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Developing a milk coffee flavor wheel for Japanese consumers

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Materials/Methods

1. Sample preparation

Sixty samples were prepared with combinations of the parameters below:

- Coffee beans: Brazil no. 2, Colombia Supremo, Ethiopia Sidamo G4, Indonesia Mandheling G1, Vietnam robusta G1
- Roasting degree: L value = 18 or 23
- Sugar content: 0% or 2.3%
- Composition: milk-rich type (70% milk and 1 shot of coffee) or coffee-rich type (40% milk and 2 shots of coffee)
- Milk fat content: full-fat (8.3% milk-solids nonfat and 3.5% milk fat) or low-fat (8.4% milk-solids nonfat and 1.5% milk fat)

2. Collection of terms

Samples were presented to 203 consumer panelists and terms were collected by freely describing the flavor characteristics.

3. Screening of terms

Collected terms were selected using the following 2 steps:

- Qualitative screening:
  Twelve experts in the development of beverage products excluded terms deemed unnecessary in describing the flavor characteristics of milk coffee.
- Quantitative screening:
  Terms used less than 0.5% of times were excluded.

4. Validation and finalization of terms

A check-all-that-apply (CATA) method using the terms was applied to the analysis of 6 milk coffee samples (Table 1) by 74 consumer panelists. Cochran's Q test and correspondence analysis were performed using XLSTAT 2019 (Mindware Inc., Japan).

5. Organization of the flavor wheel

Collected terms were arranged into a hierarchical and circular structure through discussions among 12 experts.

Table 1. Samples for CATA

	BL18	BL18-2	BL23	BL18S	EL18	EL23
Full-fat milk*	70.0	40.0	70.0	70.0	70.0	70.0
Coffee extract						
Brazil no. 2 L18	20.0	40.0	—	20.0	—	—
Brazil no. 2 L23	—	—	20.0	—	—	—
Ethiopia Sidamo G4 L18	—	—	—	—	20.0	—
Ethiopia Sidamo G4 L23	—	—	—	—	—	20.0
Sugar	—	—	—	2.3	—	—
Water	10.0	20.0	10.0	7.7	10.0	10.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

* Milk-solid nonfat: 8.3%, Milk fat: 3.5% (Units: g)

Introduction

Coffee is consumed in various styles, such as black or with milk and/or sugar. Flavor wheels for black coffee (e.g., Hayakawa et al. 2010, Spencer et al. 2016) are useful for describing flavor characteristics, but are not applicable to milk coffee.

The purpose of this study is to develop a milk coffee flavor wheel for Japanese consumers.

Results

- **53 terms describing the flavor characteristics of milk coffee were collected from Japanese consumers.**
- **The samples were discriminated using multiple combinations of the 53 CATA terms (Figure 1).**
- A total of 456 terms were initially collected.
- Quantitative and qualitative screening resulted in the selection of 53 terms.
- As a result of CATA, all terms were used at least once (data not shown).
- For 42 terms, there were significant differences among samples in the frequency of use (Cochran's Q test).

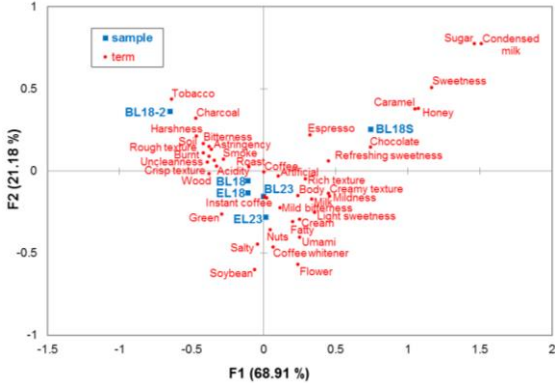

Figure 1. Correspondence analysis of CATA data. Of the 53 terms, the terms that showed significant differences among the samples are shown ($p < 0.05$).

Conclusions/Perspectives

- **The results suggested that the 53 terms were appropriate for consumers to describe the flavor characteristics of milk coffee.**
- **A milk coffee flavor wheel for Japanese consumers was created using these terms (Figure 2).**
- Further study of correlations between terms is required to optimize the position of terms on the flavor wheel.
- Japanese consumers can describe a variety of flavor characteristics of milk coffee using the wheel.

Figure 2. Milk coffee flavor wheel for Japanese consumers

References

- Hayakawa et al., 2010, *Journal of Sensory Studies,* **25**(6), 917-939 DOI:10.1111/j.1745-459X.2010.00313.x
- Spencer et al., 2016, *Journal of food science,* **81**(12), S2997-S3005 DOI:10.1111/1750-3841.13555