

Project Summary

Development of a Beef Flavor Lexicon: Finding Relationships between Beef Flavor Attributes, Meat Quality and Consumer Acceptance

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Background

Flavor is a combination of taste and aroma and it is one of the main factors that drive consumer acceptance of foods. Sensory evaluation, in combination with chemical identification of constituents, is a powerful tool to evaluate the quality of a food product. In general, sensory studies differ in terminology, type of scale used and type of panel used (consumer vs. descriptive), and are usually focused on the negative attributes of beef. Variation among sensory panel methods hampers meaningful comparisons among studies. A standardized lexicon of terms applicable among various sensory studies on fresh meats is needed. Flavor lexicons have been used for decades in several high-value products such as cheese, wine, whisky, coffee and chocolate where small changes in specific attributes can tremendously affect the consumer acceptance of the product. A standardized meat flavor lexicon can have immediate application to identify the effects of diet (grass or grain), maturity and marbling on beef flavor profile. Other applications will include the identification of processing procedures (ageing, marinating) to minimize off-flavors (sour, grassy, gamey) and maintain desirable flavors (savory, umami, salty, brothy).

Methodology

Beef from grain- and grass-fed cattle were obtained from USU and James Ranch, respectively. The beef flavor lexicon was developed using a descriptive panel. Descriptive and consumer analysis was performed following common sensory techniques. Antioxidant capacity was measured using the ORAC method and the degree of oxidation of the samples was measured using the TBA method. Volatile compounds were measured using SPME GC-MS techniques. All data was analyzed using SAS 9.3.1.

Findings

A standardized lexicon to describe flavor properties of meats was developed. This flavor lexicon includes 18 terms that describe flavor attributes found in meats. The lexicon was used in meat samples obtained from animals that were fed different diets (grass- and grain-based diets). The newly developed flavor lexicon was used to demonstrate that animal diets can affect the flavor profile of meat. Steaks from grass-fed animals were significantly ($p < 0.05$) higher in gamey, barny and grassy flavor, and lower in juicy and umami notes. Gamey, barny and grassy were negatively correlated to the degree of liking of the meat and therefore can be classified as “negative” attributes (Figure 1).

Nevertheless, steaks from grass-fed animals were rated by consumers as slightly liked (6.32), while steaks from grain-fed animals were rated as moderately liked (6.98). In addition, meats obtained from grass-fed animals were darker (Picture 1), had a higher antioxidant capacity and, as expected, a lower degree of oxidation. This was an interesting result considering that this type of samples had a significantly higher content of PUFA. Last but not least, animals' diet also influenced the volatile profile in the meat as demonstrated by the headspace analysis (Figure 2) where volatile compounds such as hexanal, 2,6-bis(1,1-dimethylethyl)-4-ethyl phenol, 2,3-Octanedione, and 1-Octen-3-ol were associated with the meat from grain-fed animals, and volatiles such as benzaldehyde,

toluene, dimethyl sulfone, 3-heptanone, hexadecanoic acid methyl ester and 2-ethyl-1-hexanol were associated with grass-fed animals (Figure 2).

Figure 1: PCA relating the flavor profile of beef obtained from grain and grass-fed cows.

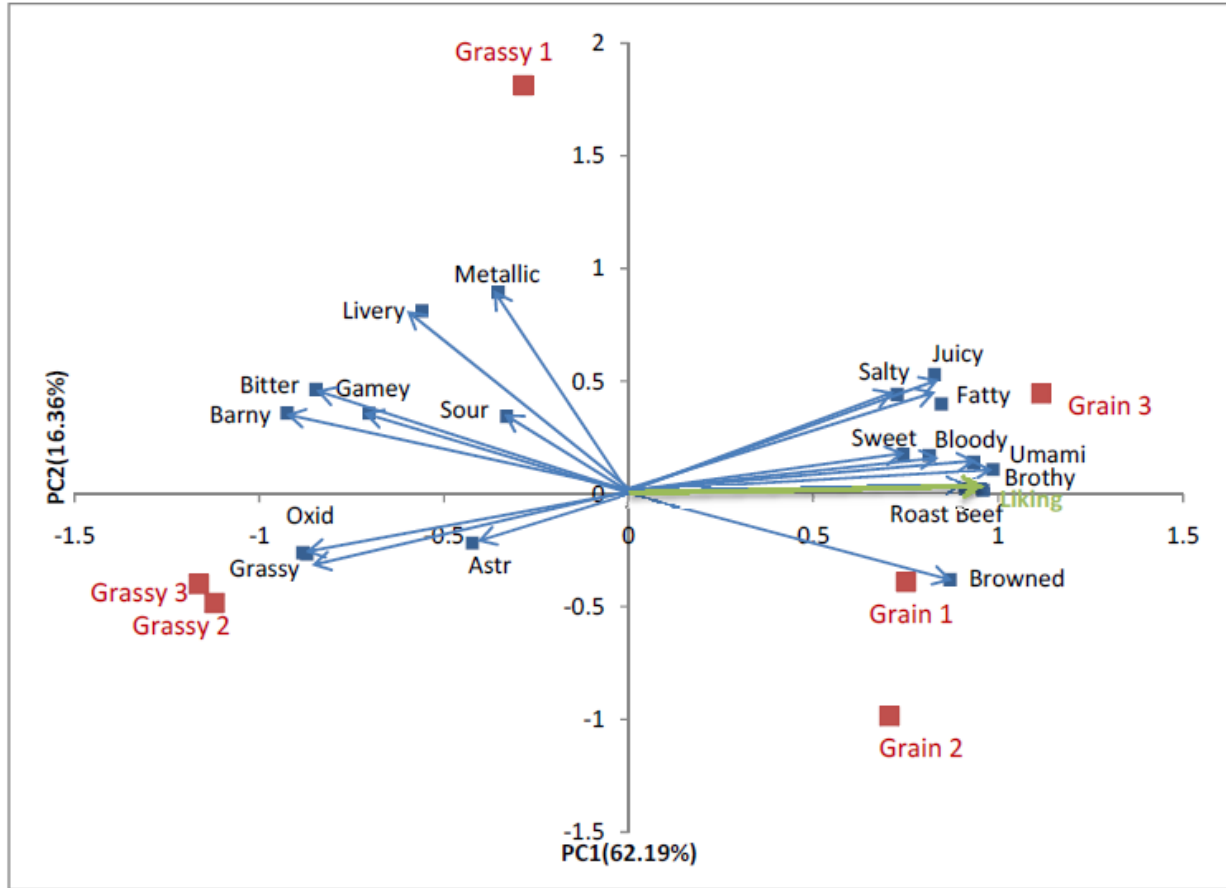
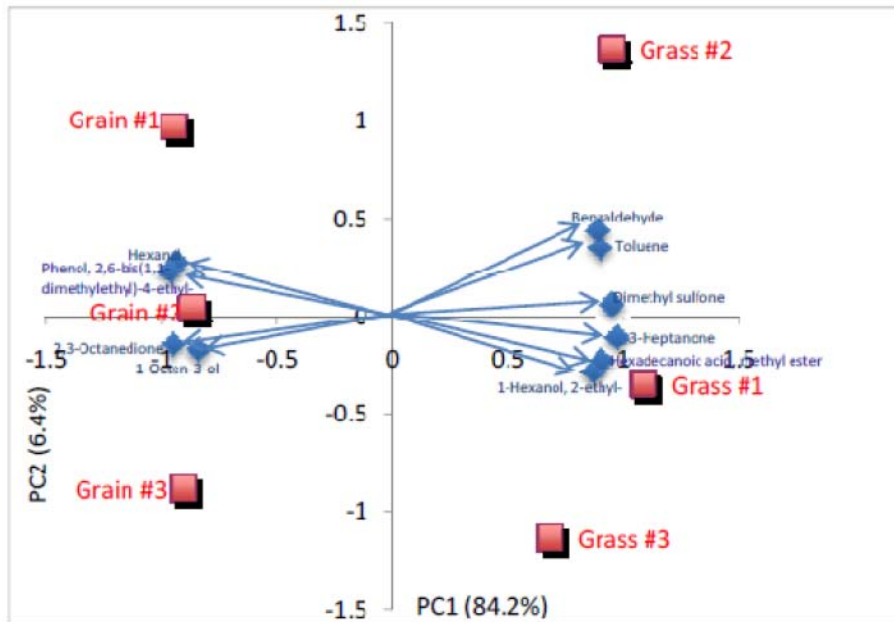


Figure 2: Relationship between the volatile compounds detected in the headspace of the samples and the type of sample.



Steaks obtained from grain- and grass-fed animals (day 12 at 1 °C in PVC packaging). Notice the significantly darker color of the steaks from the grass-fed animals (bottom).

Implications

This project provides a set of tools, which in combination can improve the characterization of beef products from the sensory, chemical and consumer perspective. Another important contribution from this project is the ability to understand the factors (flavors, aroma, fatty acid profile, etc.) that drive consumer acceptance and beef quality. The beef industry can benefit from the results presented here by understanding the relationships between flavor and volatile profile and consumer acceptance. This information could help characterize beef products and tailor the flavor profiles by modifying animal's diet. Future research should include the exploration of different cooking methods that can slightly mask some undesirable flavors and therefore increase consumers' acceptance. This will have a direct impact on the beef industry (both grass- and grain-feeding systems). Other future research should include deeper understanding of the flavors that contribute to the degree of liking by consumers. For example, when we describe a gamey flavor, what are the aromatics or volatiles associated with this flavor, and what other terms are associated to this descriptor?

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