Factors Associated With the Cross-Contamination of Hides of Scottish Cattle With *Escherichia coli* O157

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1.0 Introduction

Hide contamination of cattle has been identified as one of the major sources of verocytotoxigenic *Escherichia coli* (VTEC) O157 carcase contamination, which is a potential food safety concern. The objective of this analysis was to determine the origins and risks of hide contamination, in order to discover where intervention strategies may be most efficiently applied.

2.0 Materials and Methods

Data from a large-scale Scottish study investigating VTEC O157 epidemiology in cattle were used in this analysis. Multivariable logistic regression analysis was applied at the level of individual animals, farms and slaughterhouses to identify potential risk factors for hide cross-contamination. The study included groups of animals sent from 38 farms to 12 slaughterhouses; as a consequence, both 'group' and 'slaughterhouse' were modelled as random effects.

3.0 Results and Discussion

Of 236 cattle, 130 (55%) had contaminated hides. Using phage types to classify the contaminated hides, only 5% of study animals with contaminated hides were self-contaminated (i.e., had the same phage type on the hide as in faecal or rectal content samples) (Figure1).

A: Cross-contaminated

B: Contaminated with phage type previously found on farm of origin

C: Self-contaminated

D: Contaminated by animals in the same farm group

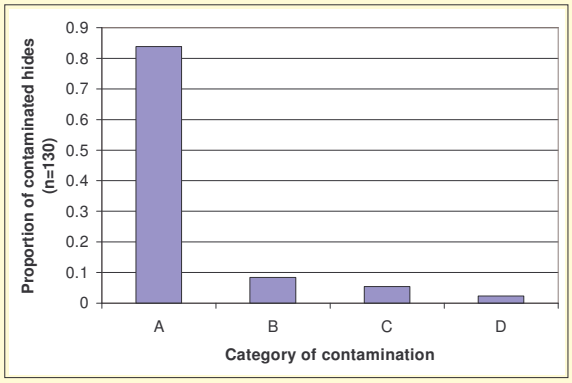

Figure 1. Most likely origin of *Escherichia coli* O157 hide contamination of beef cattle at slaughterhouse.

Furthermore, 84% of contaminated hides were contaminated with phage types never previously recorded on the farm of origin, indicating that cross-contamination was the predominant mechanism. Transport to the slaughterhouse by commercial haulier, as opposed to transport by the farmer, was associated with a borderline significant increase in the odds of a hide being cross-contaminated; transport of groups from more than one farm only occurred in commercial haulage and this may have contributed to the significance of this factor. In the slaughterhouse, providing hay to animals in lairage, and wiping down the landing area from the stunning box between each animal were associated with a borderline significant decrease in the odds of hide cross-contamination (Tables 1 and 2).

Table 1. Coefficients, standard errors, odds ratios, 95% odds ratio confidence intervals and p-values of the mixed model logistic regression analysis of the hide cross-contamination data set.

Factor	Coeff.	S.E.	OR	95% CI for OR	P
Transport (haulier)	1.7	0.9	5.7	(0.99, 33.0)	0.052
Feed in lairage (hay)	-3.2	1.7	0.04	($2.0e^{-03}$, 1.04)	0.053
Landing area practice	-3.4	1.8	0.03	($9.1e^{-04}$, 1.15)	0.060

Table 2. The variance, standard error, and intra-class correlation coefficient for the random effects in the mixed model logistic regression analysis of the hide cross-contamination.

Random effect	Variance	S.E.	I.C.C.
Farm group	2.69	1.8	0.45
Slaughterhouse	1.48	1.9	0.31*

* not significant

4.0 Conclusion

This analysis suggests that hide contamination occurs mostly at locations other than the farm, and that modifiable non-farm factors exist as potential interventions to reduce the risk of VTEC O157 hide contamination.

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