STEAM VACUUM VERSUS KNIFE TRIMMING FOR BEEF SLAUGHTER

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Introduction

Cattle arriving for slaughter can be very dirty, depending on the season and the stabling conditions both on the farm and at the meat plant. Traditionally, cattle are not cleaned before dehiding. This may cause a risk of pathogenic micro organisms spreading to the carcass during slaughter, unless careful slaughter processes are applied. Another source of contamination of the carcass with pathogenic bacteria is the faecal contamination that can occur in connection with evisceration. In the USA, steam vacuum is frequently used at several points along the beef slaughter lines. However in EU member states the method needs national approval if it is to be used to remove contamination before the veterinary inspection. This study was designed to document whether steam vacuuming is more effective in removing dirt and bacteria from the surface of a carcass than knife trimming.

Materials and Methods

The Danish Meat Research Institute (DMRI) has developed a light (approx 300 g) steam vacuum handle (now marketed by SFK Meat Systems, Denmark). The admission of steam is controlled through the handle of the equipment in order to prevent the operator from burning himself.

The temperature at the head of the steam vacuum handle was measured four times a day over six testing days.

To evaluate the risk of cross-contamination via the steam vacuum handle, some swabs of the head of the handle were taken 9-10 times a day over six testing days. The swabbing area was the area of the head of the handle that comes into contact with the meat surface, and 1 cm on the inside and outside of the head, about 20 cm^2 in all. The swabbing was done just after closing of vacuum and steam. All swabbings were done on days on which the steam vacuum equipment was used continuously at normal slaughtering speed (about 45 head/hour), so the swabs could represent the microbiological load under realistic conditions.

Figure 1: *Steam vacuum equipment in function.*

To evaluate the effect of the equipment on visual contamination, 19 carcasses with visual contamination were steam vacuumed and subsequently inspected by the local veterinary inspection authorities. Furthermore 35 carcasses were steam vacuumed on the outside round on one half of the carcass and trimmed with knife on the other half, and the carcasses were afterwards inspected by the local veterinary inspection authorities just before chilling.

The documentation of the microbiological effect of using the steam vacuum system took place over a period of six slaughter days under normal production conditions in a representative Nordic meat plant with a slaughter line speed of 40-50 head/hour. During the testing, there were two operators on a platform just after the splitting of the carcass. On one half the outside round was trimmed with a knife (operator 1), and on the other half the outside round was steam vacuumed (operator 2). Steam vacuuming was evaluatedon the outside round for 10 sec. and 30 sec. because these periods of time represent two scenarios: 1) 30 sec. is the treatment time it is possible to use at the current slaughtering speed if the operator only steam vacuums all of the outside round on both halves of the carcass, and 2) 10 sec. is a reasonable treatment period if steam vacuuming is only a part of the work the operator does.

Swabs were taken as listed in Table 1.

Table 1 Trial design.

Area	Treatment	Swabbing area	No. of samples/day	No. of repetitions	Total no. of samples
Outside round	Before trimming	100 cm^2 in	30	6	180
	With knife	the treated	30	3	90
	10 sec steam vac.	area	30	3	90
	30 sec steam vac.		30	3	90

The swabs 'before trimming' were taken just before the splitting of the carcass. The other swabs were taken just prior to chilling.

Before swabbing, the sterile gauze swabs were moistened with 0.85% NaCl buffered peptone water. Each swab was suspended in 25 ml of 0.85% NaCl buffered peptone water, stomached for 1 min. and then analysed for *E.coli* and

Aerobic Plate Count (APC). *E. coli* was obtained on Petri-film ™ EC, incubated at 37°C for 48 hours. APC was obtained in Plate Count Agar, incubated at 30°C for 3 days (NMKL no. 86, 3rd edition, 1999).
All counts were log transformed. The statistical analysis was performed with Proc. GLM (SAS Institute). Means were compared using Duncan's multiple range test (level of significance 0.01).

Results and Discussion

The temperature of the head of the steam vacuum handle was measured at 8 points on the outside of the head (Figure 2). The temperature was above 68.5°C in all the tests. At this temperature, pathogenic bacteria on the head of the equipment are killed instantly.

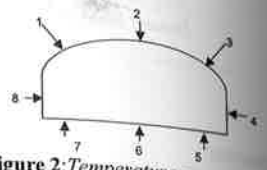

Figure 2: *Temperature measurement points at steam vacuum head.*

Fifty-eight swabs were taken from the head of the steam vacuum handle. There were no samples positive for *E. coli*, which indicates that the risk of cross-contamination with pathogenic bacteria such as *Salmonella* and *Campylobacter* is very small.

The evaluation of the effect of the equipment on visual contamination showed that steam vacuuming removed dirt and hair on fairly smooth surfaces, but colour traces from the contamination were not fully removed. If the contamination was located on cut surfaces, it was not possible to remove all of the contamination with steam vacuum without the meat getting a slightly 'cooked' appearance.

The microbiological analysis showed that there was a significant difference in the APC between knifetrimming and steam vacuuming (Figure 3). Figure 4 shows the percentage of samples that were positive for *E. coli*. Only a few samples were positive - and those samples had very low counts - making it impossible to estimate average counts. However, there was a tendency towards a reduction in *E. coli* after steam vacuuming of the outside round.

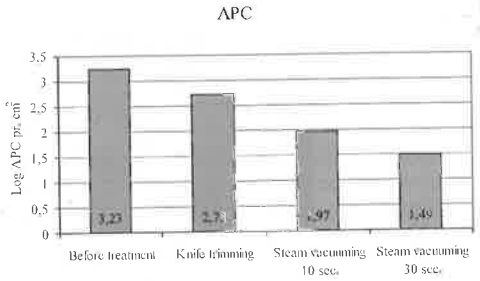

Figure 3: The average level of aerobic count (per cm^2).

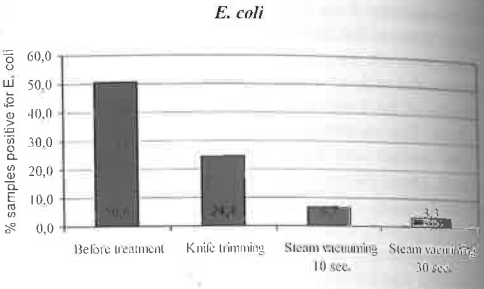

Figure 4: % samples positive for E. coli

There was also a statistically significant difference in the APC between steam vacuuming for 10 sec. and 30 sec. It was found that the longer the treatment time, the larger the reduction of the bacterial count.

Conclusions

The steam vacuum system developed by the Danish Meat Research Institute (DMRI) worked very well during the tests. High temperatures and even temperature distribution all over the head of the steam vacuum handle were recorded on all testing days. No swabs from the head of the handle were positive for *E. coli* so the risk of cross-contamination between carcasses with pathogenic bacteria is minimal. Steam vacuuming removed visual contamination effectively, and steam vacuuming gave a statistically significantly better microbiological result than knife trimming. The steam vacuum equipment has a large potential to increase product safety on the slaughter lines, but at the same time it should be pointed out that the equipment should only be used as a supplement to maintain a high level of slaughter hygiene. On the basis of this study, the Danish Veterinary and Food Administration allowed the method to be use to remove contamination on carcasses in Danish cattle abattoirs.

References

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