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Subprimal Freezing and Thawing Rates Affect Beef at Retail

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Summary

Ribeye, strip loin and top sirloin butt subprimals were either fast or slow frozen and then fast or slow thawed. Steaks were cut, placed in retail display for 8 days, and compared to fresh-never-frozen product for retail color and purge loss. Thaw purge loss was higher for slow thawed subprimals, with fast thawed product having the greatest purge loss during display. Overall, total purge loss was roughly 2-5% higher for all slow thawed products. Color data indicated frozen-thawed beef subprimals are comparable to fresh-never-frozen subprimals in color stability during day 1-4 of retail display. Total purge loss was increased for slow thawed subprimals; freezing rate had minimal effects on retail quality.

Introduction

To evaluate handling methods for frozen beef subprimals, the effects of freezing and thawing rates on retail shelf life and percent purge loss were compared to that of fresh-never-frozen product. In the retail industry subprimal pricing fluctuation occurs seasonally. If retailers can properly manage freezing and thawing rates to minimize detrimental effects on beef quality, economic value to purchasing subprimals at low seasonal prices can be obtained

Procedure

Three subprimal cuts — ribeye rolls, strip loins, and top sirloin butts — were utilized with three replications of five samples per treatment (n = 270). There were six treatments: fresh-never-frozen 14-day aged (14D), fresh-never-frozen 21-day aged (21D), blast frozen–fast thawed (BF), blast frozen-slow thawed (BS), conventional frozen-fast thawed (CF), and conventional frozen-slow thawed (CS). Blast freezing took place at the plant by placing spacers between boxes of meat on pallets at -18˚F with high air velocity. Conventional freezing also occurred at the plant with spacers between stacked pallets at -18˚F with minimal air flow. Fast thawing (to an internal temperature of 28˚F) occurred by immersion in a circulating water bath (<54˚F) for 21 hours at the Loeffel Meat Lab. Slow thawing spanned over a two week period with subprimals spaced on tables at 32˚F. Thawed subprimals were then weighed prior to cutting steaks from the *longissimus thoracis* (LT), *longissimus lumborum* (LL), and *gluteus medius* (GM). The steaks were weighed individually, placed on Styrofoam trays and wrapped with oxygen-permeable film. All wrapped steaks were then placed in retail display under continuous lighting at 35˚F for 8 days.

A Minolta Chromameter CR-400 (Minolta Camera Company, Osaka, Japan) was utilized for color measurements. Measurements were gathered with an 8 mm diameter measurement area, illuminant D65 and a 2° standard observer. The recorded measurements included L* (psychometric lightness; black = 0, white = 100), a* (red = positive values, green = negative values) and b* (yellow = positive values, blue = negative values). The Minolta was calibrated every day by normal standards with a white calibration plate that came with the machine from the manufacturer. Six random different readings were recorded on each steak daily. Discoloration percentages were estimated daily from a trained panel of five UNL meat science graduate students. Steaks were weighed at the end of display to calculate retail and total purge loss. Discoloration data were analyzed for the time at which a steak reached 40% discoloration, a value at which consumers begin to refuse to purchase

Results

Numerically, steaks from the 14D fresh-never-frozen treatment always had the best color stability (discoloration scores and a* - redness – values). All LL and LT steaks required approximately 4 d to reach 40% discoloration, with all GM steaks having 3 or more days. All frozen treatments for LL and GM steaks were equal or superior in color stability to 21D fresh steaks, except for the CS LL steaks, which discolored more rapidly. In all subprimals, purge loss during thawing was significantly higher for slow thawed subprimals. Fast thawed subprimals were equal or superior to 14D and 21D fresh subprimals in thawing purge; likely a result of thawing to subfreezing temperatures. During retail display, the greatest purge loss occurred in fast thawed treatments. Overall, total purge loss (moisture loss during thawing and retail display) when compared to 14D product was about 5% higher for slow thawed LT and GM and about 1.8% higher for slow thawed LL. These data indicate that frozen-thawed beef subprimals are comparable to fresh-never-frozen subprimals in color stability during days 1-4 of retail display. However, total purge loss was increased for slow thawed subprimals. Freezing rate had minimal effects on retail quality.

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[1]Justine J. Hosch, graduate student; Jerilyn E. Hergenreder, graduate student; Kim A. Varnold, graduate student; Asia L. Haack, graduate student; Lasika S. Senaratne, graduate student; Siroj Pokharel, graduate student; Chris R. Calkins, professor, University of Nebraska–Lincoln Department of Animal Science, Lincoln, Neb.; Catie Beauchamp, Colorado Premium Beef, Greeley, Colo.; Brandon Lobaugh, iQ Foods, Fayetteville, Ark.

[2]Funded in part by Colorado Premium and the Beef Checkoff.

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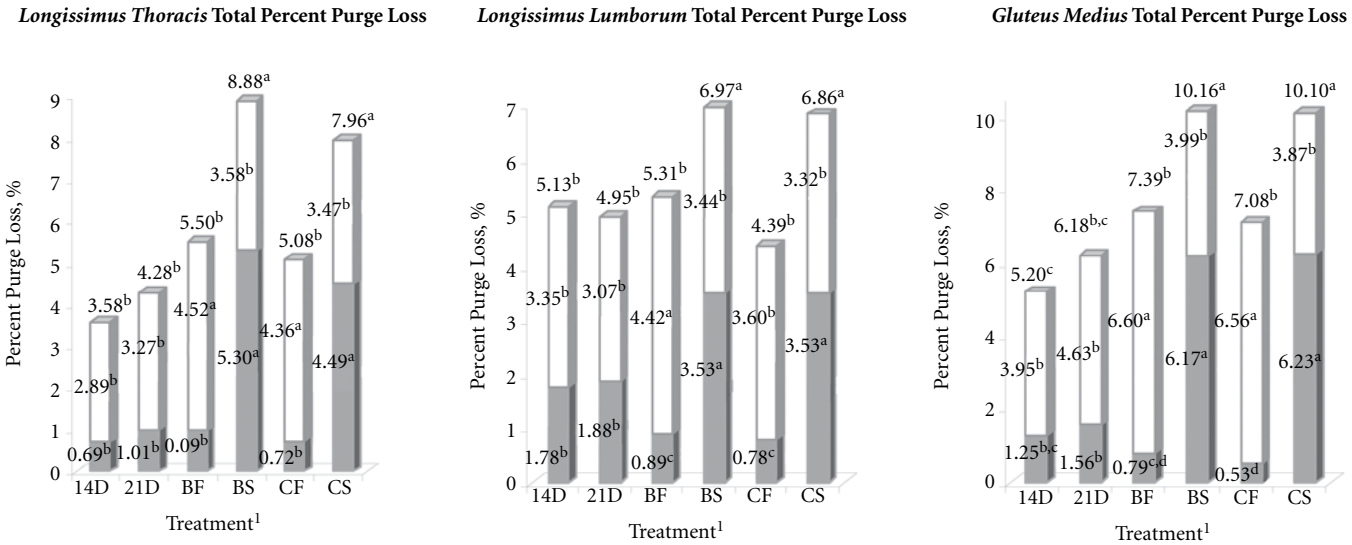
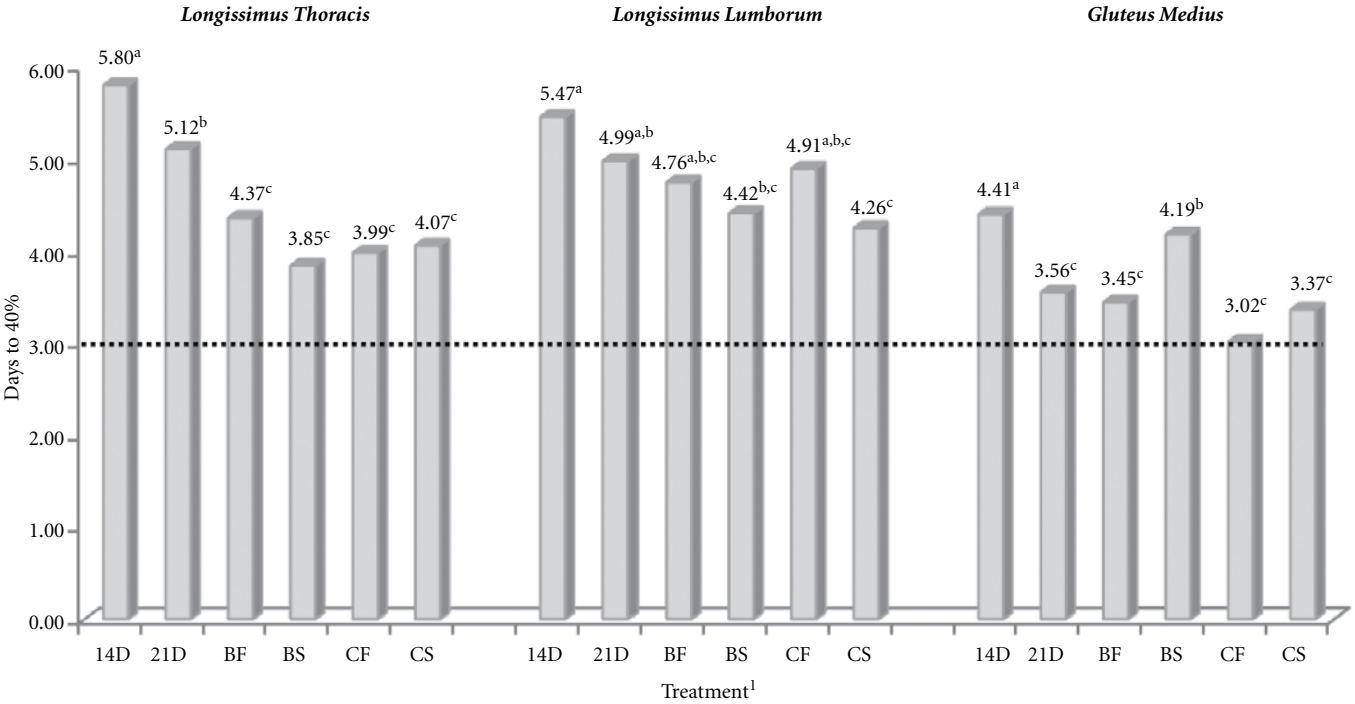


Chart legend: Lower set of numbers = thaw purge. Middle set of numbers = retail purge loss. Upper numbers = total purge loss.
[a, b, c]Signifies different superscripts, meaning values within the same muscle are different for thaw, retail, and total percent purge loss at ($P < 0.05$).
[1]14D = fresh-never-frozen and aged for 14 days; 21D = fresh-never-frozen and aged for 21 days; BF = Blast frozen, fast thaw; BS = Blast frozen, slow thaw; CF = Conventional frozen, fast thaw; CS = Conventional frozen, slow thaw. Blast frozen = boxed meat on pallets in a -18˚F freezer with high air velocity. Conventional frozen = boxed meat on pallets in a -18˚F freezer with minimal air flow. Fast thaw = immersion in a circulating water bath (<54˚F) for 21 hours. Slow thaw = placed on tables at 32˚F for two weeks.

Figure 1. Percent purge loss.



[a, b, c]Signifies different superscripts, meaning values within the same muscle are different for days-to-40% discoloration at ($P < 0.05$).
[1]14D = fresh-never-frozen and aged for 14 days; 21D = fresh-never-frozen and aged for 21 days; BF = Blast frozen, fast thaw; BS = Blast frozen, slow thaw; CF = Conventional frozen, fast thaw; CS = Conventional frozen, slow thaw. Blast frozen = boxed meat on pallets in a -18˚F freezer with high air velocity. Conventional frozen = boxed meat on pallets in a -18˚F freezer with minimal air flow. Fast thaw = immersion in a circulating water bath (<54˚F) for 21 hours. Slow thaw = placed on tables at 32˚F for two weeks.

Figure 2. Least square means for Days-to-40% discoloration.

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