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Process risk models Continued development 2010-11

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Background

Previously a process risk model was developed to utilise existing data from MLA projects and the wider literature and place it into a risk context. This model can be used as a research tool to better understand risks and identify areas within the program (particularly the pathogen and microbial contamination area) requiring further investigation. The model allows for analysis of data in a descriptive and mathematical manner and is useful within the pathogen program plan as a predictive tool to ensure MLA and the industry stays "ahead of the play" rather than just "reacting/responding" to food safety concerns. Modelling was also used to understand contamination of cartons of beef.

The maintenance and further development of the existing risk model is important to MLA for a number of reasons. Firstly, using data collected for a pathogen known to currently pose a food safety problem, the model can be used to predict prevalence and concentration of those pathogens which are foreseen to cause problems, but for which, little data exists. In addition, the model can be used to identify particular steps throughout the processing chain that present significant risk, thus providing direction as to what areas require further investigation and data collection. Carton beef models can be used to support Australia’s testing and control of pathogens such as *E. coli* O157.

Project Objectives

1. Document and explain the model to maintain transparency and accessibility to MLA and MLA's scientific risk management panel.
2. Identify parts of the existing model which may need improvement / updating.
3. Identify areas within existing data, where there may be incomplete data and a need for additional collection.
4. Specify the data requirements and allow for data obtained from a wide range of different projects within the program to be fed into the model for evaluation.
5. Contribute to the development of experimental and survey design for projects related to the model.
6. Identify areas within the processing chain which may be more important from a risk viewpoint and therefore require a greater degree of investigation / knowledge.
7. Assist in the development of recommendations for complete risk assessments, when required.
8. Assist in the development of risk management options, based on outcomes from the use of the process risk model.
9. Interact with MLA's scientific risk management panel, as required.

Results and Discussion

The following is a summary of the work undertaken as part of this project.

Coring cartons of beef trim

Alison Holdhus Small (CSIRO Division of Food and Nutritional Sciences) had collected data on core samples taken from cartons of beef trim, with the aim of relating the weight of such core samples to the external carcase surface area represented.[1] A good relationship would provide the possibility to sample cartons of beef trim using core samples, which are quick and easy to take, rather than surface slices, which are more difficult and time consuming.

Input from the present project was provided in relation to the statistical analysis of the data. The results indicated that for core sampling to achieve a surface area of 1125 cm^2, as required by the US Food Safety and Inspection service, core samples totalling about 1.8 kg would be required. This is considerably more than the 375 g of surface slices sampled by industry presently.

E. coli O157 in cartons of beef trim

Intensive sampling of cartons of beef trim, in which *E.* coli O157 had previously been detected, was undertaken by Robert Barlow and Glen Higgs (CSIRO Division of Food and Nutritional Sciences) during 2008 and 2009 as part of an MLA project. The results were largely analysed as part of a previous project (A.MFS.0187). As part of this project, two publications were developed from the earlier work, namely:

- Kiermeier, G. Mellor, R. Barlow, and I. Jenson. *Assumptions of acceptance sampling and the implications for lot contamination:* E. coli *O157 in lots of Australian manufacturing beef*. Journal of Food Protection, 74(4):539–544, 2011.
- J. Sumner, A. Kiermeier, and I. Jenson. *Verification of hygiene in Australian manufacturing beef processing—focus on* Escherichia coli *O157*. Food Protection Trends, accepted.

Beef shelf-life

Alison Holdhus Small (CSIRO Division of Food and Nutritional Sciences) had conducted two MLA funded shelf-life trials of vacuum packed beef primal. Spoilage was not observed during the first trial and subsequently, a longer second trial was undertaken. As part of the second trial, two types of primals, striploins and cube rolls from each of six abattoirs, were stored at -0.5°C for up to 30 weeks. These primals were microbiologically tested in triplicate for Aerobic Plate Counts (APC) and Lactic Acid Bacteria (LAB) at each sampling time.

The microbiological data were statistically analysed as part of this project. Modified Gompertz growth curve models were fitted to the APC and LAB data using nonlinear fixed effects models. That is, the intercept, lag phase, maximum specific growth rate and asymptote was allowed to vary between primal types and plants, while the option of pooling these parameters over primal and/or plants was undertaken using the likelihood ratio test.

[1] A. Holdus Small, N. McPhail, A. Kiermeier (2010) “The potential use of Carton Coring as a sampling method for E. coli O157 testing” report to MLA

This work has resulted in a manuscript which has been submitted to the journal *Meat Science* and is currently under review.

Risk assessment of *E. coli* O157 in burgers made from Australian beef trim

Work had previously been undertaken on the extent of contamination of lots of beef trim in which *E. coli* O157 had previously been detected (see above). Due to the low levels of *E. coli* O157 found in these lots, questions about the risk to consumers from such Australian beef trim product arose. Consequently, Ian Jenson (MLA) indicated that a risk assessment of *E. coli* O157 in burgers manufactured from Australian beef trim would be useful to help answer this question. In particular, the risk assessment is to provide information about what combinations of “proportion of lot contamination” and “concentration of contamination” are likely to give rise to significant illness rates, e.g. 20 illnesses. This will provide information about whether existing sampling and testing regimes are likely to detect, and prevent, such significant events or alternatively, what sampling and testing protocols would be required for trace-back as part of an outbreak investigation.

This risk assessment work was discussed in some detail in early May and is ongoing.

Conclusions and Recommendations

This project has provided MLA with a flexible mechanism to address a variety of statistical and modelling issues. Consequently it is recommended that funding be continued to allow ongoing provision of such services. This will also allow completion of the risk assessment.