

Determination of the Sensory Flavor Attributes of Smoke in Food Products

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INTRODUCTION

Smoking is a preservation method that is highly sought today for the unique aroma and flavor it imparts to food. There has been research conducted that considers the smoky flavor characteristics of specific products but no detailed lexicon has been published that is general enough for all smoked products.

MATERIALS AND METHODS

Samples

52 market products and 24 in-house smoked samples were used. The samples ranged from meat, sauces, cheese, fish and liquid flavorings.

Panelists

6 highly trained and experienced panelists from the Kansas State University Sensory Analysis Center participated.

Preparation

Market samples were either used as-is or prepared according to the instructions on the package. The samples that were smoked in-house were smoked using an electric smoker with wood chips. An array of types of woods were used and the products were smoked for times ranging from 2.5 hours to 4 hours. If the product did not reach the minimum safe cooking temperature, they were finished in the oven. All products were presented in cups with lids.

Sample Evaluation

Samples were labeled with random 4-digit codes and served to the panelists at a round table. Between the samples, the panelists had a 5 minute waiting period and palate cleaners to neutralize the flavors of the previous sample before continuing. The panelists discussed the flavors, focusing on the flavor imparted by the smoking process. Flavor attributes associated with the raw product were not discussed.

Development and Description of the Lexicon

The panelists revisited all the attributes they discussed on each product and narrowed down the list so that it only consisted of attributes that were related to smokiness. Definitions were written and common place references were found for each attribute.

Validation

The panelists evaluated 16 products (some unsmoked) based on the proposed lexicon and a Principal Component Analysis was run on the data to make sure each attribute was necessary.

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OBJECTIVES

The objective of this study was to determine and define the sensory attributes contributing to smoked flavor in a variety of foods and determine references to standardize those terms.

Smoky:	An acute pungent aromatic that is a product of combustion of wood, leaves or non-natural product. References: Diamond Smoked Almonds = 6.0 (a), 5.0 (f) Wood Ashes = 5.0 Preparation: Obtain ashes from burned wood (from fireplace or outdoor fire pit). Place ashes in 2 oz. glass jars with screw-on type lids. Fill jars approx. 1/3 full. This may be prepared several days in advance and stored at room temperature, tightly sealed. Prepare one jar for every 3 participants. These will be shared for smelling only.
Ashy:	Dry, dusty, dirty smoky aromatics associated with the residual of burnt products. Reference: Gerkens Midnight Black (BL80) cocoa Powder = 3.5(f) Preparation: Mix ¼ tsp of cocoa powder with 100 ml of water. Serve in 1 oz. cup.
Woody:	The sweet, brown, musty, dark aromatics associated with a bark of a tree. Reference: Diamond Shelled Walnuts = 4.0 (f) Preparation: Serve walnuts in a 1 oz. cup.

Example: 3 of the 14 attributes with their definitions and references

Eigenvectors				
Attribute	PC1	PC2	PC3	PC4
Smoky	0.133744	0.376281	0.192615	0.188221
Ashy	0.306962	0.328767	0.120942	-0.08389
Woody	0.224889	0.402062	0.205225	0.123446
Musty/Dusty	0.095717	0.4968	-0.03735	-0.15151
Musty/Earthy	0.067716	-0.15932	-0.05985	0.660541
Burnt	0.322428	-0.28612	0.294049	-0.15532
Acrid	0.315069	-0.0719	0.368692	-0.21251
Pungent	0.313603	-0.13281	-0.35047	0.177985
Petroleum-Like	0.102975	0.233039	0.12022	0.457391
Creosote/Tar	0.309963	-0.24415	0.081881	0.271616
Cedar	0.322428	-0.28612	0.294049	-0.15532
Bitter	0.359005	0.02156	-0.20127	-0.04185
Metallic	0.247849	0.117308	-0.49646	-0.27024
Sour	0.347892	-0.04247	-0.40169	0.013217

Table 1: The eigenvectors for Principal Components 1-4. The major drivers of each attribute are in bold.

CONCLUSIONS

Fourteen attributes were used in the lexicon: Smoky, Ashy, Woody, Musty/Dusty, Musty/Earthy, Burnt, Acrid, Pungent, Petroleum-Like, Cedar, Creosote/Tar, Bitter, Metallic and Sour. We believe the lexicon developed in this study is general enough to be used for any study involving smoked foods.

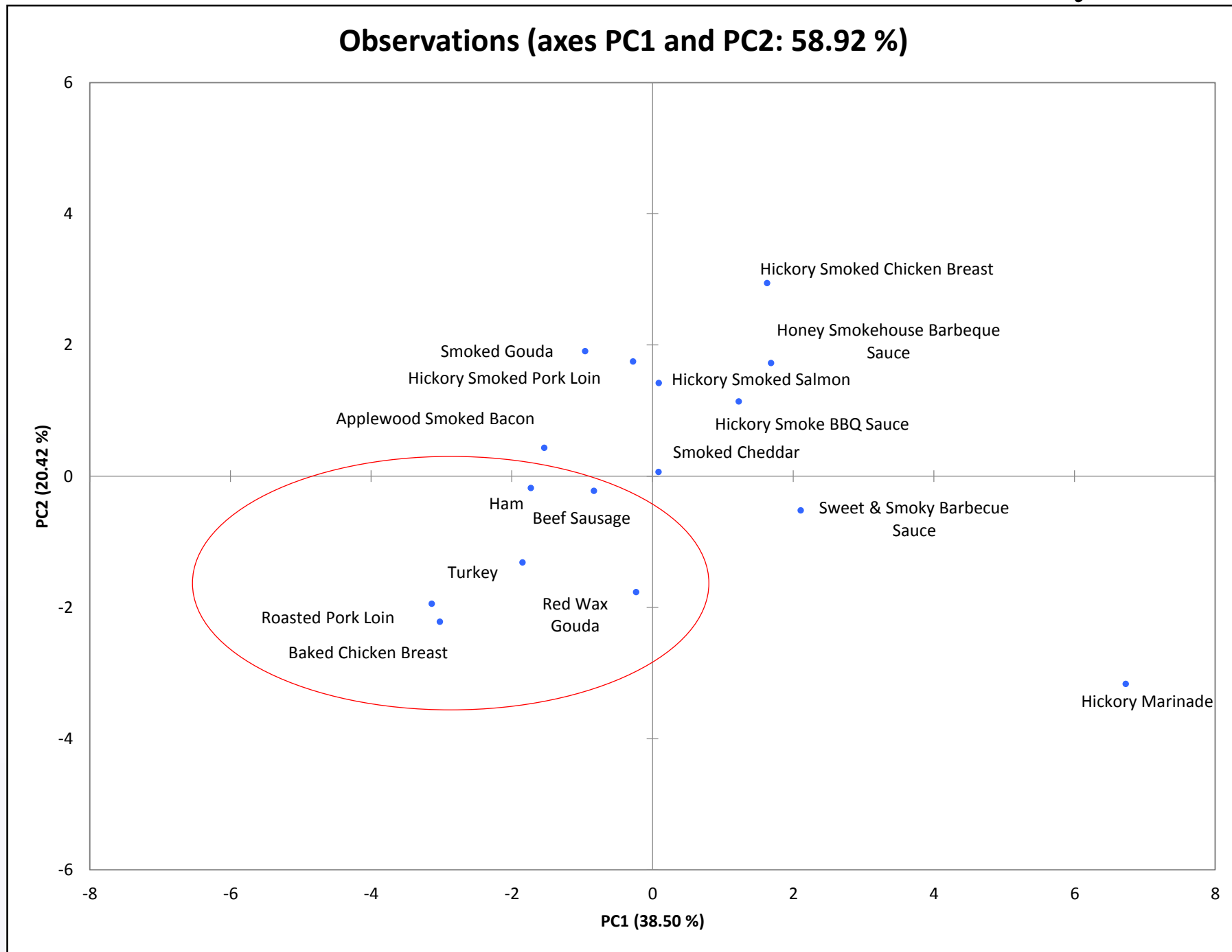
RESULTS AND DISCUSSION

After 25 sessions of lexicon development, 14 attributes were generated along with definitions and references for each. Some of the attributes already have published definitions and references (Sanchez Alan 2015) for other applications, which the panelists found appropriate for this as well, otherwise new definitions were written.

The panelists originally had smoke from different types of wood on the lexicon (Hickory, Mesquite and Fruitwood). When trying to create definitions for these attributes, no correlations could be found between products smoked using the same wood, so those attributes were discarded. Cedar, which is on the final lexicon, refers to the wood itself, not the smoke.

References consist of market products, chemicals and solutions. These references anchor a 0-15 point scale at 0.5-increments. The validation was successful. Products were differentiated as seen in Graph 1. The unsmoked products are coupled together on the graph.

The principal component analysis that was run on the data from the validation showed that all 14 attributes were necessary.



Graph 1: Validation Results. PC1 vs PC2. All of the unsmoked samples are in the red circle.

REFERENCES

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