Results for today; Ideas for tomorrow

Meat Technology Update

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Alternative techniques for the hygienic processing of offal

The need to ensure meat is safe and wholesome and a lack of adequate scientific information mean that traditional inspection decisions have been conservative. In this article we discuss findings of recent Australian studies of offal processing and outline procedures for setting performance standards for monitoring, corrective action, and verification procedures.

A recent Australian investigation has shown that certain tripe and rumen pillars that might be condemned can produce sound product. The 'Offalcom' *project* has provided a model for validating that alternative meat processing procedures can achieve the same hygienic result. A team of people from the University of Queensland, AQIS, and an export abattoir has shown that tripe and rumen pillars of good microbial quality can be produced after dry dumping of paunch contents. Similarly, burst paunches can be processed without compromising product quality.

a.

b.

Figure 1. Views of tripe: a.) raw un-scalded, showing pale muscular rumen pillars and dark-coloured mucous membrane, and b.) scalded.

Between 1997and 2000, another project, also funded by Meat & Livestock Australia, analysed the accuracy of current post-mortem inspection techniques for beef livers and kidneys. In this investigation, decisions about gross pathology and disposition made on-line by inspectors were compared with detailed histopathological and microbiological assessments.

The study revealed a moderate level of agreement in these decisions. In most cases where the decisions differed, inspectors downgraded product suitable for human consumption, reflecting a cautious approach to the inspection process.

Reviews of meat inspection procedures

A series of European studies culminated in the publication of an opinion report by the European Commission in February 2001. The report provided several recommendations about how a future post-mortem inspection system for pigs should operate.

The report considered the likely level of cross-contamination arising from the current requirements for the handling and incision of carcases and offal during post-mortem inspection. It also considered:

- alternative methods of inspection; and
- advantages that are achievable by omitting particular measures.

Results of a recent (2000) South Australian (SARDI) study of post-mortem inspection procedures for pigs indicated that detection and removal of abnormalities is unlikely to affect the level of exposure of consumers to pathogens in fresh pork.

There has long been international concern about the validity of the existing post-mortem inspection procedures. Some inspection procedures have remained largely unchanged for nearly one hundred years.

In 1985, the US National Research Council (NRC) stated that it could find no clear evidence that the traditional inspection system is based on objectives, criteria and data that relate to public health. There

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was no complete technical analysis of the hazards or benefits to human health in the traditional program. Therefore it could make no overall assessment of risks and benefits. Despite the concern expressed in 1985 by the NRC and repeatedly since, there have been few studies to assess the scientific validity of traditional post-mortem inspection programs. The Australian study is one of those few.

This newsletter discusses the issues that the project highlighted. It outlines the procedures for setting performance standards for monitoring, corrective action, and verification procedures that each establishment will need to address in order to capitalise on the findings of the project.

Current criteria for rejecting offal

Historically, meat inspection was established to ensure healthy and wholesome meat for human consumption, to protect animal health and to help prevent financial losses attributable to outbreaks or epidemics of disease. The role of ante mortem inspection is to identify animals that should not go forward for normal slaughter until a veterinary clinical examination has deemed them fit to proceed. Following slaughter there is post-mortem inspection where judgement and action in respect of faults that are identified in the carcase or offal is carried out on the slaughter line or in the retain area of the abattoir.

By tradition the defects found at post-mortem meat inspection are identified using one or more of three techniques – observation, palpation, and incision. Originally, the primary purpose of post mortem inspection was to detect and remove portions or entire carcases that were assessed as being hazardous to human health due to, for example, tuberculosis and cysticercosis. Thus, the system was designed with the primary aim of improving meat safety. However there has been a large shift in the human health hazards that we must identify – away from tuberculosis and cysticercosis, to recognized microbiological and chemical hazards.

Post-mortem inspection now identifies few defects that are of direct relevance to meat safety or human health. In fact, palpation and incision may actually contribute to a food safety risk. Indeed, there is general international acceptance that, while incision of intestinal lymph nodes may occasionally reveal evidence of a potential public health risk, it also is a proven means of spreading *Salmonella* contamination. In Australia routine incision of mesenteric lymph nodes ceased in 1986.

As carcases are eviscerated, the viscera are presented for inspection on tables or in pans. Inspection involves gross examination for contamination and pathological changes. Lungs, hearts kidneys and livers are observed and palpated and, in the case of livers, incised. The musculature of the heart and the bronchial, mediastinal, and portal lymph nodes are incised. The oesophagus, rumen, reticulum and the spleen are all observed. Affected organs are downgraded to pet food or condemned.

Paunches are occasionally punctured during or after evisceration and ingesta may spill. Traditionally, paunches and intestines that are contaminated on the serosal (outer) surface by spilt ingesta are condemned, notwithstanding the fact that they are always contaminated on the mucosal (inner) surface.

Logically, serosal contamination with ingesta should make no difference to the eventual hygienic quality of tripes or intestines if they are routinely scalded using hot water. This treatment acts as a very significant microbiological intervention. Although cleaned mountain chain pieces are not always scalded, they are invariably cooked or otherwise heavily processed before they are used as edible products.

Drawbacks of current processing and inspection practices

In the recent Australian study to evaluate current inspection practice for bovine livers and kidneys, there was only moderate agreement between on-line detections and detailed assessments made by researchers. In most cases, inspectors downgraded product suitable for human consumption, reflecting a cautious approach to the inspection process. The inspectors found kidneys more difficult to correctly classify than livers. Of 603 livers either condemned or graded by the on-line meat inspectors as suitable only for pet food (PF), 114 (19%) were classified as fit for human consumption (HC) on the basis of detailed examination by the researchers. Of 749 kidneys graded by the inspectors as suitable for pet food, the researchers classified 188 (25%) as HC. Downgrading of product that might have been recovered for human consumption translated into losses of $372 and $576 per 1000 head for livers and kidneys respectively.

The results of a large New Zealand study carried out in the 1980s revealed that several traditional post-mortem inspection procedures had no scientific basis when routinely applied to the viscera of lambs. One striking finding was the ineffectiveness of routine examination of lymph nodes of the viscera; in general, routine inspection of these nodes did not enhance the judgements based on inspection of the primary organs.

The European Commission Scientific Committee on Measures relating to Veterinary Public Health considered that the present meat inspection system has major limitations in terms of preventing zoonotic infections in humans because in many instances the defects identified pose no risk to human health.

The committee considered that the advantages of omitting particular measures in a meat inspection system are:

- reduction of cross-contamination;
- reduction of unnecessary damage to carcases;
- better application of resources to more appropriate sanitary measures.

It was against this background of the need for scientific data that the Australian project was undertaken to assess the microbiological quality of beef tripe using different processing techniques.

Dry dumping of paunches

In Australia, most abattoirs use a considerable volume of water to empty and clean each paunch (wet dumping). Dry dumping greatly reduces the amount of water used in tripe processing and is being considered carefully by many Australian abattoirs.

For the trial, the standard (baseline) process involved wet dumping the paunches using 30 L of water to help remove the contents. Rumen pillars were trimmed out and washed for 2-3 seconds before they were packed into cartons (approx. 12 kg) and frozen. Tripe, including honeycomb tripe, was scalded using hot (80°C) water, washed, cooled in a water bath, drained, sorted, packed into cartons (approx. 23 kg) and frozen. For the dry dumping variation, the paunches were opened and manually emptied of ingesta without the use of water. The paunches were emptied as much as possible by shaking.

Over the course of several months from late 1999, samples of tripe and rumen pillars were collected in an export abattoir from the baseline process and also from the dry dumping variation. They were tested for aerobic plate count (APC) and total coliform count (TCC). The results are summarized in Table 1. The samples from the dry dumping process were also tested for *E. coli* biotype 1 and for the presence of *Salmonella* and *Campylobacter* bacteria.

The results for tripe and mountain chain are comparable with recent US and New Zealand data. They indicate that the Australian microbiological guideline APC criteria for carcase meat (Sumner, 1998) are achievable for tripe. The coliform baseline values for tripe are also comparable with those obtained in the USA and NZ studies and the values comply with the Australian guidelines for coliforms on carcase meat. The coliform baseline values for rumen pillars were higher than for US and NZ ones. The reason is unclear but may relate to differences in processing techniques between the test abattoirs. The rates of detection for *Salmonella* and *Campylobacter* were relatively low compared with those reported in the US for tripe and other meats. *E. coli* counts on mountain chain were relatively high in the study. The research team subsequently revised the wash procedure used at the abattoir to a 5 second cold water wash at 250 mL/sec in order to reduce the counts.

Process	Total bacteria (Log_{10} APC/cm^2)		Coliforms (Log_{10} TCC/cm^2)	
	ST	MC	ST	MC
Baseline	3.5	3.3	1.3	2.1
Dry Dumped	3.1	3.9	1.0	2.7
Burst paunch	3.5	3.5	1.5	2.6
Dry dump & burst paunch	4.1	3.6	1.3	2.3

ST= tripe, MC=mountain chain /rumen pillar

Table 1: Comparison of method of dumping paunch contents on numbers of bacteria on washed tripe and rumen pillars.

The results of tests on tripe from the dry dumping process are comparable with the baseline process for both the total number of bacteria and for coliforms. However for mountain chain, the counts were slightly higher. Furthermore, for almost half the MC samples the numbers of *E. coli* biotype 1 fell outside current guidelines.

Notwithstanding the higher counts, the project team considered that in a system that is purpose designed for dry dumping (not the case for their trials) and with careful attention to standardized washing procedures, rumen pillars can be produced so that the residual microbial load falls within current guidelines for *E. coli* on meat products. Any increase in water usage associated with more stringent washing would be more than offset by the water savings resulting from the dry dumping itself.

Burst paunches

For the burst paunch investigation, paunches were deliberately opened so that the serosal (outer) surfaces were covered in ingesta, thereby simulating a 'worst case' scenario from the viewpoint of existing meat inspection criteria. Burst paunches did not significantly alter the residual microbial load on tripe products once they were washed, drained and trimmed for packing into cartons (Table 1).

During normal production, paunches are punctured infrequently (fewer than 1%) and in most of those cases the outcome is limited serosal contamination only. Thus it can be concluded that the processing of incidentally burst paunches during normal production is unlikely to affect the microbiological quality of derived products. Even though sets of 15 consecutive paunches were deliberately burst in the trial, there was no indication of any residual effect on the microbial load on the following 'baseline' paunches. The commercial penalty associated with ruptured paunches through the need for carcase trimming will prevent any relaxation in quality assurance.

For a small number of samples (30) from paunches that were both deliberately burst and dry dumped, the total numbers of bacteria were only marginally higher than the baseline counts. Coliform counts for both tripe and rumen pillars were not significantly different from the baseline counts. Therefore if dry dumping and recovery of incidentally burst paunches were implemented concurrently, the microbial load on the tripe products would not be significantly affected.

Outcomes from the trials

Although paunches always contain large numbers of bacteria, the trial showed that current microbiological guidelines for meat are achievable for tripe and rumen pillars produced using the standard 'baseline' technique. It also provided sufficient evidence for the project team to conclude that process variations, such as dry dumping and recovery of burst paunches, will not compromise the microbiological quality of tripe and rumen pillars. The variations could be implemented for trial as long as there was monitoring and some process refinement. The team concluded that there need not be any concern that burst paunches may lead to a relaxation in quality assurance procedures. An outcome of the project is a strengthening of existing process control systems through the development of a baseline standard and a monitoring process.

AQIS accepted the findings that it is possible to retrieve contaminated tripe using the procedures that the trial validated. The next step was to examine the long-term effect that retrieving the contaminated paunches had on the performance of the slaughter floor process. Baseline data were established for carcases contaminated with ingesta and for burst paunches. During this study, the AQIS slaughter floor inspectors used their existing discretionary powers to pass paunches that were not excessively contaminated.

Reassuringly, the baseline data improved over the course of the study.

Criteria for acceptance or rejection of contaminated tripes have now been developed. These are being used by company personnel at the abattoir to sort tripes in terms of contamination. An important requirement is that when contaminated tripe is being saved and processed, there is no cross-contamination to other tripe via surrounding equipment or personnel.

The company has AQIS approval to continue sorting the contaminated tripes as long as the baseline performance standards are met or exceeded. It has developed monitoring, corrective action and verification procedures to cover the whole process. These have been submitted to AQIS in the form of an amendment to the company's meat safety quality assurance program (MSQA). AQIS staff on the plant will routinely verify the alternative process as part of the national plant management system (NPMS).

Other interested plants can now adopt the alternative process. In order to assist its adoption, the project team has:

- developed guidelines for a modified validation process for plants using tripe processing equipment similar to that used during the trial;
- assisted with the development of performance standards and the ongoing monitoring, corrective action and verification procedures;
- assisted with the development of the MSQA amendment; and
- given consideration to a similar approach for sheep slaughter operations.

The Offalcom project has demonstrated that with pertinent scientific data, a suitable process can be developed for the recovery of tripe that otherwise would have been condemned. It has also provided the opportunity to develop a protocol for the development and validation of alternative processes, and for the development of ongoing performance standards.

The results of the investigations on livers and kidneys led the Australian research team to conclude that current organoleptic inspection techniques have only moderate accuracy in Australia and in practice the lesions upon which the condemnation decisions are made have little public health significance.

The major current public health concerns are the enteric pathogens – thus resources assigned to regulatory inspection procedures may be better utilized in preventing those pathogens entering the processing chain.

Further reading

'Enhanced recovery of key products – Final Report, October 2000'. Report of research conducted by UQ School of Veterinary Science and AQIS for MLA.

(Scientific papers on the Australian studies have been, or will be, published in the *Veterinary Record*, *Meat Science* and *The Australian Veterinary Journal*).

'Revision of meat inspection procedures' Opinion of European Commission Scientific Committee, SCVPH, February 2001.

Sumner (1998). 'Microbiological testing for the meat industry'. MLA

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For more information, contact one of the Meat Industry Services staff listed below.

Food Science Australia Meat Industry Services Section

The Meat Industry Services (MIS) Section of Food Science Australia is an initiative supported by Meat and Livestock Australia (MLA) and the Australian Meat Processor Corporation (AMPC) to facilitate market access for, and support world-class practices in, Australia 's meat industry.

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