

FSA Project no. MO 1019: Physical methods readily adapted to existing commercial lines for reducing pathogens, particularly campylobacters, on raw poultry.

## **Extension Project 2:**

### **Commercial trials to investigate the feasibility under commercial conditions of decontaminating chicken carcasses using hot water immersion at 80°C for 20 s**

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#### **Summary**

Six trials were carried out, two in one UK poultry plant and four in a second UK plant during 2005, designed to extend the results obtained in Extension Project 1, by investigating the most practicable decontamination technique testing 20 instead of four carcasses in each trial naturally contaminated with campylobacters. This was done in order to provide a better statistical basis for determining whether the proposed treatment would significantly reduce numbers of campylobacters on chicken carcasses. Numbers of pseudomonads were also monitored, since these are the principal spoilage bacteria for this product, and refrigerated shelf-life in aerobic atmosphere is directly related to numbers of pseudomonads at production. A treatment that reduced their numbers significantly would thus be beneficial to the poultry processor.

The results showed that hot water treatment would significantly reduce numbers of campylobacters on poultry carcasses from campylobacter positive flocks from about  $\log_{10} 3 \text{ cfu g}^{-1}$  to about  $\log_{10} 1.5 \text{ cfu g}^{-1}$ , measured from neck flaps, but not eliminate them. A reduction of 1-1.5 log cycles (>90%) is likely significantly to reduce the risk of human infection from poultry meat. Reductions in numbers of *Pseudomonas* spp. on carcasses were also observed, but these were not always statistically significant. This might be due to their greater numbers and their ability to multiply in the poultry processing environment and on carcasses. Nevertheless, hot water immersion is likely to benefit poultry processors by reducing numbers of pseudomonads as well as campylobacters, thus extending refrigerated shelf-life.

## Introduction

These Trials were designed to extend the results obtained in Extension Project 1, by investigating the most practicable decontamination technique with 20 instead of four carcasses in each trial, in order to provide a better statistical basis for determining whether the proposed treatment would significantly reduce numbers of campylobacters on chicken carcasses. Numbers of pseudomonads were also monitored, since these are the principal spoilage bacteria for this product, and refrigerated shelf-life in aerobic atmosphere is directly related to numbers of pseudomonads at production. A treatment that reduced their numbers significantly would thus be beneficial to the poultry processor.

## Materials and Methods

**Hot water immersion rig.** This was as developed for the main project (see details in Extension Project 1 Report).

**Racks for chilling** Two purpose-built racks (2m long, 0.5m wide and 1.7m high) were used to aid carcass handling to, from and within the chillers. The wheeled racks were constructed from extruded aluminium section machine building system (Flexlink AB, Göteborg, Sweden) and each held 20 carcasses by the legs in shackles similar to those used in poultry processing plants (Figure 1). The carcasses were arranged in two staggered rows of five on each side of each rack, so that upper row carcasses would not drip onto those below and good airflow around each bird was possible. One rack was used to hold the treated carcasses, and the other the controls. After hot water treatment had been applied to the experimental carcasses, both racks were wheeled into the plant chiller.

**Decontamination treatment and sampling** As in the Extension 1 study, 3-4 flocks were sampled on one visit, but samples from only one flock per day were examined, dependent on which were identified as campylobacter positive from examination of their caecal contents.

Forty carcasses from each flock were removed from the line immediately prior to chilling, taking care to distribute them randomly between the two racks. Ten pairs of caeca were also taken from the same flock in order to check whether the flock was positive for *Campylobacter*. The carcasses on one rack were treated by dipping them, one at a time, for 20 s at 80°C in the hot water, leaving the other 20 untreated carcasses on the other rack. Care was taken to handle the carcasses only on the legs, but no special precautions were taken to disinfect the shackles between removal of the untreated carcasses and replacing them after immersion. As soon as the treatment was complete both racks were wheeled into the plant chiller and taken out after ca. 1 h to take the samples. The hot water was replaced between batches of 20 carcasses.

Samples of neck skin were taken aseptically from all 40 carcasses after chilling.

### **Microbiological examination.**

The neck skin samples were stored in individual plastic bags at 3±1°C until examined 24-48 h later (when the campylobacter positive flocks could be identified). The neck skin was trimmed of fat and a weighed quantity (3-10 g) homogenised in 10 ml of

MRD. Subsequent microbiological examination of neck skin was carried out in the same way as the breast skin in Extension 1, except that only two groups of microbes were enumerated – *Campylobacter* spp. and *Pseudomonas* spp. No presence/absence tests were done.



**Figure 1. Rack in use in poultry processing plant (hot water rig at left).**

### **Results and Conclusions**

Table 1 summarises the results obtained from six trials – the first two at one processing plant and the last four at a second processing plant. The raw data are supplied in the Appendix. The study was moved to the second plant because *Campylobacter* positive carcasses there were found to carry higher numbers of campylobacters than those from the first processing plant. This could have been due to differing machinery or because larger birds were processed.

Numbers of campylobacters on the carcasses were reduced significantly by the hot water treatment on every occasion by 1 – 1.5 log cycles. Reduction of numbers of *Pseudomonas* spp. also occurred, but was statistically significant in only two of the five trials. The reason for this is not clear, but could have been related to more extensive environmental reservoirs of pseudomonads than campylobacters in the processing plant, and to the ability of pseudomonads to multiply on the carcasses and in the environment.

It was concluded that hot water treatment would reduce numbers of campylobacters on poultry carcasses from campylobacter positive flocks, but not eliminate them. A reduction of 1-1.5 log cycles (>90%) is likely significantly to reduce the risk of human infection from poultry meat (Rosenquist et al., 2003). Numbers of *Pseudomonas* spp. on carcasses would also be reduced by this treatment, although less reliably, possibly due to their greater numbers and ability to multiply in the poultry processing environment.

**Table 1 Effect of hot water (80°C for 20 s) on numbers of campylobacter and pseudomonas on chicken neck skin (log<sub>10</sub> cfu per g). In-plant experiment – treatment applied prior to chilling. N=20 per treatment.**

<i>Campylobacter</i>		Mean count (SD)	range	Log cycles reduction	P
Trial 1 07.01.05	<i>controls</i>	3.12 (1.01)	1.93-4.70	1.47	<0.001
	<i>treated</i>	1.65 (0.77)	0.40-2.31		
Trial 2 24.01.05	<i>controls</i>	1.75 (0.57)	0.70-2.88	0.96	<0.001
	<i>treated</i>	0.79 (0.63)	0.30-2.47		
Trial 3 12.04.05	<i>controls</i>	2.81 (0.67)	0.74-3.95	1.15	<0.001
	<i>treated</i>	1.66 (0.63)	0.26-2.73		
Trial 4 25.04.05	<i>controls</i>	2.57 (0.92)	0.58-4.83	0.68	0.011
	<i>treated</i>	1.89 (0.63)	0.77-2.93		
Trial 5 14.07.05	<i>controls</i>	2.14 (0.78)	<0.2 - 3.13		
	<i>treated</i>	0.77 (0.40)	<0.2 – 1.60	1.37	<0.001
Trial 6 15.07.05	<i>controls</i>	1.6 (0.62)	<0.1 – 2.97		
	<i>treated</i>	0.63 (0.62)	<0.1 – 2.71	0.97	<0.001
<i>Pseudomonas</i>					
Trial 2 24.01.05	<i>controls</i>	3.54 (0.34)	3.04-4.19	0.04	0.71
	<i>treated</i>	3.50 (0.36)	2.90-4.16		
Trial 3 12.04.05	<i>controls</i>	4.28 (0.73)	3.42 – 5.67	1.75	<0.001
	<i>treated</i>	2.53 (0.86)	1.52 – 4.10		
Trial 4 25.04.05	<i>controls</i>	3.46 (0.78)	1.56 – 4.73	1.21	<0.001
	<i>treated</i>	2.25 (0.99)	0.24 – 4.62		
Trial 5 14.07.05	<i>controls</i>	3.00 (0.70)	1.83-4.39		
	<i>treated</i>	2.26 (1.80)	<0.1-5.60	0.74	0.10
Trial 6 15.07.05	<i>controls</i>	3.87 (0.74)	2.6 – 5.64		
	<i>treated</i>	3.70 (0.89)	1.68-4.83	0.17	0.44

### Reference

Rosenquist, H., Nielsen, N.L., Sommer, H.M., Nørrung, B., Christensen, B.B. 2003. Quantitative risk assessment of human campylobacteriosis associated with thermophilic *Campylobacter* species in chickens. International Journal of Food Microbiology, 83, 87-103.