# Development of accurate predictive models for the assessment of the survival of Campylobacter jejuni and Campylobacter coli..

Maes o ddiddordeb ymchwil: Foodborne pathogens
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## Background

Campylobacter is the leading cause of foodborne disease in the UK and tackling this problem is a key priority for the Agency. Campylobacter is present on a significant proportion of raw poultry meat entering kitchens and poor hygiene can lead to cross-contamination of surfaces, utensils, hands and ready-to-eat foods.

Predictive models for growth and survival of foodborne pathogens are publically available and provide industry, government scientists and researchers with tools to predict pathogen behaviour in response to changes in food formulation and storage conditions. Models are available for most foodborne pathogens; and at the time of commissioning this project there was a paucity of predictive models for Campylobacter. Since then more data has been produced, which is available in ComBase.

Given the paucity of data at the time, research was needed to develop robust predictive modelling tools for Campylobacter growth and survival in food, particularly thermal death.

## Research Approach

The project aimed to develop predictive models for the growth and survival of Campylobacter in food that could be used by the food industry to address this hazard in food production and inform instructions for caterers/consumers regarding appropriate handling, cooking and storage of foods which may act as a vehicle for Campylobacter.

A systematic review of published literature on the survival of Campylobacter in foods and food-related environments was carried out to identify data gaps in this area.

The study also examined the heat resistance of Campylobacter at the population level and used isolates from food and humans. It also involved an investigation into how Campylobacter interacts with food and used highly sensitive recovery and enumeration techniques. A generic modelling approach was used to develop predictive models for growth and survival across all of the different treatment, food states and environments investigated, using the data collected from these experiments.

There has been an increase in the use of sous vide cooking, which involves vacuum packing food and cooking in a water bath at lower temperatures over a prolonged period of time. Currently

there is a gap in the data on the effect of cooking food at lower temperatures and on the growth and inactivation of Campylobacter. It is unclear whether this presents a food safety risk. The ACMSF have recommended that more research is required to look at lower cooking temperatures and reliably establish safe time/temperature combinations to reduce potential risks to consumers. As this research was looking at the thermal inactivation of Campylobacter, this work was extended to include lower temperatures to help fill the research gap associated with the issue of sous vide cooking.

These models will be made publically available, and in conjunction with the data available on ComBase, will help the food industry address this hazard in food production and inform instructions for caterers/consumers regarding handling, cooking and storage of foods which may act as a vehicle for Campylobacter.

# Results

This project generated a number of results/conclusions and the main ones have been summarised below:

1. Data generated in this project show that Campylobacter can survive at lower pH ranges (e.g. pH 5.5) when exposed to high temperatures.
2. Campylobacter attachment to chicken meat enhanced its survival only at sub-lethal temperatures (e.g. 56oC), with pre-chilling having limited impact on sensitivity to heat treatment.
3. Gradual heating of chicken meat pieces inoculated with high levels externally and internally to 70oC has demonstrated survival of low numbers of Campylobacter, which is of potential concern.
4. Given that retail surveys have found levels of up to 105 CFU/g contamination of Campylobacter on carcasses, these experimental results may suggest that the current recommendation of 70oC for two minutes may be insufficient to inactivate all Campylobacter present in chicken meat when contaminated at such levels. However, more work is required to investigate if such sub-populations of viable cells are still able to cause infection. Further work should also be undertaken to elucidate the mechanisms involved in the survival of these residual populations and their association with chicken meat surfaces.
5. Cooking chicken at lower temperatures (50 and 52oC) in a vacuum sealed pack for three and two hours respectively was inadequate in eliminating Campylobacter, although it should be noted that a high inoculum was used in these studies. Campylobacter was still isolated from whole chicken fillets following these heat treatments, with C. coli also recovered at 56oC after one hour of cooking.
6. Our findings indicate that no single model describes the survival of Campylobacter under all circumstances, and that the selection of an appropriate model should be based on individual strain and response to the type and magnitude of challenge used during experimental simulation.

The findings of this report are interesting; however there are a number of criticisms around the methodology used, such as the use of a water bath in the heating of chicken meat not being a true reflection on actual cooking practices. In addition, the project did not produce a model that was as user-friendly as anticipated, however this was due to the fact that a one-model-fits-all approach could not be achieved as the different strains used in the experimental work produced varied responses. The suggestion that the current cooking advice of 70?C for 2 minutes may be insufficient should not be interpreted on its own and should be considered alongside numerous other studies that provide a body of evidence to show this advice to be effective in eliminating Campylobacter. It is therefore unlikely that FSA will be changing its current cooking advice based on this one study. This data should be uploaded into ComBase to add to the existing data already available on Campylobacter, allowing for a much more user-friendly interface and a more realistic

prediction.

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