# Meta-analysis of the efficacy of interventions applied during primary processing to reduce microbiological contamination in beef

Area of research interest: Foodborne pathogens
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## Background

The sale and consumption of burgers served less than thoroughly cooked (LTTC) and pink in the middle is a steadily increasing trend and a number of catering chains and outlets now offer this option to customers. This prompted concerns that there may be an increased risk of exposure to E. coli O157 for consumers who prefer this type of food. Our Board concluded that burgers served LTTC should be delivered to the same level of protection as thorough cooking provides the consumer. The safe production of this product at catering establishments is likely to be significantly reliant on controls and/or interventions applied at the beef processing facilities previously in the chain, particularly slaughterhouses and cutting plants.

## Research Approach

The main aim of this study is to perform a meta-analysis of the efficacy of interventions applied during primary processing to reduce microbiological contamination in beef, to make recommendations on the effectiveness of specific interventions for beef that will inform the risk management decisions for further work. The study covers a range of GHP-based and hazard-based interventions at the abattoir stage (from receive and unload of animals to chilled carcasses) and post-abattoir stage (further processing of raw beef and packaging). The data on interventions in beef primary processing that is analysed in this study were identified in a previous critical review ("A critical literature review to assess the significance of intervention methods to reduce the microbiology load on beef through primary production", FSA project FS301044).

Relevant outcome measures for interventions were the effectiveness of each intervention in reducing log levels of indicator bacteria (aerobic colony counts (ACC), Enterobacteriaceae counts (EBC) and generic E. coli counts) and log levels of foodborne pathogens (primarily E. coli O157 and other non-O157 STEC and Salmonella spp.).

## Results

The main relevant outcome measures are:

- Hide cleanliness assessment showed consistent reduction on resulting carcasses for ACC, EBC and generic E. coli. Other cattle hide interventions investigated under commercial abattoir conditions, such as shellac hide coating and chemical washes with cetylpyridinium chloride, sodium hydroxide and proprietary sanitiser, showed significant reduction in

transfer of ACC and EBC to carcasses. This result indicates the usefulness of cattle hide interventions to proactively reduce potential carcass contamination during subsequent dehiding process

- Final beef carcass wash using cold or warm water largely showed no evidence of a reduction in levels or prevalence of microorganisms on carcasses before chilling. Several commercial trials found that water washes did not change generic E. coli prevalence on washed beef carcasses and did not reduce aerobic colony counts on beef carcasses. Overall, across all five microorganisms, steam and hot water carcass pasteurisation had the largest potential impact on decreasing the prevalence and concentration of contaminated beef carcasses
- Dry chilling following multiple slaughter line interventions under commercial abattoir conditions led to a significant reduction of ACC and E. coli prevalence on beef carcass sides. Dry chilling investigated under commercial abattoir conditions with no interventions applied in the pre-chill stage on the slaughter line, lead to significant reduction in ACC
- Water spray chilling showed inconsistent effect when investigated in commercial abattoir conditions
- Multiple pasteurisation and acid interventions led to a significant reduction in generic E. coli prevalence on beef carcass sides
- Data on the interventions' efficacy against pathogenic bacteria (Salmonella spp. and pathogenic E. coli) were mostly available from challenge trials conducted under laboratory or pilot plant conditions. Their efficacies were investigated using artificially inoculated bacteria and consequently the effects are likely exaggerated and would not reflect real life conditions that exist in abattoirs

Research report
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