Project Title: Beef flavor beyond fat

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Background

Many branded programs have resulted from the differences in meat quality that exist between cattle biological types. Claims and consumer acceptance have been established much on the premises of potential for marbling presence and guaranteed tenderness. Yet, research has been limited on sensory evaluations and differentiation beyond marblings' ability due to lack of research methodologies. With advancement in instrumentation, evaluation of beef flavor precursors between beef biological types can be examined without influence of intramuscular fat. Potential differences in the lean fraction of beef cattle breeds could provide evidence for certifying biological type flavor or even lead to a biological-type flavor.

The use of metabolomics is a relatively new technology that we can apply to beef sensory and especially to the complexity of flavor. The term metabolomics is simply defined as 'the study of as many small metabolites as possible'. More specifically, metabolites are indicators of meat and muscle metabolism and can be used to describe the general condition of tissue. Many of these metabolites serve as precursors to flavor and aroma compounds that make up the taste of beef. We believe that we can use this technology to predict and describe beef flavor. metabolites have already proven their worth in cholesterol and glucose as canaries for heart disease and diabetes, respectively. Metabolites are effectively the end of very complex interactions occurring inside the cell (in the genome) and those occurring outside the cell or organism (in the environment). In other words, metabolomics allows researchers to obtain a highly sensitive and more complete description of the phenotype. Recent advances in analytical chemistry and metabolite data analysis techniques are making metabolomics much more common in mainstream research.

Methodology

Ground beef patties, rounds were procured from each of the following treatment groups: commodity upper two-thirds choice (HC; USDA Modest and higher marbling), hearthealthy-branded beef (HEART), natural grass-fed (NATURAL), and USDA Select (SELECT). Rounds from each source were ground and supplemented with a grain-fed source of fat to form treatment batches containing 10% or 20% fat. Batches were then fine ground and formed into 112-g patties. Patties were vacuum packaged and frozen until analyzed to determine trained sensory panel, fatty acid profile, volatile compound composition and metabolomic features.

Findings

Varying lean source with a similar fat source for producing ground beef patties has little impact on the trained sensory scores. Additionally, upper 2/3 USDA Choice,

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heart-healthy-branded, and natural-branded beef have more healthy monounsaturated fatty acids compared to USDA Select beef, and USDA Select lean beef has volatile aroma compounds that tend to be different from USDA Choice, heart-healthy, or natural lean beef. Upper 2/3 USDA Choice and heart-healthy lean patties with 20% fat have significantly up regulated and USDA Select lean have down-regulated metabolites in raw meat samples, and USDA Select lean has down-regulated metabolites in cooked beef samples. Measures should be taken to limit the amount of USDA Select lean in high-quality ground beef as it appears from the metabolomic analyses that some metabolites may be related to meat flavor quality and more investigation should be done to test their effectiveness as precursors further upstream in the production process.

Implications

While the lean source and fat content of the ground beef patties used in this study had little impact on trained sensory panel scores, several differences in volatile aroma compounds and nonvolatile flavor precursors and flavor compounds were found. It was particularly interesting to see that both raw and cooked samples analyzed by metabolic profiling had compounds that contributed to differences in ground beef lean and fat content treatments. It appears that with these metabolomic findings that future research should focus on correlating these compounds with sensory and flavor traits. It may be possible to track these metabolites further back in the production of beef. This could include sampling serum from cattle destined for harvest to determine quality and sensory traits.

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