

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

PREVALENCE

Organically verses naturally raised beef cattle: Does animal husbandry affect the prevalence of *Escherichia coli* O157:H7?

Researchers in the United States recently assessed the prevalence of *Escherichia coli* O157:H7 in naturally and organically raised beef cattle. The work sampled the animals at slaughter and compared the antimicrobial susceptibility profiles of isolates recovered from each. Results indicated that there was no difference in the prevalence and antimicrobial susceptibility profiles of *E. coli* O157:H7 recovered from cattle raised on any of the sampled farms.

http://aem.asm.org/cgi/content/abstract/75/16/5421?HITS=10&sortspec=date&hits=10&maxtoshow=&FIRSTINDEX=70&resource_type=HWF&fulltext=coli&searchid=1&RESULTFORMAT=

Methicillin-resistant *Staphylococcus aureus* detections in meat

Due to recent detections of methicillin-resistant *Staphylococcus aureus* (MRSA) in meat animals (including beef cattle) a study was performed to assess the prevalence of this organism in

raw meat samples. This microorganism can cause serious clinical disease and it is thought that contamination of meat products with MRSA may occur during slaughter. Of 2217 samples, 264 (11.9%) were positive for MRSA. Prevalence in raw beef and veal was 10.6 and 15.2% respectively. Due to the relatively high prevalence detected and the potential for serious illness, further studies may be required examining transmission routes and possible means of control.

http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T7K-4V4KPK5-2&_user=1526876&_rdoc=1&_fmt=&_orig=search&_sort=d&_docanchor=&_view=c&_acct=C000052220&_version=1&_urlVersion=0&_userid=1526876&md5=bcc913248d6168db1cb0c2658b5317a7

Does cattle farm type influence *Escherichia coli* O157 prevalence?

The influence of Belgian farm type on the prevalence of *Escherichia coli* O157:H7 was examined in a recent large scale study. Factors including cattle type, target product and those associated with pen type were assessed. A total of 180 farms were examined and animals aged <8, 8 – 30 and >30 months were sampled. Sixty eight farms (37.8%) tested positive for *E. coli* O157:H7 with highest prevalence observed on dairy farms. A

significant correlation between cattle age category (animals >30 months) and prevalence of *E. coli* O157:H7 was observed on mixed dairy and beef farms, and dairy farms. The work illustrates a risk factor for increased prevalence of *E. coli* O157:H7 that should be considered in future risk analysis.

<http://www.ingentaconnect.com/content/iafp/jfp/2009/00000072/00000009/art00006>

SURVEILLANCE

Applicability of a microbial Time Temperature Indicator (TTI) for monitoring spoilage of modified atmosphere packed minced meat

A recent study introduced and assessed a microbial time temperature indicator for monitoring spoilage of modified atmosphere packed minced meat. It is based on the kinetic responses of lactic acid bacteria, building on a previous study in which growth and metabolic activity of *L. sakei* were investigated. The model is ultimately aimed at developing a tool for monitoring the quality of chilled, modified atmosphere packaged meat during distribution and storage. The work tested the model at storage temperatures of 0, 5, 10 and 15°C. Results demonstrated that *L. sakei* and other lactic acid bacteria are the dominant spoilage organisms, and are useful as a spoilage index for modified atmosphere packaged minced beef. The authors concluded that a developed microbial TTI would be valuable for monitoring the quality status of meat products throughout the chill chain.

http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T7K-4WGDR0P-2&_user=1526876&_rdoc=1&_fmt=&_orig=search&_sort=d&_docanchor=&_view=c&_acct=C000052220&_version=1&_urlVers

[ion=0&_userid=1526876&md5=50999d4d44ac50765d9bd6e409435bf5](http://www.ingentaconnect.com/content/iafp/jfp/2009/00000072/00000007/art00013)

Potential changes to the current Bovine Spongiform Encephalopathy (BSE) surveillance programs for cattle in Japan

Japanese and Canadian researchers have completed a mathematical model aimed at determining the likelihood that BSE infected cattle slaughtered for human consumption would be tested and detected by the recently (2001) implemented BSE testing program. The researchers tested both slaughtered and fallen dairy, Wagyu, Wagyu-Holstein and Holstein animals with a minimum age of 21, 31 and 41 months over a 5 year period. The work found that the probability of infected animals being detected at slaughter was very low under all of the current surveillance strategies. Based on these results calls are being made for a revision of the current BSE surveillance program of Japanese cattle.

<http://www.ingentaconnect.com/content/iafp/jfp/2009/00000072/00000007/art00013>

Development of a rapid molecular based method for the specific detection of *Salmonella* on fresh meat

Molecular-based methods are powerful tools for the detection of foodborne pathogens. Many advances have been made in this field in recent times, and a number of highly sensitive and specific detection tests are now available. DNA-based detection forms a central component of this field. Due to the highly specific and sensitive nature of DNA-based detection techniques, test optimisation and validation are essential. In a recent work undertaken in Ireland, a DNA-based detection test for *Salmonella*

on fresh meat carcasses was developed. The test was optimised and tested on 150 fresh meat carcass swabs with the researchers claiming 100% specificity for *Salmonella* and detection sensitivity equivalent to one cell following standard enrichment. Further validation by independent laboratories is required; however the test shows promise as a means of highly specific and sensitive detection of *Salmonella* in primary meat industry.

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CONTAMINATION AND CONTROL

Heat and acid tolerance responses of *Listeria monocytogenes* as affected by sequential exposure to hurdles during growth

Researchers investigated the effect of hurdle levels and sequence of application on the tolerance of *Listeria monocytogenes* to heat and acid stress. A range of strains in mixture were tested and grown at three separate pH and salt concentrations. Double sequential hurdles were also applied comprising pH adjustment then salt challenge and vice versa. Following hurdle challenge, the strains were exposed to 52°C for 2 hours and pH3.5 for 7 hours, respectively. No significant difference in tolerance to heat stress was observed, however a significant difference was observed in respect to acid tolerance. The results of this study suggest that exposing *L.*

monocytogenes strains to salt and low pH may have an effect on the resistance of this organism to pH challenge depending on the stress intensity and sequence.

<http://www.ingentaconnect.com/content/iafp/jfp/2009/00000072/00000007/art00006>

Factors affecting *Escherichia coli* O157:H7 colonisation of cattle

Cattle are the primary reservoir of *Escherichia coli* O157:H7. Canadian researchers recently investigated a number of factors to assess their influence on *E. coli* O157:H7 colonisation of cattle. These included the origin of the bacteria (strain origin and lineage) and shiga-toxin 2 production. The work found that *E. coli* lineage type predicted the amount of colonisation, that colonisation by different strains was dosage dependant, and that shiga-toxin type and production influenced colonisation. The study demonstrated that specific factors influenced cattle colonisation by *E. coli* O157:H7. Information derived from such works can form the basis of intervention strategies targeted at minimising the natural reservoir of this serious foodborne pathogen.

<http://aem.asm.org/cgi/content/abstract/75/15/5074>

Essential oils as an inhibitor of *Listeria monocytogenes* biofilms

In a recent study, the effects of disinfectant solutions derived from *Cymbopogon citratus* and *Cymbopogon nardus* (lemon grass and citronella grass respectively) essential oils on the formation of biofilms by *Listeria monocytogenes* was assessed. The work tested the oils alone and in combination on 3 and 240 hour old *L. monocytogenes* biofilms on stainless steel surfaces.

Results indicated that a combination of both essential oils could reduce the biofilm by 100% within 60 minutes. The authors suggest that they may be useful as a natural means of controlling *L. monocytogenes* biofilm formation within food industries.

http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T6S-4X1YCCX-1&_user=6629683&_rdoc=1&_fmt=&_orig=search&_sort=d&_docanchor=&_view=c&_acct=C000050221&_version=1&_urlVers=ion=0&_userid=6629683&md5=ca4fd3a1a0cd9d1ae3cdbaa3c6df5ab3

Effects of carbon monoxide-modified atmosphere packaging and irradiation on *E. coli* survival and raw beef quality

United States researchers have assessed the combined effects of irradiation and carbon monoxide in modified packaging systems on the total number of coliform bacteria recovered, *E. coli* and quality attributes of fresh beef during refrigerated storage. Following treatment, the beef was stored for 28 days at 4°C. Results were assessed at 14 and 28 days. After 14 days, the raw odours of the beef decreased while the acid/sour, rancid and grassy odours increased. Visually, the raw beef appeared greener at day 14 in the aerobically packaged product. No coliforms were detected following irradiation at any stage during the trial, independent of packaging type. The study supports the safety of combined modified packaged raw beef stored for up to 28 days with maintenance of the colour sensory attributes of the product.

http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T9G-4WGF17F-1&_user=1526876&_rdoc=1&_fmt=&_orig=search&_sort=d&_docanchor=&_view=c&_acct=C000052220&_version=1&_urlVers=ion=0&_userid=1526876&md5=03f1741e7911a0384b326f4f2f63e15e

[ion=0&_userid=1526876&md5=03f1741e7911a0384b326f4f2f63e15e](http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T9G-4WGF17F-1&_user=1526876&_rdoc=1&_fmt=&_orig=search&_sort=d&_docanchor=&_view=c&_acct=C000052220&_version=1&_urlVers=ion=0&_userid=1526876&md5=03f1741e7911a0384b326f4f2f63e15e)

Longitudinal study of *Escherichia coli* O157:H7 in a beef cattle feedlot and the role of high shedders in hide contamination

The dynamics of *Escherichia coli* O157:H7 hide and faecal prevalence and the influence of high shedding (*E. coli* O157:H7) animals on this prevalence over a 9 month period in a feedlot setting was assessed. Three hundred and nineteen cattle were distributed across 10 adjacent pens and faecal and hide *E. coli* O157:H7 levels monitored. The study found an association between high faecal prevalence with increased hide prevalence. Additionally an association between *E. coli* O157:H7 prevalence and the presence of at least 1 high or so called “super” shedder animal in a pen. Importantly, the study found that to minimise risk of contamination of cattle hides with *E. coli* O157:H7, faecal prevalence should be kept below 20% and shedding levels kept at <200 colony forming units per gram. The work has implications in terms of further pre-harvest intervention studies.

<http://aem.asm.org/cgi/content/abstract/AEM.00081-09v1?etoc>

Can the physical structure of a beef product affect *Salmonella* thermal inactivation?

A recent study investigated the influence of beef muscle structure on the thermal resistance of *Salmonella* species. The work investigated whether thermal resistance of 8 *Salmonella* strains was affected by the degree of grinding into a minced product. They tested whole muscle, coarsely ground, finely ground

and beef puree samples. The results showed that *Salmonella* isolates recovered from the whole muscle samples had the highest thermal resistance, with no difference observed among the grind types. As such, the authors recommend that consideration be given to the physical structure (not degree of grinding) of beef when developing thermal inactivation models.

<http://www3.interscience.wiley.com/journal/122513522/abstract>

Characterising lesser known *Escherichia* species: Harmless community members or hidden threat?

United States and Australian researchers have characterised a large number of little known members of the *Escherichia* genus. Using a molecular technique, the scientists have identified 5 novel phylogenetic families of *Escherichia* from isolates obtained from the environment, humans and animals. One of these, *Escherichia fergusonii* appears to have evolved at a greatly accelerated rate when compared to *E. coli*. Due to the cryptic nature of these “families”, they have gone largely unnoticed up until now, due in part to their phenotypic resemblance to *E. coli*. The scientists state that based on this, little is understood about their ecological and clinical significance, particularly in relation to food contamination and food-borne disease. More research is required to better understand these cryptic *Escherichia* lineages to ascertain what, if any, risk they pose to public health.

<http://aem.asm.org/cgi/content/abstract/75/20/6534?etoc>

Evidence-based semi-quantitative methodology for prioritisation of foodborne zoonoses

Researchers in Belgium have conducted a study in which they prioritised an extensive list of food and water borne zoonoses (transfer of pathogens from animals to humans) on the basis of risk to the food chain. The work was targeted at allowing food safety authorities to focus on those hazards that pose the greatest risk to the food chain. Scores were given to 51 zoonotic agents on the basis of risk as decided independently by a panel of 35 scientific experts in the field of animal and public health, epidemiology and food and clinical microbiology. The scores were allocated based on severity and occurrence in humans, severity of disease, economic consequence and occurrence in animals, and occurrence in food. Results from the work identified *Salmonella*, *Campylobacter*, *Listeria monocytogenes* and verotoxigenic *Escherichia coli* to be the most important foodborne zoonotic pathogens. The study allows food safety authorities to identify gaps in knowledge of foodborne agents and facilitates the development of key research questions. The authors suggest that the method can be applied for any ranking exercise and is applicable to any country.

<http://www.liebertonline.com/doi/abs/10.1089/fpd.2009.0291>

Organic acids as a barrier to food-borne disease transmission

Contamination of animal feed by pathogenic bacteria is a potential route for transmission to animals and subsequently, into the food chain. These organisms originate from soil and the animal's gastrointestinal tract, and can enter the farm environment following use of animal manures as fertilizers, as well as animals

defecating within the farm environment. Contamination can occur at any stage of the farm processing cycle, and many pathogens can actively grow in the conditions present within animal feed. The feeds are commonly heat-treated during conditioning, pelleting and extrusion which helps to control microbial loads. However, very little protection exists to prevent contamination “post manufacture”.

Dietary acidification coupled with acidification of animal feed, both using organic acids, has been shown to have a protective effect on deterioration of feed, with constant treatment shown to have a residual effect protecting feed from recontamination and preventing contamination of milling and feeding equipment. Dietary acidification, in the range of pH4 – pH6, creates unfavourable conditions for gut microflora, while lowering the pH of the animal feed itself provides a protective effect that augments the dietary acidification. Although effective, important considerations to this approach include the buffering capacity of the feed type. Cereal feeds are poor buffers, whereas protein feeds and mineral feeds are excellent buffers. As such, acidification level must be selected based on the feed aggregate. Finally, the stress level of the animal as well as age must be considered prior to acidifying the animal diet. All considered however, acidification of diet and animal feeds using organic acids appears to be an effective, “natural” approach for minimising feed contamination with microbial pathogens with subsequent potential for transmission to the food chain.

http://ethanolproducer.com/article.jsp?article_id=6027

TRANSMISSION, VACCINATION AND IMMUNITY

Potential *Campylobacter jejuni* vaccine

Collaborative research by Canadian and USA researchers have lead to a successful trial of a vaccine against the food-borne pathogen *Campylobacter jejuni*. The organism is a leading cause of bacterial foodborne illness worldwide. Illness caused by *C. jejuni* is potentially fatal and often complicated by the development of antimicrobial resistance. Furthermore *C. jejuni* infection accounts for significant economic losses worldwide. The vaccine trial, performed on monkeys, completely protected the animals from infection with no significantly negative effects. Work is now underway to further develop the candidate vaccine so that human trials may be undertaken.

<http://www.washingtonpost.com/wp-dyn/content/article/2009/08/24/AR2009082400995.html>

Risk of *Listeria* transmission from high pressure cleaning

Researchers at Kansas State University in the USA have found that cleaning using high pressure hoses can actually generate aerosols which can transfer bacterial cells such as *L. monocytogenes* away from the drain and onto food processing benches. Transfer of bacterial cells was observed as high as 5 metres above the drain. Furthermore, growth was detected after 48 hours. The researchers state that although serious in nature, the problem can be controlled with a combination of proper training and vigilance.

<http://www.meatprocess.com/Safety-Legislation/Listeria-risks-from-high-pressure-cleaning>

Can cattle administered low dose antimicrobials be a source of resistant *Escherichia coli*?

Beef and other cattle are commonly fed growth promoting antibiotics. In recent years antimicrobial resistance in bacteria is known to have increased to levels that have become a public health concern. In a recent Canadian study, scientists analysed the faeces from cattle fed and not fed growth promoting antimicrobials over a 175 day period to assess growth and persistence of *E. coli* numbers. In addition, the proportion of antimicrobial resistant (tetracycline and ampicillin) *E. coli* from those recovered was determined. Cattle were fed diets containing two antimicrobials and faecal samples were collected 12 times over the 175 day trial period. Significant numbers of tetracycline resistant *E. coli* were recovered and represented approximately 30% of the total *E. coli* identified. Numbers of all *E. coli* increased up to day 56, and numbers of tetracycline resistant *E. coli* were high even after 175 days.

Characterisation of the *E. coli* recovered showed that a diverse range was present, although this appeared to be influenced by antimicrobial growth promoter and sampling time. The study demonstrated that cattle faeces can be a significant source of antimicrobial resistant *E. coli* populations even after a prolonged period of environmental exposure.

<http://aem.asm.org/cgi/content/abstract/AEM.00944-09v1?etoc>



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

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