

Meat Safety News Digests

A collection of recent news relevant to the safety of red meat prepared by the Food Safety Program of Meat & Livestock Australia, for SAFEMEAT Stakeholders

INTERVENTIONS

Antimicrobial interventions for O157:H7 and non-O157 shiga toxin-producing *E. coli*

This USA study evaluated the efficacy of different postharvest antimicrobial interventions (ambient water, 5% lactic acid, 200 ppm hypobromous acid and 200 ppm peroxyacetic acid) in reducing *E. coli* O157:H7 and non-O157 STEC (O26, O103, O111 and O145) on beef subprimals. The relationship between antimicrobial treatments and cooking temperature (50 or 70°C) in reducing pathogens in blade tenderized steaks was also studied. Beef striploin subprimals were inoculated with a cocktail of high (10^6 log cfu/50 cm²) or low level (10^2 log cfu/50 cm²) of pathogens, subjected to antimicrobial treatments at ambient temperature, vacuum packaged and stored at 4°C for 14 days.

The effect of antimicrobial sprays was observed on samples taken immediately after treatment following inoculation with a high level of O157:H7. For both inoculation levels the O157:H7 counts were significantly reduced (1 – 2 log) during storage for all antimicrobial treatments. For non-O157 at low-inoculation level the lactic acid and peroxyacetic acid treatments resulted in a moderate (0.4 log cfu/50 cm²) but significant reduction in the

pathogens immediately after spray intervention and lactic and hypobromous acids after storage. Although, cooking reduced the detection of pathogens in steaks internalized *E. coli* O157:H7 and non-O157 were able to survive in steaks even cooked to 70°C, thereby warranting higher degree of doneness.

<http://www.ingentaconnect.com/content/iafp/jfp/2015/00000078/00000003/art00005>

Efficacy of antimicrobial compounds in reducing pathogens on fresh beef

Several antimicrobial compounds have been used in commercial meat processing plants for decontamination of pathogens on beef carcasses. However, many novel antimicrobial compounds are now available. They may be more effective and suitable for use on beef. To this end, researchers from the USA aimed to determine the efficacy of some of these novel compounds in reducing pathogens on beef carcasses. Beef flanks were used and inoculated with two cocktail mixtures of pathogens. Cocktail mixture 1 was composed of STEC serogroups O26, O103, O111, O145, and O157, whereas cocktail mixture 2 was composed of STEC serogroups O45, O121, and O157 and *Salmonella*. All inoculated beef flanks were then subjected to spray treatments with four antimicrobial compounds (i.e., hypobromous acid, neutral acidified sodium chlorite, and two citric acid-based

antimicrobial compounds). Following antimicrobial treatments, both control and treated fresh beef samples were either enumerated immediately or were stored for 48 h at 4°C before enumeration. It was found that all four antimicrobial compounds caused 0.7- to 2.0-log reductions of STECs, *Salmonella*, aerobic plate counts, and Enterobacteriaceae. All compounds also appeared to be as effective at reducing the six non-O157 STEC strains as they were at reducing *E. coli* O157:H7 on the surfaces of fresh beef.

<http://www.ingentaconnect.com/content/iafp/jfp/2015/00000078/00000003/art00004?token=005f1fdeb82cfa16813498267232d45232b6d246c38532c74665623773568293c62207d673f582f6b2bf8f2a454b4ab>

Use of a phage cocktail to reduce *Salmonella* contamination in ground meat

Researchers from Chile evaluated the efficacy of phages as biocontrol agents for *Salmonella* on ground beef meat. A strain of *Salmonella* Enteritidis was used to inoculate ground meat. Five different lytic phages were isolated from sewage samples, pickle sauce and ground beef and used to treat the inoculated meat. Both untreated and treated meat samples were then stored at 18°C and 5°C for up to 10 days. Changes in bacterial numbers were determined periodically. It was evident that phages reduced *Salmonella* numbers by 3.65 and 3.54 log units after storage at 18°C and 5°C for up to 10 days, respectively. These results indicate that the application of lytic phages as biocontrol agents in fresh meat contaminated with *Salmonella* can be a feasible, simple and specific tool that contributes to food safety of meat.

http://www.ingentaconnect.com/search/article?option1=tka&value1=meat&sortDescending=true&sortField=prism_publicationDate&pageSize=10&index=7

Survival of pathogenic *E. coli* in frozen meat and potential use of calcium oxide as an antimicrobial agent

The focus of this Korean study was to investigate the survivability of pathogenic *E. coli* in frozen meat products (-18°C) over 180 days, as well as evaluating the potentials for using calcium oxide (CaO) to reduce *E. coli* populations (i.e., EHEC, *E. coli* O157:H7 and EPEC) in meat patties during storage at 10°C and -18°C. It was evident that *E. coli* numbers in all meat products appeared to be unchanged over 180 days of frozen storage and after 3 freeze-thaw cycles. This indicated the strong survival ability of *E. coli* in frozen meat. In subsequent studies involving application of CaO, the results revealed that 1% CaO could inhibit the growth of pathogenic *E. coli* on meat stored at 10°C, but not at -18°C. It was found that 2% CaO was required to control *E. coli* growth in meat when stored at lower temperature (i.e., -18°C). These results indicate that CaO has the potential to be used as a powerful antimicrobial agent for manufacturing frozen meat products.

<http://www.sciencedirect.com/science/article/pii/S0740002015000349>

Potential application of ultrasound in the meat industry

In this review, researchers from Turkey provide a summary of basic knowledge and current applications of ultrasound technology as an alternative method in the meat industry to improve meat quality and safety. Most published data indicate that antimicrobial efficiency

of ultrasound itself is relatively low. However, ultrasound under certain conditions can become an actual and effective alternative for decontamination purposes. Previous studies have demonstrated that ultrasound has the potentials as an alternative technology for improving the meat quality and microbial safety (between 20–47 kHz/4–40 min and 5–10 min, respectively) of processed meats. Generally, application of ultrasound alone could reduce bacteria on meat by 1–2 log units.
<http://www.sciencedirect.com/science/article/pii/S0168160514006321>

SHELF-LIFE

Spoilage assessment of minced beef stored under different packaging and temperature conditions by chemometric method

The objective of this Greece study was to assess meat spoilage through the evolution of volatile compounds produced during storage. Minced meat samples were packed aerobically and under modified atmosphere (40% CO₂:30% O₂:30% N₂) and stored at 0, 5, 10 and 15°C for 650, 482, 386 and 220 hours. Meat volatile compounds were detected and measured by HS/SPME-GC/MS (headspace–solid phase microextraction–gas chromatography–tandem mass spectrometry) technique and correlated with microbiological (total viable counts, *Pseudomonas* spp., *Brochothrix thermosphacta*, *Enterobacteriaceae*, yeasts and moulds) and sensory data. The chemical analysis revealed 138 volatile compounds that were present during storage of minced meat. Further, correlation of these compounds (mainly alcohols, aldehydes, ketones and esters) with sensory scores showed possible identification of

spoilage indicators. Global models were developed for the quantitative prediction of microbial counts and sensory score of a meat sample using chemical data stored under different temperatures and packaging. The accurate classification rate for the developed model was 77.8% for fresh, 62.5% for semi-fresh and 89.7% for spoiled studied meat samples.
<http://www.ncbi.nlm.nih.gov/pubmed/25462923>

Source of *Leuconostoc gelidum*, a major spoiler in ready to eat meals

In this study researchers elucidated the origin of psychrotrophic lactic acid bacteria (LAB) (primarily responsible for food spoilage) in a ready to eat meal manufacturing plant. Comparative enumerations (incubation at 22°C and 30°C) were used to detect the psychrotrophs coupled with high throughput DNA fingerprinting technique to assess the microbial composition of environmental samples, surfaces, food ingredients and final products. Comparison of two incubation temperatures showed that microbial counts at 30°C were significantly lower than the counts at 22°C due to overlooked, psychrotrophic LAB members. *Pseudomonas* spp., *Enterobacteriaceae*, *Streptococcaeae* and *Lactobacillus* spp. were quite prevalent, whereas *Leuconostoc gelidum* was detected as a minor member of the indigenous microbiota of the raw materials and processing facility. Despite being present in low abundance *L. gelidum* was present in nearly every sampling point of the premise and developed into the most dominant microbe at the end of the shelf-life of every sampled batch of ready to eat meals. The present study showed the long term detrimental impact of

psychrotrophic LAB establishment as a resident microbiota in a processing environment along with the importance of appropriate monitoring methods to identify and rectify such situations.

<http://aem.asm.org/content/early/2015/03/09/AEM.03941-14.abstract>

Bacterial community changes in modified atmosphere packaged cold stored minced meat

The objectives of this study were to investigate the effect of three different production batches produced over several months and different preservatives (sodium lactate, potassium lactate, spice extract and a combination of sodium lactate and ascorbic acid) on bacterial community changes in minced meat packaged under a gas mixture of 66% O₂, 25% CO₂ and 9% N₂ and stored refrigerated for 9 days. Both plate count and DNA fingerprinting techniques were used to determine the number and type of bacteria and headspace gas composition was also measured. Results showed a decrease in O₂ and increase in CO₂ during storage for all MAP samples. Discolouration and off odour were also observed for all samples at the end of storage. Bacterial counts increased with storage (from 3.5 – 5.0 log cfu/g to >7.0 log cfu/g), whereas, bacterial diversity decreased dramatically with time. A relatively similar bacterial community composition was observed irrespective of the production batch and the preservative used, with *Lactobacillus algidus* and *Leuconostoc* sp. as the most dominant bacteria (>50%). This suggested that both bacteria played an important role in the spoilage of MAP minced meat. Further, the bacterial community changes during storage were probably determined by the gas mixture and the composition of the meat itself

rather than production time or preservatives used.

<http://www.sciencedirect.com/science/article/pii/S0740002015000040>

Effect of frozen storage and display duration on lamb quality

The objective of this Spanish study was to investigate the effect of frozen storage duration (0, 1, 9, 15 or 21 months) and display duration (0–24 h post-slaughter, 3 and 6 days) on the quality of modified atmosphere packed (MAP) lamb. Both displayed fresh and thawed meats were assessed for their quality based on pH, colour, lipid oxidation, water holding capacity and instrumental texture. The results revealed a general decrease in quality (i.e., lower redness and water holding capacity; higher yellowness and lipid oxidation) as frozen storage duration or display duration increased. However, lamb frozen stored up to 1 month appeared to have the same quality than fresh meat. Texture of meat also improved over display duration. In conclusion, lamb storage at -18 °C should not exceed 1 month if thawed meat would be later displayed in MAP while meat would have an acceptable quality up to 21 months without subsequent display.

<http://www.sciencedirect.com/science/article/pii/S0309174014005038>

PROCESSING

Effect of increased beef cutting pace on profitability

The researchers in this study investigated the effect of different beef-cutting paces on meat yield, quality and overall profitability. Three different paces (baseline – status quo, quantity focus – pace required to maximise quantity and

quality focus – pace required to minimise errors) were evaluated on six workers cutting three different types of beef cuts (beef fillet, sirloin and entrecote).

Different parameters such as defect rates, yield, labour cost and revenue returns were calculated. The results showed a significant decrease in yield and product quality when cutting pace was changed from baseline and quality focus to quantity focus for all meat types. Further, the increased pace also resulted in health problems in workers and an overall loss in net profit.

<http://www.sciencedirect.com/science/article/pii/S0309174015000704>

© Meat & Livestock Australia ABN: 39 081 678 364

Care is taken to ensure the accuracy of information in the publication. However, MLA cannot accept responsibility for the accuracy and completeness of the information or opinions contained in the publication. Readers should rely on their own enquiries in making decisions concerning their interests.

Reproduction in whole or in part of this publication is prohibited without the prior written consent of MLA.

Produced by the TIA [Food Safety Centre](#) for Meat & Livestock Australia

FOR FURTHER INFORMATION PLEASE CONTACT:

Manager, Market Access Science and Technology

Ian Jenson

PH: 02 9463 9264

ijenson@mla.com.au



MEAT AND LIVESTOCK AUSTRALIA, PO Box 1961 NORTH SYDNEY NSW 2059