

Meat Safety News Digest

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

ABATTOIR FOOD SAFETY ASSESSMENT AND INTERVENTION

The use of microbiological surveys to evaluate co-regulation of abattoirs in NSW

In order to develop a microbiological baseline of meat produced for domestic consumption in the state of New South Wales, chilled carcasses were sampled from 16 abattoirs. Aerobic Plate Counts (APCs) and *E. coli* counts were obtained from samples taken by sponging sites specified for each species in the Microbiological Guidelines to the Australian Meat Standard. On beef carcasses the mean log APC/cm² was 2.21 and *E. coli* was detected on 25% of carcasses, and for sheep carcasses corresponding values were 2.4 and 53%, respectively. For pig carcasses values were 2.81 and 63%, respectively. For skin-off goat carcasses APC/cm² was 1.15 and *E. coli* 27%. In the present survey, levels of indicator bacteria on carcasses processed via the co-regulatory system operated in Australia were similar to those established in surveys of abattoirs that operate the traditional system overseen by government inspectors.

http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T6S-51P9WXR-2&_user=10&_coverDate=06%2F30%2F2011&_rdoc=23&_fmt=high&_orig=browse&_origin=browse&_zone=rslt_list_item&_srch=doc-info%28%23toc%235038%232011%23999779993%232878806%23FLA%23display%23Volume%29&_cdi=5038&_sort=d&_docanchor=&_ct=31&_acct=C000050221&_version=1&_urlVersion=0&_user=

[id=10&md5=f483123a5b240d27b0d75616d7037fa6&searchtype=a](http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T6S-51P9WXR-2&_user=10&_coverDate=06%2F30%2F2011&_rdoc=23&_fmt=high&_orig=browse&_origin=browse&_zone=rslt_list_item&_srch=doc-info%28%23toc%235038%232011%23999779993%232878806%23FLA%23display%23Volume%29&_cdi=5038&_sort=d&_docanchor=&_ct=31&_acct=C000050221&_version=1&_urlVersion=0&_user=)

Implementation of targeted interventions to control *E. coli* in a commercial abattoir

The objective of this USA study was to define locations on the carcass with highest contamination of *E. coli* O157:H7 throughout the harvest process and implement targeted interventions to reduce or eliminate contamination. *E. coli* prevalence was found to be highest on the foreshank, hindshank and inside rounds in a baseline study. Steam vacuums/cones were implemented as an intervention in these specific areas on the harvest floor. At pre-evisceration, foreshank prevalence of *E. coli* was reduced from 21.7% to 3.1% after the application of steam interventions. At the final rail, foreshank prevalence in the baseline study was 4.2% while no *E. coli* was detected post-intervention implementation. *E. coli* on hindshanks and inside rounds was reduced after intervention implementation from 24.2 to 11.5% and 37.5 to 16.7%, respectively. Pathogen contamination of environmental samples collected in fabrication declined from 6.7% to 0.7% after slaughter interventions were implemented. These data indicated the areas of contamination on the carcass and implementing interventions can significantly reduce *E. coli* on the carcasses and in the fabrication environment.

http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T9G-51HMX5T-1&_user=10&_coverDate=04%2F30%2F2011&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&_view=c&_acct=C00050221&_version=1&_urlVersion=0&_userid=

[10&md5=a1da7ef23e67db6bdb80a424fe4355be&searchtype=a](http://www.meatpoultry.com/News/News%20Home/Business/2011/2/JBS%20reports%20positive%20results%20of%20food-safety%20technology%20NMA.aspx?NewsLetter=true)

USA report on initial results of food-safety camera technology

JBS USA's beef division reported results on the implementation of third-party, remote video auditing (RVA) as a food-safety intervention at a plant. The pilot project that began in June 2010 resulted in microbiological improvements when comparing positive tests from the first half of 2010 with the second half of the year, indicating that by focusing on food-safety compliance in the carcass dressing area, pathogen contamination decreased by more than 70%. Over a year JBS trialed third-party RVA programs to enhance food safety compliance among workers at eight USA-based beef processing plants. Using a system of video cameras and web-based digital video recording software, trained workers check line workers to ensure they are complying with specific food-safety practices. Any non-compliance is identified by auditors and plant officials are given electronic notification of the incident along with a link to a video clip of the incident. Feedback from the remote audits was used by plant officials to improve the training of the line workers. Using the information captured by the cameras provides feedback for the people working on the floor and focuses on areas of training opportunities.

<http://www.meatpoultry.com/News/News%20Home/Business/2011/2/JBS%20reports%20positive%20results%20of%20food-safety%20technology%20NMA.aspx?NewsLetter=true>

MICROBIAL SHEDDING PREVENTION

Feeding chitosan micro-particles to reduce *E. coli* shedding in cattle

Enterohemorrhagic *E. coli* O157:H7 (EHEC) is a significant human pathogen that can reside in healthy cattle. An intervention method involving the addition of chitosan micro-particles (CM) to feed was evaluated in this US study. The results demonstrated calves fed with

CM had reductions in EHEC recovered from rectal swab samples for the duration of shedding. The effect of CM feeding varied between calves indicating that the optimal level of CM may vary between animals or that other factors are involved in the interaction between CM and EHEC. *In vitro* studies demonstrated that *E. coli* binds to CM indicating that the reduction in shedding may result at least in part from the binding of positively-charged CM with negatively charged *E. coli* cells. Additional studies would be needed to determine the impact of CM feeding on animal production, but the results from this study indicate that supplementing feed with CM reduces the shedding of *E. coli* in cattle.

<http://aem.asm.org/cgi/content/short/AEM.0258710v1?rss=1>

HIDE CONTAMINATION AND TREATMENT

***E. coli* O157:H7 survival on cattle hides**

The objective of this USA study was to determine the time period that *E. coli* O157:H7 survives on the hides of cattle. To determine how reductions in *E. coli* O157:H7 levels in faeces related to reductions on hides, three trials were conducted following *E. coli* O157:H7 hide prevalence over time. For each trial, 36 animals were housed in individual stanchions to minimize hide contamination events. Through prevalence determination and isolate genotyping, *E. coli* O157:H7 survival on the hides of live cattle was determined to be short lived with an approximate duration of nine days or less. The results of this study suggest that any pre-harvest interventions that are to be administered at the end of the finishing period will achieve maximum effect in reducing *E. coli* O157:H7 levels on cattle hides if given nine days before the cattle are presented for processing. However, it should be noted that interventions reducing pathogen shedding would also contribute to decreasing hide contamination through lowering the contamination load of the processing plant environment, regardless of the time of application.

<http://aem.asm.org/cgi/content/short/AEM.02238-10v1?rss=1>

Treatment of cattle hides with Shellac solution

The hide-to-beef microbial transfer-reducing effects of a novel Shellac treatment of hides (using on-hair immobilisation of microorganisms) were evaluated in this Serbian study. In the hide-to-meat direct contact laboratory-based experiments, treatment of hides with Shellac produced microbial reductions on beef: up to 3.6 log CFU/cm² of total viable count of bacteria (TVC), up to 2.5 log CFU/cm² of Enterobacteriaceae and up to 1.7 log CFU/cm² of *E. coli*. In a small commercial abattoir under “worse-case” conditions (slaughtering dirty cattle, inadequate process hygiene), treatment of hides with Shellac produced microbial reductions on beef carcasses: 1.7 log CFU/cm², 1.4 log CFU/cm² and 1.3 log CFU/cm², respectively. In both laboratory- and abattoir-based trials, TVC reductions on beef achieved by the Shellac hide treatment were greater than those achieved by the comparative sanitiser rinse-vacuum hide treatment, but reductions of Enterobacteriaceae and *E. coli* did not differ significantly between the two hide treatments.

http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T9G-524FSJP-1&_user=10&_coverDate=02%2F08%2F2011&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&_view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=52b054d796801da01d9b3c79c516510a&searchtype=a

CARCASS TREATMENT

Hot water surface pasteurisation of lamb carcasses

The aims of this Norwegian study were to evaluate the microbiological effects of hot water pasteurisation of lamb carcasses, both after slaughtering and dressing, and following subsequent chilling and storage. Samples were collected from 420 naturally-contaminated lamb carcasses, with 50% of the carcasses (n =210) subject to hot water pasteurisation at 82°C for 8 seconds immediately after slaughter. Surface swab samples were collected at slaughter, after

chilling for 24 hours, and after chilling for five days. The microbial analyses included *E. coli*, Enterobacteriaceae, *Bacillus cereus*, *Clostridium perfringens* and aerobic plate count (APC). Hot water pasteurisation reduced the levels of *E. coli*, Enterobacteriaceae, *B. cereus* and APC. After 24 hours storage, the reduction in *E. coli* was increased, and after five days *E. coli* could not be isolated from the pasteurised carcasses. These results indicate that surface pasteurisation could be an important and efficient procedure for reducing generic *E. coli* and shiga toxin-producing *E. coli* on carcasses and other pathogens, and thus the risk for disease among consumers.

http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T7K-524WDXS-2&_user=10&_coverDate=02%2F10%2F2011&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&_view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=17dec5652ca66afdea516c832f3bba5a&searchtype=a

Evaluation of control over microbiological contamination of lamb carcasses

The aim of this Greek study was to quantify the hygienic status of a lamb slaughterhouse to demonstrate how the microbiological data could be exploited, improve the slaughter process by constructing control charts and to evaluate intervention steps such as steam application on the microbiological quality of carcasses. Results showed that pelt removal and evisceration were hygienically uncontrolled. Total viable count and Enterobacteriaceae increased from pelt removal to after evisceration thus indicating possible deposition of microorganisms during these operations. The processing stages of freshly produced carcasses were distinguished by Enterobacteriaceae, with evisceration contributing highest to the final Enterobacteriaceae counts. Application of steam reduced microbial counts without adverse effects on the organoleptic characteristics of the carcasses. Moreover, the construction of control charts showed that

decontamination with steam contributed to the maintenance of an in control process compared to before the application of steam, suggesting the potential use of steam as an intervention step during the lamb slaughter process.

http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T7K-528906R-2&_user=10&_coverDate=02%2F26%2F2011&_rdoc=1&_fmt=high&_orig=gateway&_origin=gateway&_sort=d&_docanchor=&_view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&_md5=f49b96416d66adc02e0cc6bcf2988fd1&_searchtype=a

GROUND BEEF CONTAMINATION, TREATMENT AND PROCESSING

Prevalence and characterization of shiga toxin-producing *E. coli* from ground beef

E. coli O157:H7 is a shiga toxin (stx)-producing *E. coli* (STEC) strain that can cause human illness. However, other non-O157 STEC strains are associated with human disease and have become an increasing concern. This USA-based study reports the prevalence and characterization of non-O157 STEC in commercial ground beef samples obtained from numerous manufacturers across the USA over a period of two years. All samples were screened by DNA amplification for the presence of stx genes, which were present in 24.3% of the samples. Then, isolation of STEC bacteria from samples that contained the stx genes was attempted. Of the 1,006 positive ground beef samples screened for stx, 7.3% were confirmed to have at least one strain of STEC present. In total, 338 unique STEC isolates were recovered from the 300 samples. All unique STEC isolates were serotyped and were characterised for the presence of known virulence factors related to adherence, toxicity, iron acquisition, and the presence of the large virulence DNA plasmid. Results of this characterisation identified 10

STEC isolates (0.24%) that may be considered a significant food safety threat, defined by the presence of stx genes.

<http://aem.asm.org/cgi/content/short/77/6/2103?rss=1>

High-pressure processing for ground beef

Cargill USA has focused research efforts on making high-pressure processing commercially viable for ground beef patties, resulting in the doubling of shelf-life from 21 to 42 days, preservation of the beef's optimal flavour and reducing bacteria that cause food borne illness and spoilage. The high pressure processing does not use high temperature, chemicals or irradiation, while retaining the nutrient value and freshness of the ground beef. High pressure processing of foods is an established treatment to mitigate contamination by harmful microbes such as *Salmonella* spp., *E. coli* O157: H7 and *Listeria* spp., without adversely affecting the product's taste and quality, hence Cargill researched in applying this technology to ground beef.

<http://www.joplinstockyards.com/news.php?article=http%3A%2F%2Fwww.cattlenetwork.com%2Ftemplates%2Frscontent.xml%3Fcontentid%3D116162199%26path%3D%2Fcattle-news%2Flatest>

FDA approves phage-based *E. coli* technology for the US

A USA company has received regulatory clearance from the US FDA for its phage-based *EcoShield* food safety product, effective against *E. coli* O157:H7, specific for use on red meat parts and trim intended to be ground. Data submitted to the FDA showed that *EcoShield* reduced or eliminated *E. coli* O157:H7 in ground meat by 95–100%. A bacteriophage is a virus that is harmless to humans, animals, and plants, but is very effective in killing bacteria. Phages may provide a non-toxic, safe, and effective means for significantly reducing or eliminating disease-causing bacteria that are sometimes present on foods.

<http://www.ift.org/Food-Technology/Daily-News/2011/March/18/FDA-approves-phage-based-E-coli-technology.aspx>

PORTABLE DETECTION TECHNOLOGY

Development of a portable spectrofluorimeter for measuring the spoilage of minced beef

A French study developed a portable fluorescence spectrometer for quantifying minced beef spoilage microorganisms. This study was carried out on samples stored aerobically and under vacuum at 5 and 15°C. Total viable counts (TVC), *Pseudomonas* spp., lactic acid bacteria, and yeast/molds counts were investigated with culture methods. Fluorescence spectra were recorded on the same samples using different excitation LEDs (280, 320, and 380 nm). Regression analysis with a validation check was used to perform calibration and develop statistical models for detection limits and error reduction. The models presented high cross-validated correlation coefficients and low standard deviation values after validation. The results indicated that portable spectrofluorimeters are promising devices to evaluate spoilage in minced beef.

http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T9G-5296737-2&_user=10&_coverDate=03%2F02%2F2011&_rdoc=1&_fmt=high&_orig=gateway&_origin=gateway&_sort=d&_docanchor=&_view=c&_acct=C000050221&_version=1&_urlVersion=0&_useId=10&md5=898559d7fc2280010bac4e7dea20755b&searchtype=a

MODIFIED ATMOSPHERE PACKAGING

Critical factors for the quality and shelf-life of MAP fresh meat - a review

The food packaging industry has responded to regulatory guidelines for greater stringency in relation to hygiene and safety. One of the areas of research that has had success is modified atmosphere packaging (MAP). The success of MAP-fresh meat

depends on many factors including good initial product quality, good hygiene from the processing plants, packaging materials, the appropriate gas mix for the product, reliable packaging equipment, and maintenance of controlled temperatures and humidity levels. Advances in plastic materials and equipment have propelled advances in MAP, but other technological and logistical considerations are needed for successful MAP systems for raw chilled meat. Understanding the interactions between the parameters is needed. This German review was undertaken to present the most comprehensive and current overview of the widely available information about the various integrated critical factors responsible for the quality and shelf-life of MAP meat with an interest to stimulate further research to optimise different quality parameters.

<http://www.ncbi.nlm.nih.gov/pubmed/21328110?dopt=Abstract>

Shelf-life of lamb meat packaged under atmospheres of various compositions

The effect of four different gas mixtures on several characteristics of fresh lamb meat quality was studied in this Spanish article. Lamb meat was packed under four different atmospheres (1: ambient air, 2: 70% O₂ + 30% CO₂; 3: 80% O₂ + 20% CO₂ and 4: 30% CO₂ + 69.6% argon + 0.4% CO) and stored in darkness and under refrigeration for 12 days. pH values and weight losses of lamb meat showed no changes during 12 days of storage and were not affected by the different atmospheres. Lightness (colour) was not significantly affected by gas atmospheres until day-12 of storage, with lamb meat packed in contact with air (1) showing the lowest lightness colour score. Atmospheres 2, 3 and 4 presented a lower microbial count of total aerobic bacteria and Enterobacteriaceae than atmosphere 1, whereas for lactic acid bacteria counts there were no significant differences.

<http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2621.2010.02515.x/full>

ATMOSPHERE TREATMENT

Effect of atmospheric pressure plasma on inactivation of pathogens

Atmospheric pressure plasma (APP) is an emerging non-thermal pasteurisation method for the enhancement of food safety. In this Korean study, the effect of APP on the inactivation of pathogens inoculated onto bacon was observed. Sliced bacon was inoculated with *Listeria monocytogenes*, *E. coli*, and *Salmonella* Typhimurium. The samples were treated with APP at 75, 100, and 125 watts of power for 60 and 90 seconds. Two gases, helium or a mixture of helium/oxygen were used for the plasma generation. Plasma with helium only reduced the number of inoculated pathogens by about 1-2 log cycles. Comparatively, the helium/oxygen gas mixture was able to achieve microbial reduction of about 2-3 log cycles. Microscopic observation of the bacon after plasma treatment did not find any significant changes, except that the spectrometric value for colour of the bacon surface was increased. These results indicate that APP treatment is effective for the inactivation of the three pathogens used in this study and could be used for other meat products.

<http://www.ncbi.nlm.nih.gov/pubmed/21056769?dopt=Abstract>

Antimicrobial action and effects on beef quality attributes of a gaseous ozone treatment

This Argentinian research studied the effects of gaseous ozone treatment at refrigeration temperatures, on microbial counts (total aerobic mesophilic heterotrophic microorganisms and inoculated *E. coli*) in culture media and in beef samples. The influence of ozone on beef quality properties such as surface colour and rancidity was also measured. The effect of gaseous ozone in culture media inoculated with *E. coli* after 3 or 24 hours treatment at 0 and 4°C resulted in 100% inactivation. For beef samples treated with the same gaseous ozone concentration, the highest microbial inhibition was observed at 0 °C and after 24 hours exposure. However,

both the surface colour and lipid oxidation of these beef samples were unacceptable. Shorter exposure times (3 hours) to the tested ozone concentration at both temperatures (0–4°C), reduced the counts of total aerobic mesophilic heterotrophic microorganisms and the counts of *E. coli*, without changing the colour or producing rancidity in beef.

http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T6S-52BPK03-5&_user=10&_coverDate=03%2F09%2F2011&_rdoc=1&_fmt=high&_orig=gateway&_origin=gateway&_sort=d&_docanchor=&_view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=8cb4162ade92a35fae19b3461f24f437&searchtype=a

BACTERIAL CHARACTERISATION

Characteristics of Shiga toxin-producing *E. coli* from meat and milk products

In this German study, they analysed 593 foodborne STEC strains for their serotypes and for nine virulence genes. The strains grouped into 215 serotypes. The foodborne STEC were grouped into different categories in relation to the species of the food-producing animal (cattle, pigs, sheep, goats, red deer, wild-boar and hare). Statistical analyses revealed similarities between the animal origin of the food and the virulence genes of foodborne STEC. The properties of foodborne STEC were compared with published data on faecal STEC from food producing animals. Virulence profiles and serotypes from food showed similarities to those of faecal STEC that were from the same animal species. The findings from this study indicate that the food-producing animals represent an important source for the entry of STEC in the food chain. Sound hygiene measures implemented at critical stages of food production (milking, slaughtering, and evisceration) should be most effective in reducing the frequency of STEC contamination of food.

http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T7K-524WDXS-1&_user=10&_coverDate=02%2F10%2F2011&_rdoc=1&_fmt=high&_orig=search&_origin=sea

[rch& sort=d& docanchor=&view=c& acct=C000050221& version=1& urlVersion=0& userid=10&md5=eb95969d3b2ab9780692296beb241d1b&searchtype=a](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC30050221/?sort=d&docanchor=&view=c&acct=C000050221&version=1&urlVersion=0&userid=10&md5=eb95969d3b2ab9780692296beb241d1b&searchtype=a)

Genomics of *E. coli* O157:H7 from the bovine host

Cattle can be a reservoir of shiga toxin-producing *E. coli* O157:H7 (STEC). The differences in host prevalence, transmissibility and virulence phenotypes among strains from bovine and human sources are of major interest to the public health community and livestock industry. This USA study used DNA genomic analysis to reveal the divergence into three lineages. Lineages I and I/II strains are commonly associated with human disease, while lineage II strains are represented in the healthy bovine host. To assess the genetic flexibility on a genome-wide scale, USA researchers have sequenced the whole genome of a bovine-associated *E. coli* O157:H7 isolate. Comparative analysis of this isolate enabled them to accurately place bovine lineage II strains within the genetically homogenous *E. coli* O157:H7 lineage. This study catalogued numerous novel lineage II-specific genomes, some of which appear to be associated with the pathogenic potential and niche-adaptation within the bovine rumen.

<http://aem.asm.org/cgi/content/short/AEM.02554-10v1?rss=1>

© 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 [Food Safety Centre](#) for Meat & Livestock Australia



FOR FURTHER INFORMATION PLEASE CONTACT: