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Identifying the Influence of Post-Mortem Aging Length and Method on Flavor and Tenderness of Beef Strip Loins

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Objectives

Aging of beef is one widely-accepted method to enhance palatability characteristics. There has not been a study published aimed specifically at identifying the effect of aging on flavor compound development. Therefore, the objective of this study was to identify compositional changes in flavor and tenderness of beef aged at different lengths and using different methods.

Materials and Methods

Pairs of strip loins ($n = 38$) were collected from commodity USDA Choice beef carcasses and fabricated into a total of 8 sections per carcass. Sections were randomly assigned to 1 of 8 aging treatments: 1) 3 d wet-aged; 2) 14 d wet-aged; 3) 28 d wet-aged; 4) 35 d wet-aged; 5) 49 d wet-aged; 6) 63 d wet-aged, 7) 21 d dry-aged; 8) 14 d wet-aged followed by 21 d dry-aged. Upon completion of treatment, sections were fabricated into 3 steaks, each of which was allocated for sensory, shear force, or chemical analysis. Sensory attributes, including beef lexicon flavor notes and tenderness, were quantified by a trained panel using a 15-point scale. Slice shear force (SSF) and Warner-Bratzler (WBSF) shear force was determined for each sample. Uncooked samples were analyzed for volatile organic compounds known to contribute to beef flavor as well as fatty acids. Treatment comparisons made within the same carcass were tested for significance using SAS PROC GLIMMIX (SAS Inst. Inc., Cary, NC) with $\alpha < 0.05$.

Results

Wet-aging longer than 35 d resulted in decreased ($P < 0.01$) ratings for beef flavor ID, browned, and roasted fla-

vors and increased ($P < 0.01$) ratings for sour, oxidized, nutty, musty/earthy, and liver-like. However, beef wet-aged up to 28 d showed no change ($P \geq 0.05$) in flavor notes. Dry-aging resulted in the greatest ratings for beef flavor ID, browned, and roasted. Additionally, the additive effect of using both wet- and dry-age methods resulted in intensification of the musty/earthy and nutty flavor notes typically associated with dry-aged beef, as well as sour notes. The SSF and WBSF generally decreased as aging time increased. Yet, no significant differences ($P \geq 0.05$) in SSF values were found past 35 d of wet-aging, and no significant differences ($P \geq 0.05$) in WBSF values were found past 28 d of wet-aging. Volatile flavor compound analysis showed n-aldehydes nonanal, octanal, and hexanal increase up to 35 d of wet-aging and decrease at subsequent aging lengths. Additionally, Strecker aldehydes phenylacetaldehyde, 2-methylbutanal, and 3-methylbutanal all increased after 35 d of wet-aging. Finally, ethanol production increased substantially after 35 d of wet-aging, while acetaldehyde production decreased at the same aging length.

Conclusion

These findings show aging as an effective method of improving palatability attributes in beef. Yet, utilizing extreme aging parameters changes the flavor profile of beef, as notes of sour, oxidized, nutty, musty/earthy, and liver-like develop, without a meaningful improvement in tenderness. This change in flavor profile may, in part, be due to volatile changes late in the wet-aging period, where the oxidative breakdown of lipids, generation of aldehydes, and the dehydrogenation of acetaldehyde to ethanol occur. Additionally, dry-aging in combination with wet-aging creates a unique flavor profile. Ultimately, these results provide a baseline for establishments to select an aging protocol best suited for their need in promoting a high-quality eating experience.