Reducing Campylobacter cross-contamination during poultry processing

Maes o ddiddordeb ymchwil: Foodborne pathogens
Hyd yr astudiaeth: 2005-07-01
Cod prosiect: FS990010 (M01039)
Cynhaliwyd gan: The University of Bristol

Background

Campylobacter has been and remains a priority for the Food Standards Agency and it is well understood that a major source of Campylobacter in food is through contaminated poultry meat. To minimise Campylobacter contamination of carcasses, the main contamination pathways need to be identified and effective control steps within and at the end of production need to be determined.

This project looks at practical control strategies within the slaughterhouse, and outputs from the project informed the Food Standards Agency Risk Reduction Strategy.

Research Approach

This study aimed to reduce cross-contamination of poultry with Campylobacter during processing in slaughterhouses, by developing best practice guidelines. This project comprised of five key objectives in order to achieve this:

- identification of a typical processing system for poultry;
- quantifying and identification of the main contamination routes in current processing;
- development of methods for reducing cross contamination;
- evaluation of these methods and
- identification of the key scientific data.

To achieve these objectives, the research team surveyed six chicken processing lines and produced a written report with these data, forming an overall description of a typical processing line. A separate report was produced on the assessment of hygiene, disinfection and cleaning regimes. The team identified how different processing methods affected transfer of Campylobacters from positive chickens to Campylobacter negative chickens. Additionally, the transfer from Campylobacter positive chickens to their carcasses at different points in the processing line was also studied. In both instances, the level of contamination was quantified using laboratory based culture methods for Campylobacter enumeration. Enterobacteriaceae counts were also performed as an indication for possible routes of contamination. Practical investigations and discussions around available data determined which points in the processing line interventions would be the most effective at reducing Campylobacter cross contamination. This allowed the research team to direct their investigations at end stage treatments (prior to chilling), as this was determined to be the most effective stage for intervention. Different treatment methods were assessed by carrying out investigations during normal processing, where possible,

and by laboratory experiments using a specially constructed rig. The research team for this project collaborated with the team for FSA project MO1045 (“Evaluation of data generated by meat plants for current HACCP verification purposes and future slaughterhouse hygiene purposes”). They combined data from both projects with other published information to develop best practice guidance for reducing Campylobacter cross-contamination in poultry slaughterhouses.

Results

Six chicken, two turkey and one duck processing line were surveyed from lairage to portion cutting and staff interviewed. The information gained was used to inform continuing studies of current industrial practice and allow targeting of more detailed experimental evaluative measurements. The results from all chicken plants were further combined into an anonymous description of a ‘typical’ UK chicken processing plant. There were too few turkey and duck plants to form a representative sample. Where applicable the ‘typical’ chicken plant was contrasted to the turkey and duck lines. The survey also included an assessment of hygiene, disinfection and cleaning regimes, on which a separate report was written. The effectiveness of the most commonly-used commercial disinfectants was tested against a panel of Campylobacter isolates and other bacteria.

The abattoir survey revealed that the techniques used in all chicken processing plants were similar, and that the cleaning and disinfection methods were effective against Campylobacters. However, because poultry processing is highly mechanised and is conducted at speeds up to 12,000 carcasses per hour, effective cleaning and disinfection cannot be carried out between flocks, only between shifts – overnight or over the weekend. Also, cross-contamination between adjacent carcasses on the line was unavoidable, and occured via the machinery and by direct contact.

Numbers of Campylobacters on neck-flaps from Campylobacter negative (C–) flocks processed after Campylobacter positive (C+) flocks were almost always <25 cfu g-1, (160/170 were <25 cfu g-1, seven between 25 and 99 cfu g-1 and three between 100 and 999 cfu g-1) whereas those from neckflaps from C+ flocks were significantly higher (of 105 examined, two (2%) contained <25, ten (9.5%) between 25 and 99, 49 (46.5%) between 100 and 999 and 43 (42%) 1000 or more). A further investigation was then carried out to determine whether the first few carcasses from the C- flocks carried higher numbers of campylobacters than those observed in the previous survey. Five neck-skins were examined from the first ~100 carcasses processed, five from carcasses ~500-600 and five from carcasses ~5000-5100 of all flocks processed over several days and from two different poultry plants. Four C- flocks processed after C+ flocks were identified and the numbers of Campylobacters per g neck-skin compared with those obtained from carcasses at the same points during processing of C+ flocks. After the first ~100 carcasses, almost all the carcasses from C- flocks had <25 cfu Campylobacters g-1 neck-skin, while numbers on neck-flaps of carcasses from C+ flocks remained high throughout 28/56 (50%) exceeding 100 cfu g-1, and 10/56 (18%) exceeding 1000 cfu g-1. The study also assessed numbers of Campylobacters transferred from Campylobacter positive chickens to their carcasses during processing. Visits were made to chicken processing plants on five occasions. 10 samples of necks or neck-skins were taken at each of six points on the line during the processing of four flocks at each visit, and numbers of Campylobacters, Enterobacteriaceae capable of multiplying at 41.5°C, and pseudomonads were enumerated. Enterobacteriaceae were included as indicators of Campylobacter contamination, as they were found in similar numbers in the intestine, and not all flocks were colonised with Campylobacters. Pseudomonads were an index of contamination that occurred from the processing environment. Most carcass contamination with Campylobacter spp. and Enterobacteriaceae was detected after scalding with little obvious increase after plucking, or after evisceration. Contamination with pseudomonads increased steadily all down the line after scalding.

In order to clarify which process was the most important source of carcass contamination with Campylobacters, batches of chicken carcasses were removed from the line immediately after plucking and dipped in water at 80°C for 20 s before replacement on the evisceration line. Control carcasses (processed normally) were taken after evisceration, as well as carcasses that had been decontaminated with hot water after plucking. All were sampled by examination of neck flaps or necks and the carcass rinse method. Results showed that plucking and evisceration contributed to a similar degree to numbers of Campylobacters and Enterobacteriaceae on the fully processed carcasses.

An extensive literature review, brain-storming sessions and discussions were held in order to identify the methods most likely to be successful in reducing numbers of campylobacters on carcasses from Campylobacter-positive (C+) and Campylobacter negative (C-) flocks. With C+ flocks the problem is to try to minimise transfer to the finished carcass, of Campylobacters present in high numbers in the intestinal contents and on the feathers of the birds. Practical investigations in processing plants showed that similar proportions of contamination was occurring at two main points - during the scald and pluck stage, and subsequently during the evisceration steps. It was therefore concluded that reducing significantly the numbers of campylobacters reaching the carcasses during scalding and plucking would be of little benefit if subsequent processing steps during evisceration contributed a similar number. However, a better system for scalding and plucking and/or cleaning and disinfection all along the line between flocks might be effective in reducing cross-contamination from C+ to C- flocks. However, the studies conducted under Objective 2 showed that there was little cross-contamination from C+ to C- flocks beyond the first few hundred carcasses. The other clear possibility was to investigate the effect of end-product treatment of the fully processed carcasses, either immediately before, during or after chilling. The possibilities were to use physical (e.g. steam at atmospheric pressure or dipping in hot water) or chemical (e.g. chlorine, chlorine dioxide (CD), acidified sodium chlorite (ASC), ozone, trisodium phosphate
(TSP), mixtures of peroxy acids (PAA)).

Naturally contaminated Campylobacter-positive chicken carcasses, obtained from a commercial processing line immediately post-evisceration but prior to the inside-outside wash, were treated in a purpose-built automated spray rig. Replicated batch treatments for 15 s and 30 s of chemical and water only spray wash were performed. Untreated control carcasses were examined to provide baseline data for the initial numbers. Numbers of colony-forming units (CFU) per g of skin excised from neck and breast locations were determined using selective agar media. For analysis, the results were subdivided into six microbe-type/skin-location combinations with each subdivision ranked by:
a) CFU remaining after treatment;
b) mean reductions, and
c) the proportional change in numbers of samples below the limit of detection (LoD).

The three groups of bacteria responded similarly to the chemicals applied, with maximum reductions of 1 – 2 log cycles. Campylobacter spp. were no more susceptible than the other two groups. Generally ASC and TSP were more effective in reducing microbial counts than PAA, with CD and water having the least effect. A 30 s chemical treatment was usually more effective than a 15 s treatment. Where only a short (15 s) spray time is possible, ASC appears the most effective. Where longer treatments are possible, TSP becomes the most effective, but has environmental drawbacks. Similar reductions had been obtained in a previous FSA project, using steam at atmospheric pressure or dipping in hot water.

This project involved a large literature review of a number of different stages along the processing line. The particular focus was on interventions in reducing Campylobacter contamination on the carcass. The panel agreed that lots of useful information had been identified but a drawback was that some of it was sourced from out of date literature. The work on decontamination techniques was particularly insightful although the mechanism for rating the interventions was somewhat

subjective.

Research report
PDF
Gweld Reducing Campylobacter cross-contamination during poultry processing - Research report as PDF(Open in a new window) (4.76 MB)