

## 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

### CONTROLS

#### Controlling *Escherichia coli* O157:H7 using bacterial viruses

Research into bacteriophage (viruses that infect bacteria, commonly termed phage) as a means of food pathogen control is currently popular. In a recent research article, a cocktail of naturally occurring bacteriophage has been shown to reduce *E. coli* contamination on fruit, vegetables, meat and hard surfaces under experimental conditions. The study used multiple strains of *E. coli* O157:H7 and different concentrations of phage. Results showed that all of the phage mixtures significantly reduced *E. coli* numbers and indicate that these agents may help control *E. coli* O157:H7. This work highlights the potential for relatively inexpensive, effective and “green” biocontrol of potentially dangerous *E. coli* strains within the food industry.

Abuladze, T., (2008). *Applied and Environmental Microbiology* 74(20): 6230 - 6238  
<http://aem.asm.org/cgi/content/abstract/74/20/6230>

#### Evaluation of an “anti-*Salmonella*” bacterium for use against persistent *Salmonella*

The ability of an *E. coli* strain to reduce *Salmonella* in persistently infected cattle herds was assessed. The strain was found to produce a substance similar to a bacteriocin (a toxin produced by bacteria that targets other bacteria) and decreased levels of *Salmonella* in laboratory tests. Less *Salmonella* was shed in cattle that had been given the *E. coli* strain. The researchers believe that the *E. coli* strain may naturally control *Salmonella* species in persistently infected cattle herds.

Patton, T., *American Journal of Veterinary Research* 70(1): 92 - 98  
<http://avmajournals.avma.org/doi/abs/10.2460/ajvr.70.1.92>

#### Prevalence and characterisation of *Salmonellae* in commercial ground beef in the United States

A large number of commercially prepared ground beef samples were collected from seven (7) regions in the USA over a 24-month period and tested for the presence of *Salmonella enterica*. The study found that overall prevalence was low (4.2%), and of the samples that were positive, *S. enterica* numbers were determined to be less than 2 cells per gram of ground beef. Regional differences in prevalence were not identified. Multiple serotypes were isolated and a low prevalence of multi-drug resistant strains was observed. The authors concluded that the prevalence of *Salmonella enterica* in the USA commercially prepared beef is low but should be further evaluated with new and different methods of detection.

Bosilevac, J., (2009). *Applied and Environmental Microbiology* 75(7): 1892 - 1900  
<http://aem.asm.org/cgi/content/abstract/75/7/1892?etoc>

#### Risk scoring as a method for setting priorities in monitoring antimicrobial resistance in meat and meat products

A semi-quantitative risk assessment model was developed to assess consumer risk of acquiring antimicrobial resistant pathogens through consumption of different meat types. The model focused on three key risk components; (1) prevalence of the resistant microbe, (2) human health consequences and (3) consumption volume of a specific product. The model evaluated each step in the food chain to establish a prevalence score for *Campylobacter* spp., *Enterococcus* spp. and *Escherichia coli* in the meat products/product categories tested. Based on these collective components the meat products were rated as a high, medium or low human health risk. Results of the model indicated that chicken and pork presented the highest human health risk, followed by beef and

### DETECTION AND SURVEILLANCE

veal. The model presents a new way to rank the risk of antimicrobial resistance in food products.

Presi, P., (2009).. *International Journal of Food Microbiology* 130(2): 94 - 100

[http://www.sciencedirect.com/science?\\_ob=ArticleURL&\\_udi=B6T7K-4V8G9Y8-](http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T7K-4V8G9Y8-)

[5&\\_user=1526876&\\_rdoc=1&\\_fmt=&\\_orig=search&\\_sort=d&view=c&\\_acct=C000052220&\\_version=1&\\_urlVersion=0&\\_userid=1526876&md5=ab8998a36154dca9db2b3ea05b71d5fc](http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T7K-4V8G9Y8-5&_user=1526876&_rdoc=1&_fmt=&_orig=search&_sort=d&view=c&_acct=C000052220&_version=1&_urlVersion=0&_userid=1526876&md5=ab8998a36154dca9db2b3ea05b71d5fc)

### **Determining how specific microbial groups affect the spoilage of beef**

Microbial release of volatile compounds contributes to meat spoilage. In a recent study, single strains and mixtures of different strains of mesophilic (bacteria that grow best at moderate temperatures) and psychrotrophic (grow best at low temperatures) bacteria were used to contaminate beef chops that were packed and stored at 7°C. After one month, the meat chemical profiles were dramatically different depending on the type of contaminating bacteria. Some molecules were identified only when the meat was contaminated by a specific species. Compounds such as 2-ethyl-1-hexanol, 2-buten-1-ol, 2-hexyl-1-octanol, 2-nonanone, and 2-ethylhexanal were detectable only for *C. maltaromaticum*, which also produced the highest number of aldehydes, lactones, and sulfur compounds. The highest number of alcohols and ketones were detected in the headspace of meat samples contaminated by *P. fragi*, whereas the highest concentrations of some alcohols, such as 1-octen-3-ol, and some esters, such as isoamyl acetate, were produced by *S. proteamaculans*. The study results showed that different microbial species release different types of volatile compounds that then contribute to meat spoilage at differing levels, effecting meat quality during storage. This information could be used to extend the storage life of meat by targeting those microbial species that contribute most to the spoilage process.

Ercolini, D., (2009). *Applied and Environmental Microbiology* 75(7): 1990 - 2001  
<http://aem.asm.org/cgi/content/abstract/75/7/1990?etoc>

### **Development of a risk-ranking framework to evaluate potential high-threat microorganisms, toxins, and chemicals in food**

The USA Food and Drug Administration and Institute of Food Technologies have developed a new risk-ranking framework, to allow comparison of microbiological and chemical hazards, and determine the impact of different hazard-food combinations. The prototype can give a single value to assess the potential hazard, taking many variables into account. This value is termed the annual pseudo-disability adjusted life years

(pDALY). The web-based program gives an output including hazard and dose-response assumptions, per capita consumption by population group and annual p-DALY. This technique considers a number of factors that affect high-risk foods in one simple assessment value.

Newsome, R., (2009). *Journal of Food Science* 74(2): 39 – 45

<http://www.ingentaconnect.com/content/bpl/jfds/2009/00000074/00000002/art00008>

### **Using *Enterobacteriaceae* to predict the absence of *Salmonella* on beef carcasses**

In a recent study, the correlation between the absence of *Enterobacteriaceae* (Gram negative bacteria of enteric origin) and the absence of *Salmonella* within beef abattoirs was conducted to evaluate its potential predictive power. The method was tested on both small and large data sets obtained over a 7-month period from abattoirs, before and after cleaning and sanitisation. Around 98% of the carcasses that were negative for *Enterobacteriaceae* were also negative for *Salmonella*. *Salmonella* contamination rates of final post – intervention carcasses were 1.1 and 7% for two data sets that also tested positive for *Enterobacteriaceae*. Results showed that the absence of *Enterobacteriaceae* was an accurate indicator of absence of *Salmonella*. The findings may be useful in abattoir hygiene evaluation and intervention efficiency.

Ruby, J. and Ingham, S. (2009). *Journal of Food Protection* 72(2): 260 - 266

<http://www.ingentaconnect.com/content/iafp/jfp/2009/00000072/00000002/art00005>

### **Evaluation of two feed types on the prevalence of *Escherichia coli* O157:H7 and *Salmonella* species in cattle faeces**

An association between feeding dried distiller's grains and dry-rolled corn to cattle and the prevalence of *E. coli* O157:H7 in cattle faeces has been suggested. In a recent study, researchers aimed to determine the effect of feeding these products to cattle on faecal prevalence of *E. coli* O157:H7 and *Salmonella* species. No significant effects were observed for either food type on either of the tested bacterial species/genus. An overall prevalence of *E. coli* O157:H7 of 5.1% was observed and did not change over the time course of the study. Prevalence of *Salmonella* species were not affected by feed type, however prevalence did increase over the sampling period from less than 1% in week one to 77.5% in week seventeen. This was observed in animals fed dried distiller's grains and dry-rolled corn as well as control

animals not on this diet. This study showed no association between feeding dried distiller's grains and dry-rolled corn to cattle and the prevalence of *E. coli* O157:H7 in cattle faeces. This contradicts previous works and suggests a need for further research.

Jacob, M., (2009).. *Foodborne pathogens and Disease* 6(2): 145 - 153

<http://www.liebertonline.com/doi/abs/10.1089/fpd.2008.0159>

## RESISTANCE, VACCINATION AND IMMUNITY

### Measuring the influence of organic and non-organic farming methods on microbiological contamination of beef

The prevalence of common human food-borne pathogens, including antimicrobial resistant strains, in organic and non-organically produced beef was compared in a recent study. These bacteria included *E. coli*, *L. monocytogenes*, *Salmonella* spp. and *S. aureus*. No significant difference in pathogen prevalence was observed between the two farming methods, and no *Salmonella* species were recovered from any of the samples. No association between administration of antimicrobials to beef cattle and resistance was demonstrated. The study showed pathogen prevalence to be independent of farming practice, at least within the constraints of this study. Interestingly, *E. coli* and *S. aureus* isolates recovered from the organically produced beef samples showed significantly lower antimicrobial resistance when compared to the non-organically produced beef.

Miranda, J., (2009).. *Meat Science* 82(2): 284 - 288

[http://www.sciencedirect.com/science?\\_ob=ArticleURL&\\_udi=B6T9G-4VFK82K-2&\\_user=10&\\_coverDate=06%2F30%2F2009&\\_rdoc=1&\\_fmt=&\\_orig=search&\\_sort=d&view=c&\\_acct=C000050221&\\_version=1&\\_urlVersion=0&\\_userid=10&md5=0812206865b204753c33291d026b3ab3](http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T9G-4VFK82K-2&_user=10&_coverDate=06%2F30%2F2009&_rdoc=1&_fmt=&_orig=search&_sort=d&view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=0812206865b204753c33291d026b3ab3)

### Large scale *E. coli* O157:H7 vaccine trial shows promise

A two-dose vaccination schedule using a new target-specific vaccine has shown promise in reducing colonisation of *E. coli* O157-H7 in feedlot cattle. In a large scale clinical trial of the new vaccine it was observed that cattle that had been treated with the vaccine were 92% less likely to be colonised with *E. coli* O157-H7. Cattle represent a major reservoir for this important pathogen. Reduction of this reservoir through administration of a vaccine presents a simple means of pathogen control with significant food industry and public health implications.

Smith, D., (2009). *Foodborne Pathogens and Disease* 6(2): 155 - 161

<http://www.liebertonline.com/doi/abs/10.1089/fpd.2008.0136>

### *E. coli* immunity in farmers and abattoir workers to be tested

Researchers in the United Kingdom are commencing a study to determine the level of immunity to *E. coli* O157:H7 in farm and abattoir workers. The study focuses on the Grampian region of the U.K. which has one of the highest rates of human *E. coli* O157:H7 infection in the world. The work is based on the premise that low level, frequent exposure to the pathogen can invoke a protective immune response in a person. It is anticipated that the research will elucidate the reasons why some individuals resist infection with *E. coli* O157:H7 more effectively than others.

<http://www.farminguk.com/news/E.-coli-O157-study-to-test-immunity-levels10206.asp>

### Antimicrobial resistance in *Escherichia coli* from beef farms

A recent study investigated the prevalence and patterns of antimicrobial resistance in *E. coli* isolated from 29 beef farms in the USA. This is believed to be a valuable marker for potential transmission of antimicrobial resistance to pathogenic microorganisms. Key findings included moderate levels of antimicrobial resistance to one or more of the antimicrobials tested, with feedlot cattle and calves identified as having the highest prevalence of antimicrobial resistant *E. coli*. Cow-calf farms were identified as having a significantly lower risk of resistant *E. coli* strains than those in feedlots. Interestingly, the presence of *E. coli* resistant to specific antimicrobials in feedlot cattle increased from arrival until mid-feeding point and this persisted until slaughter. The work will help assess the potential for transmission antimicrobial resistance within the beef industry.

Carson, C., (2008). *Canadian Journal of Veterinary Research* 72(2): 119 - 128

<http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2276896>

## PATHOGEN RESERVOIRS

### How *Salmonella* survives in the environment

A recent study has demonstrated that *Salmonella* have a system enabling them to survive within free-living amoebae in the environment. Amoebae are single celled organisms that are extremely common throughout a range of environments. The ability to survive within amoebae provides a means of environmental persistence and indicates that

amoebae may be an important vector for the spread and transmission of *Salmonella* from the environment to animals, foods and humans. The research provides valuable insight into the life cycle of *Salmonella* and presents novel means of controlling the organism.

Bleasdale, B., (2009). *Applied and Environmental Microbiology* 75: 91 - 98

[http://www.liv.ac.uk/news/press\\_releases/2009/03/salmonella.htm](http://www.liv.ac.uk/news/press_releases/2009/03/salmonella.htm)

### **Risk factors for *Escherichia coli* O157 and *Campylobacter* species in young cattle**

Shedding patterns and risk factors for dispersion of *E. coli* O157:H7 and *Campylobacter* species in young cattle was assessed. Farm animals are a known reservoir for these organisms and the study aimed to identify key factors contributing to environmental transmission with subsequent risk reduction of human infection. The study

sampled 30 groups of young cattle from 30 farms over a 7-month period. Findings included an association between larger herd size and increased pathogen prevalence, and a decrease in pathogen prevalence with an increase in the number of suckler calves. Risk factors for *E. coli* O157:H7 and *Campylobacter* species noted by the authors included poor drinking water management practices, sourcing water from external suppliers and housing the animals indoors. The study demonstrates the prevalence of *E. coli* O157:H7 and *Campylobacter* species within a farm environment and highlights a means of minimising the risk of high level incidence within cattle herds.

Ellis-Iversen, J., (2009).. *Journal of Food Protection* 72(3): 490 - 496

<http://www.ingentaconnect.com/content/iafp/jfp/2009/00000072/00000003/art00006>



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