



Analyzing Beef Color Stability Differences with Metabolomics

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Objectives

Beef longissimus and psoas muscles have different color stability and biochemical profiles. Inherent metabolite differences in muscles can significantly affect biochemical properties and metmyoglobin reduction. However, limited research has utilized metabolomics technique to characterize metabolites related to beef color. Therefore, the objective was to compare metabolite profile differences between beef longissimus and psoas muscles during display.

Materials and Methods

Ten beef longissimus lumborum (LL) and psoas major (PM) muscles were collected 3-d postmortem from a processing plant. Steaks were cut from each muscle type and displayed under retail conditions for 7 d. Surface color, biochemical properties, and metabolite profiles were analyzed during display. Two grams of muscle tissue were collected at different time points (0, 3, and 7 d) from the samples and stored at -80°C . The metabolites were then extracted by placing half gram of muscle tissue in 1.5 mL of methanol in a glass vial for 20 h at room temperature (25°C). Two hundred microliters of the methanol extract containing metabolites from each sample was used for metabolomic analysis. Ribitol was added as an internal standard. Both samples were dried

under nitrogen, derivatized, and metabolites were separated by gas chromatography and analyzed by mass spectrometry (GC/MS). Chromatography data were analyzed using Chemstation software and the spectra were deconvoluted using AMDIS software. Mass profiler professional was used for statistical and multivariate analysis. The compounds were identified using the Fiehn metabolomics library and the NIST mass spectral library.

Results

Psoas major discolored ($P < 0.05$) by d 3 compared with LL. There were significant differences in metabolite concentrations ($P < 0.05$) for each muscle type at each time point. On d 0, 18 compounds were significantly lower ($P < 0.05$, fold change > 2) in PM compared to LL. But on d 7, there were 34 metabolites lower in PM than LL, ($P < 0.05$, fold change > 2) which included some important TCA and glycolytic substrates like D-glucose, fructose, citric acid, and D-malic acid. There were also significant differences in amino acids like L- serine, threonine, methionine, proline, isoleucine etc.

Conclusion

The results suggests that inherent metabolite differences between the 2 muscles also could contribute to differences in color stability.