THE IMPACT OF FREEZING/REFRIGERATING SUBPRIMALS AND/OR STEAKS ON QUALITY AND PALATABILITY CHARACTERISTICS

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I. INTRODUCTION

Purveyors, retailers, and/or foodservice operators often respond to changing market conditions by purchasing a greater quantity of subprimals than immediately needed and storing the excess for subsequent use. Freezing beef products has been shown to increase tenderness or decrease shear force values [1-5], a cohesive effort to evaluate the compound effect of subprimal and steak storage parameters on consumer acceptance and quality attributes has not been addressed. Therefore, this study was designed to determine how various combinations of refrigerated and frozen storage of subprimals and steaks impacted product colour, cook yield, tenderness, and consumer acceptability.

II. MATERIALS AND METHODS

After post-fabrication aging time (21 d), USDA Choice ribeye rolls (n = 10) and top sirloin butts (*n* = 10) were assigned to one of four treatments: 1) Frozen/Frozen. Subprimals were frozen (-28.9 °C) for 30 days, thawed for seven days under refrigeration (-1.1 °C), portioned into steaks, which were frozen (-15.2 °C) for 30 days. After 30 days, steaks were thawed for two days under refrigeration (-1.1 °C) and evaluated within seven days, for approximately 98 days of storage. 2) Frozen/Refrigerated. Subprimals were frozen (-28.9 °C) for 30 days, thawed for seven days under refrigeration (-1.1 °C) portioned into steaks, which were evaluated within seven days of cutting, for approximately 65 days of storage. 3) Refrigerated/Frozen. Subprimals were portioned into steaks, and steaks were frozen (-28.9 °C) for 30 days. Steaks were thawed for two days under refrigeration (-1.1 °C) and evaluated within seven days of thawing, for approximately 60 days of storage.4) Refrigerated/Refrigerated. Subprimals were portioned into steaks and were evaluated within 7 days of cutting, for approximately 28 days of refrigerated (-1.1 °C) storage. Measurements including purge, colour, cooking yields, tenderness, and consumer acceptability were taken from steaks. Steaks (*n*= 240 total) were cooked on a commercial flat-top grill pre-heated to 177 °C ± 3 °C. Internal steak temperatures were monitored during cooking. Panellists (*n* = 80) evaluated the samples using a 9-point scale (1 = dislike extremely; 9 = like extremely) for overall liking, flavour liking, tenderness liking, and juiciness liking. One steak from each subprimal (*n* = 40 steaks, per subprimal type) was used to evaluate WBS force as described by Tindel *et al.* [6]. Data were analysed utilising JMP® Pro (Version 15.2.1; SAS Institute Inc., Cary, NC). The Fit Y by X function was used for one-way ANOVA analysis. When appropriate pairwise comparisons of least squares means were conducted using *Student's t*-tests; differences were considered significant if $P \leq 0.05$. Data were generated by steak type.

III. RESULTS AND DISCUSSION

For top sirloin butts, the Frozen/Frozen and Frozen/Refrigerated treatments ($P = 0.0067$) had the greatest subprimal purge percentage compared to the other treatments. For both subprimal types, there were differences ($P < 0.0001$) between storage treatments for steak purge percentage. Frozen/Refrigerated ribeye and top sirloin steaks treatment had among the highest steak purge percentage, whereas Refrigerated/Refrigerated had the lowest. Ribeye and top sirloin steaks from Refrigerated/Refrigerated resulted in the greatest ($P < 0.0001$) cook yield compared to all other treatments. There were no differences ($P > 0.05$) in cook time among storage conditions for either steak type. Ribeye steaks from Frozen/Frozen had the greatest WBS force values compared to the Refrigerated/Frozen and Refrigerated/Refrigerated treatments. Consumer panellists rated

Frozen/Frozen top sirloin butt steaks lower (P < 0.05) than other treatments for overall liking, flavour, and juiciness.

Table 1. Least squares means of consumer panellists' scores[a] for attributes of ribeye and top sirloin steaks stratified by storage treatment

Treatments	*n*	Overall liking	Flavour liking	Tenderness liking	Juiciness liking
Ribeye steaks					
Frozen/Frozen	10	6.10	6.25	5.71	5.85
Frozen/Refrigerated	10	5.90	6.30	5.41	5.14
Refrigerated/Frozen	10	6.89	6.86	6.58	6.14
Refrigerated/Refrigerated	10	6.73	6.46	6.64	6.44
SEM		0.29	0.23	0.39	0.37
P-value		0.058	0.240	0.072	0.092
Top sirloin steaks					
Frozen/Frozen	10	5.16b	5.48b	4.86b	4.55b
Frozen/Refrigerated	10	6.26a	6.40a	6.19a	5.90a
Refrigerated/Frozen	10	5.99a	6.21a	5.66ab	6.03a
Refrigerated/Refrigerated	10	6.19a	6.14a	5.68ab	6.01a
SEM		0.22	0.22	0.30	0.28
P-value		0.004	0.026	0.031	0.001

Least squares mean within an attribute and main effect lacking common letters (a-d) differ ($P < 0.05$); [a] Consumer scale: 1 = dislike extremely; 9 = like extremely

IV. CONCLUSION

Storage conditions played a greater role for quality and consumer acceptability for top sirloin steaks than ribeye steaks. Overall, freezing both subprimals and steaks posed the greatest challenge in quality and palatability. Findings from this research project could greatly impact beef purchasing decisions made by companies to increase profitability, availability, and flexibility as market trends frequently fluctuate.

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