Assessment of the influence of condensation scalding on microbial contamination of pork carcasses

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Abstract

Scalding has been identified as one of the measures which can control microbial contamination of pork carcasses. In this Food Standards Agency funded study the effectiveness of condensation scalding on levels of microbial contamination on pork carcasses was investigated by examining the changes in total aerobic populations at two slaughterhouses where condensation scalding was in routine use. Sampling was by the Food Standards Agency recommended sponge swab-sampling method for carcass sampling in abattoirs and carcasses were sampled before and after scalding and on entry to the chiller. Following scalding, a 1-2 log_{10} cfu/cm² difference in reduction of the mean total aerobic counts was observed, with the lower temperature scald proving more effective. However, at chilling no difference was seen in contamination levels and there was no evidence that condensation scalding increased bacterial adhesion to scalded meat surfaces. The differing results of these two nominally similar vertical scalding systems indicates that there are other factors involved which need to be investigated further in order to understand how to obtain the best reduction of microbiological contamination.

Introduction

Hot water scalding has been demonstrated to remove a substantial proportion of the skin microflora (Borch et al. 1996; Berends et al. 1997). However, there are reports of increases in total aerobic count following hot water tank scalding (Warriner et al. 2002) and of Salmonella being isolated from scalding tank water (Swanenburg et al. 2001; Hald et al. 2003). It has been hypothesised that a reduction in water temperature to below 60°C and/or a build up in the amount of organic material suspended in the scald tank could facilitate bacterial survival and increase the chances of cross-contamination at this stage (Dickson et al. 2003; Hald et al. 2003). Condensation scalding (vertical scalding), although not a new development in the dressing of pork carcasses, has become more widespread, but little has been published on the efficacy of the method in reducing microbial contamination. Such systems, which inject and/or spray hot water, are advantageous over hot water tank systems in that carcasses are only in contact with fresh water, they are easy to ventilate during emergency stops, no damage to carcass surfaces occurs and water consumption is vastly reduced as water vapour is required for operation.

Materials and methods

Two abattoirs which used condensation scalding were visited during 2006-7. Microbiological sampling of carcasses for Salmonella was carried out by the Food Standards Agency recommended swab-sampling method for carcass sampling in abattoirs, so that contamination rates obtained would reflect the levels routinely determined by UK abattoirs (Anon, 2006). Individual carcasses were sampled after bleeding, after scalding and pre-chill. Thirty five carcasses were sampled over two visits at Slaughterhouse B and ten carcasses evaluated at Slaughterhouse E. In some instances sources of cross contamination such as scald water and fomites were also sampled. Salmonella was determined as presence/absence by standard enrichment techniques and levels of the organism were estimated by a semi-quantitative approach. As well as sampling for Salmonella, total aerobic bacterial contamination was enumerated.
Results

A Slaughterhouse B

![Graph showing bacterial counts for A Slaughterhouse B]

B Slaughterhouse E

![Graph showing bacterial counts for B Slaughterhouse E]

Figure 1 Total aerobic counts of pork carcasses after the bleeding and scalding processes and prior to chilling. SD; standard deviation.

The total aerobic counts from the two slaughterhouses are shown in Figures 1A and 1B. Similar initial counts were present on the carcasses prior to scalding, however, after scalding there was a difference of 1-2 log_{10} cfu/cm² in the mean count, with slaughterhouse E showing the lower counts. This was surprising as the scald procedure in slaughterhouse B was carried out at an indicated temperature of 65.8°C for 8 min and so would be expected to be more effective than that at slaughterhouse E which ran at 63.7°C for 4.5 min. However there are differences between the two scalders. The scalders at slaughterhouse B were considerably older (installed in earlier 1990s) and was a straight through line with no pre-scald washing of the carcasses. The scalders at slaughterhouse E were about 10 years newer, was serpentine in operation and, in particular, had an integrated pre-scald washing unit. The additional pre-scald wash procedure may be important in helping to reduce surface contamination by, for example, helping to remove large amounts of organic debris or freeing matted hair.
Another notable difference was the level of variation carcass to carcass at each slaughterhouse. In slaughterhouse B there was a much greater variation in counts post scalding (as evidenced by the standard deviation values), despite the results being on a larger sample size. This slaughterhouse was visited on two occasions and this may mean there was a difference in the running conditions between each visit which could account for this effect. Despite this difference post scalding, the final carcasses at chilling showed similar counts of $\sim 2 \log_{10} \text{cfu/cm}^2$, demonstrating the significance of other processes in controlling the final flora level of the carcasses.

**Discussion**

Although condensation scalding offers many advantages to the processor as carcasses always come into contact with clean water and the volume of water used is reduced, some data have suggested that this method of scalding increases the potential for bacterial attachment by changing the surface of the carcass (Warriner et al., 2001). Comparison of data from slaughterhouses using condensation scalding with slightly varying parameters has shown that although the levels of bacteria are different following scalding under the two conditions, the counts on the final carcasses were similar and not substantially different from those produced by slaughterhouses using conventional methods (Richards et al. 2007). As the more stringent scald parameters produced a lower reduction in counts by condensation scalding, it suggests that the control of microbial loads by the method relies on factors other than time-temperature parameters. The effectiveness of the pre-scald washer used in combination with scalding may be an important feature which improves the microbial load seen after scalding in Slaughterhouse E.

**References**


Richards et al. 2007. *Salmonella* contamination of pork carcasses: UK baseline culture-based data determined by sponge sampling during 2006. *ibid*

