The incidence of *Salmonella* on beef carcasses in Irish abattoirs

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Background

During standard slaughter, dressing, and butchering processes enteric bacteria arising from animal intestinal contents and/or during hide removal may lead to contamination of carcasses in the processing environment (Elder *et al.* 2000, Mc Evoy *et al.* 20001). In 1988 the first isolates of *Salmonella typhimurium* DT104 were obtained from two cattle farms in England. Ten years later *S. typhimurium* DT104 was present in a wide range of animals species and humans in the United Kingdom, most European countries and the United States (Hollinger *et al.* 1998, Dargatz *et al.* 1998). Public and animal health agencies are becoming increasingly concerned about the occurrence of *S. typhimurium* DT104, as this pathogen is being increasingly associated with higher hospitalisation and mortality rates in comparison to other *Salmonella* infections in humans (Wall *et al.* 1994). Information on the extent of *Salmonella* contamination on beef carcasses in Irish abattoirs during standard slaughtering, dressing and butchering processes was not previously available. This lack of information was addressed by carrying out a study in nine export abattoirs with a slaughter rate of >30,000 per year, to determine the presence of *Salmonella* on beef carcasses.

Objectives

To determine the extent of *Salmonella* contamination on beef carcasses during conventional slaughter, dressing and butchering practices in Irish abattoirs.

Methods

Nine Irish export abattoirs located in 3 regions of the country were visited. In each abattoir, 30 beef carcasses were chosen, throughout the day to give a representative sample of the animals slaughtered. Whole body swabs were carried out on carcasses using sponges soaked in phosphate buffered saline (PBS). One side of an animal was examined pre chill and the other post chill, the sponges were stored at 4°C in chill boxes and transported to the laboratory for analysis.

Salmonella Each sponge was placed in 200 ml of Buffered Peptone Water (Oxoid) which was incubated at 37°C for 24 h. After incubation immuno-magnetic separation (IMS) was performed using *Salmonella*, dyno-beads (Dynal , UK). After IMS separation 100 µl of the re-suspended beads/bacteria complex was added to Rappaport Vassiliadis Broth (RVB) (Oxoid) and incubated at 42 °C for 24 h. From the RVB broth 10 µl was streaked onto two agars [1] Mannitol Lysine Crystal Violet Brillant Green agar (MLCB) and [2] Modified Brillant Green Agar (BGA) and incubated at 37° C for 24 h. Presumptive *Salmonella* colonies were then screened for serogroup identification using the Wellcolex rapid test Kit (Abbott, Murex, UK). Single isolated suspect positive colonies were streaked onto plate count agar (PCA) (Oxoid) purified and bio-chemically characterised. *Salmonella* polyvalent agglutinating sera (polyvalent H phase 1 and 2 and polyvalent 0 groups A-G) (Abbott, Murex, UK) were performed for final *Salmonella* confirmation. *Salmonella* isolates which were confirmed as positive were serotyped to species level. *S. typhimurium* isolates were phage typed, and isolates confirmed as DT104 were further investigated to determine their antibiotic profiles.

Results and discussion

Beef carcass from 690 animals were examined for *Salmonella*, 98 carcasses were positive, giving an incidence of 14%. Of these 6% were isolated pre chill and 8% post chill. The majority of the isolates were *S. typhimurium* (12%), with *S. agona* (1%) and *S. dublin* (1%) also present. Fig. 1 shows the percentage of *Salmonella* positive carcasses in the nine Irish abattoirs. Almost 30% of the carcasses in two abattoirs, 6 and 7

were positive for *S. typhimurium*. The majority of carcasses positive in these two abattoirs were beside each other in the chill, suggesting that cross contamination between carcasses may have taken place. Carcasses that were positive pre chill, were not positive post chill. More than one species of *Salmonella* was found in a number of the abattoirs visited. In abattoir 4, both *S. typhimurium* and *S. agona* were isolated from different carcasses, while in abattoir 6 both *S. typhimurium* and *S. dublin* were isolated from different carcasses. *S. typhimurium* was isolated in 7 of the 9 abattoirs investigated. During the sampling period the highest number of *Salmonella* isolates were collected in April (late Spring) and October (late Autumn). There were no *Salmonella* positive carcasses during the months of January, May, June, September or December. When the antibitoic resistant profiles for the *S. typhimurium* isolates (83 carcasses) were determined it was found that 96% (80 carcasses) were multi resistant. The isolates were resistant to ampicillin [25 μg], chloramphenicol [30 μg], erthromycin [30 μg], tetracycline [30 μg], sulphafurazole [300 μg], streptomycin [10 μg] and penicillin G [25 units]. Of the remaining 3 isolates, 1 was resistant to 4 of the antibiotics, erthromycin [30 μg], sulphafurazole [300 μg], streptomycin [10 μg] and penicillin G [25 units]. The remaining 2 isolates were inconclusive for ampicillin [25 μg], but susceptable to the other seven antibiotics.

Conclusion

This study indicates that *S. typhimurium* DT104 has a high incidence on beef carcasses. Carcasses found positive pre-chill in the majority of cases were not the same carcasses found positive post chill. Cross contamination may account for the high numbers of positive carcasses occurring either [1] during standard slaughter and dressing processes, [2] carcasses coming into contact with contaminated surfaces during the loading or unloading of the chills or [3] as a result of contamination by operatives. Improvements in manufacturing practices, especially during hide removal, bunging and when loading or unloading the chills may help to reduce the dispersal of enteric material.

References

Elder, R.O., Keen, J.E., Siragusa, G.R., Barkocy-Gallagher, G.A., Koohmaraie, M. and Laegreid, W.W. 2000. Correlation of enterohemorrhagic *Escherichia coli* O157 in feces, hides and carcasses of beef cattle during processing. Proceedings of the National Academy of Sciences 97: 2999-3003.

McEvoy, J.M., Doherty, A.M., Sheriden, J.J., Thomson-Carter, F.M., Garvey, P., McGuire, L., Blair, I.S., and McDowell, D.A. 2000. The incidence and spread of *Escherichia coli* O157:H7 at a commercial beef abattoir. Concerted Action CT-98-3935 Verocytotoxigenic *Escherichia coli* in Europe 5:12-27.

Hollinger, K., Wray, C, Evans, S, Pascoe, Chappell, S, and Jones, Y 1998. *Salmonella typhimurium* DT104 in cattle in Great Britain. Journal of American Veterinary Medical Association 12: 1732-1733.

Wall, P.G., Morgan, D., Lamden, K., Griffin, M., Threlfall, E.J., Ward, L.R., Rowe, B. 1995. Transmission of multi-resistant strains of *Salmonella typhimurium* from cattle to man. The Veterinary Record 6: 591-592.

Dargatz, D.A., Wells, S.J., Fedorka-Cray, P.J. and Akkina, J. 1998. The Veterinarian's Role in diagnosis, treatment and prevention of Multi-Resistant *Salmonella typhimurium* DT104. Bovine Practitioner. 32: 1-6.

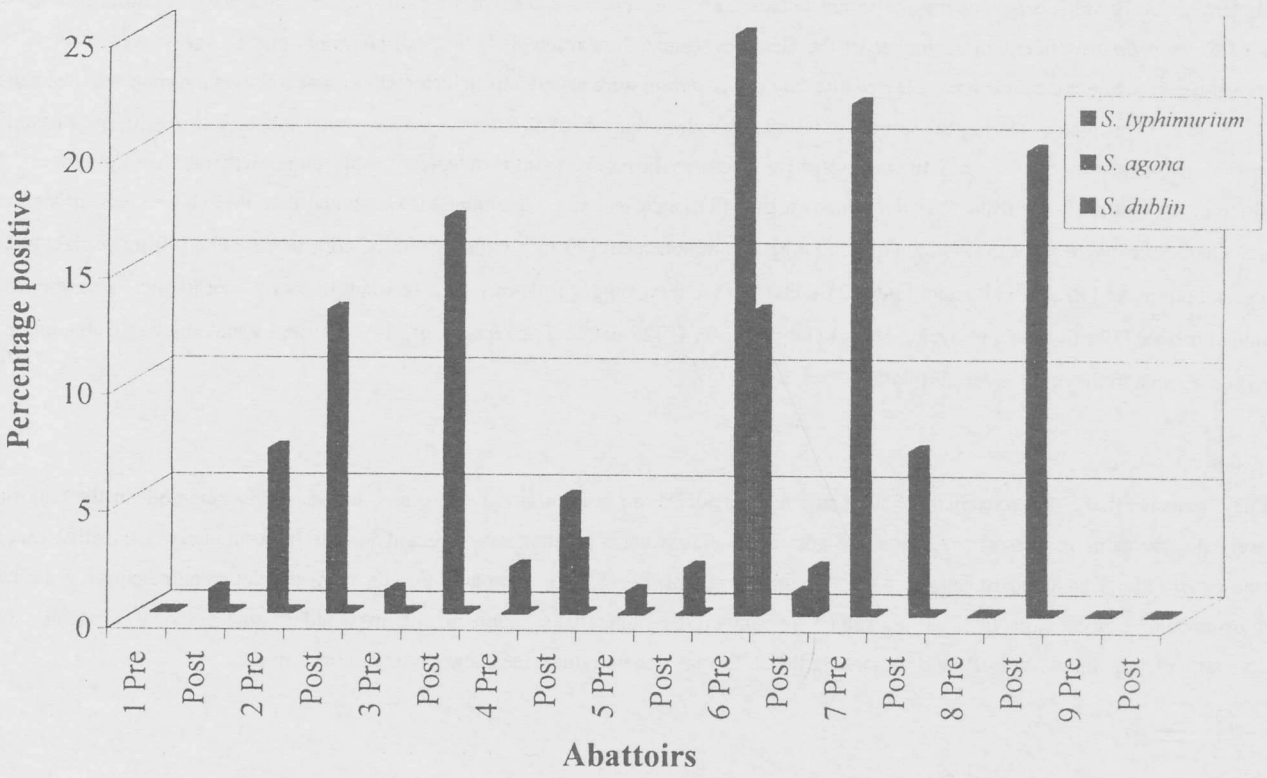

Fig. 1 Percenatge of beef carcasses positive for *Salmonella* in nine Irish abattoirs