

Quantitative Fate of *Escherichia coli* O157:H7 through the Calf Processing Chain

John Mills¹, Robyn Clemens¹, Teck Lok Wong², Angela Cornelius², Guillaume Le Roux¹, Shelley Urlich¹, Gale Brightwell¹, Graeme Jarvis³ and Roger Cook⁴

¹AgResearch (MIRINZ Centre), Hamilton, New Zealand; ²Institute of Environmental Science & Research Ltd, Christchurch, New Zealand; ³MIRINZ Inc. (Meat & Wool New Zealand), Wellington, New Zealand; ⁴New Zealand Food Safety Authority, Wellington New Zealand.

ABSTRACT

Microbiological risk assessments generally rely on cross-sectional surveys at individual steps in the food chain to provide data for modelling exposure which, combined with dose-response information, is used to estimate risks to consumers. While internationally studies of *E. coli* O157:H7 in the meat chain have concentrated on feedlot cattle, few if any have investigated forage-based meat production chains, e.g. those in New Zealand (NZ). The low (0.002%) prevalence on NZ beef suggests that it isn't a significant source of this pathogen. However, while the prevalence on NZ "unweaned" veal is also relatively low at 0.6%, the reported higher shedding rates in calves than adult cattle provided an opportunity to carry out a quantitative longitudinal study of *E. coli* O157:H7 contamination through calf processing plants during the 2005 season.

Nine representative plants were selected on geographical location and carcass decontamination method; chemical (Inspexx 200™ or acidified sodium chlorite) or physical (steam vacuum). *E. coli* O157:H7 was isolated from 11% of calf rectal swabs, but was not detected in similar swabs from adult cattle. The opening cut lines on calf hides were contaminated at a much higher rate (43%) possibly reflecting cross-contamination during transportation and pre-slaughter lairage, but this did not translate to equally high carcass contamination on the cut lines immediately after opening (9%). Similarly, counts of *E. coli* O157:H7 were two logs lower on the carcass than on the hide (median of approx -2.0 log₁₀ MPN/cm²) and decreased a further 2% and 0.5 log₁₀ count following decontamination.

These data indicate that NZ calf dressing procedures are hygienically efficient, and that exposure of consumers to *E. coli* O157:H7 prior to cooking would be very low. However, the existing interventions were not wholly successful, and more studies are required to identify where in the chain tighter controls would be most effective.

INTRODUCTION

While shiga-toxicogenic *Escherichia coli* O157:H7 (NM) is associated with 70-90 notified cases of gastroenteritis in New Zealand (NZ) per annum, not one case to date has been attributed to regulated food.

E. coli O157:H7 (NM) is reasonably "unlikely" to occur on New Zealand manufacturing grade beef (a.k.a. trim). Low prevalence (0.002%) suggests that it isn't a significant source of this pathogen.

However, while the prevalence on NZ bulk boned "unweaned" veal is also relatively low at 0.6%, the reported higher shedding rates in calves than adult cattle provided an opportunity to carry out a quantitative longitudinal study of *E. coli* O157:H7 contamination through calf processing plants during the 2005 season, specifically looking at faecal and hide carriage, and contamination before and after intervention strategies.

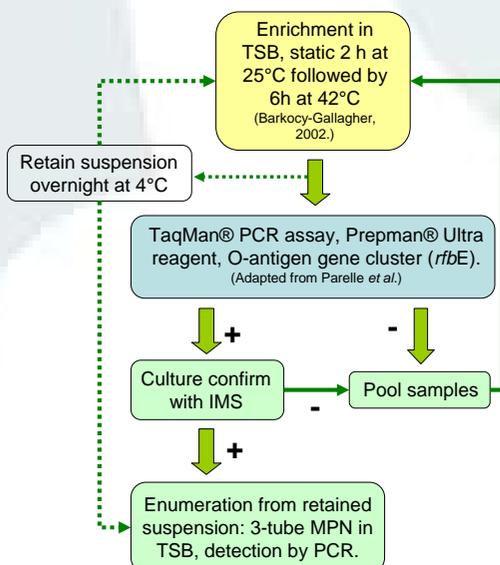
METHODS

Sampling plan

Nine premises: North & South Islands
Eight sampling days, whole season (Apr-Oct)
Three interventions: Inspexx 200™ (carcass wash)
Acidified sodium chlorite (opening cut lines)
Steam vacuum (opening cut lines)

Sample collection (each sampling day)

20 rectal swabs (bobby calf & adult cattle)
20 hide samples, 2cm x 10cm excision from opening cut lines
2 x 20 carcass sponge samples (pre- & post-intervention, respectively), opening cut lines & rectal orifice
5 boning room environmental, 100cm² FlexiSwab samples,
All samples suspended in maximum recovery diluent (MRD), with 0.1% sodium thiosulphate added to post-chemical intervention samples.



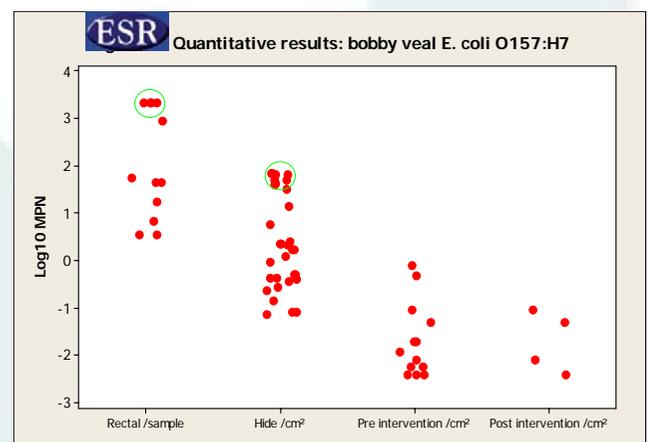
RESULTS

Prevalence of *E. coli* O157:H7 (NM) decreased through the chain but was not substantially reduced by interventions. *E. coli* O157:H7 (NM) was not detected in faeces from adult cattle nor in the boning room samples.

Bobby veal: Toxigenic *E. coli* O157:H7 (culture positive)

Premise	Location	Intervention	Date	Calf faecal	Carcass samples n=20		
					Hide	Pre-	Post-
A	N	Inspexx	24/08/2005	1	13	3	1
C	N	Inspexx	25/07/2005	2	7	0	0
D	N	Steam-vac (h)	15/08/2005	0	10	2	1
D	N	Steam-vac (h)	7/09/2005	0	0	0	0
F	N	Inspexx	22/06/2005	3	6	2	4
G	N	Inspexx (h)	13/07/2005	8	16	8	7
H	N	ASC	2/08/2005	2	1	0	0
N	S	Steam-vac	11/10/2005	0	0	0	0
O	S	Steam-vac	23/08/2005	1	16	2	0
S	S	Steam-vac	27/09/2005	0	0	0	0
Totals				17	69	17	13
n=				160	160	200	200
% Incidence				11%	43%	9%	7%

In contrast, counts of *E. coli* O157:H7 (NM) were two logs lower on the carcass than on the hide (median of approx -2.0 log₁₀ MPN/cm²) and decreased a further 2% and 0.5 log₁₀ count following decontamination.



CONCLUSION

NZ calf dressing procedures are hygienically efficient resulting in low levels of contamination by *E. coli* O157:H7 (NM) on bobby calf carcasses. Decontamination interventions further reduce the numbers to the extent that exposure of consumers to *E. coli* O157:H7 (NM) prior to cooking would be very low.

References

- Barkocy-Gallagher G, Berry E, Rivera-Betancourt M, Arthur T, Nou X, Koochmaria M. 2002. Development of methods for the recovery of *Escherichia coli* O157:H7 and *Salmonella* from beef carcass sponge samples and bovine faecal and hide samples. *Journal of Food Protection* 65: 1527-34
- Parelle S, Dilasser F, Grout J, Fach P. (2004) Detection by 5'-nuclease PCR of Shiga-toxin producing *Escherichia coli* O26, O55, O103, O111, O113, O145 and O157:H7, associated with the world's most frequent clinical cases. *Molecular and Cellular Probes* 18: 185-92.