Campylobacteriosis in New Zealand Part one – the early days

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In the UK, the bacterial pathogen campylobacter is the number one cause of human gastrointestinal illness.

The same is true in other developed countries and in New Zealand in particular, where surveillance data for 2006 revealed an unacceptable 15,873 cases of reported campylobacteriosis. At a rate of 379 cases per 100,000 people, this was three to four times the disease rates reported for Australia and England and Wales, respectively, and 30 times that reported for the USA.

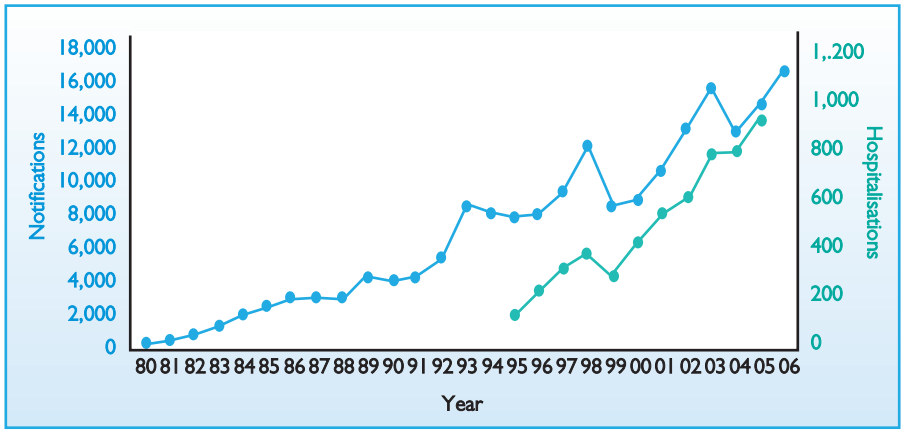

Fig. 1. Annual number of notification (1980-2005) and hospitalisations (1996-2005) for campylobacteriosis in New Zealand (reproduced with permission from M. Baker).

Setting the scene

While it is recognised that reporting practices differ between and even within some countries, for example Australia, New Zealand's rate was still very high. It is a fascinating situation given that campylobacter is generally considered by microbiologists to be a bit of a wimp as far as foodborne pathogens go.

One thing we are certain of is that it has a predilection for chickens and it has been estimated that the consumption of undercooked contaminated chicken meat contributes to ~70% of campylobacteriosis cases in the UK. So why have New Zealand's campylobacter disease rates been higher than in other countries, and what has been done to deal with the situation?

What follows is the story of how New Zealand's scientists, regulators and the poultry industry worked together to deal with a problem bug spiralling out of control.

Campylobacter certainly is not a new problem and a detailed review of the pathogen was recently published in International Food Hygiene. A summary of key information is presented here.

Two species – C. jejuni and C. coli – cause the majority of cases of human campylobacteriosis. These bacteria have strict growth requirements and are sensitive to freezing, but, significantly for fresh poultry, they appear to survive well under refrigeration. The complexity of environmental reservoirs, transmission routes and amplifiers through the food chain makes the control of campylobacter particularly challenging.

While campylobacteriosis is most commonly associated with the consumption of contaminated food or water, the disease may also occur following occupational contact with infected animals that harbour the pathogen in their intestinal tract, usually without outward signs of infection.

Faecal contamination of farm land and water by animals can perpetuate environmental reservoirs. Infection of broiler chickens is thought to occur primarily during production, and there are conflicting views on the possibility and significance of vertical transmission, from egg to chick. As a consequence of cross-contamination, an estimated 65% of retail poultry in the UK is positive for campylobacter. The pathogen is however inactivated by adequate cooking, but good hygienic practices in the kitchen and in food service establishments are crucial to prevent further cross-contamination to other foods.

Table 1. Prevalence of Campylobacter jejuni and C. coli in New Zealand retail meats.

Meat	Sample numbers	C. jejuni	C. jejuni & C. coli	C. coli	Prevalence (%)
Beef	230	7	1	0	3.5
Unweaned veal	90	8	0	1	10.0
Chicken	**230**	**199**	**5**	**1**	**89.1**
Lamb or mutton	231	14	1	1	6.9
Pork	230	18	0	3	9.1

Preliminary trials

The New Zealand poultry industry had started work on campylobacter in 2004/2005 with a survey of prevalence over an 18 month period. This indicated that 74% of carcases measured after immersion chilling had detectable campylobacter. It also demonstrated seasonal and geographical patterns that make control in some regions more difficult than others.

The prevalence trial was supplemented by a more limited enumeration following final chilling. These results indicated that the levels (both prevalence and counts) on New

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Zealand poultry were similar to those reported from overseas and provided no explanation for the high rate of human illness. In 2006, an article published in the New Zealand Medical Journal described the increase in campylobacteriosis cases (Fig. 1) as a 'serious campylobacteriosis epidemic' and correlated this with a considerable increase in consumer poultry consumption, from 4kg per person in 1981 to 30kg per person in 2005.

The authors called on the New Zealand Food Safety Authority (NZFSA) to remove fresh chicken meat from the retail market, and promoted freezing as a temporary intervention until campylobacter levels on chicken meat could be reduced.

The same year, NZFSA formalised details of the Campylobacter in Poultry Risk Management Strategy (CRMS) to tackle the growing incidence of campylobacteriosis.

This strategy focused on poultry meat as the primary source of campylobacter infection for consumers. The objectives of the CRMS were:

- To reduce incidence of foodborne campylobacteriosis by 50% over five years.
- To estimate proportion attributable to poultry and other sources.
- To determine relative contributions of different interventions through the food chain.
- To continue to make well informed risk management decisions on appropriate control measures.
- To assess effectiveness of risk management decisions.
- To coordinate and prioritise research activities.

The bigger picture

To better understand the 'big picture' all aspects of the farm-to-fork continuum, from on-farm practices, environmental sources of contamination, poultry processing practices and interventions, to the retail environment and consumer perceptions and poultry handling practices, were considered in the CRMS. Much of the research funded by NZFSA was conducted by the Institute of Environmental Science and Research (ESR) Ltd, a crown research institute that currently services NZFSA's core scientific requirements. Several key attribution related projects were also undertaken by Massey University, and the poultry industry continued to be proactive in evaluating a variety of processing interventions such as the use of Acidified Sodium Chlorite (ASC).

Quantifying the problem

Broiler chicken meat can become contaminated with campylobacter as a result of cross-contamination during transportation and processing. Contamination of chicken livers also occurs, although there is some debate as to whether this is an in vivo event prior to slaughter. Unfortunately once campylobacter becomes established in broiler sheds it quickly spreads from bird-to-bird, resulting in high prevalence levels in retail broiler chicken meat. In the largest survey of retail meat conducted in New Zealand during 2003-2004, 89% (205/230) of broiler chicken meat samples were found to be contaminated with C. jejuni, C. coli or both (Table 1).

Campylobacters were also detected on other meats, but their prevalence was considerably lower (≤10%). In a separate survey, 100% of 30 chicken livers were found to be surface contaminated with campylobacter, with internal contamination detected in 90% of samples.

Clearly, based on New Zealand survey results, reducing the incidence of foodborne campylobacteriosis by 50% over five years would require a significant reduction in prevalence (and numbers) of campylobacters on broiler carcases to occur first.

The proportion of cases attributable to broiler chicken meat and other sources was estimated based on a three year study of campylobacteriosis in New Zealand.

Results suggested that up to 75% of cases of the disease may be attributable to poultry, similar to the UK estimate. The remaining 25% of cases were predominantly related to cattle, with sheep, wild birds and environmental waters also making a small contribution. Cases related to poultry tended to be more prevalent in urban areas, while ruminants were more likely to be sources of infection in rural settings, particularly in young children and in occupational situations where there is potential for contact with ruminant faeces.

In the same study, analysis of C. jejuni types in food and clinical cases using a technique called multilocus sequence typing (MLST) identified one strain – designated sequence type 474 – found in both poultry and human cases which accounted for 25-34% of human illness over the three year period but is relatively rare internationally.

This raises a number of questions, for example, are people more likely to get sick from this strain than others? Is it more pathogenic and/or a better survivor? Is this why rates of campylobacteriosis are higher in New Zealand than elsewhere?

More work to be done

More work needs to be done to answer these questions conclusively but knowing that one strain makes such a large contribution to disease is a significant step forward in developing strategies against it.

This MLST attribution data from Massey University, which well and truly established that broiler chicken meat was the major source of campylobacteriosis cases in New Zealand, and the NZFSA response that action had to be taken altered the mindset in the industry.

They accepted that this was their problem and they had to take action. There was unprecedented cooperation between industry members in the field of campylobacter control including benchmarking of best practice and visits to the primary processing areas of factories by competitors. There was also a commitment to transparency of data on this subject which is still in place. ■

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Part two of this article will describe more recent progress made to combat campylobacteriosis in New Zealand.