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The Influence of Rate of Cooking, Cooking Temperature, and Degree of Doneness on Volatile Compounds Related with Flavor and Tenderness

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Objectives

This study evaluated the influence of oven temperature and steak degree of doneness (DOD) on flavor related volatile compounds at different depths within a steak (surface, mid, center).

Materials and Methods

Beef strip loin steaks were randomly assigned to cookery treatment combinations (n = 20) at 30 replicates each. Individual steaks served as the experimental unit. Four oven temperatures (65.5°C, 177°C, 246°C, 343°C) and 6 DOD (57°C, 63°C, 68°C, 74°C, 79°C, 85°C) were utilized. After cooking, steaks were chilled, vacuum packaged, and frozen. Steaks were then allocated to groups of 10 within each set of 30 replicates that represented 3 replications for chemical analysis. The replicates were then sliced parallel to the cooked surface at a thickness of 0.4-mm to produce 3 layers (surface, middle and center). Individual volatile compounds were analyzed through a split-plot one-way ANOVA, where treatment combinations were the whole plot and steak layer was the sub-plot.

Results

A total of 71 volatile compounds were quantitated (ng/g cooked sample). Of these, 32 quantitated volatile compounds were impacted by a 2-way interaction of TRT×LAYER ($P \leq 0.05$). Eight Maillard reaction compounds had a 2-way TRT×LAYER interactions ($P \leq 0.05$). Among Maillard products, Strecker aldehydes, pyrazines and sulfur compounds differentiated ($P \leq 0.05$) in agreement with the surface layer differing to mid and center. Twenty-two lipid derived compounds quantitated had a 2-way TRT×LAYER interactions ($P \leq 0.05$). Thirty-four quantitated volatile compounds were impacted by the main effect of layer (surface, mid, center) within a steak ($P \leq 0.05$). Only 8 out of 71 volatile compounds were impacted by the main effect of treatment combinations ($P \leq 0.05$). Among lipid derived compounds, hexanal concentrations differed ($P \leq 0.05$) at each layer (surface, middle and center)- being highest in center and lowest in surface. The same was not apparent for maillard derived compounds, where the majority of the quantitated volatile compounds differed at each layer ($P \leq 0.05$) but were highest in surface layer and lowest in center.

Conclusion

Previous research has shown that compounds of similar pathways follow the same path with respect to volatile compounds formation on being cooked. Treatment combinations influenced both Maillard reaction and lipid derived volatile compounds. The greatest impact of treatment combinations seems to have occurred with lipid derived products where variation of lipid volatile compounds was reduced within surface layer.

