WHAT'S NEW

Summaries of recent publications

Meat technology-What's new

3/10 – June 2010

Distribution of micro-organisms on cattle hides

The hide is a major source of possible contamination of carcases during the processing of cattle. This can be via direct contact, indirect contact through hands or equipment, or airborne transfer. Scientists in Europe investigated the distribution of bacteria on the hides of cattle at slaughter by swabbing the rump, flank, brisket, neck and distal part of the front leg (metacarpus). They also studied the distribution of bacteria 'vertically' on the hide by sampling the outer shaved hairs from a long-haired animal and comparing with samples from the inner shaved hairs. The transfer of bacteria from the hide to the carcase surface was also estimated by sterilising a piece of meat and placing a piece of hide of the same size on it for 2 seconds and removing by lifting or sliding away.

The hides of 40 cattle from three different geographic regions all contained generic *E. coli*, but no *Salmonella*. The average total viable count (TVC) was 6.7 log cfu/cm^2 and the average *Enterobacteriaceae* count was 4.3 log cfu/cm^2. The most heavily contaminated areas were the metacarpus and brisket, with TVC counts of 6.9 and 7.1 log cfu/cm^2 respectively. They also had the highest counts of the faecal indicator organism *Enterobacteriaceae* and the highest prevalence of *E. coli*. There was no relationship between visual cleanliness scores for the animals and the microflora levels.

There was no statistical difference between the bacterial numbers on the hairs from the outer layer and the hairs from the layer close to the skin. Although the hides were not visually dirty, the results indicated that there may not be a benefit in clipping along cutting lines.

Only a small proportion of organisms on the hide were transferred to the meat surface under the contact conditions of the trial. Between 0.5% and 0.00002% of TVC were transmitted to the meat. The meat safety risks are still significant though, because of the very high levels of organisms on the hide.

Effect of freezing method and duration of storage on lamb meat quality

Freezing is the only option for the long-term storage of meat to retain properties similar to that of fresh meat; however, frozen meat is often discriminated against because of perceived reductions in meat quality, that are not clearly supported by scientific evidence. The quality of frozen meat can be influenced by the rate of freezing, the storage conditions and the length of storage. Meat that is slowly frozen can have large ice crystals that damage the structure leading to increased moisture loss on thawing. Packaging, storage temperature and exposure to light influence the rate of deterioration during frozen storage, with the degree of lipid oxidation normally determining the end of the storage life.

Freezing could satisfy periods of low supply of lamb in Spain; therefore, Spanish researchers have investigated the effects of freezing rate and storage period on meat quality and chilled display life. Lamb chops were overwrapped with oxygen-permeable film and frozen using air at –30°C, –40°C or nitrogen at –75°C, then stored in cardboard boxes at –18°C for 1, 3 or 6 months. After thawing they were displayed at 2–4°C for up to 10 days, and compared with fresh meat.

Neither freezing method nor duration of storage up to 6 months significantly affected the pH, colour, lipid oxidation or water-holding capacity of the lamb chops. The length of display had the greatest influence on quality attributes, and all parts of meat were unacceptable after 4 days of display. Slower freezing rates and longer storage times reduced quality when the meat was displayed for longer than one day. The small deterioration in quality should not give consumers concerns about frozen meat.

UV light inactivation of pathogens on foods and SS surfaces

Ultraviolet light (UV-C at 154 nm) is approved by the US Food and Drug Administration and is widely used for decontamination of air and water and some liquid foods. Many studies have been conducted on the efficacy of UV-C radiation for inactivation of foodborne pathogens, but they have mainly concentrated on a single bacteria on a single food type. A US study used a range of UV-C intensities to assess the inactivation of a cocktail of *Salmonella, Listeria monocytogenes*, and *Staphylococcus aureus* inoculated on to the surfaces of sausages, eggs, fruit, meat and stainless steel.

Pathogen reductions on foods from exposure to UV-C ranged from 0.5 log/g on meat and poultry, to almost 4 log/g on tomatoes with doses of 0.5 to 4.0 J/cm^2. No pathogenic bacteria were recovered from the stainless steel samples treated with 0.4 J/cm^2 of UV. In order of decreasing effectiveness, the products on which UV-C radiation deactivates pathogenic bacteria are: stainless steel > Roma tomatoes and jalapeno peppers > frankfurters and bratwurst > shell eggs > raw meat and chicken. UV-C would be effective for decontamination of stainless conveyors and work surfaces in food plants, and for smooth-skinned fruit and vegetables. It would also be effective for treating precooked sausages prior to further processing, but is of only marginal effectiveness on raw meat.

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Effects of experience with swabbing on numbers of bacteria recovered

Swabbing with cellulose acetate sponges is the preferred method of sampling carcases in meat plants for microbiological testing. The number of bacteria recovered from the surface of the meat depends on the condition of the surface and the way the sponge is applied. Plant management would like assurance that the results of microbiological sampling by different personnel at the meat plant are directly comparable. A Canadian study compared the results of sampling by experienced and inexperienced personnel when swabbing pig, beef and buffalo carcases.

Groups of five people—consisting of 2 or 3 experienced and inexperienced people—sampled randomly allocated sites on groups of 25 carcases, and the sponge swabs were analysed for total aerobic count and coliforms or *E. coli*. In the case of the aerobic counts, the means from each of the five samplers of beef carcases differed by less than 0.5 log units. Similarly, for coliforms, counts from four of the five samplers were similar. Therefore, it was concluded that the numbers of bacteria recovered from carcases by swabbing with sponges are unlikely to be substantially different when collected by experienced or inexperienced people using the same procedure.

The effect of high pressure and freezing on *E. coli* in ground beef

High pressure processing (HPP) has been used commercially as a non-thermal method of food preservation for such foods as sliced meats, fruit juice, ready-to-eat meals and seafood. Its application to ground beef has been studied in the US. Samples were inoculated with *E. coli* and treated at 400 MPa for 10 minutes at –5°C or 20°C, then stored frozen or chilled.

There was a 1-log CFU/g reduction in *E. coli* when pressure treated at –5°C and a 3-log reduction at 20°C. Samples stored frozen at –20°C showed a further 1-log reduction after treatment at –5°C, and an additional 2-log reduction after 20°C treatment. Those stored chilled at 4°C showed no further reduction in bacterial numbers. HPP also tends to sensitise bacteria to other interventions. The *E. coli* bacteria surviving after the pressure treatment in this study were sensitised to reduced pH (levels 3 and 4), bile salts at 5% and 10% and a mild heat treatment of 55–65°C.

Time to collapse following slaughter without stunning in cattle

Halal and Schechita slaughter are recognised by the Muslim and Jewish faiths as the appropriate methods for killing animals for meat consumption. There is concern that when these methods of slaughter are used without prior stunning, the welfare of animals may be compromised due to the time taken for the animals to lose consciousness. Halal slaughter without prior stunning was observed in an abattoir in Belgium where cattle were restrained in an upright position and the time to collapse following the Halal cut was recorded. It was considered that time to collapse was a useful indicator of the early stages of loss of consciousness.

During the observation of the slaughter of 174 cattle, the average time to final collapse was 20 seconds, but 8% of the animals took 60 s or longer to collapse. Fourteen percent of the animals stood up again after the initial collapse, and it is likely that they were distressed. A high proportion of the animals that took a long time to collapse had blood clots in the severed carotid arteries, possibly resulting in blood pressure to the brain remaining high enough to maintain consciousness due to supply from lesser blood vessels.

E-mail or post?

We have received a number of requests for the newsletters to be sent out electronically rather than as a hard copy. The newsletters are uploaded each issue onto the website (www.meatupdate.csiro.au). By signing on from the main page link, readers can receive an email notification when the new issues are uploaded onto the website.

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Contact us for additional information

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