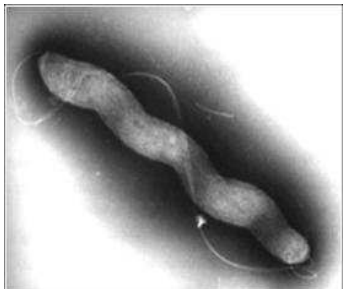
Project number: 6123
Funding source: Teagasc
Date: January 2015
Project dates: Jun 2011 – Oct 2014

The Control of *Campylobacter* in Irish Poultry



Key external stakeholders:

Poultry farmers, Poultry processors, The Food Safety Authority of Ireland (FSAI), Department of Agriculture, Food and the Marine, Retailers, Safefood, Consumers

Practical implications for stakeholders:

The main outcomes of this research are data that's supports the argument that all birds harvested post first-thinning should be subject to Campylobacter mitigation activities and a combination technology that has the potential to kill between 10,000 and 100,000 *Campylobacter* per cm^2 on chicken carcasses.

Main results:

- Thinning introduces *Campylobacter* into broiler flocks; caecal counts in birds at second thinning are similar, regardless of flock status at first thinning and reducing the time between first and second thinning to a maximum of 4 days is not an effective control strategy. All post-first thinning birds should be considered to be high risk and subject to logistic slaughter and possibly carcass freezing.

- The sequential treatment of trisodium phosphate and capric acid in conjunction with ultrasonication at 80 kHz will kill 10,000 *Campylobacter* per cm^2 on chicken carcasses.

Opportunity / Benefit:

Processors could improve the safety of poultry and poultry products by subjecting all post first thinning broiler carcasses to crust freezing.
Processors could significantly reduce Campylobacter on broiler carcasses using a combination of ultrasonication and chemical treatments. Although these are not currently permitted under EC legislation, the situation is under review and the data generated in this project should help inform a positive outcome.

Collaborating Institutions:

UCD

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Dr. Leonard Koolman
External collaborators: Dr. Paul Whyte (UCD)

1. Project background:

Campylobacteriosis is the most frequent cause of gastroenteritis in Ireland and across the EU. Moreover, *Campylobacter jejuni* has been associated with the development of Guillain-Barre syndrome, a chronic and potentially fatal disorder of the peripheral nervous system. Poultry are the primary source of *Campylobacter*. The European Food Safety Authority (EFSA) recently reported that 98.3% of Irish poultry carcasses are contaminated and the levels of *Campylobacter* are the highest in the EU.

2. Questions addressed by the project:

- What effects do age and thinning practices have on the *Campylobacter* carriage rate and levels in broilers.
- What is the growth rate of Campylobacter in the caecum?
- Can ultrasonication enhance the decontamination effect of clean label ingredients on poultry carcasses?
- What virulence genes (genes associated with disease in humans) are found in Irish Campylobacter?
- What effect does oxidative stress have on the expression of virulence genes?

3. The experimental studies:

Chemical decontamination studies were undertaken in the laboratory as were growth experiments using cecal contents. Molecular methods were used to examine a range of Campylobacter isolates for the presence of known virulence genes and investigate their expression upon exposure to hydrogen peroxide.

4. Main results:

The main results are;

- Combining chemical decontaminants with ultrasonication can significantly (p<0.05) enhance reductions in bacterial populations compared to chemical treatments applied alone.
- *Campylobacter* grow rapidly in the caecum.
- The *flaA* gene is common in all *Campylobacter* isolates. The *flaB* gene is not essential for motility in some strains. An alternative secretion system to that encoded by *flhA* and *flhB* may be present in *C. coli*. Chemotaxis genes are common in *C. jejuni* but not in other species. The *cdtABC* genes were commonly distributed amongst *Campylobacter* strains while *wlaN* was rarely detected. The CmeABC efflux system is common in *Campylobacter* strains. The *sodB* gene was frequently detected in *C. jejuni* and *C. coli*.

- Oxidative stress can affect the virulence of *C. jejuni* in a strain-dependent manner.

5. Opportunity/Benefit:

The Knowledge and data generated here could inform a more effective *Campylobacter* control strategy in which the carcasses of all post first thinning birds are treated as high risk and subject to crust freezing. Moreover, with a change in legislation this project has delivered a technology that will kill most if not all of the *Campylobacter* on poultry.

6. Dissemination:

The data generated in this project was disseminated at several conferences and workshop including safefood Campylobacter Knowledge Network events and at the Global Food Safety-Solutions for Today and Tomorrow international conference, 23rd to 25th October 2012, Crowne plaza Hotel, Dublin 15.

Main publications:

1. Koolman, L., Whyte, P., Meade, J., Lyng, J. and Bolton, D. J. (2014). Use of chemical treatments applied alone and in combination to reduce *Campylobacter* on raw poultry. *Food Control*, 46, 299-303.

2. Koolman, L., Whyte, P., Meade, J., Lyng, J. and Bolton, D. J. (2014). A Combination of Chemical and Ultrasonication Treatments to Reduce *Campylobacter jejuni* on Raw Poultry. *Food and Bioprocess Technology*, 7, 3602-3607.

3. Koolman, L., Whyte, P. and Bolton, D. J. (2014) An investigation of broiler caecal *Campylobacter* counts at first and second thinning. *Journal of Applied Microbiology*, 17(3), 876-881.

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4. Bolton, D. J. (2014) Campylobacter virulence and survival factors. *Food Microbiology* (Accepted for publication 1st December 2014).

5. Koolman, L., Whyte, P., Burgess, C. and Bolton, D. J. (2014). Prevalence and distribution of virulence-associated genes in a selection of *Campylobacter* isolates of poultry and human origin. Submitted to Foodborne Pathogens and Disease (Accepted for publication 7th December 2015).

Popular publications:

Bolton, D. J. (2014) Understanding Campylobacter: the €2.4bn bug. TResearch front cover and 9(4), 18-19.

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