

IDENTIFYING STORAGE THRESHOLDS IN FROZEN AND CHILLED RED MEATS

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Project Description

Red meat (lamb and beef) are important global commodities and as such, industry must deliver safe and quality product to often distant end-users – to do otherwise would incur substantial market access and economic penalties. Chilled and frozen storage have each been applied to fulfil this need and have proven independently successful; evident from their universal use to preserve red meat and their broad scientific validation. Their combination, however, and usefulness across long-term durations has not received comparable exploration and as a consequence the associated advantages and implications on red meat quality may have been overlooked.

Project Content

This project aimed to study the effect of different chilled-then-frozen storage durations on red meat quality. This entailed two staggered and complementary experiments (including two simultaneous replicates) testing lamb and beef respectively. It should be noted that sample collection, preparation, processing and chilled (ageing) storage occurred at and with the cooperation of commercial Australian abattoirs.

// *Experiment 1:* Lamb loins (360) were randomly selected and assigned to 5 chilled storage periods (0, 2, 4, 6 and 8 weeks) x six ensuing frozen storage periods (0, 4, 8, 12, 24 and 52 weeks) set at two different frozen storage holding temperatures (-12 and -18 °C).

// *Experiment 2:* Beef loins (48) which met Japanese market specifications were selected; divided into 4 equal portions (192) which were then assigned to each of 4 chilled storage periods (0, 2, 3 and 5 weeks) followed by the same frozen storage periods and holding temperatures as Experiment 1.

These were analysed for sensory traits; microbial loads; lipid and fatty acid composition; and protein degradation and oxidation characteristics – which were in turn compared to existing thresholds defining consumer acceptability.

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Project Outcome

This project demonstrated that there are no apparent quality limitations with holding lamb or beef frozen across extended periods of time at -12 °C. There were expected improvements in tenderness of both meats from ageing, but significant improvements in lamb beyond 2 weeks chilled storage were not observed. Microbial thresholds were not breached during the chilled and frozen storage of either meat types, with the beef cold chain especially noteworthy because of its very low levels of bacteria detected and this demonstrating the controls available from good management.

There was a notable decline in unsaturated fatty acid levels in the beef over chilled and frozen storage durations – a result that requires future investigation to protect the ‘healthy’ image of grass-fed beef. Displaying either lamb or beef after longer chilled and frozen storage durations will lead to a rapid deterioration in colour stability and although this is not a recommended practice, anecdotal intelligence suggests this practice does occur in some importing countries and it would be opportune to inform these markets of the likely negative effect on consumer acceptance and preferential purchase.

Benefit for Industry

It is apparent, provided lamb and beef is managed to have low microbial loading, that chilling and extended frozen storage can be used to stabilise or even the supply of these meats, without a reduction in the tenderness, the development of rancidity or other adverse effects. This provides industry with flexibility (esp. when managing production gluts, and unforeseen market shifts or closures). It also provides a scientific basis from which claims of reduced quality as a result of chilled product moving to a frozen state for an extended period, to be countered. It is imperative, however, that an appropriate chilled storage period is applied prior to freezing to maximise improvements in tenderness.

The finding that product can be held long term at -12 °C instead of -18 °C offers considerable energy saving potential to industry. This would reduce ‘waste’ and improve the efficiencies of long term storage and transportation of lamb and beef – and consequently alone represents a significant return on investment into this project. Furthermore, a Masters student in Meat Science was trained as a result of this study; an important achievement as industry moves to employ more skilled people to move meat quality to new heights.

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