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THE HYGIENIC EFFICIENCY OF TWO NEW ZEALAND BEEF DRESSING LINES

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Keywords: microbial contamination, process hygiene, decontamination, *E. coli*, aerobic plate count, beef carcass

Introduction

In healthy slaughter animals, the tissues that ultimate become "meat" are generally regarded as sterile (Nottingham, 1982). Contamination of these tissues with microorganisms is an undesirable but unavoidable consequence of the process by which live animals are converted into meat (Ayres, 1955). Regulatory authorities around the world are actively reviewing the microbiological status and safety of meat produced within, or imported into, their jurisdictions, e.g. USDA-FSIS (1995). Presently, there are two, but not necessarily mutually exclusive, advocacies to assure the hygienic adequacy of carcass meats: proactive prevention or limitation of contamination and reactive removal of that contamination. New Zealand has adopted the proactive approach without recourse to mandatory chemical decontamination procedures (NZMIHC, 1993). The present study was undertaken to determine and compare the hygienic efficacy of two modern beef slaughter and dressing lines associated with conventional cold deboning beef packing operations.

Materials and Methods

Dressing system The study examined the dressing procedures and associated carcass contamination at export meat plants during normal processing. The general sequence of operations for the 440 head/day and 160 head/day dressing systems is presented in Figure 1. In both plants, samples were taken from sides as soon after the final wash as was possible within the physical constraints imposed by each system.

Sampling procedure The 15 sample sites, Figure 2, were selected to include suspected "at-risk sites" as well as the standard sampling sites. At-risk sites included those in the vicinity of opening cuts and both internal and external sites likely to be contamination during evisceration. Swab samples were taken from 5 cm^2 areas at each of the 15 sites on 24 beef sides at each of the plants studied. Aerobic plate counts at 37°C and Petrifilm™ (3M, Auckland, NZ) *Escherichia coli* enumerations were performed on samples from all 15 sites.

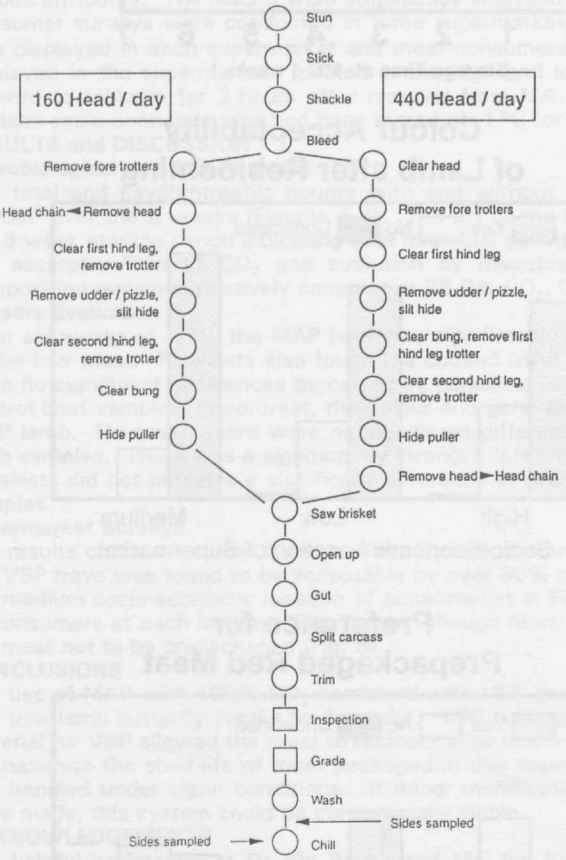

Figure 1. General sequence of operations in the 160 head/day and the 440 head/day beef dressing systems studied.

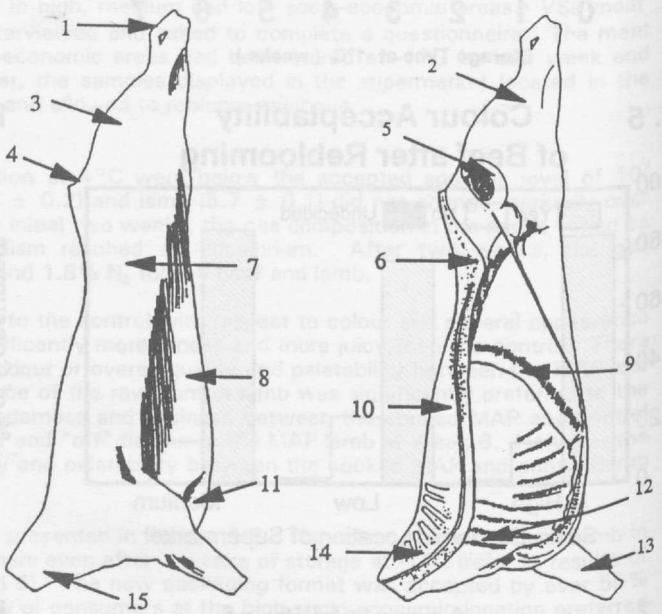

Figure 2. Location of sample sites on beef sides. 1. Hock. 2. Inside leg. 3. Outside leg (Standard). 4. Bung. 5. Aitch Bone (Standard). 6. Lumbar. 7. Mid Waist. 8. Flank (Standard). 9. Skirt. 10. Thoracic Vertebra. 11. Brisket (Standard). 12. First Rib. 13. Inside Foreleg. 14. Cervical Vertebra. 15. Neck (Standard).

Results and Discussion

The mean aerobic plate counts for the 15 sample sites on beef sides from the two plants are presented in Figure 3. With a single, but statistically insignificant, exception, the slower 160 head/day plant produced dressed sides with lower contamination than did the faster chain speed 440 head/day plant. This suggests that the increased chain speed, necessary to accommodate a larger daily throughput, compromises hygiene. An alternative explanation is that the differences were a consequence of the general contamination present in each plant. Clearly this is an area that requires further investigation, although taken at face value, the limited number of results available from the present study indicates that in achieving higher chain speeds there is a cost in processing hygiene. This conclusion is supported by industry experience in plants that adjust line speeds and manning rates to accommodate a range of daily throughputs.

The fact that the rate of contamination on washed beef sides was generally very low, less than 100 bacteria/cm^2, should not be overlooked when overall process acceptability is considered. While differences between the processes maybe statistically significant, it is highly unlikely that the absolute differences are large enough to alter product storage life or compromise product safety. Carcass contamination observed in the present study is not unlike that reported by Jericho *et al.*, (1994) for unwashed sides in six Canadian abattoirs.

The superior hygienic performance of the lower-capacity plant is also evident from the *E. coli* counts, Figure 4. However, in both systems the numbers of *E. coli*, indicator organisms of faecal contamination, were very low, and showed unevenly distribution across the sample sites. The almost random distribution of very low numbers of *E. coli* on beef sides suggests that none of the sites sampled had been directly contaminated with faecal material. Alternatively, this result could be interpreted as showing that faecal contamination was effectively removed or dispersed by carcass washing. The influence of natural or experimental faecal contamination at specific sites on microbial counts obtained at those sites needs to be determined. Such a line of experimentation should logically be extended to determine if carcass washing is simply a cosmetic measure removing visible contamination or a hygienic measure that removes microbial as well as macro-contamination.

Conclusions

1. The microbial contamination distribution patterns on beef sides from the two plants were essentially the same.
2. The rate of microbial contamination was lower at the lower processing speed, suggesting that microbial contamination and chain speed may be related.
3. With both plants, microbial contamination on dressed washed beef sides as measured by aerobic plate counts and *E. coli* counts was very low.
4. Current New Zealand beef dressing practices produce hygienically acceptable carcasses without the need to apply mandatory decontamination procedures.

References

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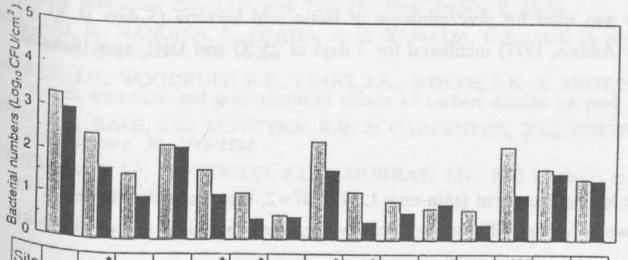
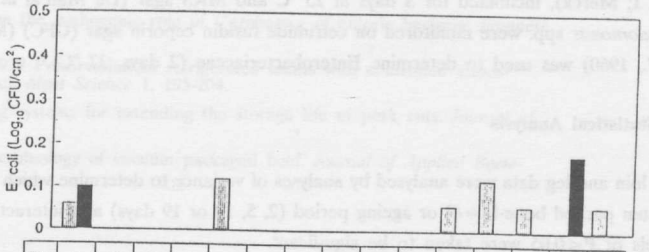


Site	1	2*	3	4	5*	6*	7	8*	9*	10	11	12	13***	14	15
□	3.31	2.45	1.54	2.21	1.63	1.09	0.57	2.29	1.12	0.90	0.74	0.70	2.18	1.66	1.43
■	3.00	1.67	1.00	2.15	1.06	0.49	0.53	1.63	0.42	0.64	0.84	0.36	1.06	1.56	1.41

Figure 3. Mean Aerobic Plate Counts (n=24) at 15 sites on beef sides from a 160 head/day (black columns) and a 440 head/day (light columns) beef dressing plant (significant difference between plants * P<0.05, *** P<0.001).



Site	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
□	0.06	0	0	0	0.12	0	0	0	0	0	0.06	0.12	0.06	0	0.06
■	0.10	0	0	0	0	0	0	0	0	0	0	0	0	0.18	0

Figure 4. Mean *E. coli* Counts (n=6) at 15 sites on beef sides from a 160 head/day (black columns) and a 440 head/day (light columns) beef dressing plant. Note the difference in scale between this Figure and Figure 3. Counts below the limit of detection ($\log_{10}$/cm^2 = 0.000) are reported as 0.