# INVESTIGATION INTO MECHANISMS UNDERPINNING DRY-AGING IMPACTS ON BEEF QUALITY ATTRIBUTES AND FLAVOR-RELATED COMPOUNDS

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## I. OBJECTIVES

Postmortem aging has been well known to improve meat palatability. Dry aging, specifically, has been known to improve flavor of the meat, generating unique flavor such as beefy and umami. However, compounds that are associated with dry-aged beef flavor have not been fully identified and understood. Thus, the objective of this study was to identify flavor-related compounds that can be naturally liberated through different aging methods.

## II. MATERIALS AND METHODS

Paired beef loins (*M. longissimus lumborum*) from 13 cull cow carcasses (42 mo +, Holstein) were collected 5 d postmortem, split into 4 equal portions, and randomly assigned to 4 different aging treatments: wet aging (WA), conventional dry aging, dry aging in water-permeable bag, and conventional dry aging with ultraviolet light (2 treatment/d, 5 J/s/treatment) for 28 d at 2°C, 65% relative humidity, and 0.8 m/s air flow. After aging, loins were trimmed, and steaks were collected for sensory evaluation, biochemical analyses, and metabolomics analysis. Steaks were evaluated for various flavor and palatability attributes by both trained ($n = 11$) and consumer ($n = 130$) panelists. The free amino acid concentration, fatty acid profile, and volatile content were measured for all treatments. Metabolomics were analyzed using an ultraperformance liquid chromatography electrospray ionization mass spectrometry system. All data were analyzed using PROC GLIMMIX of SAS (SAS Institute Inc., Cary, NC). Least-squares means for all traits were separated (F-test, $P < 0.05$) using the PDIFF option. Principal component analysis was performed on the metabolites using R software.

## III. RESULTS

From the analysis, 1,407 metabolites were detected, and 60 were significantly affected by the treatments ($P < 0.05$). Of these, 44 were able to be identified. Greater abundance of protein metabolites was observed in all dry aging treatments compared to WA. Similarly, free amino acids analysis also showed significant treatment effect, where dry-aged samples had greater abundance of amino acids compared to WA ($P < 0.05$), except for aspartate, hydroxyproline, and cysteine. No difference in the fatty acid profile was found between different aging treatments ($P > 0.05$). More lipid-related metabolites, however, were identified in the WA treatment, potentially from the limited exposure to the environment. Volatile analysis indicated that dry aging generated more volatile compounds, especially from

hydrocarbon and alcohol groups, compared to WA. Additionally, more sulfur containing compounds, such as thioproline and erysothiopine, were observed in dry aging treatments compared to WA. Sulfur containing compounds have been often related to desirable flavor in beef product. The trained panel identified that conventional dry aging steaks and steaks dry-aged in water-permeable bag had significantly lower fat and sour flavor and a trend of lower oxidized flavor ($P = 0.07$) compared to steaks from WA and conventional dry aging with ultraviolet light. The consumer panel, however, found no differences in sensory attributes between treatments ($P > 0.05$).

## IV. CONCLUSION

The results showed that dry aging treatments resulted in greater amino acids and sulfur containing compounds, whereas more lipid-related compounds were observed in WA. This observation potentially indicates that different postharvest aging methods could affect the liberation of flavor-related compounds of beef. Further research correlating these compounds to sensory quality and conducting pathway analyses to elucidate the underlying mechanisms by which dry-aged beef flavor-related compounds can be generated is currently underway.

Keywords: cull cow, dry aging, metabolomics, volatile compounds