

A Comparison of Two Multivariate Techniques to Analyze Descriptive Data from Seasoned Beef Samples

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Introduction

Three cuts of steak (strip, chuck-eye and top blade) of two USDA grades (choice and select) underwent seasoning and tenderization treatments to study whether flavor and texture quality could be enhanced within cut and grade of steak. Data from descriptive analysis of seasoned steak samples was analyzed using canonical variate analysis (CVA) and principal components analysis (PCA) to determine which method was more insightful in explaining the results of the study. Treatments included – 1)seasoning alone; 2) a combination of seasoning + bromelain; or 3) control (no seasoning and/or bromelain). All of the steaks were cooked to medium doneness (71°C). Six highly-trained descriptive panelists evaluated the samples. A total of 72 samples were evaluated on 21 flavor and texture attributes.

Objective

Data was analyzed using two multivariate statistical methods to understand what type of conclusions could be drawn from each type of analysis. These methods included principal components analysis and canonical variate analysis.

Principal Component Analysis (PCA)

- Conducted using the covariance matrix and is based on averaged data (averaged over judges and replicates)
- Result accounted for 76% of variation within the data
- Results indicate that both grades of chuck-eye and top blade samples were improved in flavor with the treatments
- Choice strip control appears to be the most tender of all samples
- Bromelain treatment improved tenderness in chuck-eyes of both grades and in select top blades.

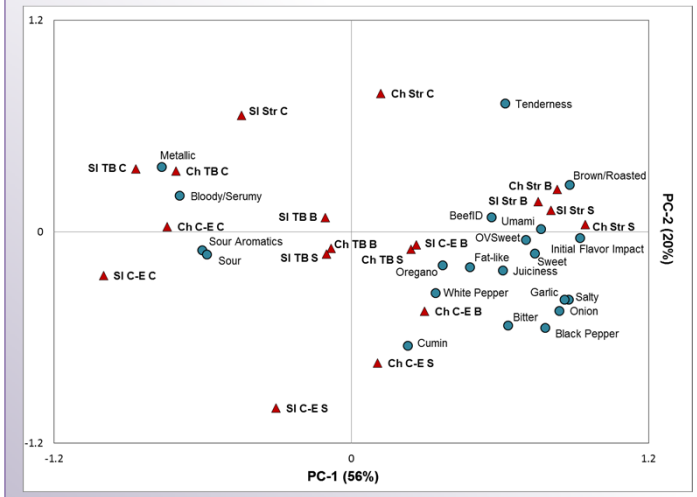

Figure 1. Sensory map of the first two principal components for seasoned beef steak samples

USDA grade is denoted with Sl for select and Ch for choice

C-E B= Chuck-eye seasoning + bromelain, C-E C= Chuck-eye control, C-E S= Chuck-eye seasoning, TB B= Top blade seasoning + bromelain, TB C= Top blade control, TB S= Top blade seasoning, Str B= Strip seasoning + bromelain, Str C= Strip control, Str S= Strip seasoning

Canonical Variate Analysis (CVA)

- Data is not averaged, variation among replications and judges is taken into account
- Circles for each data point represent confidence regions
- Result accounts for 73% of variation within the data, which was similar to PCA
- Both grades of top blade and chuck-eye steaks had increased flavor with either treatment
- Chart indicates that choice and select strip with either seasoning alone or seasoning + bromelain had similar flavor and tenderness
- Choice and select chuck-eyes had slightly increased overall tenderness when treated with bromelain

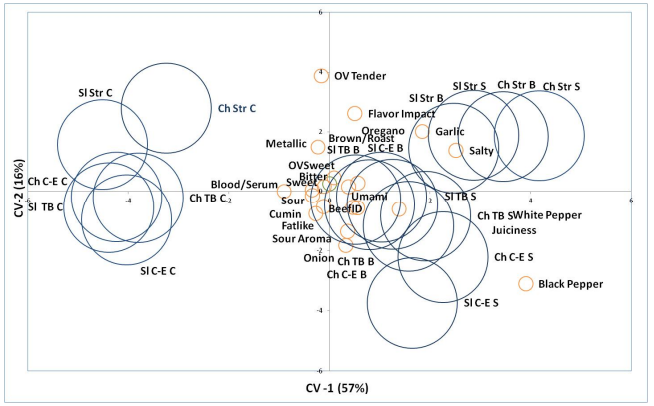

Figure 2. Sensory map of canonical variate analysis for seasoned beef steak samples

USDA grade is denoted with Sl for select and Ch for choice

C-E B= Chuck-eye seasoning + bromelain, C-E C= Chuck-eye control, C-E S= Chuck-eye seasoning, TB B= Top blade seasoning + bromelain, TB C= Top blade control, TB S= Top blade seasoning, Str B= Strip seasoning + bromelain, Str C= Strip control, Str S= Strip seasoning

Conclusions

- Overall, CVA and PCA showed very similar results
- PCA results may be slightly more insightful in this case
  - Showing control top blade to be more bloody/serumy and metallic than other samples
  - Choice top strip with higher overall tenderness than other samples
  - These results cannot be inferred directly from this CVA
- Both can be helpful for determining differences among samples and identifying how treatments impacted the samples
- CVA is more statistically significant and considers the variability in the whole data set, in this study PCA is able to provide more insightful results

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