

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

PRE-PROCESSING PATHOGEN CONTROL

Exploring how pathogens can be controlled on live animals

The USA Food Safety and Inspection Service, Animal & Plant Health Inspection Service and the Agricultural Research Service in the USDA will meet to discuss ways to improve food safety in beef before cattle are slaughtered, as most regulations and inspections are post mortem. The USDA is interested in exploring how pathogens can be controlled on live animals to reduce the possibility that beef could become contaminated with Shiga toxin-producing *E. coli*, *Salmonella* and other pathogens. They will work with producers to set-up food safety practices to minimize food safety risks. The USDA is interested in the conditions of animals entering plants before slaughter, as well as when slaughtering takes place, and the amount of contamination on the hides of the animals. Current research indicates at least two pre-harvest interventions, 1) probiotics – dairy foods or dietary supplements containing live bacteria added to the beneficial bacteria already found in the bovine gastrointestinal tract, and 2) vaccines could be effective in reducing faecal shedding in cattle.

<http://www.meatpoultry.com/Writers/Bernard%20Shire/Ratcheting%20up%20food-safety%20efforts.aspx>

E. coli O157:H7 shedding in beef calves born to cows vaccinated prepartum

This USA study was conducted to examine the performance, health, and shedding characteristics of beef calves that were vaccinated with an *E. coli* O157:H7 siderophore receptor and porin (SRP) bacterial extract. The calves were born to cows vaccinated prepartum with the same vaccine. Calves born to vaccinated cows had significantly higher titres of anti-*E. coli* O157:H7 antibodies in their blood at branding. At entry to the feedlot, overall faecal *E. coli* O157:H7 prevalence was 23% among calves, with the lowest prevalence (15%) in vaccinated calves from vaccinated cows, and then next lowest (19%) was calves vaccinated born to non-vaccinated cows. Faecal shedding of *E. coli* O157 on arrival to the feedlot did not correlate with faecal shedding at slaughter. The *E. coli* O157:H7 SRP vaccination treatment had no effect on feedlot calf health or performance such as prevalence of lung lesions or liver abscess or morbidity, retreatment, or mortality numbers. The results of this study indicate that the timing of vaccination of calves against *E. coli* O157:H7 may be an important consideration for maximizing the efficacy of this vaccine. <http://www.ingentaconnect.com/content/iafp/jfp/2011/00000074/00000010/art00002>

Effect of reducing wet distiller's grains fed to cattle on of *E. coli* O157:H7

USA researchers investigated if feeding a lower level of wet distiller's grains with solubles

(WDGS) at the end of the feeding period reduces *E. coli* O157:H7 load at harvest. Cattle were fed 0, 40, or 70% WDGS. For three of the treatments, WDGS was reduced midway through the study. Prior to the reduction of WDGS, animals fed diets with 40 or 70% had higher prevalence of *E. coli* O157:H7. After the dietary switch, animals had faecal *E. coli* O157:H7 prevalence similar to those of animals fed no WDGS whereas animals kept on the 40% WDGS had the highest faecal prevalence. Similar relationships between the treatments were observed for hide samples. Time after dietary switch was found to be important, as animals fed lower levels had significantly lower faecal prevalence after 56 days, but not after 28 days. The results indicate that cattle can be switched to lower levels of dietary WDGS (15% or less) 56 days prior to harvest to reduce *E. coli* O157:H7 in faeces and on hides. <http://www.ingentaconnect.com/content/iafp/jfp/2011/00000074/00000010/art00004>

Characterization of non-O157 shiga-toxin producing *E. coli* (STEC) from bovine farms

The objective of this study was to examine the prevalence of non-O157 STEC on beef and dairy farms in Ireland, and to characterise the isolates in terms of serotype and virulence markers. Bovine faecal samples and farm soil samples were collected from 20 farms over a 12-month period. Shiga toxin-positive samples were cultured and examined for the presence of toxin genes. Positive isolates were serotyped and examined for a range of virulence factors. Shiga-toxin and attachment genes were further examined for known variants. Significant numbers of faecal and soil samples were toxin gene-positive with a higher occurrence in late summer and early autumn. One hundred and seven STEC isolates were recovered representing 17 serotypes. O26:H11 and O145:H28 were the most clinically important serotypes found, with O113:H4 being the most frequently isolated. However, other serotypes

were also found to carry toxin and virulence genes.

<http://aem.asm.org/cgi/content/short/AEM.06190-11v1?rss=1>

PROCESS CHAIN FOOD SAFETY PERFORMANCE

Performance of food safety management systems in the lamb production chain

To test a developed microbial assessment scheme, European researchers assessed the microbiological status of the whole lamb production chain at slaughterhouses, a processing plant, and butcher shops selling whole or cut lamb carcasses that had a food safety management system (FSMS) according to legislative requirements. The highest bacterial counts were found in the slaughterhouses in samples taken from the meat, contact surfaces and operators' hands and/or gloves especially after hide removal and evisceration. Microbial safety level profiles were constructed for each establishment and provided indications of which pathogens, hygiene indicators, or utility parameters required attention to improve the performance of the microbiological control protocols of the implemented FSMS.

<http://www.ingentaconnect.com/content/iafp/jfp/2012/00000075/00000001/art00014>

PROCESSING CONTAMINATION CONTROL

Enhanced control of microbiological contamination at a beef packing plant

The aims of this Canadian study were to investigate control measures for microbiological contamination in a beef packing plant. The microbial counts recovered from swabs from carcasses after skinning was 2.2 log CFU/cm². A 5% lactic acid spray on un-eviscerated carcasses reduced aerobic bacterial counts by 1 log unit; but subsequent carcass dressing operations, a second treatment with lactic acid, pasteurizing,

and carcass cooling had no effect upon the number of bacteria. Conveyor belts carried similar bacterial numbers to the cooled carcasses and aerobic and coliform counts were higher on the trimmed products and conveyors than carcasses. The coliform counts from skinned carcasses were <1 log CFU/cm². The numbers were reduced by the washing but increased after evisceration operations. The lactic acid spray and pasteurization reduced coliforms to below detectable level. No coliforms or were recovered from cooled carcasses except 1 of the 50 hindquarter swabs. The results indicate that most cooled carcasses carry coliforms at low levels but that product can be contaminated with small numbers of coliforms during carcass processing. <http://www.ingentaconnect.com/content/iafp/jfp/2012/00000075/00000001/art00022>

Survival of *E. coli* on beef sprayed with lactic acid

Canadian researchers investigated the effects of spraying 5% lactic acid on membrane, fat and cut muscle surfaces of beef inoculated with *E. coli*. Spraying with 5% lactic acid reduced the highest numbers of *E. coli* on membrane surfaces by up to 4 log units; on fat or cut muscle surfaces bacterial counts were reduced by ≤ 1.5 log unit, and the reductions declined with decreasing volumes of lactic acid. Spraying with water only reduced the numbers of *E. coli* on membrane surfaces but had little effect on the numbers of *E. coli* on fat or cut muscle surfaces, even with high initial contamination. Spraying lactic acid in any volume reduced the numbers of *E. coli* on all surfaces. However, samples inoculated with *E. coli* at <1 log cfu/cm² and sprayed with lactic acid still had recoverable counts of *E. coli*. The results indicate that spraying relatively heavily contaminated cuts or trimmings with 5% lactic acid can reduce numbers of *E. coli* by between 0.5 and 1 log unit. However, such a treatment is likely less effective for reducing numbers of these bacteria on lightly contaminated product. <http://www.sciencedirect.com/science/article/pii/S0956713511005627>

Efficacy of existing interventions to control shiga toxin-producing *E. coli* (STEC)

Recent USA research investigated whether various chemical treatments that reduce *E. coli* O157:H7 contamination on beef trimmings may also reduce non-O157 Shiga toxin-producing *E. coli* (STEC), such as the six non-O157 STEC serotypes (O26, O45, O103, O111, O121, and O145), as well as *Salmonella* Newport and *Salmonella* Typhimurium. This study found that existing industry decontamination treatments (such as lactic acid, acidified sodium chlorite, peroxyacetic acid, sodium metasilicate, Bromitize, SYNTRx 3300 and AFTEC 3000) had the same effect against the non-O157 STEC serotypes and *S. Newport*/*Typhimurium* antibiotic resistance phenotypes. <http://www.meatpoultry.com/News/News%20Home/Food%20Safety/2011/12/Existing%20interventions%20control%20all%20STEC%20study.aspx>

Efficacy of trimming to control *E. coli* O157:H7 surrogates on subsequent subprimals

USA researchers evaluated the effectiveness of trimming external carcass surfaces from subprimals during production to reduce *E. coli* O157:H7 surrogates. Carcass sides were inoculated with a cocktail of three non-pathogenic *E. coli* strains, before entering the blast chill cooler. Following a 48 hour chill, sides were processed to produce eight subprimals. Microbiological swab samples were taken from the original carcass fat surface area, initial lean surface area, trimmed fat surface, and trimmed lean surface area. Newly exposed lean surfaces had lower counts *E. coli* than the external fat surfaces. However, fat and lean surfaces that were not inoculated became contaminated during the fabrication process. The results indicated trimming external surfaces reduced levels of pathogens, but under normal fabrication processes, pathogens were still spread to newly exposed surfaces.

<http://www.sciencedirect.com/science/article/pii/S0309174011002968>

PRODUCT TREATMENT TECHNOLOGY

Cold atmospheric pressure plasma treatment of ready-to-eat meat

Danish researchers investigated the application of cold atmospheric pressure plasma for decontamination of sliced meat inoculated with *Listeria innocua*. Inoculated samples were treated with several power levels for 2–60 seconds inside bags containing oxygen and argon. Treatments resulted in a reduction (up to 1.6 log CFU/g) of *L. innocua*, however there was no correlation between time and intensity of treatment and reduction in bacteria. Multiple treatments with a 10 minute interval increased reduction of *L. innocua* with increasing number of treatments. Concentrations of thiobarbituric acid reactive substances (TBARS) increased with power, treatments and storage time after up to 14 days of storage at 5°C. Surface colour changes included loss of redness after 1 and 14 days of storage, regardless of plasma treatment. The results indicated that plasma may be applicable in surface decontamination of pre-packed RTE food products. However, sensory acceptability may be an issue. <http://www.sciencedirect.com/science/article/pii/S0740002011003017>

Effects of packaging and irradiation on *E. coli* O157:H7 in ground beef patties

USA researchers investigated the efficacy of controlling *E. coli* O157:H7 in ground beef patties by combining irradiation with vacuum packaging or modified atmosphere packaging (MAP). Fresh ground beef patties were inoculated at 5 log CFU/g. Single patties, packaged with vacuum or high-CO₂ MAP, were irradiated at 0 (control) and three levels of intensity. The D₁₀-value (dose required to reduce bacterial numbers by 90%) for *E. coli* O157:H7 was similar for vacuum- and MAP-

packed patties. Irradiation with highest dosage reduced *E. coli* O157:H7 by around 3.0 log, while lower doses achieved reductions of 1.0 to 2.0 log. After irradiation, the number of *E. coli* O157:H7 on beef patties in refrigerated storage (4°C) did not change significantly for 6 weeks. Temperature abuse (at 25°C) resulted in growth in vacuum-packaged patties treated with the lower doses, but no growth in MAP packages. The results indicate that combining irradiation with MAP and vacuum packaging for control of *E. coli* O157:H7 in ground beef patties during refrigerated storage had a similar effect on bacterial reductions. However, in the event of temperature abuse, high-CO₂ MAP appeared to be more effective at limiting growth.

<http://www.ingentaconnect.com/content/iafp/jfp/2011/00000074/00000012/art00003>

BACTERIAL CHARACTERIZATION

Isolation and characterization of shiga toxin-producing *E. coli* (STEC) in retail beef-products

South Korean researchers investigated the prevalence of shiga toxin-producing *E. coli* (STEC) in edible beef intestinal samples. A total of 23 STEC strains were isolated from 15 samples. The isolation rates of STEC from edible beef intestines were <6% from any of the products. All STEC isolates harboured either one or both toxin genes simultaneously. Among the 23 isolates, 13 strains were identified as 11 different O serogroups. However, enterohemorrhagic *E. coli* (EHEC) O157, O26, and O111 strains were not isolated. The highest resistance rate observed was against tetracycline, followed by streptomycin and ampicillin. This study showed that edible beef by-products can be potential vehicles for transmission of antimicrobial-resistant pathogenic *E. coli* to humans. <http://www.liebertonline.com/doi/abs/10.1089/fpd.2011.0994>

Antimicrobial susceptibility of *Staphylococcus aureus* from retail ground meats

The aim of this USA study was to characterize antimicrobial resistance in *Staphylococcus aureus*, including methicillin-resistant (MRSA) from raw meat products. Samples of ground beef, ground pork, and ground turkey were collected by random sampling from stores of three grocery chains. Two hundred *S. aureus* isolates were recovered by direct-plating. Nearly 70% of the *S. aureus* tested for antimicrobial susceptibility were resistant to tetracycline, less so to penicillin, ampicillin, methicillin, erythromycin, clindamycin, gentamicin, and chloramphenicol, oxacillin, cefoxitin, or quinupristin-dalfopristin. One-third of the isolates were susceptible to all tested antimicrobials. More turkey and pork isolates were resistant to ampicillin, penicillin, and tetracycline than were beef isolates. The authors suggested that further investigations on MRSA in the food supply are needed despite the low rate of MRSA found in this particular study, as well as the lack of such previous research.

<http://www.ingentaconnect.com/content/iafp/jfp/2011/00000074/00000010/art00006>

REGULATORY NEWS

USDA to expand *E. coli* tests to non-O157 STECs

The USDA has announced the addition of six serogroups of non-O157:H7 shiga-toxin producing *E. coli* (nSTEC) that will be considered adulterants in non-intact raw beef, including ground beef and tenderized steaks. The six *E. coli* serogroups include: O26, O103, O45, O111, O121 and O145. As adulterants, if product represented by tested samples of raw beef contains any of the six strains it will not be allowed into commerce for sale to consumers. The USDA plans to initially focus testing on beef trim production before it is distributed to grinding facilities. The USDA based its decision to focus on the non-O157 strains on information from the Center for Disease Control and Prevention, which has determined these strains are responsible for more than 112,000 foodborne illnesses annually in the USA. The additional testing protocol calls for using samples that are already being taken to test for other pathogens, in what the agency hopes will be a streamlined and efficient part of processors current test-and-hold protocols. <http://www.meatpoultry.com/News/News%20Home/Food%20Safety/2011/9/USDA%20to%20expand%20E%20coli%20tests%20to%20non-O157%20STECs.aspx>

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