



## Metabolomic Predictors for Flavor Potential of Beef Steaks Differing in Quality Grade, Aging Time, and Degree of Doneness

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**Keywords:** aging, degree of doneness, metabolomics, quality grade, sensory  
Meat and Muscle Biology 3(2):120

### Objectives

The objective of this project was to explore metabolomic predictors that could determine the potential of beef strip loin steaks differing in quality grade, aging time, and degree of doneness to develop positive flavors.

### Materials and Methods

USDA Select ( $n = 18$ ) and USDA Upper 2/3 Choice ( $n = 18$ ) beef strip loins (IMPS 180) were collected from a processing plant. Loins were halved, and each half was wet aged for either 10 or 20 d in a cooler kept at 2°C. After aging, loins were cut into 2.54 cm steaks, individually vacuum packaged and stored in a freezer at -40°C. Prior to cooking steaks were thawed in a 4°C cooler for 12 to 24 h. Steaks were cooked on a flat top griddle set to 204.4°C ( $\pm 11.1^\circ\text{C}$ ) to one of three degrees of doneness: 63°C (medium rare), 71°C (medium) or 80°C (medium well). A six-member expert trained descriptive attribute panel was trained on 16 major attributes, 4 other attributes, and 3 texture attributes from the beef lexicon for 6 d prior to testing. Panelists were trained to scale each attribute on a sixteen-point intensity scale (0 = none, 15 = extremely intense). Panelists were served two random, representative cubes (1.3 cm  $\times$  1.3 cm  $\times$  steak thickness) from each steak in a plastic souffle cup labeled with a random three-digit code. Panelists were seated in a bread-box-style booth under red lighting to eliminate degree of doneness bias. Portions from one raw steak from Quality Grade (QG)  $\times$  aging combination from each loin was used for high performance liquid chromatography (HPLC) analysis. Samples were homogenized and extracted with a water/acetonitrile solution before being filtered. The lipid fraction was removed via solid phase extraction. Samples were then centrifuged and

injected into the HPLC. Data was analyzed as a factorial arrangement of a completely randomized design.

### Results

USDA Choice steaks had more intense beef flavor identity, brown, roasted, fat-like, salty, sweet, sour, umami, buttery, and overall sweet flavors and were juicier and more tender compared to USDA Select steaks, which were more intense in metallic and bitter flavors ( $P < 0.05$ ). Steaks aged for 20 d were juicier and more tender than 10-d aged steaks ( $P < 0.05$ ). However, 20-d aged steaks also had more intense sour, liver-like, and musty earthy/humus flavors and a less intense brown flavor compared to 10 d aged steaks ( $P < 0.05$ ). Steaks cooked to 80°C had more intense beef identity, brown, roasted, and umami flavors than steaks cooked to a lower degree of doneness ( $P < 0.05$ ). Steaks cooked to either 63°C or 71°C had more intense bloody, metallic, and sour flavors and are juicier and more tender than steaks cooked to the higher degree of doneness ( $P < 0.05$ ). The HPLC analysis of raw steak samples indicated a total of 54 compounds appeared in at least 80% of one treatment. Additionally, there were 2 peptides and 1 sugar that were significantly ( $P < 0.05$ ) upregulated in the Choice, 20-d-aged strip loins. Additionally, 14 compounds were identified that were shared across all four QG  $\times$  aging combinations. This included 11 peptides, 2 phospholipids, and 1 heterocyclic aromatic hydrocarbon.

### Conclusion

These compounds could be indications of the potential for steaks to form positive flavor attributes found in USDA Choice steaks and 20-d aged steaks as described by trained panel analysis.