Preparation of Clean Livestock for Slaughter: Effect of Cleaning Practices on the Microbiological Quality of Beef Carcasses

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Background

The cleanliness of cattle supplied for slaughter has been previously considered an important factor in the supply of safe meat. In theory, the dirtier the condition of the stock when slaughtered, the greater the microbiological contamination of the carcass. Therefore, the supply of clean stock (free from dags (concrements) and other physical contaminants) is seen by many as the critical control point in reducing or minimising the microbiological contamination of the carcass, thus increasing the safety of the subsequent meat product/s (USDA 1996). Conflicting reports prevail as to the impact cleaning cattle has on the microbiological loading of the carcasses. Van Donkersgoed *et al* (1997) showed that with the correct dressing and chilling techniques there was no correlation between the cleanliness level of stock and microbiological contamination. In contrast Ridell and Korkeala (1993) showed that cleaning had a positive affect on reducing microbiological contamination.

Objectives

The purpose of this study was to evaluate the effects of different cleaning techniques on the microbial quality of beef carcases.

Methods

Three trials were conducted on cattle sourced from feedlots in South East Australia. One trial was undertaken in summer and two during winter.

Summer Trial

Twenty Murray Grey steers of similar liveweight and age were randomly selected from 1 pen after 275 days on a feedlot ration and randomly allocated to 4 cleaning treatment groups; spray wash, spray wash with detergent shearing and nil treatment (control). All cattle were totally free of dirt dags and were rated a category 1 on the UK Meat Hygiene Services grading scale. However all had a very high level of dust. Cleaning was undertaken 24 hrs pre-slaughter. Animals were removed from food 6 hrs prior to transport to an export abattoir 300 km away. Cattle were penned overnight in lairage with fresh water available and then slaughtered at a rate of 46 head per hour.

Winter trial 1

Two hundred Hereford and Hereford cross steers of similar liveweight and age were randomly selected from a pen of approximately 280 steers after 160 days on a feedlot ration. All were of a similar dirt loading (Category 3 and 4 on the UK Meat Hygiene Services grading scale). All steers were randomly allocated to 8 treatment groups; Pre-shorn - Spray wash, Spray wash, Pre-shorn – shear, Shear, Pre-shorn – Spray wash and detergent, Spray wash and detergent, Pre-shorn – Mechanical robotic dag removal device, Mechanical robotic dag removal device (MRDRD). All treatments (except for the pre-shearing, which was undertaken 8 weeks earlier) were undertaken on Day 1. Days 2 to 4 the cattle, in their treatment groups, were placed on clean rice hulls, feed and water. On Day 5 the cattle were slaughtered at a rate of 60 head per hour.

Winter trial 2

One hundred Hereford and Hereford cross steers of similar liveweight and age were randomly selected from a pen of approximately 250 steers. All steers had been on the same ration for 180 days prior to slaughter and were assessed as Category 3 and 4 on the UK Meat Hygiene Services grading scale. All of the selected steers were randomly allocated to five treatment groups; Nil treatment (control), Spray wash, Hand rake, Post-slaughter Shear, Air knife (Post-slaughter). All treatments were applied on day 1 with slaughtering taking place on day 2. Cattle were kept in their treatment groups on water without feed until slaughtered at a rate of 55 head per hour.

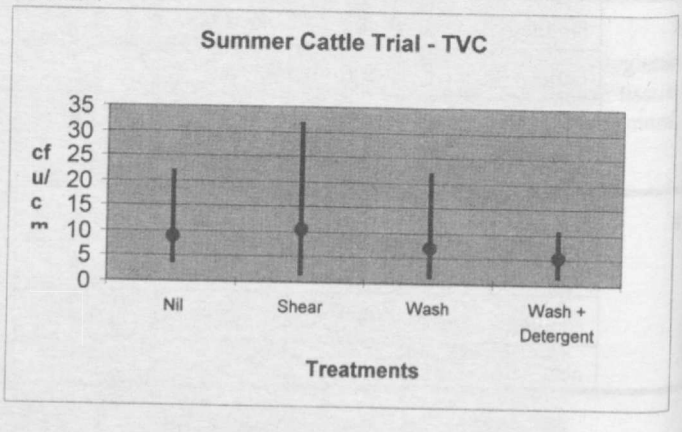
Samples

Three site composite sponge samples were collected from one side of each carcass at least 12 hours post-slaughter. The sites selected were the rump, flank and brisket to meet the US Department of Agriculture sampling regimes (USDA 1996b). Each site was 10x10cm, so that one sample consisted of 3x100cm^2 sites. Samples were transported to the laboratory below 4°C, within 12 hours of collection and tested within 24hrs of sampling. All Samples were tested for *E. coli* and coliforms using Petrifilm™ count plates and total plate counts (AS 1766.1.3, 1991).

Results and Discussion

In the summer trial there was no statistical difference between any of the treatment groups (Figure 1) in $\log_{10}$ plate counts. Coliform and *E. coli* counts were found to be below detectable limits. This trial was implemented to set a baseline for clean cattle.

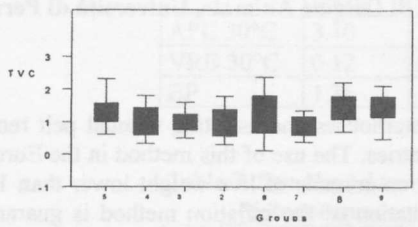
Figure 1:



Winter trial 1 $\log_{10}$ TVC/cm^2 are presented in Figure 2. There are some statistically significant differences between the groups, however, the box plot shows that these differences are small and that, overall, the counts on carcasses were so low (less than $\log_{10}$ 2.5/cm^2) that any differences are negligible. Some of the groups had detectable coliform counts, but were extremely low. There are only a small number of carcasses in this trial with detectable *E. coli* levels. None of the carcasses are above the lower limit for

the USDA/FSIS 3 class-sampling plan.

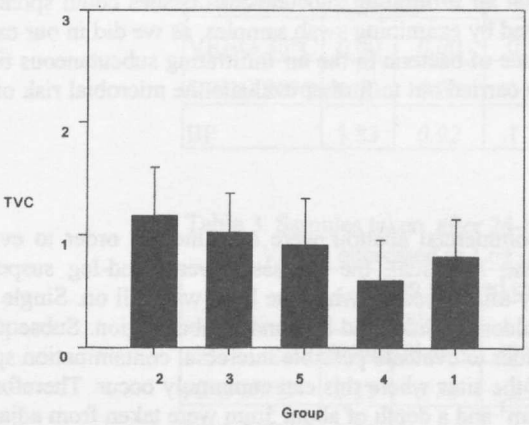
Figure 2: Winter Trial 1 – $Log_{10}TVC/cm^2$



Key:
2 Pre-shorn – spray wash
3 Spray wash
4 Pre-shorn - shear
5 Shear
6 Pre-shorn – Spray wash & detergent
7 Spray wash & detergent
8 Pre-shorn – MRDRD
9 MRDRD

In Winter trial 2 only log_{10} TVC's are provided (Figure 3) as the coliform and *E coli* counts are below the limit of detection of the test for all groups. Figure 3 shows that treatment groups Spray wash and Raking resulted in significantly higher TVC than the untreated group.

Figure 3: Winter Trial 2 – $Log_{10}TVC/cm^2$



Key:
1 Control
2 Spray wash
3 Hand rake
4 Shear post slaughter
5 Air knife post slaughter

Conclusions

- All carcasses in the three trials had microbial levels well within the USDA (1996) microbiological requirements.
- There was no correlation between visual contamination and microbial levels.
- There were no significant differences in microbial loading observed for each cleaning treatment.
- There were no significant differences in Total Viable Counts observed between cleaning treatments.
- There were no significant differences in *E.coli* or Coliform counts due to cleaning practices (most were detectable limits.

Recommendations

Current general guidelines should be adhered to:

- Cattle should be emptied out (denied access to food but not water) for a minimum of six hours prior to transportation.
- Cattle should be transported in a clean dry transport in order to ease the risk potential.
- Cattle should have minimal stress applied in order to reduce the risk of shedding.

In addition:

- with the correct dressing and chilling procedures, combined with quality assurances systems already in place, the level of contamination of cattle normally accepted for slaughter in Australian abattoirs will have little effect on carcass contamination.

References

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Acknowledgments

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