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A risk profile of the Australian red meat industry: Approach and management

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Abstract

A risk profile of microbial, chemical and physical hazards across the supply continuum for the Australian beef, sheep and goat meat industries was developed. The aim was to provide risk managers with a risk rating of hazard:meat and meat product combinations, advise on the feasibility and advisability of risk analyses and identify research and development priorities. Hazard:red meat combinations arising from manufacturing and catering settings that have been associated with food-borne illness and their risk ranking are reported elsewhere. The profiling process was completed within a one-year timeframe and involved a planned iterative consultation process between risk managers and assessors to ensure outputs remained relevant to current risk management concerns.

Keywords: Risk profile; Red meat; Australia

1. Introduction

The Australian red meat industry is composed of approximately 25 million cattle and 120 million sheep. Australia is the world's largest exporter of beef (23% of total world exports) and the second largest exporter of sheep meats (42% of total world exports). Ruminants have been shown to carry human food-borne pathogens such as *Clostridium perfringens*, *Campylobacter jejuni*, enterohaemorrhagic *Escherichia coli* and *Salmonella* spp. in their gut. Co-mingling of animals, intensive rearing methods and stress (such as starvation and transport) increase the shedding and transmission of pathogens in animals (Grau & Brownlie, 1968; ICMSF, 2002; Nottingham, 1982). In terms of processed meats in 2003 202,000 tonnes of red meat was manufactured for value added products such as hamburgers and sausages and a range of cured, cooked, fermented and dried meats.

Given its role in the global meat trade, where public health concerns can adversely affect trade, the protection of consumers elsewhere is a high priority for the Australian industry as reflected by its strong commitment to Codex guidelines (FAO/WHO, 1995). Importantly, the 1995 World Trade Organisation Agreement on the Application of Sanitary and Phytosanitary Measures (WTO/SPS agreement) was made to ensure that importing countries could not impose non-tariff barriers to trade. Under this Agreement, foods can be freely imported if they provide an appropriate level of (consumer) protection (ALOP), as determined by the importing country. This approach requires pathogens in foods to be managed by exporting countries. Risk

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assessment is a recognised approach for demonstrating ability to meet a country's ALOP (ICMSF, 2002). In Australia, Food Standards Australia New Zealand (FSANZ) is formulating the development of Primary Production and Processing Standards on risk analysis principles (Martin et al., 2003).

Risk assessment has become the tool of choice for a variety of functions, including framing of risk-based regulation and of prioritising research and development to fill data gaps and reduce uncertainties. Some risk assessments have been done in response to well-publicised food-borne incidents e.g. enterohaemorrhagic *E. coli* in hamburgers, *Vibrio parahaemolyticus* in oysters and *Listeria monocytogenes* in ready-to-eat foods (FSIS, 2003). These quantitative microbiological risk assessments characteristically required large resource inputs and were done over a long timeframe (4–5 years), by which time many changes have occurred to industry practice which reduced the relevance of the assessments or the assessments were marred by lack of data, many assumptions and large uncertainties.

More recently whole industry sectors, e.g. seafood in Australia have employed risk assessment as a means of estimating risks from selected hazard:product pairings (Sumner & Ross, 2002). At first sight, risk assessment of an entire industry is daunting in terms of the wide range of microbiological, chemical and physical hazards in a wide range of raw and processed products. However, for this type of exercise risk profiling, rather than risk assessment, offers an alternative that is cost-effective in terms of resources and time.

Risk profiling is one activity in preliminary risk management and has recently been defined as 'a description of a food safety problem and its context' (CAC, 2003a). Risk profiling involves the systematic collection of information needed to make a decision on what will be done next and where resources should be allocated to more detailed scientific assessment. The risk profiling process typically provides information on: the hazard, exposure to the hazard, adverse health effects, public health surveillance information, control measures, and other information relevant to risk management decision-making. The provision of a comprehensive description of the food safety problem associated with the pathogen(s):commodity combination(s) has more recently been advocated (CAC, 2003b).

It was against this background that, in 2002, the Australian meat industry developed a risk profile of all raw and processed meat products across the supply continuum for microbial, chemical and physical hazards. This was done to assist public health and industry risk managers prioritise strategic food safety issues to ensure protection of consumers both domestically and in Australia's international red meat markets. The profiling process was completed within a one-year timeframe and involved a whole-of-industry approach (regulators, companies and consumers). The process by which the profile was implemented and managed is reported here as an example of how a large across-industry risk profile can be undertaken in a timely manner. Details of hazard identification and risk ratings are contained in Sumner et al. (in press-a) and Sumner, Ross, Jenson and Pointon (in press-b).

2. Terms of reference

The scope of the risk profile was to focus on public health hazards attributed to the consumption of red meat and processed meat. Specified objectives included identifying:

- Public health hazards that enter any point of the food chain for beef, sheep or goat meat products produced in Australia and rank them in terms of risk to the consumer.
- Potential public health hazards where too little information exists for a confident ranking of risk.
- Areas where further information may be required to effectively assess or manage risk.
- Potential management strategies for the identified hazards.
- Hazard:product combinations for which there may be value in performing further risk analyses.

3. Project initiation

The project was initiated by a Steering Committee, comprising representatives from the competent authorities responsible for meat hygiene in both the domestic and export sectors, and industry representatives. The Steering Committee appointed a project manager to coordinate all aspects of the risk profiling, most importantly to inter-relate with risk assessment teams and perform the role of facilitator at each of the expert consultations between risk managers and assessors.

4. Project design

The Steering Committee assumed the role of risk manager and was instrumental in setting the scope and terms of reference for the profiling exercise, and developing the methodology in consultation with the project manager. Key elements in the design were:

- Strong spine of consultation and peer review as manifested by a sequence of risk manager review and feedback to the assessors in a series of expert consultations (Fig. 1).

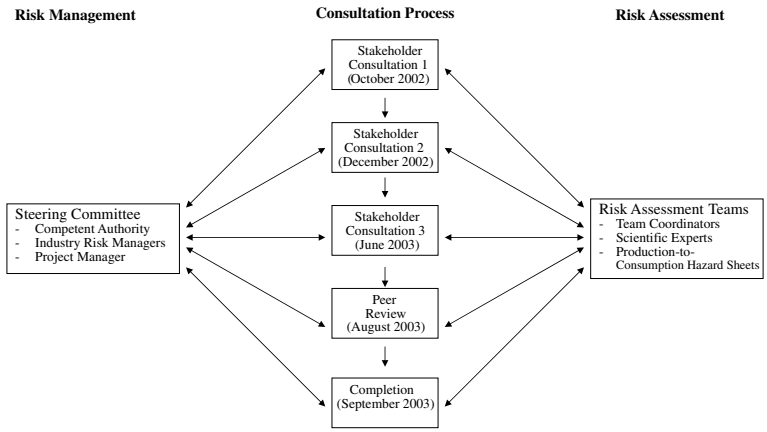

Fig. 1. Risk profile process.

- Selection of risk assessment teams to prepare hazard sheets covering the farm-to-fork continuum (Fig. 2).
- Planned regular consultations between risk managers and assessors.
- Establishing and monitoring the achievement of project milestones to ensure timely completion.
- Peer review at all stages, including a final, international review.

5. Conduct of the profiling exercise

The first expert consultation of 25 people brought the risk assessors together with the Steering Committee, with public health surveillance experts, officials from the competent authorities responsible for setting meat safety standards across Australia and with those responsible for providing information to meet market access requirements. The consultation was structured to inform all participants of the outputs required, detail the approach, identify contributors and data sources, and confirm project milestones.

Data were compiled by multidisciplinary risk assessment teams (Fig. 2) for each hazard into Hazard Sheets that were based on the risk assessment framework (CAC, 1999). Coordinators for each risk assessment team and team members, usually responsible for multiple Hazard Sheets, were appointed at the first consultation. Hazard identification data (Sumner et al., in press-a), type and severity of illness in consumers, level of contamination in animals and product, burden of illness in humans, and control procedures currently in place were documented. Hazard sheets were compiled for known and potential hazards associated with red meat. This process provided the operational framework leading to extensive consultation between experts across the supply continuum, including public health experts. The data were then synthesised to provide risk rating outputs for hazard:product combinations (Sumner et al., in press-b).

Two risk rating tools were used in the present exercise: a qualitative scheme (FSA, 2000; ICMSF, 2002) and the spreadsheet tool, Risk Ranger (Ross & Sumner, 2002). The former generated risk outputs such as low, medium and high. Risk Ranger outputs included a risk rating from 0 to 100 and an estimate of annual illness in the target population.

The exposure assessment process was used to identify uncertainties (data gaps) for specific hazard:product combinations. This process assisted definition of appropriate research activities to obtain a better estimation of risk.

The selection of hazard:product pairings for the hazard identification step (CAC, 1999) followed an iterative process. The public health record for the years 1991–2002 was reviewed to list meat-associated outbreaks responsible for gastrointestinal illness. In Australia, a consistent and complete recording has begun under the auspices of OzFoodNet (OzFoodNet Working Group, 2002, 2003). Three outbreak settings were considered: those attributable to a manufacturing process, food service sector and meal preparation in the home. Risk managers refined these lists during expert consultations 1 and 2.

The second expert consultation held 4 months into the project was used to present preliminary risk ratings to stakeholders who attended the first consultation. This step initiated the process of reviewing the alignment between the risk ratings and the public health record. In doing so, the process ensured that the assumptions used in both risk rating approaches, when there was a lack of reliable data, were examined and consensus achieved. This led to a revision of some risk ratings and the production of new ratings to examine "what if" contributing factor and mitigation scenarios. This process

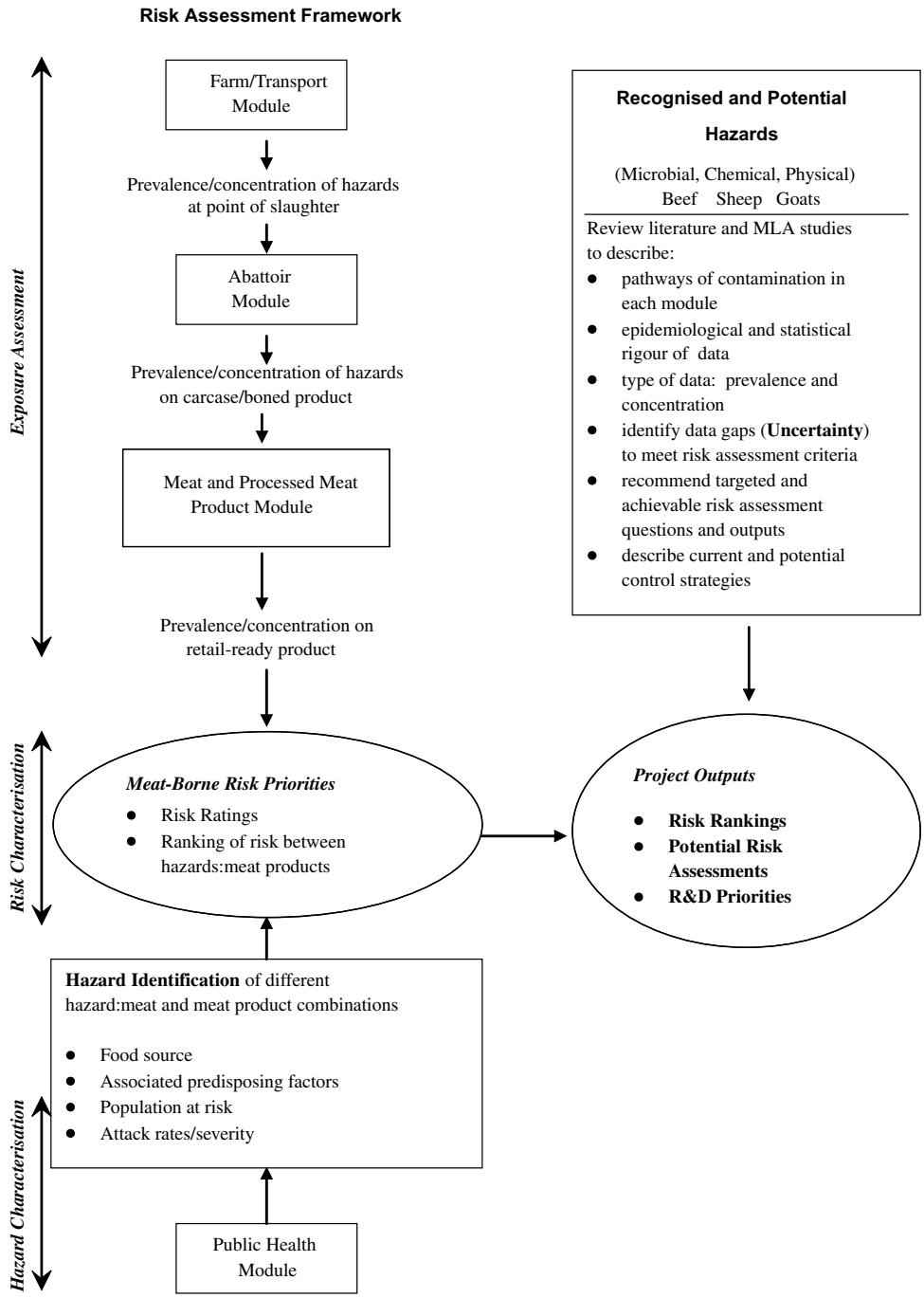

Fig. 2. Project development framework for profiling and managing risks associated with red meat borne food safety hazards.

led to the identification of uncertainties and the relative importance of these in estimating consumer exposure.

The final expert consultation was used to review the major findings and allow a much wider audience of 45 stakeholders to provide feedback on the results of the project. This included senior officials from primary industry, competent public health authorities for meat hygiene at the national and state levels, Food Standards Australia New Zealand, peak meat industry councils, abattoir operators and manufacturing and retailing industry sector representatives. The expert consultations were used as a part of the risk communication process (FAO/WHO, 1998), bringing together risk assessors, risk managers and other stakeholders. As a result of the three expert consultations key industry and government food safety policy officials were involved in the design and review of the project. The approach aimed to ensure the production of a consensus report that has wide acceptance and use by all stakeholders.

6. Results and discussion

The profiling exercise was completed within the prescribed 12-month timeframe. In summary, the profile established low risk ratings for pathogens in raw meats (products with a terminal cooking step) and for cooked cured meats. Uncooked comminuted fermented meats (UCFM) were ranked as a low risk when the process was adequate to inactivate the expected loading of pathogens on incoming raw ingredients. Risk ratings were higher for *L. monocytogenes* in ready-to-eat meat products, for *Salmonella* in kebabs and for enterohaemorrhagic *E. coli* and *Salmonella* in UCFM where the process was not adequate to inactivate these hazards in raw materials (Sumner et al., in press-b).

An estimation of risk associated with exposure to chemical hazards from red meat demonstrated that the risk from chemical residues in Australian meats is negligible (NRS, 1997, 1998, 1999a, 1999b, 2000, 2001; ANZFA, 1998). This is supported by the infrequent detection of residues above the maximum limit (ML) and lack of an established link to illness at levels found in meat. Risk from chemical exposure through meat is extremely low (almost zero) in comparison to the risk from microbial hazards (Meat & Livestock Australia, 2003a, 2003b). The result demonstrates that current risk management practices for the control of chemical residues in Australian meat products are effective. These controls include a national system of agricultural and veterinary chemical registration (APVMA), prescription with written instructions for use and withholding period for a broad range of veterinary medicines. Other relevant programs include Commodity Vendor Declarations for feedstuffs (CVD), Vendor Declarations for the sale of livestock (NVD), general monitoring of consumer exposure (ANZFA, 2001; FSANZ, 2003), and residue levels in meat at slaughter (AFFA, 2000, 2001, 2002), and targeted residue surveillance programs (NARM, 2000; NORM, 1998). Nevertheless, these integrated programs demonstrate the importance of effective chemical residue management to underpin market access.

While microbial hazard:meat and meat product combinations of concern are reported here, the risk profile provided comprehensive information and data across the entire supply chain for both recognised hazards and potential hazards eg well cooked and undercooked hamburgers (Enterohaemorrhagic *E. coli*-EHEC), Uncooked Comminuted Fermented Meats (UCFM/Salami) (EHEC and *Salmonella* spp.), ready-to-eat meats with extended shelf life (*L. monocytogenes*) (Meat & Livestock Australia, 2003a, 2003b; Sumner et al., in press-a, in press-b). This not only included the foods and supply chain sectors that have been associated with meat-associated outbreaks, but also the sources of likely contamination, levels of contamination in animals and meat products, factors contributing to the development of risk and the extent and effectiveness of current risk management practices. Consequently, the risk profile project brought together, for the first time, the available national information from public health and research and monitoring programs to provide a baseline of hazard levels and risk for stakeholders.

There was substantial departure from one of the principles and guidelines for microbial risk assessment (CAC, 1999; WHO, 2000) namely, separation between risk managers and risk assessors. In the present risk profiling exercise there was regular interaction between assessors and managers, facilitated by the project manager. No attempt was made to influence the assessment process. Rather, interaction allowed assessors to update managers over assumptions, data gaps, uncertainties and perceived difficulties. Managers were able to offer advice on the relative importance of factors which both maintained momentum in the assessment teams and minimised work that might otherwise have been of low relevance. While, at the time (2002–2003) this interaction seemed at odds with the conduct of previous microbiological risk assessments it is interesting that Codex (CAC, 2004a, 2004b), Buchanan (2004), and Buchanan, Dennis, and Miliotis (2004) have recommended a planned, iterative communication process between the two risk analysis disciplines. This is equally applicable to risk profiling. In terms of its impact on focus and adherence to timelines for the present exercise, the importance of appropriate interaction cannot be understated.

It is clear that, in the strict sense, working (and meeting) a timeframe can be seen as a constraint on the effectiveness of the exercise. In practice, however, this proved not to be the case since resources were augmented as necessary and the importance of the role of the project manager in identifying and satisfying resource needs cannot be under-emphasised. Similarly, the responsiveness of the Steering Committee in addressing these needs was essential.

In addition to the expert consultations, at which a wide cross-section of stakeholders was consulted, the risk profile report was circulated among risk managers such as the national Meat Standards Committee, the Australian Quarantine and Inspection Service (AQIS) and Food Standards Australia New Zealand (FSANZ), to help develop a more informed policy and work program (Safe Food Qld, 2003). The results of the project have been used by SAFEMEAT (a government-industry food safety partnership) to help set strategic food safety research priorities for the Australian red meat industry.

The risk profile provides the meat-processing sector with a comprehensive resource for hazard analysis (Buchanan, 1995; Panisello, Quantick, & Knowles, 1999). The report provided a large component of the technical resource used to develop an on-farm

HACCP-based food safety scheme for the Australian red meat industry (Horchner, Brett, Gormley, Jenson, & Pointon, in press).

In order to achieve the agreed milestones negotiated with the Steering Committee, the project manager was required to provide a written monthly report that identified progress against the work plan, resources required to address unforeseen issues and guidance needed on planning the expert consultations. As part of this planned interaction between risk managers and assessors, draft reports including data gaps and assumptions were provided to a broad range of stakeholders prior to each consultation. The open and transparent process provided confidence for a broad range of stakeholders to engage strongly with the risk profile project and assured that input from these parties was incorporated during the profiling, rather than at the end. The engagement and guidance from the consultations provided a process for ensuring the requirements were appropriately resourced. This in turn ensured the work was completed within a predetermined timeframe.

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