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Further Investigations of Dry-Aging Impacts on Palatability Attributes and Metabolomic Profiles of Beef Loins

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Objectives

Dry-aging is a natural value-adding process, where primal/sub-primal cuts are stored without packaging materials in a controlled cooler for several weeks. While dry-aging is known for the development in palatability attributes (flavor in particular) of meat, compounds associated with dry-aged flavor have not been fully established. Given metabolomics is an emerging analytical technique that enables detection and measurement of small compounds, we hypothesized that chemical compounds associated with dry-aged flavor (or other palatability attributes) could be identified by using the metabolomics approach. Therefore, our objective in this study was to identify key metabolites associated with eating quality attributes of dry-aged beef via using metabolomics analysis. This study was further investigation of our previous study, where significant improvements in eating quality attributes were found in the low marbled/grass-fed beef loins through dry-aging.

Materials and Methods

Paired beef loins (*M. longissimus lumborum*) from 9 beef carcasses (Angus, Select Grade) were obtained at 7 d postmortem, cut into 2 sections and assigned to 3 different aging methods: conventional dry-aging (DA), vacuum packaged wet-aging (WA) and dry-aging in a high water permeable bag (DAW) for 28 d at 2°C as previously reported. After aging, multiple steaks from each section were collected for consumer panel sensory evaluation ($n = 120$) and metabolomics analyses. The consumer panelists were asked to provide additional descriptive comments on eating quality attributes, which were quantified for further analysis. Selected samples ($n = 5$) from each treatment were analyzed by UPLC-ESI-MS metabolomics. The relative abundance of metabolites was quantified and normalized for the statistical analyses. Data were analyzed by split-plot ANOVA using PROC MIXED from SAS (SAS Inst. Inc., Cary, NC) and LS means were separated ($P < 0.05$). Principal component analysis (PCA) was performed on the metabolites using R software.

Results

The metabolomics platform detected 1,666 compounds, in which 125 metabolites were found to be significantly responsive to aging treatments ($P < 0.05$). PCA analysis exhibited distinct clusters of metabolites between dry-aged and wet-aged treatments (PC1 55.1%). Higher abundance of compounds possibly related to flavor, such as thiamine thiazole, thymidine monophosphate and pyroglutamic acid were observed in DA and DAW compared to WA ($P < 0.05$). Multiple glutamine containing dipeptides as well as adenosine monophosphate were also observed to be higher in DAW and DA compared to WA ($P < 0.05$). Based on the consumer comment analysis, descriptive flavor attributes (e.g., beefy, smoky) were observed more frequently in DA samples compared to WA counterparts. The comment analysis also indicated that there was a higher preference toward DA over WA in most eating quality attributes, which were in agreement with our previous sensory results.

Conclusion

The results from the current study found that some flavor-related metabolites were liberated through dry-

aging, which could be associated with dry-aged taste/flavor of beef loins. Descriptive comments from non-trained consumer panelists effectively provided descriptive attributes of dry-aged beef. Further research on identifying potential biomarkers for dry-aged flavor/taste by correlating those metabolites, other volatile chemical compound analysis, and sensory results is highly warranted.