



## Impact of Packaging and Muscle Type on Beef Flavor Development

K. R. Vierck<sup>1\*</sup>, J. F. Legako<sup>1</sup>, and J. C. Brooks<sup>1</sup>

<sup>1</sup>Department of Animal and Food Sciences, Texas Tech University, Lubbock, TX, USA

\*Corresponding author. Email: kelly.vierck@ttu.edu (K. R. Vierck)

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### Objectives

The objective of this study was to determine the influence of packaging type on production of beef flavor volatile compounds.

### Materials and Methods

Beef strip loins (IMPS #180) and top sirloin butts (IMPS #184) were selected from USDA Low Choice carcasses ( $n = 40$ , 20/subprimal). Seven d postmortem, subprimals were fabricated into 2.54 cm representative steaks of the *Longissimus lumborum* (LL) and *Gluteus medius* (GM). Steaks were then placed into one of four randomly assigned packaging treatments: carbon monoxide motherbag (0.4% CO/30% CO<sub>2</sub>/69.6% N<sub>2</sub>; CO), high oxygen modified atmosphere packaging (80% O<sub>2</sub>/20% CO<sub>2</sub>; HIOX), traditional polyvinyl chloride overwrap (OW), and rollstock (ROLL). Steaks designated for the OW treatment were placed in ROLL treatment until retail display. Steaks were aged in the absence of light for 14 d, then subjected to a 48-h retail display under fluorescent lighting in coffin cases. Following retail display, steaks were immediately vacuum packaged and frozen at -20°C until further analysis. Prior to volatile compound analysis, steaks were thawed at 2–4°C. Steaks were then cooked to 71°C using clamshell grills. Immediately after cooking, six 1.27 cm cores were removed, then minced using a coffee grinder. Five g of sample was weighed into a glass vial, sealed, then analyzed using gas chromatography-mass spectrometry. Compounds evaluated were chosen from major flavor pathways.

### Results

Three compounds, carbon disulfide, 2-pentylfuran, and benzaldehyde elicited a packaging type × muscle interaction ( $P \leq 0.048$ ). Carbon disulfide was present in the

highest concentration ( $P < 0.05$ ) in CO GM and ROLL LL steaks, but was present in the lowest amount ( $P < 0.05$ ) in OW GM and ROLL GM steaks. For benzaldehyde, HIOX GM steaks produced the greatest concentration ( $P < 0.05$ ) compared to all other treatments, with the exception of ROLL LL, which was similar ( $P > 0.05$ ). A similar trend existed for 2-pentylfuran, as high oxygen GM steaks produced over three times higher concentrations ( $P < 0.05$ ) of 2-pentylfuran compared to all other treatments. Nine compounds, primarily lipid derived, were impacted by a packaging main effect ( $P < 0.043$ ). For 2-propanone, pentane, and hexanoic acid, methyl ester, HIOX packaging produced the greatest concentration ( $P < 0.05$ ) compared to all other treatments. Additionally, HIOX steaks produced a greater amount ( $P < 0.05$ ) of methanethiol than OW or ROLL steaks. High oxygen steaks produced more ( $P < 0.05$ ) 1-pentanol, 1-octen-3-ol, and nonanal than CO steaks, but were similar to ROLL and OW steaks. Carbon monoxide packaging produced the greatest amount ( $P < 0.05$ ) of 2,3-butanediol compared to all other treatments. Five compounds were impacted by the muscle main effect ( $P \leq 0.039$ ). The GM steaks produced a greater concentration of 2,3-butanedione ( $P = 0.011$ ), 3-hydroxy-2-butanone ( $P = 0.002$ ), octanoic acid ( $P < 0.001$ ), and dodecanal ( $P = 0.021$ ) than the LL steaks. The LL produced a greater amount of decanal ( $P = 0.039$ ) than the GM.

### Conclusion

These results indicate packaging and muscle each impact flavor, however, packaging effects are primarily lipid derived and muscle more readily impacts Maillard product production. Additionally, HIOX packaging produces a large amount of lipid derived compounds from degradation and oxidation, which may form the basis for its negative flavor profile. This indicates HIOX packaging should be avoided to produce more positive flavor notes in beef.