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A Trial to Define the Output of Taste Sensing System Applied to Beef Extracts

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1. Background:

Taste is an important factor to consumer's food choice. Sensory test and chemical analysis have been carried out to evaluate beef taste. However, trained panels are requied for reliable sensory test. Furthermore, the sensory traits of beef could not be explained clearly by chemical analysis. The development of simple system to evaluate beef taste is needed, which is based on human's palatability and has objectivity and repeatability.

In previous study, Nakai *et al.*(1998) applied taste sensing system to beef extract which successfully distinguished the taste of Japanese Black steers (Wagyu), Holstein steers, and imported beef. The taste sensing system including eight sensor probes; each probe was made by different fatty acid menbrene transducer, and the responce of sensor probe is different from each other. The electrical output of eight probes was subjected to principal component analysis. But in the previous study, the meanings of principal compontnts (PCs) could not be defined.

On the other hand, the taste of beef extracts are constructed with whole intensity of taste and individual traits of beef. Development of method to define the PCs as these factor is needed to evaluate beef taste with taste sensing system.

2. Objectives:

In this study, we applied beef extract to taste sensing system and tried to define the output of taste sensing system by principal component analysis.

3. Methods:

3.1. Sample preparation

Gluteus medius muscles from three kinds of beef (Wagyu, Holstein steers, and imported beef) were used. 100g of beef minced twice. The minced sample was boiled with 0.9 L of water and filtered by filter paper (Karita No.103 and Advantec No.131). The filtered solution was applied to taste sensing system.

3.2. Beef extracts dilution and application to taste sensing system

The beef extracts were diluted to detect PCs meaning whole intensity of taste by teste sensing system. Dilution was occured with water to the ratio of 1/2 and 1/10 from basal extracts. The diluted extracts were applied to taste sensing system (Anritsu Co. SA402) with eight kinds of sensor probe. Beef extracts were applied to taste sensing system for three times of one extract.

3.3. Principal component analysis

Data collected from eight sensor probes were subjected to principal component analysis.

4. Results and Discussions:

Table 1 shows proportions of principal component analysis. Values of PC1 were increased from 0.634 to 0.915 and 0.985 by addition of sensor output data from diluted samples at the ratios of 1/2 and 1/10, respectively.

The result of principal component analysis applied to three kind of beef extracts at the diluted ratio of 1 is shown in figure 1A. X and Y dimensions indicate PC1 and PC2, respectively. Extracts were distinguished in this result, but the meanings of PC1 and PC2 could not be defined.

Figure 1B shows the result of principal component analysis subjected to sensor output from extracts diluted at the ratio of 1 and 1/2. Proportion of PC1 was 0.915, and PC1 values related to dilution ratio. It suggested that meanings of PC1 was whole intensity of taste. Each value of PC2, the proportion was 0.077, was different from other samples and other trial. It suggests that PC2 means individual traits of samples or driftage of sensor output.

Figure 1C shows the result of principal component analysis subjected to sensor output from extracts diluted at the ratios of 1,

1/2 and 1/10. Proportion of PC1 was 0.985. The values of PC1 related to dilution ratio. It suggested that the meanings of PC1 was whole intensity of taste. Each value of PC2 was different from other extracts and other trial in figure 1C. However, the proportion was low (0.011) to define the meanings of PC2. These sensor outputs from beef extracts diluted at the ratios of 1, 1/2 and 1/10 were well explained by only PC1.

In this study, sensor analysis was made for 3 times of each sample. The values of PC, especially PC2, were drifted from each trial of sensor analysis. It was suggested that the driftage of values were derived from adsorption of substances to sensor probes.

The proportion of PC2 was 0.077 and 0.011 in the results shown in Table 1. It suggested that use of diluted samples at the ratio of 1/2 with not-diluted samples was good to define the meanings of both PC1 and PC2. Sensor analysis with more samples, minimize of sensor driftage and examination of relationship between sensory test and the values of PC2 are needed to define the meanings of PC2 more clearly. Furthermore, development of standard solution is also needed to calibrate values of PCs for evaluattion of beef taste with taste sensing system.

5. Conclusions:

We applied diluted beef extracts to taste sensing system, and distinguished the extracts. We could define the meaning of PC1 as whole intrensity of taste by principal component analysis. It was suggested that PCs could be defined with using diluted sample at the ratios of 1 and 1/2 by using of taste sensing system to beef extracts.

6. Pertinent literature:

Nakai, H., Ikezaki, H., Sato, K., Sasaki, K., and Mitsumoto, M. 1998. Application of Taste Sensing System to Beef. *Proceedings of 44th ICoMST*. 592-593.

Table 1. Proportions of principal components

Dilution ratios	Proportions of principal component (PC)		Cumulative proportion of PC1 and PC2
	PC1	PC2	
1	0.634	0.292	0.926
1, 1/2	0.915	0.077	0.991
1, 1/2, 1/10	0.985	0.011	0.996

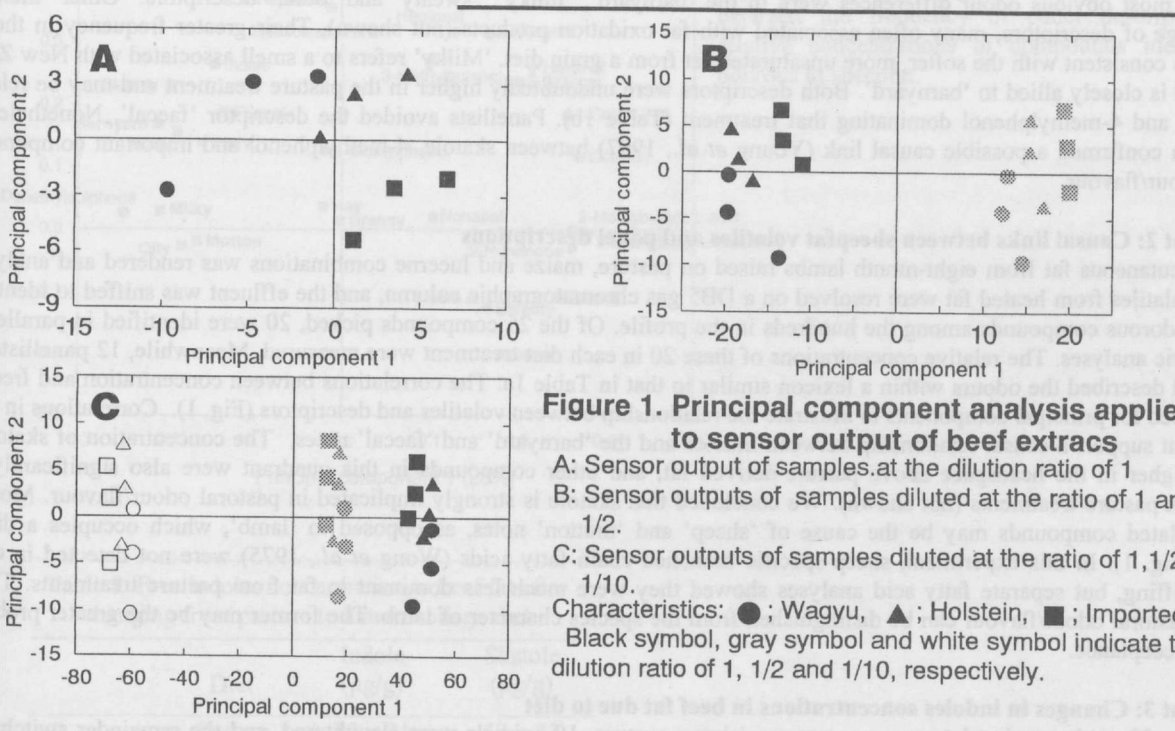

Figure 1. Principal component analysis applied to sensor output of beef extracs

A: Sensor output of samples.at the dilution ratio of 1
B: Sensor outputs of samples diluted at the ratio of 1 and 1/2.
C: Sensor outputs of samples diluted at the ratio of 1,1/2 and 1/10.
Characteristics: ●; Wagyu, ▲; Holstein, ■; Imported beef. Black symbol, gray symbol and white symbol indicate the dilution ratio of 1, 1/2 and 1/10, respectively.