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A COMPARISON OF GREEN TEAS FROM AROUND THE WORLD

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Abstract

The objective of this study was to determine what flavor differences exist among a wide range of green teas (n=138) produced in various countries. Green teas can be grouped based on their flavor profiles. **The country of origin** appears to have a strong influence on the flavor of green tea probably because similar **processing methods** are widely used within each particular country and flavor is dependent, in part, on processing. In this study we found that roast-processed teas were mostly responsible for brown-related flavors and steam-processed teas were responsible for green-related flavors. The **prices** of the green teas did not differentiate the flavors of the samples. Often highly priced green teas were grouped with low-priced green teas from the same manufacturer or country of origin according to their flavor attributes. Differences in the **tea plant varieties** or cultivars seem to affect the flavors in green tea. However, those were not known for many samples in this research and more study will be needed to determine the effects of specific differences in varieties or cultivars.

Introduction

The flavor of green tea may differ due to the differences in tea plant varieties, regions of origin, climates, harvesting seasons, processing methods, and other factors (Xu & Chen, 2002). However, only limited data on the flavors of green tea were found and that information mostly discussed Korean teas.

The **objective** of this study was to evaluate a large group of green tea samples, focusing on brewed leaf green tea to understand the sensory differences that exist among a wide range of green tea samples that vary in countries of origin, prices, varieties and cultivars, and manufacturing methods.

Materials and Methods

Green tea samples from 9 different countries:

China (n=46)	India (n=6)	Japan (n=40)
Kenya (n=3)	Korea (n=31)	Sri Lanka (n=4)
Taiwan (n=4)	Tanzania (n=1)	Vietnam (n=1)

2 samples of unknown origin

Green tea samples varied in:

Manufacturing methods : steaming, roasting, baking, hand processing, machine processing, crushing, rolling, and/or tying leaves together into bunches

Price range: ~ USD 2/100 g to + USD 400/100 g

Sample Evaluation

A modified flavor profile method

A 0-15 point scale was used with 0.5 increments

Statistical analyses

The number of times an attribute was detected was recorded.

Principal components analysis

Cluster analyses

Using the raw scores or the principal component

Methods: Centroid (central distance measures), Wards (minimum variance method), and K-means clustering

Results and Discussion

Flavor attributes describing green teas

Thirty-one attributes were used to describe the teas. Bitterness was detected in all samples. Brown, astringent, and green attributes were present in more than 75% of samples. Some attributes, such as beany, Brussels sprouts, celery, green herb-like, brown spice, nutty, almond, animalic, citrus, fermented, floral/perfumy, grain, medicinal, and mint, were used in less than 10% of the samples, often providing unique, characterizing flavors to those samples.

Cluster Analyses

Green tea flavors differ and can be grouped based on their flavor profiles.

Cluster analysis (*PC Scores*):

16 groups and the sizes of clusters varied

Provided information on what flavors are common in green tea

Cluster analysis (*Raw flavor intensity data*):

22 clusters of green teas, with more individual clusters

Only six clusters had 10 or more tea samples in the clusters &

16 clusters had less than 10 samples in each cluster

groupings based on the individual flavor profiles and better at defining unique teas or identifying outliers

Processing methods or the countries of origin seemed to influence the flavor of green teas the most.

The roast-processed teas responsible for brown-related flavors

The steam-processed teas responsible for green-related flavors

Chinese samples: mostly roast-processed, higher brown flavors

Japanese samples: mostly steam-processed with a few exceptions, more green flavors

Korean samples: either roast-processed or steam-processed

Prices of green teas did not differentiate the flavors of the samples.

Conclusion

This research also suggests that green teas could be developed, marketed and sold to meet the needs of many different consumers. The clusters found in the this study could be used as marketing segments for green tea, enabling consumers to select teas that meet their personal flavor preferences. These findings may help green tea processors, marketers, retailers and ultimately consumers better understand the green tea choices they have.

References

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