

The Effects of Thawing Method on Consumer Palatability Ratings of Beef Strip Loin Steaks

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Abstract

The objective of this study was to determine palatability differences in beef strip loin steaks among various U.S. Department of Agriculture approved thawing methods and those commonly utilized by consumers. Paired Low Choice beef strip loins were collected and fabricated into six sections. Each section was fabricated into 1-in steaks and assigned one of six thawing methods including: countertop, cook from frozen, cold water, hot water, microwave, and refrigerator. Steaks were cooked to a peak internal temperature of 160°F and samples were fed to consumers to evaluate juiciness, tenderness, flavor liking, overall liking, acceptability of palatability traits, and perceived level of quality. Results of consumer sensory evaluation indicated that there were no differences ($P > 0.05$) among the six thaw methods for juiciness, tenderness, and flavor liking. However, all treatments had an average rating of at least 57 for overall liking, indicating a high level of eating satisfaction. For all thaw methods, at least 82% of steaks were rated as overall acceptable. Additionally, for all thaw methods, consumers rated at least 79.1% of steaks acceptable for juiciness, tenderness, and flavor liking. Furthermore, thaw method did not have an impact ($P > 0.05$) on the perceived level of quality of samples. Therefore, consumers should use whichever thawing method is most convenient or best suits their needs.

Introduction

Beef is often frozen in the U.S. to help preserve and extend shelf life. In 2022, the USDA reported that the U.S. exported \$11.7 billion of beef (USDA, 2023). Exported beef is commonly frozen to preserve quality and ease in transportation. In many instances, beef is thawed before cooking, but it is unknown how beef palatability is impacted by thawing method. There is evidence that thawing method impacts properties such as water holding capacity, thawing loss, and cooking loss (Zahir, 2021). Also, there is evidence that trained panelists rate myofibrillar tenderness lower ($P < 0.05$) in frozen steaks rather than thawed steaks (Obuz and Dikeman, 2003). However, there has been limited consumer research done evaluating various thawing methods and the impact on beef palatability. The objective of this study was to determine palatability differences in beef strip loin steaks among various USDA approved thawing methods and those commonly utilized by consumers.

Experimental Procedures

Paired Low Choice beef strip loins (Institutional Meat Purchase Specifications #180) were collected from a Midwest commercial processing facility ($n = 15$ pairs). Each pair was fabricated into six sections and cut into 1-in steaks. Each section was assigned one of the six different thawing methods. Thawing methods included: countertop, cook from frozen, cold water, hot water, microwave, and refrigerator. Steaks thawed on the countertop were thawed at 62-68°F for 5 hours. Cook from frozen steaks were cooked immediately after removal from the freezer while still frozen. Steaks thawed in cold water were placed in 35-37°F water for 24 hours. Steaks thawed in hot water were placed in a sous vide machine with 104°F water for 20 minutes (± 2 minutes). Microwaved steaks were placed in a retail microwave at 50% power for 3 minutes, rotated, and microwaved for 3 minutes. Steaks thawed in the refrigerator were placed in a 35-37°F refrigerator for 24 hours. Steaks were cooked to an internal peak temperature of 160°F measured with a temperature probe placed in the geometric center of the steak. Consumers were given 0.39-in \times 0.39-in samples which they evaluated for juiciness, tenderness, flavor liking, and overall liking, attribute acceptability, and perceived level of quality (premium quality, better than everyday quality, everyday quality, or unsatisfactory quality) and reported their responses using a Qualtrics survey. Samples were rated on a 100-point scale with 0 indicating dry, tough, or dislike extremely, and 100 indicating extremely juicy, extremely tender, or like extremely. Consumers also answered demographic questions and self-reported information about their beef consumption. Data were analyzed as a completely randomized block design.

Results and Discussion

For beef demographic data, consumers reported that the most important beef palatability trait was flavor with 56.7% of consumers indicating it as the most important. Tenderness was rated as the most important by 33.3% of consumers. Additionally, consumers reported the trait they experienced the most variability with was tenderness. Results of consumer sensory evaluation indicated that there were no differences ($P > 0.05$) among the six thaw methods for juiciness, tenderness, flavor, and overall liking (Table 1). However, all treatments had an average rating of at least 57 for overall liking, indicating a high level of eating satisfaction. For all thaw methods, at least 82% of steaks were rated as overall acceptable. Additionally, for all thaw methods, consumers rated at least 79.1% of steaks acceptable for juiciness, tenderness, and flavor liking. Furthermore, thaw method did not have an impact ($P > 0.05$) on the perceived level of quality of samples.

Implications

Thawing method did not impact juiciness, tenderness, flavor liking, or overall liking, and therefore consumers should use whichever thawing method is most convenient or best suits their needs.

Acknowledgments

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References

- Obuz, E., and M. E. Dikeman. 2003. Effects of cooking beef muscles from frozen or thawed states on cooking traits and palatability. *Meat Science* 65:993-997. doi:10.1016/S0309-1740(02)00314-5
- USDA Foreign Agricultural Service. 2023. Beef & Beef Products. <https://www.fas.usda.gov/data/commodities/beef-beef-products> (Accessed August 31, 2023).
- Zahir, H. G. 2021. Impact of different thawing methods on physico-chemical characteristics, electrophoretic profile and sensory evaluation of frozen beef longissimus dorsi muscle. *Journal of Animal and Poultry Products* 12:7-14. doi:10.21608/jappmu.2021.149200

Table 1. Least squares means for consumer sensory evaluation of palatability characteristics¹ and percentage of samples rated as acceptable of frozen beef strip loin steaks using various thaw methods

Trait	Countertop ²	Cook from frozen ³	Cold water ⁴	Hot water ⁵	Microwave ⁶	Refrigerator ⁷	P-value	SEM ⁸
Juiciness	60.8	59.2	65.5	58.1	56.8	57.1	0.28	2.9
Tenderness	60.6	56.9	63.8	60.8	56.8	57.6	0.38	2.8
Flavor	61.8	62.7	62.3	60.5	56.1	62.2	0.19	2.1
Overall liking	62.6	60.8	65.9	61.6	57.0	62.7	0.18	2.4
Juiciness acceptability	82.6	81.8	92.0	80.9	79.1	80.0	0.17	4.2
Tenderness acceptability	82.2	79.9	87.9	91.6	80.6	81.5	0.12	3.9
Flavor acceptability	87.4	87.4	91.1	87.4	84.8	85.7	0.80	3.5
Overall acceptability	85.2	82.6	95.2	86.3	87.4	83.7	0.13	4.0

¹Sensory scores: 0 = extremely dry/tough/dislike extremely; 50 = neither dry nor juicy/neither tough nor tender/neither like nor dislike; 100 = extremely juicy/tender/like extremely.

²Thawed at 62-68°F for approximately 5 hours.

³Cooked immediately upon removal from the freezer while still in a frozen state.

⁴Thawed in individual plastic containers of 35-37°F water for 24 hours.

⁵Thawed in 104°F water for 20 minutes (± 2 minutes).

⁶Microwaved in a retail microwave at 50% power for 3 minutes, rotated, and microwave for an additional 3 minutes.

⁷Thawed at 35-37°F in open air in a refrigerator.

⁸SEM (largest) of the least square means.