

CONSUMER SENSORY EVALUATION OF SIX BEEF MUSCLES COOKED WITH MULTIPLE DRY HEAT METHODS

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I. INTRODUCTION

Flavor development in meat products occurs through chemical reactions with the addition of heat, through various pathways, including the Maillard reaction and thermal lipid degradation [1]. These pathways can be impacted due to the differences in heat transfer, due to varying product composition, types of heat delivery, and other thermodynamic impacts. Therefore, the objective of this study was to determine the effect of dry cookery method on consumer ratings of steaks from various muscles.

II. MATERIALS AND METHODS

Beef strip loins (IMPS #180), top sirloin butts (IMPS #184), paired tenderloins (IMPS #189), paired shoulder clods (IMPS #114) and chuck rolls (IMPS #116) were selected from USDA Low Choice carcasses (Small⁰⁰-Small¹⁰⁰ marbling score; n = 20) from a commercial beef processing facility in Texas, USA. Subprimals were transported to the Gordon W. Davis Meat Laboratory at Texas Tech University (TTU) under refrigeration and aged for 21 d prior to fabrication. At fabrication, subprimals were cut into 2.54 cm representative steaks of each muscle (Longissimus lumborum [LL], Gluteus medius [GM], Psoas major [PM], Triceps brachii [TB], Infraspinatus [IF], and Serratus ventralis, [SV]). Steaks were then vacuum packaged and frozen at -20°C until further analysis.

Prior to panel evaluation, steaks were thawed for 24 h at 2-4°C. Steaks were then subjected to one of four randomly assigned dry cookery methods: on one of four randomly assigned cooking methods: charbroiler grill (CHAR), clamshell grill (CLAM), convection oven (OVEN), or salamander broiler (SALA). Cooking surfaces were heated to 200°C and monitored during cooking using surface thermocouples (Magnetic K thermocouple 88402K: Omega; Stamford, CT, USA). Steaks were cooked to a medium degree of doneness (71°C), then immediately placed into ice, vacuum packaged and chilled until panel sessions. One hour prior to panel sessions, vacuum packaged steaks were placed into a circulating water bath at 63°C until serving. Steaks were cut into 2.54 × 1 × 1 cm cubes and two cubes were served to each panelist.

Consumer panels were conducted using the methods previously administered at TTU [2,3]. Untrained consumer panelists (n = 300) were recruited from the Lubbock, Texas area in groups of 20. Panelists evaluated eight samples in an incomplete block design due to the number of treatments (n = 24) for flavor, tenderness, juiciness, and overall liking on unstructured 10 cm line scales using a digital ballot on an electronic tablet. Each panelist was also asked to rate each trait as acceptable or unacceptable and designate each sample as unsatisfactory, everyday, better than everyday, or premium quality. Each ballot consisted of a demographics sheet, a purchasing motivators sheet, and eight sample ballots. During the panel, panelists were provided with water, apple juice, and unsalted crackers to serve as palate cleansers.

Data was analyzed as a 4 × 6 factorial arrangement, with cooking method, muscle, and the cooking method × muscle interaction serving as fixed effects and panel and round serving as random effects. Differences were considered significant at $P < 0.05$.

III. RESULTS AND DISCUSSION

There were no cooking method × muscle interactions for all traits evaluated ($P \geq 0.29$).

Cooking Method

Consumers rated CHAR steaks greater ($P < 0.05$) than CLAM steaks for flavor, tenderness, and juiciness. Additionally, CLAM steaks were rated lower ($P < 0.05$) than all other methods for tenderness. Moreover, OVEN steaks were rated similar ($P > 0.05$) for flavor and juiciness to both CHAR and CLAM steaks ($P > 0.05$). When asked to rate steaks as acceptable for tenderness or juiciness, CLAM steaks had a lower percentage of steaks rated as acceptable in comparison to all other treatments ($P < 0.05$). No differences were observed between cooking methods for overall liking ($P = 0.06$), as well as the percentage of steaks rated as acceptable for flavor and overall ($P = 0.44, 0.26$).

Muscle

Psoas major steaks were rated higher ($P < 0.05$) than all other muscles for flavor, tenderness, and overall liking. Additionally, PM steaks had the greatest percentage of steaks ($P < 0.05$) rated as acceptable for flavor and tenderness. Consumers rated IF steaks similar ($P > 0.05$) to PM steaks for juiciness and had a similar percentage of steaks rated as acceptable for juiciness and overall acceptability. For tenderness and overall liking, IF steaks were rated lower ($P < 0.05$) than PM steaks, but higher than all other muscles ($P < 0.05$). Consumers rated SV steaks similar ($P > 0.05$) to IF, GM, LL, and TB steaks for flavor. Serratus ventralis steaks were also rated higher ($P < 0.05$) than GM, LL, and TB steaks for juiciness, but were similar ($P > 0.05$) to TB steaks for overall liking. Consumers rated GM, LL and TB steaks the lowest ($P < 0.05$) for flavor, tenderness, and overall liking. When asked to rate steaks as acceptable for flavor, PM steaks had the greatest percentage of steaks rated as acceptable ($P < 0.05$), followed by IF steaks, which were similar ($P > 0.05$) to LL, SV, and TB steaks, but higher than ($P < 0.05$) GM steaks. A similar trend was observed for tenderness acceptability, however, IF steaks had a greater percentage of steaks ($P < 0.05$) rated as an acceptable for tenderness than all other muscles. Consumers rated a greater percentage of PM and IF steaks as acceptable for juiciness ($P < 0.05$) than all other muscles, followed by SV and TB steaks ($P < 0.05$), then LL and GM steaks ($P < 0.05$) had the lowest percentage of steaks rated as acceptable for juiciness. For overall acceptability, PM and IF steaks had the highest percentage of steaks rated as acceptable ($P < 0.05$) and were greater ($P < 0.05$) than all other muscles were lower and similar ($P > 0.05$)

IV. CONCLUSION

These data indicate that cooking method and muscle effects are independent of one another, which indicates that various dry heat cookery methods can be applied to different muscles with equal success. Additionally, high quality muscles, such as the PM and the IF can provide the consumer with a quality eating experience, regardless of cooking method.

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