Scientific Interpretive Summary

Resuscitation of putative viable but non-culturable (VNC) foodborne bacteria of significance to New Zealand

A viable but non-culturable cell (VNC) has been defined as "a cell which is metabolically active, while being incapable of undergoing the cellular division required for growth". Research into the putative viable but non-culturable (VNC) bacteria state was instigated when S. Brandenburg started to cause illness in large numbers of sheep in New Zealand. Although carcasses of infected animals would be positive shortly after pelt removal, the prevalence of apparently affected carcasses decreased quickly over time. Meat products at retail did have very low counts of S. Brandenburg which were shown by risk modelling to be unlikely to cause foodborne disease in humans. However, there was a scientific concern that some organisms might have entered into a VNC state and organisms would not be dead but only not-culturable. It has been hypothesised that some of these organisms might still be pathogenic after consumption.

A scientific project was commissioned to determine whether New Zealand strains of foodborne pathogens can enter the VNC state. The approach used to illustrate the resuscitation phenomenon reported in the literature for Salmonella was applied to several organisms of priority public health significance in New Zealand i.e. Salmonella Brandenburg PFGE type 14, the 'outbreak' strain of L. monocytogenes and New Zealand isolates of Campylobacter and Shiga-toxin producing E. coli (STEC).The methodology included the addition of autoinducer molecules from other enteric microbes that might assist with resuscitation.

The project was successful in being able to bring certain strains of foodborne pathogens into the VNC state. However, these VNC organisms could not be resuscitated after the use of a number of reported and empirical methods, including heat-shock, antioxidants, siderophores and autoinducers. These results concur with an increasing number of reports in the literature that have failed to resuscitate VNC cells by in vitro methods. As it was not possible to resuscitate VNC cells of these four bacterial species using a range of methods, no attempts were made to resuscitate VNC cells on meat samples.

Further work focused on the survival of VNC cells in various human fluid environments encountered after ingestion. VNC cells of C. jejuni were the most sensitive to the simulated human fluids, being killed by all three fluids. L. monocytogenes VNC cells were only sensitive to simulated gastric fluid, while S. enterica spp. and E.coli VNC cells were unaffected by any of the simulated human fluids.

This project, together with outcomes of other research projects, indicates that there is little likelihood of gastrointestinal pathogens leaving a VNC state and contributing a significant foodborne exposure to consumers.

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