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Introduction

Beef palatability and eating experience is driven primarily by U.S. Department of Agriculture quality grade and marbling levels. Beef USDA quality grade consists of both marbling levels and maturity. Conventionally, marbling texture has not been a consideration of quality grades. Currently, only one study has assessed the effects of marbling texture on beef palatability. Despite this, preferences for fine or medium marbling exist with both packers and retailers, as approximately 75% of branded beef programs under the supervision of USDA-AMS require fine or medium textured marbling, which equates to losses of premiums for packers and producers (USDA, 2016). The objective of the study was to evaluate the effects of marbling texture on trained sensory panel ratings of beef strip loin steaks of varying USDA quality grades and marbling textures.

Key words: marbling, palatability, trained sensory panel

Experimental Procedures

Strip loins from three quality grades, Top Choice (Modest⁰⁰ – Moderate¹⁰⁰ marbling), Low Choice (Small marbling), and Select (n = 117; 39/quality grade), were obtained from a Midwestern beef processor. To select the strip loins, the USDA Marbling Texture reference card (USDA-AMS-LS-SB-02) was used as a guide to visually sort loins into fine, medium, and coarse textured groups. To qualify into a texture group, at least 75% of the marbling had to meet the standard of fine, medium, or coarse textured marbling. For each quality grade, 13 strip loins were selected and transported refrigerated to the Kansas State University Meat Laboratory. Strip loins were then fabricated into 1 inch steaks, vacuum packaged, and aged for 21 days before freezing at -20°F.

Steaks were thawed prior to each sensory panel session at 39°F for 24 hours. After thawing, steaks were prepared to a medium degree of doneness (160°F) on clamshell grills (Cuisinart Griddler Deluxe, Cuisinart, East Windsor, NJ). After cooking, steaks were sliced into 0.4 in. cubes with 2 cubes served to 8 member panels. Panelists were trained according to the AMSA guidelines for sensory evaluation and evaluated samples for initial and sustained juiciness, myofibrillar tenderness, connective tissue amount, overall

tenderness, beef flavor intensity, as well as off-flavor intensity on continuous line scales on electronic tablets (Toshiba Encore 2, Toshiba, Tokyo, Japan) using a digital survey (Qualitrics, Provo, UT). Each line scale was anchored at both ends and at midpoints with descriptive terms (0 = extremely dry/tough/none/unbeef-like/bland, 100 = extremely juicy/tender/abundant/beef-like/intense).

Results and Discussion

There were no quality grade \times texture interactions ($P > 0.05$) for all traits evaluated (Table 1). Panelists rated coarse marbled steaks higher than medium marbled steaks for initial juiciness ($P < 0.05$), but rated both as similar to initial juiciness of fine marbled steaks ($P > 0.05$). However, coarse marbled steaks were rated higher ($P < 0.05$) for sustained juiciness and beef flavor intensity compared to both fine and medium marbled steaks. Fine and medium steaks were rated as similar ($P > 0.05$) for sustained juiciness. All marbling texture treatments were rated as similar ($P > 0.05$) for myofibrillar tenderness, connective tissue amount, and off-flavor intensity.

Top Choice steaks were rated higher for both initial and sustained juiciness ($P < 0.05$) than Select steaks for both initial and sustained juiciness, but were similar to Low Choice steaks ($P > 0.05$). Furthermore, panelists rated all quality grades similar ($P > 0.05$) for myofibrillar tenderness, connective tissue amount, overall tenderness, and off-flavor intensity. However, Top Choice and Low Choice steaks were similar ($P > 0.05$) and more intense in beef flavor ($P < 0.05$) than Select steaks.

Implications

These results indicate steaks with coarse textured marbling are juicier and have an increased beef flavor when compared to fine and medium textured steaks. This indicates coarse marbled beef should not be discriminated against and should be included in branded beef programs, as it improves eating experience when compared to both fine and medium textured steaks. Furthermore, this would allow for increasing profits for both the packer and wholesaler.

Table 1. Least squares means for trained panel ratings¹ of grilled beef strip loin steaks of varying USDA quality grades and marbling texture treatments

Treatment	Initial juiciness	Sustained juiciness	Myofibrillar tenderness	Connective tissue amount	Overall tenderness	Beef flavor intensity	Off-flavor intensity
Marbling texture							
Fine	61.4 ^{ab}	49.5 ^b	74.1	8.8	70.8	39.6 ^b	1.7
Medium	60.3 ^b	48.5 ^b	71.5	8.2	68.4	38.5 ^b	1.4
Coarse	65.5 ^a	54.5 ^a	73.6	9.2	69.8	42.6 ^a	1.8
SEM ²	1.8	2.0	1.6	0.7	1.6	1.1	0.7
P-value	0.04	0.03	0.17	0.55	0.53	0.01	0.88
Quality grade							
Top Choice ³	65.8 ^a	55.16 ^a	74.7	8.3	71.5	42.2 ^a	2.0
Low Choice	62.4 ^{ab}	50.6 ^{ab}	73.3	8.2	69.9	40.5 ^a	1.3
Select	59.1 ^b	46.7 ^b	71.2	9.8	67.6	38.0 ^b	1.6
SEM	1.8	2.0	1.6	0.7	1.6	1.1	0.7
P-value	0.01	0.003	0.34	0.22	0.18	0.01	0.67
Quality grade × Texture							
P-value	0.33	0.38	0.83	0.81	0.89	0.85	0.18

¹Sensory scores: 0 = Extremely dry/tough/none/unbeef-like/bland, 100 = Extremely juicy/tender/abundant/beef-like/intense.

²Standard error (largest) of the least squares means.

³USDA marbling score of Modest⁰⁰-Moderate¹⁰⁰.

^{abcd}Least squares means in the same main effect (quality grade or marbling texture) without a common superscript differ (P<0.05).