effects of different freezing/thaw-ageing regimens on physicochemical, biochemical characteristics and meat quality attributes of lamb loins

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Abstract

New Zealand red meat is in demand around the world; consumers recognise the safe, healthy, clean and green values of New Zealand's pasture-raised beef lamb and venison. Meat is transported chilled in containers to overseas markets, and recently container ships have started to travel slower to reduce fuel consumption. This has resulted in the meat spending longer in the containers, meaning that key quality attributes of lamb cannot be guaranteed anymore. Finding an alternative method to provide the overseas consumers with chilled meat of the required quality is a top priority for the industry. Currently during container transport, meat is ageing for 6/8 weeks but with the newly introduced longer transport time to overseas markets it is too long for the meat in terms of food quality. Frozen meat is traditionally aged first before freezing. Previous observations show that 2 weeks ageing for lamb is enough to give equivalent quality attributes to the meat as ageing for 8 weeks. In the current study meat is frozen first and then thawed-aged and it was therefore hypothesised that by increasing the thawing-ageing temperature the ageing process could be accelerated.

This thesis focused on determining the effects of different freezing/thawing-ageing regimens on meat quality and physical and biochemical characteristics of lamb loins. To study the effect of the different regimens, 10 treatments were set up and 90 loins in total have been used. The loins were randomly assigned to three different freezing conditions named Slow Freezing (SF), Fast Freezing (FF) and Very Fast Freezing (VFF) followed by three different thaw/ageing regimens: -1.5°C, 1°C and 3.5°C. A control group was included as treatment number 10, the Control group represents a non-frozen treatment with only 2 weeks of ageing.

The effects on the quality of the loins were evaluated through the use of quality measurements such as pH, colour, water holding capacity, tenderness and lipid oxidation. Other analyses used to give an indication of the mechanisms for any quality differences were histology and metabolomics. The data suggest that FF and VFF resulted in a greater water-holding capacity and colour stability than SF. Ageing at 3.5°C showed a general trend for accelerated lipid oxidation compared with ageing at -1.5°C and 1°C. SF seems to contribute to damage along the fibre whereas FF and VFF show obvious holes within the fibres. These different types of damage may lead to lesser or varying meat quality.

Overall, this work found that FF and VFF showed benefits over SF in several aspects of meat quality, but the differences were small. The results also suggest that FF or VFF could be used to avoid some of the common quality defects associated with freezing first and then thaw-ageing. This may potentially provide an opportunity for the New Zealand meat industry to utilise frozen storage/shipping and so saving money while still meeting the consumer demands for high quality fresh meat.

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