

## 外国語要旨

### **Analysis of intraoral sensations using individual evaluations of palatability**

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This study examined the intraoral sensations related to appealing flavor, focusing on the textures, particularly roughness and smoothness, resulting from the food particles, as well as on the intensity of the flavors, such as flavors that are “too light” or “too salty.” Using samples of prepared foods and a model system, the primary factors related to the intensity and desirability of the perceived sensory characteristics were clarified. Group and individual preference trends regarding texture and flavor intensity were also compared, and an attempt was made to create a new method of evaluating palatability incorporating both viewpoints.

First, granular sensation, the texture related to the particles composing the food, was examined, and the primary causes of granular sensation were identified using potato potage (soup), azuki bean paste, and chicken soboro (ground-chicken bowl). As a result, the main causes of granular sensation were identified as food grain size and shape, water content, viscosity, hardness, and temperature.

Then, samples composed of microcrystalline cellulose particles and dried powdered red bean paste suspended in dispersion media such as water purified via reverse osmosis and xanthan gum solution were used as “particle sensation models” to individually examine the impacts of a variety of primary factors influencing granular sensation and a food’s palatability. When the impact the characteristics of a food’s grains had on granular sensation was examined, it was found that the intensity of the granular sensation and the food’s palatability had a significant correlation with the median grain diameter, grain roundness, standard deviation of the coefficient of friction, and maximum coefficient of friction. Additionally, the intensity of the granular sensation weakened with the viscosity of the dispersion medium and strengthened with palatability. Among samples with identical grain density, the intensity of the granular sensation was evaluated to be higher for samples with medium viscosity than for samples with high or low viscosity. A connection to a decline in granular sensation caused by the grain coating and the length of the intraoral retention time stemming from the viscosity of the dispersion medium was also noted. Furthermore, when the impact of the flavor of the dispersion medium was examined, it was found that the sweetness of granulated sugar and the saltiness of table salt lessened the granular sensation, while sourness intensified the granular sensation. On the other hand, in model samples where the dispersion medium was scented using strawberry, lemon, or vanilla extract, there was no clear difference in the intensity of granular sensation or palatability, and the impact on the perception of granular sensation was minimal. Furthermore, when the temperature of the model system samples was regulated to one of three temperatures, a low temperature, room temperature, or a high

temperature, it was found that the intensity of granular sensation for high-temperature samples was significantly lower than that of the room-temperature or low-temperature samples, clarifying that the sample temperature impacts the granular sensation.

Based on the results of the above study using the model system samples, the impact of differences in pulverization conditions, flavoring, and temperature on intraoral sensations, such as granular sensations of the samples were examined using carrot puree. When the impact of differences in pulverization conditions was examined, it was determined that the grain size in the carrot puree also had a large impact on the texture perceived intraorally. The smoothness of the carrot puree increased as flavoring was added via granulated sugar; however, when citric acid was added, no impact on the intensity of granular sensation or smoothness was observed. When the impact of the sample temperature on the carrot puree's intraoral sensation was examined, no significant relationship between viscosity and the intensity of granular sensation or smoothness was found.

Additionally, in order to identify trends in individual taste preferences regarding the intraoral sensation of carrot puree, ratings of the intensity of granular sensation and desirability of carrot puree samples featuring five different pulverization conditions were plotted for each panelist and subjected to single regression analysis. The results demonstrated that preference trends among panelists could be classified into four groups: falling, rising, inverted U-shaped, and U-shaped. The desirability of granular sensation and overall desirability were found to conform to different trends among panels with a descending-curve preference trend and panels with an ascending-curve preference trend. This demonstrates a need, particularly when performing sensory evaluations of preference models, to focus not only on average ratings from an overall panel but also on understanding separate preference trends among panelists before turning one's attention to the sensory evaluation results.

Therefore, to focus on flavor, one major factor in food desirability, foods in which the amount of flavoring was changed in a graduated manner were used as model foods for measuring preferences regarding flavor intensity. The effectiveness of this method was evaluated using a paper questionnaire and sensory evaluation.

First, the J-PrefQuest questionnaire was created. In this questionnaire, photos of model foods such as jam or soy sauce, where the amount of flavoring was changed in a graduated manner were presented; participants were asked to select the amount of flavoring they thought was the most appropriate. Flavorings and recipes capable of reflecting preferences regarding fatty, salty, sweet, and umami flavors were selected, yielding a total of 17 model foods. Photographs of model foods in which the amount of flavoring had been changed to conform to one of three levels were taken, and the J-PrefQuest questionnaire was created.

To examine whether J-PrefQuest could be used with a pool of Japanese panelists, the

questionnaire was provided to 161 general consumers. As a result, it was confirmed that it was easy for general consumers in Japan to use the J-PrefQuest question format to supply their responses, and J-PreQuest demonstrated itself to be capable of classifying consumers according to their taste preferences using cluster analysis.

Next, in order to provide a more accurate measurement of individual preference trends regarding flavor intensity, 70 female students were asked to use the J-PrefQuest questionnaire to provide sensory evaluations of the desirability of the flavor of six model foods by tasting samples that had been adjusted to five different levels of flavoring. Based on the obtained results, attempts were made to calculate the presumed optimum amount of flavoring for each panelist. Using the five model foods, it was possible to determine the presumed optimum amount of flavoring for over 70% of the panelists. Additionally, when the same panelists were given a questionnaire using J-PrefQuest, the amount of flavoring they deemed desirable based on looking at photographs and their presumed optimum flavoring amounts determined using sensory evaluations were compared to identify correlations. As a result, it was determined that the desirable flavoring amount as evaluated by panelists using photos of model foods might be under- or overestimated and might not reflect their true preferences regarding flavor strength. Therefore, it is suggested that while it is effective to use J-PrefQuest as a simple means of classifying group preferences, it has its limits as a method of understanding preference trends at the individual level.

Individual preferences regarding flavor were also measured via a sensory evaluation using samples gradated based on different flavor intensities; using these results, individual preference trends regarding flavor intensity were then classified into five patterns. It was suggested that examining these individual-level preference trends could reveal new information for developing highly palatable foods.

Based on the above findings, it is clear that the use of a model system applicable for a variety of foodstuffs is effective for examining the impact food characteristics have on the palatability and the intensity of sensory characteristics of foods. It is also clear that by performing sensory preference evaluations using different samples gradated based on flavor or texture, it is possible to understand and classify individual and group preference trends.