Projective mapping and descriptive analysis of commercial fish floss in Yogyakarta Region

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Abstract. This study aimed to determine the quality of commercial fish floss in the Yogyakarta region based on the similarity and dissimilarity in the dominant spices perceived by panelists. Projective mapping (PM) or napping has attained much attention in recent literature as a method for fast sensory profiling and measurement of consumer perception. Configurations from PM have been shown to provide similar product maps. Observation of projective mapping was carried out on ten commercial fish floss using 80 untrained panelists. Panelists were instructed to group samples according to their perception in a sheet flat area 60 x 60 cm

The result of the study was able to detect 12 flavored spices obtained; samples were scattered in four groups of dominant herbs. Fish floss AK, KF_T, and DE contain nutmeg, turmeric, tamarind, and ginger as the dominant flavor. The brands N_S, TS, and SM exhibit dominant taste of fish flavor, candlenut, lemongrass, and a slight chili. N_L, SR, and KF_L had the dominant taste of bay leaves, coriander, cutcherry, and chili. SF_S brand had a dominant flavor of galangal. The result of this study can be used as a reference for the development of the fish floss industry in the Yogyakarta area for new industries and the destination of new products from various raw materials of fish.

1. Introduction
Fish floss is a fish product which is processed by steaming and frying. Various spices are added to produce good taste and prolong the shelf life. Fish floss is generally marketed in various types of packaging to maintain product quality [1]. It is important to pay attention to the physical aspects of food and marketing new products to give a good impression of quality. This will have an impact on understanding the desires of consumers to buy products on the market [2]. Trained panelists and quantitative descriptive analysis are usually chosen to determine the character of the product's sensory characteristics. In the food industry, the time needed to obtain trained panelists for a series of product tests is an issue that needs to be resolved. So there is a need of a way to find answers quickly from consumer products without the need to train these panelists [3].

Projective mapping (PM) or napping is a method in sensory testing that is popularly used to determine the character of the product being tested. PM is preferred because the implementation procedure is simple but effective to determine the overall differences between samples [4]. The basis of the PM method is to identify and characterize product samples with similar (dis) characteristics [5]. In general, PM panelists are asked to use the overall similarity of characteristics in the sample, both in terms of sensory value, preference, or other aspects of the food field, to place the position of the
sample in the sheet [6]. Projective mapping or flash profile is impressive because it does not require panelist training [7] because achieving consensus among trained panelists on descriptive sensory testing will be difficult for some types of product [8].

Fish floss is one of the important fish products in the city of Yogyakarta. Products sold have a variety of fish raw materials, both freshwater, and marine with a variety of spices. Most fish flosses are produced by home industries and packaged using plastic packaging, aluminum foil, or a combination of both with local market segmentation. Mapping of fish floss products in the city of Yogyakarta using PM is expected to give an idea of the characteristics of fish floss products that consumers are interested in.

2. Material and methods

2.1. Sample and sample preparation

Ten fish floss products were selected as samples, taken from several retail stores in the city of Yogyakarta (table 1). All fish floss samples were the products of small and medium enterprises, most of which come from Sleman Regency. Fish floss was the final product and can be consumed directly, so that presentation to the panelists was done directly. Several fish floss samples (10 ± 2 g) were placed on small cups gave a three-digit random number and immediately prepared when the test to be carried out. Panelists tasted the fish floss samples that were served and asked to assess the mapping sheet.

Table 1. Information on fish floss samples

| Brand | Composition* | Production |
|-------|--------------|------------|
| N_S   | Salmon, mahi-mahi, spices, cooking oil, palm sugar, salt | Nayaru, Sleman |
| KF_L  | Catfish, spices, cooking oil | Khansa Food, Sleman |
| KF_S  | Salmon, spices, cooking oil | Khansa Food, Sleman |
| SM    | Freshwater pomfret, spices, cooking oil | Nayaru, Sleman |
| AK    | Tuna, spices | Kenanga, Yogyakarta |
| TS    | Tuna, spices | LJF, Boyolali |
| SR    | Catfish, cooking oil, salt, and cooking oil | Sari Rasa, Sleman |
| N_L   | Catfish, spices, cooking oil, palm sugar, salt | Nayaru, Sleman |
| DE    | Tuna, spices, salt | Abon Daun Emas, Sleman |
| KF_T  | Tuna, spices, cooking oil | Khansa Food, Sleman |

*) The composition is taken from the information written on the packaging label.

2.2. Panelist

A total of eighty untrained panelists aged 20-29 years (men, n = 32 and women, n = 48) were taken from local communities and were familiar with and used to consume fish floss products. This was done to ensure that panelists were familiar with the character of fish floss and knew the main spices commonly used as seasonings. Panelists were people who were interested and willing to participate in this test.

2.3. Procedure

2.3.1 Hedonic Test. Panelists were asked to taste the fish floss samples and expressed their preference for product appearance, aroma, taste, and texture. Hedonic test assessments used a scale of 1-5, with a score of 1 = very dislike; 2 = dislike; 3 = rather like; 4 = like; and 5 = really like.
2.3.2. **Projective mapping.** Panelists were asked to taste each product sample and wrote down descriptions of the sensory characteristics that emerged. Panelists put each product sample on a square sheet of paper measuring 60 x 60 cm by the description felt by the panelist. Samples of products that were considered to have similar sensory properties were placed close to each other, and vice versa. If the sample was considered to have differences, the sample was placed apart from each other. Panelists were allowed to change the position of the sample to confirm the assessment. After the final and no changes, the panelists were asked to write down the three-digit numbers of each sample on the sheet of paper. Panelists were then asked to group groups of samples that had sensory similarities. Once grouped, panelists conducted ultra-flash profiling [9] freely writing descriptions of the sensory properties of the groups that have been determined.

2.4. **Statistical analysis**
Hedonic data were analyzed using Kruskal Wallis and the Mann-Whitney method. PM data were processed using multiple factor analysis (MFA) and hierarchical cluster analysis (HCA) using SPSS (version 20, IBM, Chicago, IL, USA). MFA was used to project data of each panelist and brought up a perception map of the product and sensory characteristics felt by the panelists [10].

3. **Results and discussion**
The implementation of the projective mapping to find out the sensory characteristics of fish floss products takes place more easily and quickly. PM or also known as 'napping' is a method of free profiling tasks based on techniques to build their vocabulary from panelists [11]. PM is also known as a method that can be used quickly to obtain a complex mapping of products tested. Another advantage obtained from this method is that it is potentially used as a consumer research tool to gather relevant vocabulary and direct feedback from consumers [1]. The sensory characteristics of 10 samples of fish floss from the PM, along with hedonic test scores are presented in table 2.

| Samples  | General Characteristics          | Panelist preference score* |
|----------|---------------------------------|----------------------------|
| N_S      | Fish flavor, candlenut, lemongrass | 3.6b                      |
| KF_L     | Chili, coriander                | 4.3c                      |
| KF_S     | Galangal                        | 3.58b                     |
| SM       | Lemongrass                       | 3.64b                     |
| AK       | Ginger                          | Na                        |
| TS       | Candlenut, fish flavor, lemongrass | Na                       |
| SR       | Coriander, Cutcherry            | 4.12bc                    |
| N_L      | Coriander, Bay leaves           | 3.7bc                     |
| DE       | Tamarind                        | Na                        |
| KF_T     | Ginger, tamarind, nutmeg, turmeric | 2.82a                   |

*) The score was the panelist's preference level for the product on a scale of 1 - 5, score 1 = very dislike, and score 5 = very like. Values followed by different letters indicated a significant difference (P<0.05). Na = product sample was not available temporarily when the test was carried out.

The panelists detected the aroma of spices used as fish floss seasonings, including the smell of fish, candlenut, lemongrass, chili, coriander, galangal, ginger, cutcherry, bay leaves, tamarind, and turmeric. The aroma of these spices appeared quite strong because it was commonly used as the main ingredient in making fish floss. Some herbs such as coriander, garlic, palm sugar, tamarind, galangal, bay leaves, and turmeric are ingredients commonly used as fish floss spices [12]. The preference of the panelists for the samples showed that there was a significant difference in the aroma, taste, and texture of the fish floss. The appearance of fish floss did not show significant differences. The highest hedonic score
of fish floss was indicated by KF_L, which was not significantly different from SR and N_L. This most preferred product shows that consumers prefer freshwater fish floss than marine fish floss. This was due to the floss of seawater fish having a fishy aroma that consumers did not like.

The Biplot MFA obtained (Figure 1) from the statistical test illustrated the sensory space produced by the panelists. The variance shown was 39.85% (F1 = 21.77%; F2 = 18.08%). The plot results showed that the fish floss samples were almost evenly distributed, with the ideal proportions being shown by samples of SM products.

**Figure 1.** Biplot MFA sample products from PM data along with hedonic scores. Description: values followed by different letters indicate a significant difference (p < 0.05).

MFA results from 10 fish floss samples and sensory characteristics determined by panelists (Figure 2) showed a total variance of 39.85% contributed by F1 (21.77%) and F2 (18.08%). This value was low because it was a characteristic of a PM that uses untrained panelists. Three descriptive tests, namely QDA, flash profiling, and projective mapping were done, and the most significant variance results were QDA, followed by FP and PM [1]. The PM results were the lowest because the characterization results obtained were the direct result of sample mapping in sheets. While for FP, panelists were asked to bring up terminology between samples, and QDA had the highest score because the results obtained were the consensus from trained panelists.

MFA fish floss showed the relationship between samples with the strongest attributes sensed by panelists. Scents that are more often detected by panelists will be in the middle area of the MFA and vice versa, the less detected will be located outside the MFA. Ten samples of fish floss products were divided into four groups of the most dominant sensory characteristics. Samples of DE, AK, and KR_T were found in the F1 positive axis and the positive F2 axis (quadrant 1), owing to the character of ginger, tamarind, nutmeg, and turmeric. The KF_S sample was found in the F1 negative and F2 positive axis (quadrant 2) having galangal aroma character. The N_L, SR, and KF_L samples were found in the negative F1 and F2 axis (quadrant 3), having the characteristics of coriander, cutcherry, chili, and bay leaves. Samples of SM, TS, and N_S were found in the F1 positive axis and negative F2
axis (quadrant 4), dominated by the character of lemongrass, candlenut, and fish flavor. The MFA result associated with hedonic scores showed that the fish floss products favored by the panelists were products that were in the quadrant three which have the dominant character of coriander, cutcherry, chili and bay leave aroma.

![MFA plot of 10 commercial fish floss samples in Yogyakarta](image)

**Figure 2.** MFA plot of 10 commercial fish floss samples in Yogyakarta

From the MFA plot, there were four groups of dominant aroma characters in fish floss samples, with several overlapping plots. In the sample plots DE, AK, and KF_T in quadrant 1, the scent characters of ginger and tamarind were in the nutmeg and turmeric plots. This indicated that the aroma of tamarind and ginger was more specific to the sample than the aroma of nutmeg and turmeric; likewise, the lemongrass character in the sample plots SM, TS, and N_S was in quadrant 4. Meanwhile, the sample N_L, SR, and KF_L, which were in quadrant 3, showed an interaction between the aroma of bay leaves, cutcherry, and chilies, and bind to each other through coriander aroma. The KF_S sample plot had its character with the dominant galangal aroma and was not related to other scents. Each aroma of spices recognized by the panelist is a type of spice that had a strong aroma and often used in cooking. The spice with a strong smell made the aroma easily recognizable by panelists. The consumers will easily detect differences and assess the characteristics of a product if they are familiar with the product. Conversely, if consumers are not familiar with the product, they will have difficulty in detecting differences. This condition will affect the valuation position in PM [13].

Dendrogram results of HCA (figure 3) illustrated the closeness of the relationship between fish floss samples. Unlike the MFA plot results which was dividing the samples into four groups, the HCA dendrogram divided the sample into three groups. These three groups were distinguished based on the similarity of aroma detected by the panelists.
Figure 3. Dendrogram of hierarchical cluster analysis of fish floss samples from projective mapping

These result indicated that fish floss sold in the city of Yogyakarta had almost the same aroma character, and there were no samples that had a real dominant aroma. Although the tests conducted were able to categorize existing samples, the result of PM in this study was unable to show interactions of panelists' preference for fish floss samples. To get a better picture of PM results on panelists' preferences, further research was needed on the application of PM combined with consumer preference tests.

4. Conclusions
Projective mapping of commercial fish floss available and sold in the city of Yogyakarta divided the fish floss into four groups of dominant aromas. The PM implementation was relatively easy and inexpensive to find out the sensory characteristics of the fish floss. However, research combining the projective mapping with consumer preference test was needed to obtain a broader picture of the application of the PM to characterize the commercial fish floss.

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