the number of pathogens present on newly exposed lean and fat surfaces of subprimals.

Methods

- Beef carcasses ($n = 10$) were inoculated along the hide pattern opening before entering the blast chill cooler.
- A gelatin slurry containing a bacterial cocktail of three rifampicin-resistant, non-pathogenic *E. coli* Biotype I strains.
- Carcasses underwent a 48h chill, eight subprimals were generated from each beef side: brisket, shoulder clod, chuck roll, ribeye, short loin, top sirloin, inside round, and bottom round.
- Microbiological samples were taken from the original carcass surface, initial lean surface, trimmed fat surface (where applicable), and trimmed lean surface (where applicable).



Results

Table 1. Least squares means for trimming location effect on counts of rifampicin-resistant *E. coli* for all subprimals.

Trimming location	Log ₁₀ CFU/cm ²
<i>Brisket</i>	
Before trimming, fat	3.8a
After trimming, fat	1.8b
Before trimming, lean	1.2b
After trimming, lean	< 0.7c ¹
<i>Shoulder clod</i>	
Before trimming, fat	3.7a
After trimming, fat	0.8b
Before trimming, lean	1.1b
<i>Chuck roll</i>	
Before trimming, fat	3.3a
Before trimming, lean	0.9b
After trimming, lean	1.4b
<i>Ribeye</i>	
Before trimming, fat	2.9a
After trimming, fat	0.9bc
Before trimming, lean	< 0.7c
After trimming, lean	1.1b
<i>Short loin</i>	
Before trimming, fat	2.3a
After trimming, fat	< 0.7b
Before trimming, lean	0.9b
<i>Top sirloin</i>	
Before trimming, fat	2.9a
After trimming, fat	1.2b
Before trimming, lean	1.7b
<i>Inside round</i>	
Before trimming, fat	3.5a
After trimming, fat	2.3b
Before trimming, lean	0.9c
After trimming, lean	< 0.7c
<i>Bottom round</i>	
Before trimming, fat	2.6a
After trimming, fat	2.2a
Before trimming, lean	1.1b
After trimming, lean	0.8b

^{a, b, c} Means lacking a common letter within a subprimal differ ($P < 0.05$).

¹ Value denotes samples below the minimum detection level of 0.7 log CFU/cm².

Conclusions

- There are minimal changes in the lean surfaces of subprimals compared to the opportunity to remove fat surfaces.
- Fat and lean surfaces that were not inoculated became contaminated during the fabrication process.
- Trimming external surfaces reduced levels of pathogens, but under normal fabrication processes, pathogens were still spread to newly exposed surfaces.



Acknowledgements

This project was funded, in part, by The Beef Checkoff.



Inactivation at various temperatures of bovine viral diarrhea virus in meat derived from persistently infected cattle

C. L. Bratcher*, B. S. Wilborn, H. M. Finegan, S. P. Rodning, P. K. Galik, K. P. Riddell, M. S. Marley, Y. Zhang, L. N. Bell, M. D. Givens
Auburn University, Auburn, AL, USA

Bovine viral diarrhea virus (BVDV) is a pathogen that causes gastrointestinal, respiratory and reproductive disease in cattle. Based on available research, BVDV is not considered zoonotic.

Objective:

To evaluate the detectable concentration of BVDV in four primal cuts of beef from persistently infected (PI) animals immediately after slaughter, aging, freezing, and cooking to variable temperatures.

Materials and Methods

- Six PI cattle known infected: genotype 1a (n=4), genotype 1b (n=1) or genotype 2 (n=1) strain of BVDV.
- Samples from the interior of primal cuts: (chuck, rib, loin, and round) removed fresh (Day 0) and after aging 2, 7, 14, 21 days and three ground products: (ground chuck, ground round, and ground beef) grab samples prepared from each carcass after 2d,
- Samples frozen, thawed and assayed for BVDV raw or after cooking to 55, 60, 65, 70, 75, and 85°C.
- Samples assayed for detection and titration of infectious BVDV using virus isolation after being minced with sterile scissors and subsequently blended in a commercial blender.

Results:

Treatment	Mean viral Concentration ^a	Range ^a	Sample testing free of virus ^b
Fresh Day 0	5.83	4.4-6.4	0/24
Aged Day 2	6.37	4.8-7.1	0/24
Aged Day 7	6.20	4.7-7.1	0/24
Aged Day 14	6.11	4.7-6.9	0/24
Aged Day 21	5.98	4.9-6.7	0/24
Frozen of Day 2	5.91	4.9-6.2	0/42
Cooked to 55 °C	3.90	VND-5.0	16/42
Cooked to 60 °C	4.33	VND-5.8	26/42
Cooked to 65 °C	1.99	VND-3.0	30/42
Cooked to 70 °C	3.69	VND-5.3	40/42
Cooked to 75 °C	Virus not detectable		42/42
Cooked to 85 °C	Virus not detectable		42/42

^alog₁₀ cell culture infective doses/g of beef

^bAs determined by amplification of bovine diarrhea virus in monolayers of Madin Darby bovine kidney cells

VND = virus not detected

The concentration of BVDV after aging varied significantly depending on the duration of aging (p = .05) but not depending on the cut of meat or the animal. The concentration of BVDV in frozen, thawed, uncooked beef varied significantly depending on preparation as a ground product compared to not ground (p = .01). The average cell culture infective doses [50% endpoint; CCID₅₀]/g of intact meat was 10^{5.85} compared to 10^{6.01} CCID₅₀/g of ground meat. The cut of meat, preparation as a ground product, or animal did not significantly impact detection of BVDV after cooking to any temperature.

Conclusion

Viable BVDV in beef survives aging, freezing, and thawing. To destroy BVDV in beef cuts, internal temperatures must exceed 70°C during cooking. Care should be taken to ensure that susceptible hosts such as pigs are not fed improperly cooked meat, meat by-products or waste food originating from PI cattle.

Yolanda Ruiz-Navajas, Manuel Viuda-Martos, Elena Sánchez-Zapata, Esther Sendra, Estrella Sayas-Barbera, Juana Fernández-López & José Angel Pérez-Alvarez.

IPOA Research Group (UMH-1 and REVIV-Generalitat Valenciana). AgroFood Technology Department. Escuela Politécnica Superior de Orihuela. Miguel Hernández University. Crta. Beniel km. 3,2. E-03312 Orihuela Alicante (Spain). E-mail: yruiz@umh.es

INTRODUCTION

Many of the valuable sensory properties of meat products diminish with time. This may be attributed to a large number of factors, however, the most limiting factor of a food's shelf life is the growth of microorganisms, whether they are molds, bacteria, or yeasts. A range of synthetic agents have been used to inhibit the bacterial growth in meat products, although concerns about the safety of these chemicals have increased consumer demand for natural food products. Essential oils (EOs) obtained from many plants have recently gained in popularity and excited scientific interest. The antimicrobial properties of aromatic plant essential oils have been widely assessed in a wide variety of foods.

OBJETIVES

The aim of this study was investigated the effectiveness *In vitro* of the EOs from two species of thymus such as *Thymus moroderi* and *Thymus piperella* on growth of selected food-borne indicators as *Aeromonas hydrophila* and *Listeria innocua* in homogenate meat products (minced meat and cooked meat).

MATERIAL AND METHODS

Plant materials

Thymus piperella and *Thymus moroderi* were collected from the south-east of Spain during the flowering period

Extraction of essential oil

The essential oils (EOs) of *Thymus moroderi* and *Thymus piperella* were extracted from entire plant by hydro-distillation using a Clevenger-type apparatus for 3 h. The oily layer obtained on top of the aqueous distillate was separated and dried with anhydrous sodium sulphate (0.5 g). The extracted essential oil was kept in sealed air-tight glass vials and covered with aluminium foil at 4 °C until further analysis.

Preparation of food samples

Ten grams of minced meat (50 % pork and 50% beef), dry-cured meat ("longaniza de pascua) or cooked meat (Turkey sausage) products were added to 90 mL of water and homogenized in a Stomacher until smooth and agar-agar was added (1.5%). All prepared food was autoclaved at 121 °C for 15 min prior to eliminate contamination from organisms that may already be present in the food. The pH of the food samples ranged between 6 and 7.

Bacterial cultures

The essentials oils were individually tested against *Listeria innocua* CECT 910 and *Aeromonas hydrophila* CECT 5734. These species were supplied by the Spanish Type Culture Collection (CECT) of the University of Valencia.

Antimicrobial assay

The agar disc diffusion method (ADDM) was used to determine the antibacterial activities of the essential oils. A suspension (0.1 mL of 10⁶ CFU/mL) of each microorganism was spread on the meat homogenates medium plates. Filter paper discs (9 mm) were impregnated with 40 µL of the each EO and placed on the inoculated plates; these plates were incubated at 37 °C for 24 h. The concentration effect (CE) was studied for to ascertain which doses (40, 20, 10, 4 and 2 µL) of essential oil had an inhibitory effect on bacterial growth. All tests were performed in triplicate.

RESULTS AND DISCUSSION

The antimicrobial activity of *Thymus moroderi* and *Thymus piperella* EOs and CE values in meat homogenates against the *Aeromonas hydrophila* bacterial can be seen in Table 1.

Table 1—The concentration effect of *Thymus piperella* and *Thymus moroderi* EO against *Aeromonas hydrophila* in meat homogenates. Diameter (mean and SD) of inhibition zone (mm) including disc diameter of 9 mm

	Concentration (µL)	<i>Aeromonas hydrophila</i>		
		Minced meat (mm)	Dry cured meat (mm)	Cooked meat (mm)
<i>Thymus piperella</i>	40	31.50±0.70 ^a	N.A.	25.00±1.24 ^a
	20	26.00±0.00 ^b	N.A.	15.50±0.70 ^b
	10	22.00±0.00 ^c	N.A.	13.00±0.00 ^c
	5	19.00±1.41 ^d	N.A.	11.00±0.00 ^d
	2	16.00±0.00 ^e	N.A.	N.A.
<i>Thymus moroderi</i>	40	15.00±0.00 ^a	N.A.	18.00±0.70 ^a
	20	11.50±0.70 ^b	N.A.	15.00±0.00 ^b
	10	N.A.	N.A.	12.00±0.00 ^c
	5	N.A.	N.A.	N.A.
	2	N.A.	N.A.	N.A.

For the same essential oil, values followed by different letters within the same column are significantly different ($P < 0.05$) according to Tukey's multiple range test. N. A., Non active



Figure 1—Antibacterial effect of *Thymus piperella* and *Thymus moroderi* EO against *Aeromonas hydrophila* in meat homogenates

The antimicrobial activity of *Thymus moroderi* and *Thymus piperella* EOs and CE values in meat homogenates against the *Listeria innocua* bacterial can be seen in Table 2.

Table 2—The concentration effect of *Thymus piperella* and *Thymus moroderi* EO against *Listeria innocua* in meat homogenates. Diameter (mean and SD) of inhibition zone (mm) including disc diameter of 9 mm

	Concentration (µL)	<i>Listeria innocua</i>		
		Minced meat (mm)	Dry cured meat (mm)	Cooked meat (mm)
<i>Thymus piperella</i>	40	25.00±0.00 ^a	N.A.	20.50±0.70 ^a
	20	19.00±0.00 ^b	N.A.	18.00±0.00 ^b
	10	16.50±0.70 ^c	N.A.	14.00±0.00 ^c
	5	14.50±0.70 ^d	N.A.	11.50±0.70 ^d
	2	N.A.	N.A.	N.A.
<i>Thymus moroderi</i>	40	14.00±0.00 ^a	N.A.	N.A.
	20	12.00±0.00 ^b	N.A.	N.A.
	10	N.A.	N.A.	N.A.
	5	N.A.	N.A.	N.A.
	2	N.A.	N.A.	N.A.

For the same essential oil, values followed by different letters within the same column are significantly different ($P < 0.05$) according to Tukey's multiple range test. N. A., Non active



Figure 2—Antibacterial effect of *Thymus piperella* and *Thymus moroderi* EO against *Listeria innocua* in meat homogenates

CONCLUSION

The essential oils of *Thymus piperella* and *Thymus moroderi* essential oils can be used to control the growth of bacteria related with the food spoilage in a variety of meat and meat products. However, Many factors in food could be responsible for the reduction of antimicrobial activity of plant extracts when applied on different types of food. The antimicrobial activity of spices and oils diminished in foods as a result of the solubilization of the antimicrobial agents into the food's lipid fraction. The use of plant-derived antimicrobials in food may be hampered by effective dosages, interference by food constituents or other food-grade compounds, unsuitable water activity, incompatible pH or processing regimen.

Decontaminating beef subprimals destined for non-intact products by using combinations of water washing and/or trimming

J. L. Lemmons*, L. M. Lucia, M. D. Hardin, J. W. Savell, and K. B. Harris

Center for Food Safety, Meat Science Section, Department of Animal Science, Texas AgriLife Research, 2471 TAMU, Texas A&M University, College Station, TX 77843-2471

Keywords: *E. coli* O157:H7, translocation, decontamination, beef, non-intact

Introduction

- Previous research has shown that the prevalence of *E. coli* O157:H7 on beef subprimals is low; however, there is a possibility that the exterior surfaces of the subprimals could be contaminated.
- If the exterior surface of a subprimal is contaminated with *E. coli* O157:H7, blade tenderization or needle injection can force the pathogen into the sterile interior.
- This presents a potential health risk to the consumer; non-intact meat cooked to lower degrees of doneness has an increased risk of internalized pathogens surviving thermal inactivation.
- As a result of this potential health risk, FSIS has declared raw, non-intact beef adulterated if it contains *E. coli* O157:H7.

Objective

- To evaluate the impact of water washing and partial- or full-surface trimming as possible pathogen reduction strategies for vacuum-packaged beef subprimals destined for non-intact use.

Methods

- Ninety-six top sirloin butts (cap-on) and ninety-six semi-center cut top sirloin butts (cap-off) were used.
- Seven treatments were assigned utilizing
 - ✧ water washing (WW),
 - ✧ full-surface trimming (FT),
 - ✧ partial-surface trimming (PT),
 - ✧ water washing followed by full-surface trimming (WWFT),
 - ✧ water washing followed by partial-surface trimming (WWPT),
 - ✧ full-surface trimming followed by water washing (FTWW), and
 - ✧ partial-surface trimming followed by water washing (PTWW).
- Water washing involved washing the entire exterior surface with tap water. Full trim removed all exterior surfaces. Partial trim removed only the dorsal surface.
- Two inoculum levels were used: a low inoculum of 10^2 and a high inoculum of 10^4 .
- Following inoculation, the subprimals were vacuum packaged and stored for either 0, 14, or 28 days.
- Upon removal from storage, the following sites were evaluated: exterior of the bag, purge, the inoculation site on the subprimal, the area adjacent to the inoculation site, and the surface opposite from the inoculation site.

Results

Table 1. Least squares means for storage day \times cap \times treatment effect on counts (\log_{10} CFU/cm²) of *E. coli* O157:H7 at the inoculation site or inoculated side of top sirloin butts^a.

Treatment	Cap on			Cap off			SEM
	Day 0	Day 14	Day 28	Day 0	Day 14	Day 28	
High							
Initial	4.98 A ^b	4.79 A	4.62 A	4.97 A	4.77 A	4.67 A	0.09
WW	4.76 A	4.66 A	4.28 B	4.81 A	4.43 B	4.44 A	0.13
WWFT	< 0.70 B ^c	0.95 B	< 0.70 C	0.93 B	1.23 C	1.43 B	0.19
WWPT	< 0.70 B	0.75 B	< 0.70 C	0.95 B	0.70 C	0.73 B	0.19
FTWW	< 0.70 B	0.85 B	< 0.70 C	1.05 B	1.60 C	1.13 B	0.19
PTWW	< 0.70 B	0.75 B	0.80 C	0.88 B	1.45 C	0.90 B	0.19
FT	< 0.70 B	0.85 B	< 0.70 C	0.75 B	1.00 C	0.83 B	0.19
PT	0.73 B	< 0.70 B	< 0.70 C	< 0.70 B	0.73 C	1.40 B	0.19
Low							
Initial	2.91 A	2.36 A	2.33 A	2.66 A	2.30 A	2.27 A	0.06
WW	2.38 B	2.20 A	2.19 A	2.51 A	2.35 A	2.24 A	0.09
WWFT	< 0.70 C	< 0.70 B	0.12				
WWPT	< 0.70 C	0.75 B	< 0.70 B	< 0.70 B	< 0.70 B	< 0.70 B	0.12
FTWW	< 0.70 C	< 0.70 B	0.12				
PTWW	< 0.70 C	< 0.70 B	0.12				
FT	< 0.70 C	< 0.70 B	0.12				
PT	< 0.70 C	< 0.70 B	< 0.70 B	< 0.70 B	< 0.70 B	0.73 B	0.12

^a Inoculation site was a 100 cm² area on the dorsal surface. Inoculated side was the entire dorsal surface.

^b Numbers within columns within inoculation levels with different letters significantly differ ($P < 0.05$).

^c Detection limit = 0.7 \log_{10} CFU/cm².

Conclusions

- Of the treatments applied, water washing alone was the least effective for both high and low inoculated subprimals.
- Full trimming, with or without a water wash, proved to be the most effective treatment used to reduce *E. coli* O157:H7 to non-detectable levels.

Acknowledgements

This project was funded, in part, by The Beef Checkoff.

AgriLIFE RESEARCH
Texas A&M System



The Potential for Cultured Sugar and Vinegar to Inhibit *Clostridium* in Uncured Ham

Peter Sijtsema¹, Renate Zumbrink¹, Jarret Stopforth², Diana Visser¹, Rhys Jones¹



Introduction

Foodborne botulism is a severe disease resulting from the consumption of a preformed neurotoxin produced by *Clostridium botulinum*. As little as 30ng of neurotoxin is sufficient to cause illness and death may occur in extreme cases. Suppression of toxin formation in foods is therefore desirable and this has traditionally been achieved by adding nitrite. However, nitrite addition has come under attack stemming largely from perceptions about its impact on health.

Products containing cultured sugar and vinegar have been developed for the control of *Listeria monocytogenes* in uncured meats and have been proposed as alternative inhibitors of botulinum toxin production (Wanless et al. 2010) as well as the growth of *Cl. perfringens* (Jackson et al. 2011). In the present study, a *Cl. sporogenes* model was used to evaluate the efficacy of a cultured sugar and vinegar formulation in uncured pork hams. As a model for *Cl. botulinum* growth, the *Cl. sporogenes* model offers an alternative means of assessing the risk of toxin formation, currently measured by expensive mouse neutralization tests (Larson et al. 2003).

Objective

To determine the efficacy of cultured sugar and vinegar in delaying the growth of *Cl. sporogenes* in uncured ham stored at different temperatures.

Formulations

Uncured hams were formed from:

- 80.0 % pork topside.
- 14.5 % water.
- 2.0 % modified corn starch.
- 1.5 % maltodextrin.
- 1.0 % sodium chloride.
- 0.7 % carrageenan.
- 0.3 % sodium tri-polyphosphate.

Treatments consisted of incorporating cultured sugar and vinegar (PuraQ® Verdad NV55, Purac America, Lincolnshire IL) into formulations at levels of 3, 4 and 5%. Control hams were left untreated.

Materials and Methods

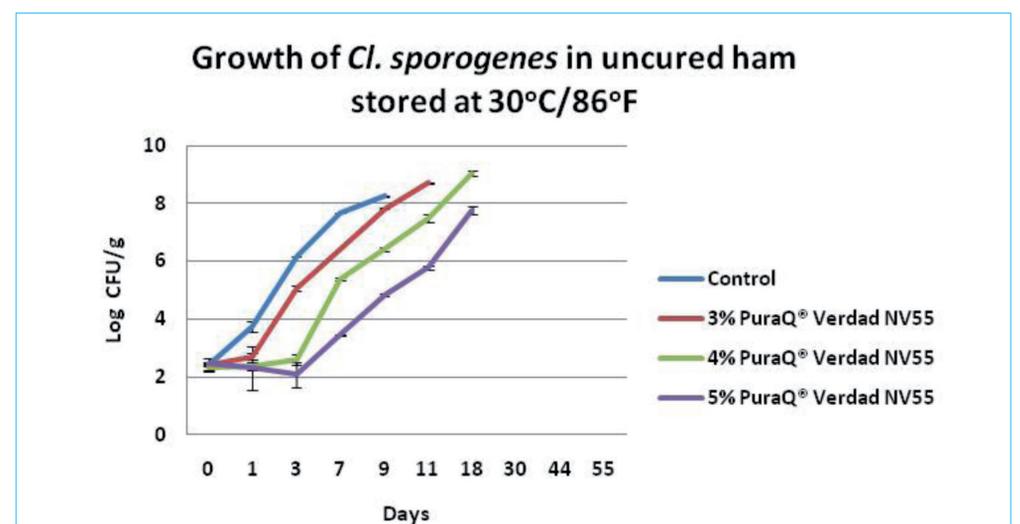
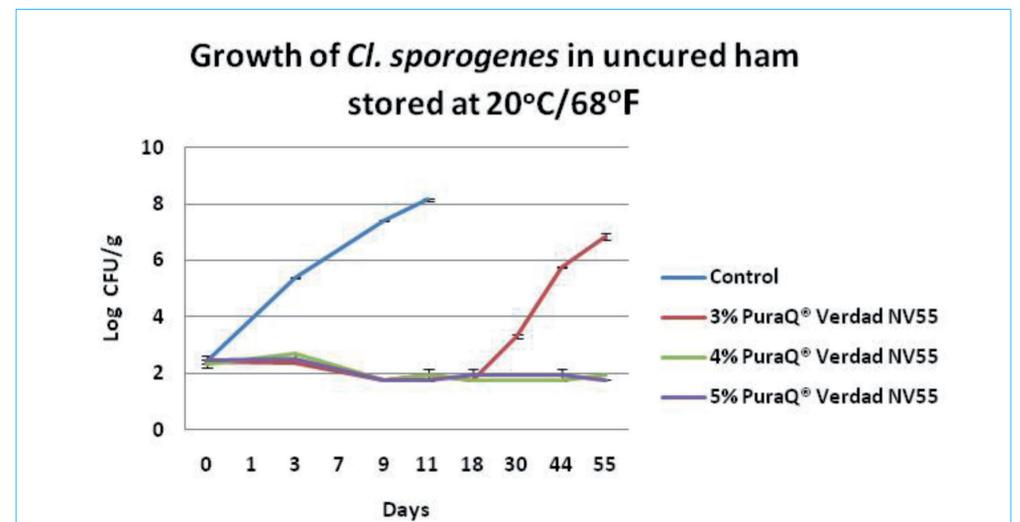
Preparation of hams

- Pork topside was ground at 13 mm.
- Ingredients were mixed into a brine added to ground pork.
- Pork/brine was mixed and tumbled for 4 h (inc. 30 min rests).
- Each batch was molded inside a cook-crimp bag.
- Hams were cooked in a water bath at 82°C/180°F for 15 min/cm ø plus 15 min.
- Hams were cooled in ice water for 1 h and stored at 0°C.

Inoculation

- Spores prepared as described by Peck et al. 1992.
- Replicate (2) hams inoculated with *Cl. sporogenes* spore mixture: strains NCTC 532, 8594, 12935 and 13020.
- Spore mixtures were added to the shredded meat during preparation in a disinfected bowl chopper to achieve a final of 100-500 spores/gram.
- 30 gram portions were placed into barrier bags and vacuum sealed.
- Packs were divided between three incubation temperatures (30°C/86°F, 20°C/68°F and 12°C/54°F) and stored for 55 d.
- At intervals duplicate packs for each treatment were opened and contents homogenized 1:3 in dilution fluid.
- Serial dilutions of homogenate were made and 50 µl aliquots plated onto BHI-agar using a spiral plater.
- Plates were incubated anaerobically at 37°C/98.6°F for 48 h.

Results



Cl. sporogenes growth was not observed in any treatment stored at 12°C/54°F

Conclusion

- When stored at 20°C, use of 3% cultured sugar and vinegar completely inhibited growth of *Cl. sporogenes* in uncured hams for up to 18 days while use of 4 to 5% inhibited outgrowth through 55 days.
- When stored at 30°C, 4-5% cultured sugar and vinegar inhibited growth of *Cl. sporogenes* in uncured hams to 3 days.
- Results indicate that use of cultured sugar and vinegar products in the formulation of uncured hams can successfully inhibit the growth of *Cl. sporogenes* and by implication potentially the growth of *Cl. botulinum*.
- Further work is needed to validate the use of cultured sugar and vinegar as an inhibitor of *Cl. botulinum* in ready-to-eat meats.

References

- Jackson, A.L., C. Kulchaiyawat, G.A. Sullivan, J.G. Sebranek and J.S. Dickson. 2011. Use of natural ingredients to control growth of *Clostridium perfringens* in naturally cured frankfurters and hams. *Journal of Food Protection*. Vol 74. No.3, 2011, pages 417-424.
- Wanless, B.J., L. M. McDonnell, and K.A. Glass. 2010. Effect of nitrite and natural antimicrobials on *Clostridium botulinum* toxigenesis in model frankfurter and ham products. *Institute of Food Technologists Annual Meeting Abstract # 038-11*. Chicago, IL. June 17-20, 2010.
- Larson, A.E. and E. A. Johnson. 2003. Efficacy of clostridial plate counts as a substitute for botulinum toxin detection during botulinal challenge studies of foods. *IAFP 2003 meeting Abstract # P101*.
- Peck, M.W., D.A. Fairbairn and B.M. Lund. 1992. The effect of recovery medium on the estimated heat-inactivation of spores of non-proteolytic *Clostridium botulinum*. *Letters in Applied Microbiology*. 1992 No. 15, pages 146-151.

¹PURAC Biochem, Arkelsedijk 46, PO Box 21, 4200 AA, Gorinchem, The Netherlands.

²PURAC America, 111 Barclay Boulevard, Lincolnshire Corporate Center, Lincolnshire, IL 60069, USA.

"This poster is for convenience purposes only and PURAC expressly disclaims any warranties for non-infringement of third party patent rights and possible liabilities for inaccuracies. For additional information please contact PURAC Biochem B.V. attn. Peter Sijtsema p.sijtsema@purac.com, Arkelsedijk 46, 4206 AC Gorinchem, the Netherlands."

Lactic acid spray reduces *Campylobacter* and *Pseudomonas* on hot poultry carcasses

Rhys Jones¹, Diana Visser¹, Lee Galligan², Dean Burfoot³, Mark Field⁴



Introduction

Campylobacter is a common cause of food poisoning in many countries and the most common source is poultry meat. It is estimated to affect 600,000 people in the US each year. Its survival on poultry may be enhanced by association with protective *Pseudomonas* biofilms (Trachoo, Frank et al. 2002). Reducing levels on poultry is therefore desirable. Spray treatment of carcasses with lactic acid (LA) is an effective method for reducing bacterial populations on raw meat and poultry (Cutter and Rivera-Betancourt 2000; Castillo, Lucia et al. 2001; Loretz, Stephan et al. 2010). Recent work has demonstrated that a 4% LA solution, buffered to a pH of 3.7 and sprayed onto chicken carcasses post inside-outside washer can reduce aerobic plate counts (APC) with no degradation of visual acceptance (Campden BRI R&D Reports No. 297 and 298). In a follow-up study, the effect of LA treatment on a range of microbial populations acquired during carcass processing was examined, with a focus on the reduction of naturally acquired *Campylobacter* populations.

Aim

To determine the effect of 4% buffered LA solution on reducing *Campylobacter* and *Pseudomonas* populations when sprayed onto fresh chicken carcasses.

Methods

Treatment

An electrostatic spray system was used to apply buffered (pH 3.7) 4% LA (Purac FCC80) solution to two sets of 36 fresh pre-weighed chicken carcasses at a commercial processing plant after leaving the inside/outside washer. One set was treated prior (hot) to chiller entry. The second set was treated after (cold) chiller exit. A third set (control) was untreated. Hot and cold carcasses were re-weighed after treatment (average weights were found to increase after spraying by 4.5g/kg for hot carcasses and 11.2g/kg for cold carcasses, with differences attributed to acid draining more easily from hot carcass cavities). Controls were reweighed post chilling. Spraying consisted of a 17s application per bird. Treated and control carcasses were placed in plastic bags and stored at 4°C for approximately 2h before being transported chilled for microbiological analysis.

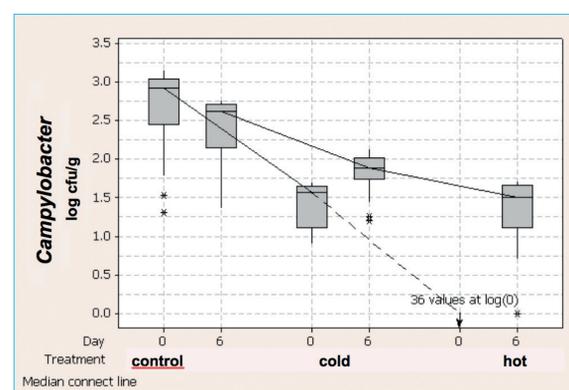
Sampling and assay

5 cm² excision samples were removed from the skin on the left side of breasts and tested the same day of kill (day 0) for aerobic plate count (APC), coliforms, *Pseudomonas*, *E. coli* and *Campylobacter*. The skins of the right side breasts were similarly sampled and tested after 6 days storage at 4°C. Excision samples were homogenized in dilution fluid. APC and *Pseudomonas* counts were determined using PCA and *Pseudomonas* agars respectively. Coliforms and *E. coli* were counted using respective Petrifilm methods. *Campylobacter* populations were measured on mCCD agar.

Statistics

Means were analyzed for significance using Student's t-test. Non-normally distributed data were assessed qualitatively, based on median-trends with reported differences being strong or very strong. Counts below the limit of detection were interpreted using the Fischer Exact test based on (Hornung and Reed 1990).

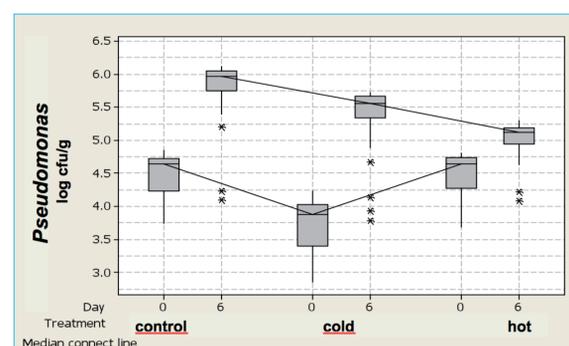
Results



Legend
Box = Median, Quartiles 2&3
Bars = Quartiles 1&2
* = outliers
connecting line = median trend

Campylobacter

Average initial counts were above 2.5 log cfu/g on control carcasses and there was a significant trend for counts to be lower after treatment, with none detected on hot-treated carcasses. A similar trend was observed after 6 days storage.



Legend
Box = Median, Quartiles 2&3
Bars = Quartiles 1&2
* = outliers
connecting line = median trend

Pseudomonas

Average initial counts were above 4.5 log cfu/g on control carcasses, increasing to approximately 6 log cfu/g after 6 days storage. There was a significant trend towards lower counts on treated carcasses at 6 days storage, with hot-treated carcasses producing the greatest reduction.

APC's on hot-treated carcasses were significantly lower than controls at both day 0 (0.3 log cfu/g lower) and day 6 (1.3 log cfu/g lower). APC's on cold-treated carcasses were significantly lower at 6 days storage only (0.9 log cfu/g lower). Coliform populations (composed partially of *E. coli*) were not detected on most treated carcasses initially, but were similar to controls at day 6.

Conclusion

Significant reductions in naturally acquired populations of *Campylobacter* and *Pseudomonas* can be achieved on chicken carcasses after spraying with lactic acid solution. Reductions in APC can also be achieved.

References

- Castillo, A., L. M. Lucia, et al. (2001). *Journal of Food Protection* 64: 738-740.
- Cutter, C. N. and M. Rivera-Betancourt (2000). *Journal of Food Protection* 63: 1326-1332.
- Hornung, R. and L. Reed (1990). *Applied Occupational and Environmental Hygiene* 5: 46-51.
- Loretz, M., R. Stephan, et al. (2010). *Food Control* 21: 791-804.

¹Purac, P.O. Box 21, 4200 AA, Gorinchem, the Netherlands; ²Purac, 111 Barclay Blvd Suite 100, Lincolnshire, IL 60069, USA; ³Campden Technology Ltd, Station Road, Chipping Campden, GL556LD, UK; ⁴Two Sisters Food Group, Dial Lane, West Bromwich, B700EQ, UK.

This poster is for convenience purposes only and PURAC expressly disclaims any warranties for non-infringement of third party patent rights and possible liabilities for inaccuracies. For additional information please contact PURAC Biochem B.V. attn. Rhys Jones, Arkelsedijk 46, 4206 AC Gorinchem, the Netherlands. email: r.jones@purac.com