

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

Pathogens in Animals

Evidence for the transmission of *Campylobacter* species by flies and slugs

A recent study in the United Kingdom has demonstrated that flies and slugs are capable of transmitting *Campylobacter* species from ruminant faeces. The work used a DNA sequence based method to assess the relatedness of *Campylobacter* species recovered from flies, slugs and faeces on a single farm in Scotland. Common DNA sequence types were identified between the three vectors, suggesting that transmission and carriage was occurring among them.

The work demonstrates carriage of *Campylobacter* species by flies and slugs for the first time, and may, in part, explain the distribution of *Campylobacter* species, contributing to epidemiological and other distributor studies. Furthermore, the work reinforces the need to minimise exposure of food and food contact surfaces to these agents.

<http://www3.interscience.wiley.com/journal/123299652/abstract>

Evidence for prolonged survival of *Campylobacter* spp. in cattle manure

Researchers have demonstrated for the first time that *Campylobacter* spp. excreted in cattle faeces can survive for prolonged periods. *Campylobacter* species, particularly *C. jejuni*, are a very common cause of food-borne gastrointestinal illness in humans. Commonly, *Campylobacter* species were believed to only persist within the gut of animals.

However, researchers in Canada recently investigated the persistence of naturally-occurring *Campylobacter* in aerobic compost constructed of manure from beef cattle that were administered chlortetracycline and sulfamethazine or from cattle not administered antibiotics (control). The study

clearly identified viable cells after prolonged periods, providing strong evidence for environmental persistence outside of the animal gastrointestinal tract. The study has important implication in terms of potential food spoilage and transmission of *Campylobacter* through the food supply chain.

<http://aem.asm.org/cgi/content/abstract/76/4/1110>

Bacteriophage as biocontrol agents for *Escherichia coli* in cattle

Bacteriophage, viruses that infect and destroy bacteria, have considerable promise as additives targeted at the control of food-borne pathogens. These agents are harmless to humans and animals, and may theoretically target the food-borne pathogens while still on the farm. As such, screening of bacteria or "bio-prospecting" for these agents has become popular.

In a recent study, researchers have searched for bacteriophage (phage) with the potential to control enterohaemorrhagic and shiga-toxin producing *E. coli*. The researchers isolated a range of phage from these bacterial species isolated from both minced beef samples and cattle faeces.

A total of 16 phage were recovered, each displaying a range of unique properties. Following extensive screening, four of the phage (types CA911, CA933P, MFA933P and MFA45D) were shown to have considerable activity against the *E. coli* types of interest. Furthermore, the phage demonstrated acid resistance conducive to biocontrol applications *within* cattle. This has the potential to control a known pathogenic *E. coli* reservoir, and has significant food safety implications.

<http://www3.interscience.wiley.com/journal/123315754/abstract>

Citrus compounds used to control biofilm formation in *Escherichia coli* O157:H7

Flavonoids, a compound present in citrus, have been successfully used to inhibit biofilm formation by *E. coli* O157:H7. The research, conducted in Texas, USA, found that flavonoids inhibit cell-to-cell communication (known as quorum sensing) in *E. coli* O157:H7. Quorum sensing involves, among other things, secretion of compounds known as autoinducers by bacteria, which are then detected by other bacteria and results in the induction of a response such as the formation of a biofilm. All of the flavonoids tested were successful at “scrambling” this message, particularly naringenin, a secondary metabolite present in many citrus species. Flavonoids pose no risk to human health at all, and given the demonstrated inhibitory effects that they can induce in bacteria, may represent an effective, natural, biocontrol agent.

<http://www3.interscience.wiley.com/journal/123244193/abstract>

Evaluation of a direct-fed microbial product on the prevalence and load of *Escherichia coli* O157:H7 in feedlot cattle

In a recent USA study, the efficacy of direct-fed-microbials (DFM), as a pre-harvest intervention for the reduction of *E. coli* O157:H7 in faeces and hides of cattle, and for weight gain, was evaluated. A large number of cattle (n = 526) were split among 16 pens, and half were administered direct-fed *Bacillus subtilis*, while the other half were not. Hides and faecal samples were collected after defined time periods.

No significant difference between the DFM-treated and non-DFM treated group was detected. This was observed for both shedding of *E. coli* O157:H7 and for weight gain in the DFM treated cattle. Comparably minor weight gain was observed in the DFM-treated animals, and faecal shedding and hide contamination with *E. coli* O157:H7 remained high. The researchers concluded that DFM was an ineffective pre-harvest intervention against *E. coli* O157:H7.

<http://www.ingentaconnect.com/content/iafp/jfp/2010/00000073/00000002/art00021>

Risk factor analysis of *Salmonella* species recovered from USA feedlot cattle

Preharvest intervention represents a key area of interest for the reduction of contamination in the farm-to-fork food processing cycle. In a recent USA-based study, the presence of *Salmonella* species in faecal samples collected from 73 cattle feedlots, were assessed for

correlation between management and demographic factors.

A positive association between components of cattle feed (brewers grain, corn gluten), mixed herd penning and cattle farm was identified. Negative association was observed for cattle feed (alfalfa, clover) and administration of tetracycline antimicrobials prior to sampling.

Overall, the researchers suggest that given the positive association observed between the specific components of cattle diet and detection of *Salmonella* species, more research into this area as an intervention focal point is warranted. <http://www.liebertonline.com/doi/abs/10.1089/fpd.2007.0068>

Feeds and residues

Assessment of antimicrobial breakdown in manure

The antimicrobial oxytetracycline (OTC) is administered to cattle in the USA to control disease. This antimicrobial is only partially absorbed by the animal's digestive tract, with the remainder known to pass through the animal with pharmaceutical activity retained, eventually breaking down in manure. Given that cattle in the USA produce approximately 64 million tons of manure annually, the rate of OTC breakdown in manure is important as it poses a risk for the development of tetracycline-resistant bacteria.

The scientists found that OTC breaks down more rapidly at elevated temperatures and moisture levels, but slowed in decreased oxygen levels. Furthermore, it was observed that OTC breaks down in manure faster than soil, likely to be the result of the increased temperature, organic matter and water content in this medium. The work highlights the time taken for breakdown of OTC following excretion into the environment, and suggests that it may provide information to farmers which would allow them to maximise the breakdown of OTC on their farms.

<http://www.ars.usda.gov/is/pr/2010/100304.htm>

Host source and DNA type are correlated with levels of toxin production by *Escherichia coli* O157:H7 strains

Three, broad, distinct lineages, based on genetic differences, are recognised in *E. coli* O157:H7 strains. These lineages are known to differ in their distribution throughout cattle and humans. Shiga-toxin production by *E. coli* O157:H7 is a major pathogenesis element. In a recent Canadian study, the ability of *E. coli*

O157:H7 of different lineage to produce Shiga-toxin was assessed. Results from the study indicated that there were lineage specific differences in both Shiga-toxin type and production, and that this could be correlated to strains recovered from humans and cattle. This indicates that some *E. coli* O157:H7 strains are potentially more virulent, with greater capacity to cause disease. This has significant food safety implications, as it implies that some populations of *E. coli* O157:H7 are higher risk than others. Recognition of these strains may aid studies investigating the reservoir of higher risk *E. coli* O157:H7 populations, and help discern the reasons for the increased propensity for toxin production. <http://aem.asm.org/cgi/content/abstract/76/2/474?etoc>

Drug residues recovered in feed after various feedlot mixer truck cleanout procedures

Scientists have conducted a study to assess the effectiveness of two methods of equipment cleanout for reducing drug carryover in feedlot mixer trucks. The two methods, commonly used in the industry, were sequencing and flushing. Feed samples were collected from total mixed rations before and after various feed mixer equipment cleanout procedures. Medicated rations contained either 11 ppm of tylosin, or 166 or 331 ppm of chlortetracycline.

Results from the study showed that there was no significant difference between the two clean-out methods, and the researchers concluded that current cleanout methods appear to keep the residue of chlortetracycline and tylosin very low. <http://www.ingentaconnect.com/content/iafp/jfp/2010/0000073/00000001/art00013>

Molecular detection of prohibited animal products in livestock feeds

Rapid and routine detection of prohibited animal products in livestock feeds is necessary to ensure compliance and maintain food safety standards in many parts of the world. However, to date, no effective method has been applied. Recently, scientists in Canada have trialled a highly specific molecular method, called single strand conformation polymorphism, to attempt to identify prohibited animal constituents within livestock feeds. The researchers analysed samples that contained both prohibited and allowable animal products.

The method allowed specific detection of all animal product additives, including trace amounts of cattle derived products. The researchers called the trial a success, and, although an expensive

methodology at the moment, hope that it paves the way for less expensive, rapid tests in the future. <http://www.ingentaconnect.com/content/iafp/jfp/2010/0000073/00000001/art00020>

Pathogens in meat

Presence and characterisation of shiga toxin-producing *Escherichia coli* and other potentially diarrheagenic *E. coli* in retail meats

Researchers in the USA have conducted a large scale study to determine the prevalence of diarrheagenic *E. coli* strains in retail meats. The study analysed 7258 *E. coli* strains collected over a 5-year period from retail sources. All of the strains were screened for shiga toxin genes, and 1275 strains were screened for genes associated with other diarrheagenic factors.

A total of 20 strains tested positive for shiga toxin genes, and 11 tested positive for alternative diarrheagenic factors. These strains were further divided into a broad range of subtypes based on other molecular based tests. Most of the toxin-positive strains were recovered from minced beef. The results highlight a high risk food source, and provided insight into the level of contamination present in retail meats. <http://aem.asm.org/cgi/content/abstract/AEM.01968-09v1?etoc>

Shelf-life

Survival of *Pseudomonas fluorescens* on beef carcass surfaces in a commercial abattoir

The influence of a commercial chilling process on survival of *P. fluorescens*, a common spoilage microbe in fresh meat, on a variety of beef carcass surfaces was recently assessed. The carcasses were inoculated both prior (hot inoculated) and after (cold inoculated) chilling.

P. fluorescens counts were found to significantly increase following hot inoculation, while they declined or remained unchanged on the cold inoculated carcasses. In addition, differences were observed in survival of *P. fluorescens* associated with chiller relative humidity and water activity.

The results of this work have the potential for extrapolation to other food processing contaminants. The work may aid in the identification of a contamination source, and the

establishment and refinement of critical control points within abattoir systems.

[http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T9G-4YJCKY8-3&_user=1526876&_coverDate=03%2F07%2F2010&_rdoc=6&_fmt=high&_orig=browse&_srch=doc-info\(%23toc%235114%239999%239999999999%239999%23FLA%23display%23Articles\)&_cdi=5114&_sort=d&_docanchor=&_ct=62&_acct=C000052220&_version=1&_urlVersion=0&_userid=1526876&md5=6518dc9f08b0b44605610c087bbae365](http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T9G-4YJCKY8-3&_user=1526876&_coverDate=03%2F07%2F2010&_rdoc=6&_fmt=high&_orig=browse&_srch=doc-info(%23toc%235114%239999%239999999999%239999%23FLA%23display%23Articles)&_cdi=5114&_sort=d&_docanchor=&_ct=62&_acct=C000052220&_version=1&_urlVersion=0&_userid=1526876&md5=6518dc9f08b0b44605610c087bbae365)

Addition of a *Lactobacillus* bacterium for the control of beef spoilage microflora in modified atmosphere packaging

The potential for the addition of harmless protective bacterial cultures to packaged fresh products has received considerable attention lately. Recently, the effect on sensory quality attributes and spoilage bacteria present on MAP stored beef by the addition of *Lactobacillus curvatus* strain CRL705 was assessed. This organism has previously been shown to produce potent bacteriocins; toxins produced by bacteria that inhibit other bacteria.

In the study, *L. curvatus* rapidly became the dominant population on MAP packaged beef, controlling the growth of a range of spoilage bacteria. This was correlated with a 10-day increase in the time taken for the beef product to show signs of spoilage. Furthermore, an acidic "off" flavor of the beef product was only detected 60 days after refrigerated storage, and no "off" odours were detected at all. The researchers concluded that the bacterial strain has the potential for considerable extension of MAP stored beef products, with little influence on the products sensory attributes.

[http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T9G-4YC80XN-1&_user=1526876&_coverDate=02%2F11%2F2010&_rdoc=31&_fmt=high&_orig=browse&_srch=doc-info\(%23toc%235114%239999%239999999999%239999%23FLA%23display%23Articles\)&_cdi=5114&_sort=d&_docanchor=&_ct=62&_acct=C000052220&_version=1&_urlVersion=0&_userid=1526876&md5=2acd60a87c541f76d553925242b7c030](http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T9G-4YC80XN-1&_user=1526876&_coverDate=02%2F11%2F2010&_rdoc=31&_fmt=high&_orig=browse&_srch=doc-info(%23toc%235114%239999%239999999999%239999%23FLA%23display%23Articles)&_cdi=5114&_sort=d&_docanchor=&_ct=62&_acct=C000052220&_version=1&_urlVersion=0&_userid=1526876&md5=2acd60a87c541f76d553925242b7c030)

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Microbiological methods

Comparison of excision verses swabbing, and swab verses gauze, in microbiological sampling

Spanish researchers have compared two microbiological sampling methods, excision and swabbing, as well as a range of swabs and gauze sampling media, to assess their effectiveness in determining production process hygiene. A total of 215 samples were collected (bovine, equine, ovine and porcine) using both excision and swab methods. Additionally, the samples were collected using four different swabbing materials; cellulose, polyurethane and viscose sponges, as well as medical gauze. Total viable counts were determined and comparisons made based on this, as well as qualitative factors including the person who collected the sample and animal species.

Results from the study indicated that all of the qualitative parameters had a significant effect on the total viable bacterial count (TVC). TVC was significantly greater when the excision method was used, as well as from samples collected using cellulose, polyurethane and viscose sponges. Interestingly, no significant effect from these parameters was observed based on the total Enterobacteriaceae counts. Additionally, the cellulose, polyurethane and gauze swabs gave high counts of Enterobacteriaceae.

The researchers recommend using the cellulose, polyurethane and gauze swab methods as this was the most reproducible method. The work highlights the need for consistency in sampling methods within food processing facilities to minimise the risk of variable food production process hygiene results.

<http://www.ingentaconnect.com/content/iafp/jfp/2010/00000073/00000001/art00014>



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

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