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## Meat and Muscle Biology™



## Impacts of Aging Sequence and Freezing Rate on Quality Attributes and Oxidative Stability of Frozen/Thawed Pork Loins

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### Objectives

Aging is known to improve quality attributes of frozen/thawed meat by minimizing quality defects, such as purge/drip loss, texture and/or color. In frozen/thawed meat, the extent of quality deterioration is considerably influenced by freezing rate, as it impacts on the size, distribution, and/or location of ice crystals. This, in turn, results in the physicochemical and structural damages to muscle tissue. However, there have been no available literatures on the effect of aging sequence (between aging and freezing/thawing) and freezing rate on frozen/thawed meat quality attributes. Therefore, the objective of this study was to evaluate the combined effects of aging sequence and freezing rate on quality attribute and oxidative stability of frozen/thawed pork loins.

### Materials and Methods

At 1 d postmortem, pork loins (*M. longissimus dorsi*) were removed from 1 side of 6 carcasses. Each loin was cut into 6 equal-length sections and vacuum-packaged. Then, 6 treatments, comprised of 3 aging/freezing sequences (freezing/thawing without aging, aging prior to freezing/thawing, or freezing before thaw/aging) and 2 freezing rates (slow vs. fast), were randomly assigned to the loin sections. Slow-freezing was conducted in a commercial  $-20^{\circ}\text{C}$  blast freezer, whereas fast-freezing was performed in a liquid nitrogen cabinet ( $-80^{\circ}\text{C}$ ). Aging of the loin section in a vacuum bag was conducted in a  $1^{\circ}\text{C}$  cooler for 19 d. Once assigned initial freezing was completed (either slow or fast), the loin section were stored in the  $-20^{\circ}\text{C}$  freezer for 6 wk, and thawed in the  $1^{\circ}\text{C}$  chilling cooler for 2 d. Purge/thaw loss, cooking loss, shear force, color (CIE  $L^*$ ,  $a^*$  and  $b^*$ ), 2-thiobarbituric acid reactive substances

(TBARS), carbonyl content and histology of thawed pork loins were determined. The PROC MIXED of SAS (SAS Inst. Inc., Cary, NC) was used for data analysis ( $P < 0.05$ ) by using least significant differences.

### Results

No interactions between aging sequence and freezing rate on purge/thaw loss and cooking loss were observed ( $P > 0.05$ ). The highest purge/thaw loss was found in the loin section assigned to frozen first then thaw/aged (12.4%) compared to frozen/thawed only (8.5%) or aged/frozen/thawed (7.8%) samples ( $P = 0.0003$ ). This result indicates the importance of aging and aging sequence for WHC of frozen/thawed meat. No difference in cooking loss of pork loins between treatments was found ( $P > 0.05$ ). Aged/frozen/thawed pork loins had a lower shear force than frozen/thawed only pork loins ( $P = 0.0223$ ). Further, slow-frozen then thaw/aged loin had the lowest shear force among treatments ( $P < 0.0001$ ). Aging tended to increase initial  $L^*$  (lightness), regardless of its combination sequence with freezing/thawing ( $P < 0.05$ ). No differences in the TBARS value and carbonyl content of frozen/thawed pork loins were found between treatments ( $P > 0.05$ ). Based on histological analysis, severe structural damages were observed in the slow-frozen then thaw/aged loin section.

### Conclusion

The results of the current study found that the sequence of aging prior to freezing play a significant role in affecting the WHC and texture of frozen/thawed pork loins. Moreover, this study confirms that fast-freezing could be an effective process to improve WHC of frozen/thawed meat products, regardless of aging combination and/or its sequence.