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Volatile Compounds from Enhanced and Non-Enhanced Beef Strip Steaks of 3 USDA Quality Grades Cooked to Multiple Degrees-of-Doneness

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Objectives

Beef palatability is greatly influenced by flavor. This study was conducted to determine the impact of enhancement (E) with a brine solution on generation of volatile compounds in 3 USDA quality grades (QG) of beef steaks cooked to different degrees of doneness (DOD).

Materials and Methods

Paired beef strip loins representing USDA Prime ($n = 24$), Low Choice ($n = 24$), and Low Select QG ($n = 24$), were collected at a commercial beef processing facility and maintained in vacuum packaging and refrigeration (2°C) until further processing. All treatments, both enhanced and unenhanced were aged for 21 d. However, after 14 d of aging, half of the paired strip loins from each QG ($n = 12$) were enhanced with a solution (0.35% salt and 0.40% sodium phosphate) at a target of 8% additional weight within the end product. Strip loins weights were recorded before and 15 min after injection to determine actual percentage pump. Enhanced strip loins were then vacuum packaged and stored at 2°C for an additional 7 d. Strip loins that were not chosen for enhancement were aged for 21 d under vacuum at 2°C. Steaks of 2.5 cm thickness were produced and assigned to 1 of the 3 DOD (Rare: 60°C; Medium: 71°C; Well-Done: 82°C). Experiments were set up with 12 replicates per treatment and a split-plot ANOVA was used with a factorial arrangement of QG and E as the whole plot and DOD as the sub-plot. All comparisons were tested at a significance level of $\alpha = 0.05$.

Results

The majority of quantitated volatile compounds were impacted by a 3-way interaction of E×QG×DOD ($P \leq$

0.05). Thirteen Maillard reaction compounds had 3-way E×QG×DOD interactions ($P \leq 0.048$). Among Maillard products, Strecker aldehydes, pyrazines, and sulfur compounds differentiated in concentration ($P < 0.05$) for well-done non-enhanced steaks with USDA Prime QG having the highest concentration for all compounds. However, concentrations did not differ ($P > 0.05$) at lower degree of doneness within non-enhanced steaks. Among enhanced steaks there was no differentiation ($P > 0.05$) due to QG. Fifteen lipid derived compounds quantitated had a 3-way E×QG×DOD interaction ($P \leq 0.038$). Among lipid derived compounds, hexanal concentrations were greater ($P < 0.05$) in rare, Prime non-enhanced and enhanced steaks compared with their well-done counterparts. The same was not apparent for Low Choice or Low Select among both non-enhanced and enhanced beef, where Low Select of each enhancement group were similar ($P > 0.05$) between rare and well-done steaks. Meanwhile, Low Choice non-enhanced increased ($P < 0.05$) in quantity of hexanal from rare to well-done, and Low Choice enhanced decreased ($P < 0.05$) in quantity of hexanal from rare to well-done. Interestingly, within medium and well-done, non-enhanced and enhanced steaks hexanal quantity was inversely related with quality grade, where Prime was lower ($P < 0.05$) than both Low Choice and Low Select.

Conclusion

Enhancement of beef steaks influence both Maillard reaction and lipid derived volatile compounds. The greatest impact of enhancement seems to have occurred with Maillard products where variation of Maillard compounds was reduced within enhanced product.