

Project number: 5706**Date:** March, 2012**Funding source:** FP6 (FOOD-CT-2007-036245)**Project dates:** Jan 2007-Dec 2011

Pork food safety



Key external stakeholders:

Irish pork producers, Irish pork processors, regulatory function (FSAI & DAFM), retailers.

Practical implications for stakeholders:

- Pig farm: Urea or ammonia may be used to disinfect *Salmonella* and/or *Yersinia enterocolitica* contaminated pig slurry.
- Pig abattoir: A time-temperature combination of 2.67 min at 60°C is required to achieve a 1 log reduction in *Y. enterocolitica* in scald tank water. The predicted equivalent at 65°C is 0.59 min.
- Pig abattoir: Cross contamination occurred in the lairage and during carcass processing. More effective sanitation is recommended.

Main results:

The incidence and spread of *Salmonella* and *Y. enterocolitica* on Irish pig farms could be reduced through the application of urea or ammonia to disinfect animal waste. *Y. enterocolitica* contamination on pork carcasses would be reduced if the time-temperature combination in the scald tank was set at a minimum of 2.67 min at 60°C or equivalent and cross contamination of carcasses could be prevented if the lairage area was disinfected more efficiently. All of this would result in reduced pathogen contamination on pork carcasses and in pig products thus protecting public health and pork consumers.

Opportunity / Benefit:

This project provided information on the control of key pathogens in Irish pork at the farm and processor stages. Interested industry and regulatory personnel should contact Dr. Declan Bolton directly to discuss implementation. The main benefit of implementing the results of the project would be a reduced risk of pork associated illness thus protecting public health and the reputation of the Irish food industry. Furthermore, the current status of the Irish pig industry in European Food Safety Authority (EFSA) league tables would improve.

Collaborating Institutions:

UCD

Teagasc project team: Dr. Declan Bolton (PI)
External collaborators: Prof. Francis Butler, UCD

1. Project background:

Salmonella spp. and *Yersinia enterocolitica* are both associated with pigs and pork products and are a major cause of foodborne disease in Europe. Despite many years of research, there are still several fundamental questions which required answers before more effective control strategies on the pig farm and in the pork abattoir could be designed and implemented. This project set out specifically to answer questions relating to control in pig waste and the prevention of cross contamination on the farm, control during scalding and the prevention of cross-contamination in the abattoir and to add to a growing body of knowledge on key source of *Salmonella* in pigs and on carcasses from birth to carcass chill.

2. Questions addressed by the project:

- How long do *Salmonella* and *Y. enterocolitica* survive in pig slurry and would ammonia and/or urea treatment kill these pathogens?
- What is the main source(s) of *Salmonella* along the pork chain from birth to carcass?
- What temperature should be used in the scald tank to ensure *Y. enterocolitica* are killed?

3. The experimental studies:

Slurry survival studies: *Salmonella* Anatum, *Salmonella* Derby, *Salmonella* Typhimurium DT19, and *Y. enterocolitica* bioserotypes 4, O:3, 2, O:5,27 and 1A, O:6,30 were selectively marked by insertion of the plasmid, pGLO encoding for green fluorescent protein (GFP) and for ampicillin resistance. Strain cocktails were inoculated into fresh pig slurry (control), slurry treated with urea (final concentration 2% w/w) and slurry treated with ammonia (final concentration 0.5% v/v) and stored at 4°C, 14°C and 25°C. Bacterial counts were determined at regular intervals >urea, as did incubation temperature; 4°C > 14°C > 25°C.

Scald tank studies: A mixture containing one wild type and one green fluorescent protein mutant strain of *Yersinia enterocolitica* were heat treated at 50, 55 and 60°C in samples of commercial scald tank water. Surviving cell numbers were estimated by plating treated suspensions on selective and non-selective agars. Resulting cell numbers were used to estimate D-values for the treated mixed cell suspension.

Tracking study: On category 1 and category 2 pig farms; rectal, throat, environmental and/or carcass samples were obtained at birth, farrowing, 1st weaning, 2nd weaning, finishing, transport, lairage, bleeding and chilling and tested for *Salmonella* using International Standards Organization methods (ISO 1981). Confirmed isolates were serotyped (Kauffmann-Whyte), phage typed, genotyped (PFGE) and tested for resistance to a range of antibiotics by broth microdilution. Singleplex PCR reactions were then used to test for several resistance determinants; *int1*, *bla_{CIT}*, *bla_{Tem}*, *bla_{PSE-1}*, *bla_{OXA-1}*, *floR*, *catA1*, *aadA1*, *aadA2*, *tetA*, *tetB*, *tetG*, *sul1* and *aphA1*. PCR was also performed to detect the left junction, *thdF-S001* and the right junction, S004-*int2* or S004-*yidY* of *Salmonella* genomic island 1 (SGI1) and the virulence genes; *invA*, *spvC* and *rck*.

4. Main results:

The incidence and spread of *Salmonella* and *Y. enterocolitica* on Irish pig farms could be reduced through the application of urea or ammonia to disinfect animal waste. *Y. enterocolitica* contamination on pork carcasses would be reduced if the time-temperature combination in the scald tank was set at a minimum of 2.67 min at 60°C or equivalent and cross contamination of carcasses could be prevented if the lairage area was disinfected more efficiently. All of this would result in reduced pathogen contamination on pork carcasses and in pig products thus protecting public health and pork consumers.

5. Opportunity/Benefit:

The opportunity is the control of key pathogens in Irish pork at the farm and processor stages. Interested industry and regulatory personnel should contact Dr. Declan Bolton directly to discuss implementation. The main benefit would be a reduced risk of pork associated illness thus protecting public health and the reputation of the Irish food industry. Furthermore, the current status of the Irish pig industry in European Food Safety Authority (EFSA) league tables would improve.

6. Dissemination:

Information was presented at international conferences in Ireland and Spain.

Main publications:

Bolton, D. J., Ivory, C. and McDowell, D. A. (2012). 'The effect of urea and ammonia treatments on the survival of *Salmonella* spp. and *Yersinia enterocolitica* in pig slurry'. *Journal of Applied Microbiology* (submitted)

Popular publications:

Bolton, D. J. (2011) 'A small tracking study of *Salmonella* in pigs from birth to carcass'. Oral presentation at the Q-Pork Chains International Conference 'Salmonella in Pork Production' held at Teagasc Food Research Centre, Ashtown, 6th October 2011.

Bolton, D. J., Ivory, C. and McDowell, D. A. (2011) 'The effect of urea and ammonia treatments on the survival of *Salmonella* and *Yersinia enterocolitica* in pig slurry'. Poster presentation, Society for Applied Microbiology (SfAM) International Summer Conference, 47th July 2011, Clontarf castle, Dublin, Ireland, Abstract Book, page 27.

Sheridan, J. and Bolton, D. J. (2011) A small tracking study of *Salmonella* in pigs from birth to carcass. Oral presentation at the Sustainable and diversified pork chains from science to practice, international conference, 27th to 28th October 2011, Palma de Mallorca, Spain.

7. Compiled by: Dr. Declan Bolton