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Relationship between Descriptive Flavor and Texture Attributes on Volatiles of Ground Beef

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Objectives

The objective of this study was to better understand the impacts of various ground beef formulation methods on volatile aromatic compounds through GC/MS/Olfactory and trained descriptive sensory panel analysis.

Materials and Methods

Sixteen treatments including 4 meat sources (chuck, regular, sirloin, round), 2 fat percentages (10 and 20%), and 2 grind treatments (6.4 mm grind and bowl chopped) were formulated Patties were formed with a patty maker using a 2.54 cm mold and cooked on a commercial flat top to an internal temperature of 70°C. Samples for GC analysis (n = 124) were placed in glass jars with a Teflon cover and allowed to thaw in a 70°C water bath. A SPME was inserted into each jar and the headspace was collected for 2 h. The SPME was injected into a multi-dimensional GC/MS/Olfactory machine and aroma compounds were separated, identified, and smelled. A trained descriptive attribute panel evaluated 144 samples for beef flavor and texture attributes using the Beef Lexicon (Adhikari et al., 2011).

Results

Partial least squares regression biplot were developed to illustrate trained descriptive flavor panel and volatile aromatic compounds that contributed to flavor. A cluster of beef flavor identity, roasted, umami, refrigerator stale, and cooked milk flavor attributes, as well as 2-(hexyloxy)-ethanol, decanal, 2-heptanone, hexanoic acid, and 3-ethyl-2,5-dimethyl-pyrazine volatile compounds, and chuck bowl chopped 20% lipid and sirloin 6.4 mm 20% lipid ground beef treatments were identified as contributing positively to flavor and texture. A cluster of butanoic acid, trimethyl-pyrazine, 3-methyl-butanal, 2-propanone, 2-butanone, 2-ethyl-6-methyl-pyrazine, acetic acid, methanethiol, octane, 2,5-dimethyl-pyrazine, and 2-ethyl-5-methyl-pyrazine, medicinal flavor, and round 6.4 mm 20% ground beef patties represents attributes that positively impacted flavor, but negatively impacted texture. A majority of the volatile compounds positively impacted perception of flavor. Volatile compounds were positively associated with texture. Bitter, liver-like, and sour descriptive attributes, as well as 2-nonenal clustered indicating both a negative impact for texture and flavor. A cluster surrounding particle size, springiness, petroleum like, burnt, and smoky charcoal flavor attributes, 2-methyl-butanal and 2-ethyl-3,5-dimethyl-pyrazine volatile compounds, and regular 6.4 mm 20% fat, chuck 6.4 mm 20% fat, regular bowl chopped 20% fat, round bowl chopped 20% fat, and sirloin bowl chopped 10% fat treatments, clustered indicating a negative impact on flavor but positive impact on texture.

Conclusion

This study confirmed that fat level contributes to flavor development but is one of the first to highlight the importance of ground beef texture to the eating experience. Differences in relationships among beef flavor attributes, texture attributes, and aromatic volatiles are present through the manipulation of meat source, fat percentage, and grind treatments.