

Project number: 5406
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Beef and Dairy Farm Hazard Analysis and Critical Control Point (HACCP) with particular emphasis on *Salmonella* Control



Key external stakeholders:

Beef farmers, beef processors, scientists, regulatory personnel, medical doctors, veterinarians, epidemiologists, microbiologists, consumers, EFSA

Practical implications for stakeholders:

Up-to-date information on sources of key pathogens on Irish farms will facilitate improvements in food safety control activities, specifically the development of HACCP type systems.

Main results:

Verocytotoxigenic *Escherichia coli* (VTEC) and *Salmonella* were present on Irish farms. Although penta-resistance was detected in the *Salmonella* isolates, the genes encoding this resistance were not grouped in the 43kb stretch of DNA located on the *Salmonella* chromosome called *Salmonella* genomic island 1 (SGI1). Both VTEC and *Salmonella* survive for up to 102 days in the farming environment.

Opportunity / Benefit:

This project provides data for risk analysis and the development of hazard analysis and critical control point (HACCP) type systems for farms, to minimize pathogen carriage in livestock.

Collaborating Institutions:

University College Dublin

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Teagasc project team: Dr. Declan Bolton (PI)

External collaborators: Prof. Seamus Fanning (University College Dublin)

1. Project background:

In recent years food safety has become a major societal concern. Salmonellosis and campylobacteriosis are the most frequently reported zoonotic diseases transmitted from animals to humans via food. Verocytotoxigenic *Escherichia coli* O157 infections are less frequent but of considerable public health concern as they are associated with serious diseases such as haemorrhagic colitis (HC) and haemolytic uraemic syndrome (HUS). Although a variety of foods may serve as vectors of foodborne illness, the farm is the original source of all of these pathogens and there is strong association between prevalence in the animals and post harvest prevalence on carcasses.

2. Questions addressed by the project:

- What are the sources of *Salmonella*, *E. coli* O157 and *Campylobacter* contamination on different farms?
- What are the antibiotic resistance patterns and are these associated with SGI in the *Salmonella* isolates?
- How well does *Salmonella* and *E. coli* O157 survive in the farming environment?

3. The experimental studies:

Four farms were surveyed over the duration of one year; [1] beef, dairy plus horses, [2] beef, dairy plus pigs, [3] beef, dairy plus poultry and [4] beef, dairy, sheep and deer. Samples of animal faeces and environmental sources, such as animal's drinking water and soil, as well as other sources of possible contamination, wild bird and rodent faecal samples for example, were examined for the presence of *Salmonella* species, *Escherichia coli* O157 and *Campylobacter* species using standard methods. *Salmonella* isolates were phenotypically and genetically characterised for antibiotic resistance using disc diffusion, PCR and gene sequencing techniques. *Salmonella* and VTEC survival was assessed in slurry, soil, cattle faeces and trough water.

4. Main results:

Water was identified as a source of *Salmonella* and cattle, deer and the farm dog were identified as vectors that may carry and/or spread VTEC around the farm and from farm to farm. *Salmonella enterica* Typhimurium DT193 was the predominant *Salmonella* serotype/phagetype detected. Although these isolates displayed a penta-resistant phenotype, this was not arranged in SG11. Both *Salmonella* and VTEC survived for extended periods (up to 102 days) in the farm environment.

5. Opportunity/Benefit:

The data generated in this research should be used to develop HACCP type systems to control the incidence and spread of pathogens on farms. This should include a control point (CP) to ensure water used for animals is clean and pathogen free. Routine monitoring of livestock including non-food animals for *Salmonella* and VTEC is also recommended and the importance of ensuring those in contact with animals, especially children, wash their hands properly afterwards is highlighted.

6. Dissemination:

Dissemination was primarily achieved through peer reviewed publication and presentation at national and international conferences.

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Main publications:

O'Neill, C. J., Bolton, D. J. and Fanning, S. (2011) Comparative studies on the survival of Verocytotoxigenic *Escherichia coli* and *Salmonella* in different farm environments. *Agriculture, Food and Analytical Bacteriology*, 1 (2), 116-122.

Bolton, D. J., O'Neill, C. and Fanning, S. (2012) A preliminary study of *Salmonella*, verocytotoxigenic *Escherichia coli*, *Escherichia coli* O157 and *Campylobacter* on four mixed farms. *Zoonoses and Public Health*. May;59 (3):217-28.

7. Compiled by: Dr. Declan Bolton
