A critical review of the impact of food processing on antimicrobial resistant (AMR) bacteria in meats and meat products

Area of research interest: Antimicrobial resistance
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Background

Tackling AMR is a high priority area for the UK government as well as a concern worldwide, and until recently AMR research has largely focused on farm animal and human health. There is relatively little knowledge on the impact that secondary food processing has on AMR. This critical review helps to inform risk assessments by providing evidence for how processing impacts on the presence of AMR bacteria in meat and meat products, as well as help identify more accurately the knowledge gaps that currently exist.

This was a recommendation by the Advisory Committee on the Microbiological Safety of Food (ACMSF) 'Task and Finish' Group.

Objective and Approach

The ACMSF have identified that there is an evidence gap on the impact of processing on the presence of antimicrobial resistant (AMR) bacteria in meat; as much of AMR research effort has been focused on AMR in farm animals, retail food and in humans.

The aim of this study was to provide insight into the impact that established and novel secondary meat processes have on AMR bacteria and the impact on the transfer of antimicrobial resistance genes (AMG). Included in this is a consideration of bacterial stress responses and the use of sub-lethal food processing technologies and the potential transfer of resistance genes.

A critical review of the peer reviewed and grey literature, relating to AMR bacterial populations and the spread of genetic materials conferring AMR, in association with meat after secondary processing, was undertaken. This review considered a range of processing steps, processing interactions with plasmid conjugation and phage activity, as well as other aspects of genome plasticity, such as survival of extracellular genetic material which could give rise to new AMR. The review also took into consideration both pathogenic and commensal AMR bacteria.

The review used systematic searching to identify publications which was then critically appraised by two reviewers using an assessment questionnaire. Source databases searched were primarily be the Clarivate Analytics (formerly Thomson-Reuters) Web of Science and Pubmed databases. The study considered the opinion of multiple reviewers and there was statistical analyses of the data collected to ensure consistency of theses assessments.

This review is addressing a key recommendation from the ACMSF Task and Finish AMR Group and overall will feed into the UK cross-government AMR strategy by providing useful information on the role meat processing plays in the development and spread of AMR bacteria. It is anticipated that this review will help identify where future surveillance and research activities are needed, which will inform public health as it will provide further knowledge on the presence and potential transfer of AMR.

Results

This review focused on secondary meat production and the possible sources of AMR. The review found that a major barrier to meta-analyses of published studies is that different isolation and AMR determination methodologies have been used by different authors. The review also suggested that testing for AMR in starter cultures for fermented meats could be built into purchase specifications for FBOs or FBOs could be provided with validated methodologies designed to cure AMR plasmids from their strains. Another area that the review found that needs more work is the role biofilms play in AMR transmission their community composition and their role as a physical barrier to effective sanitation.

Overall, this study has determined that gaps in the knowledge concerning AMR associated with SPMMP exist, and many of these are due to many ways in which AMR may be reported.

Research report
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