

Kansei Evaluation of Natto Packages-Focusing on Text Mining and Color Analysis

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ABSTRACT

This study aims to visualize ambiguous package impressions of natto (fermented soybeans) and investigate the relationship between package characteristics and color and purchase intention. In this study, two analysis methods, color analysis and text mining were used to analyze the results. We used color analysis to investigate whether there is a relationship between natto packaging and color using cluster analysis. The text mining method investigated the relationship between purchasers' thoughts and natto packages. As a result, the color analysis showed a relationship between the impression and the color of the natto package, which made it possible to conduct a survey based on objective criteria rather than visually checking and concluding. In addition, text mining showed that six clusters were obtained as purchasers' thoughts and that these clusters influenced their willingness to buy.

Keywords: Natto, Package, Kansei evaluation

INTRODUCTION

In recent years, interest in Japanese food has spread around the world, and it has been reported that Japanese food is the number one preferred cuisine in the world. Then, interest in the packaging of Japanese food has also increased, and many studies have been conducted, such as a study on the packaging and color of Japanese sake and a study on the relationship between the impression of tea packaging and consumption behavior. In addition, more and more emphasis has been placed on package design from the viewpoint of marketing as well as research on packaging and purchase intention. However, even though package design can significantly impact buyers, there are few studies on the packaging of Japanese food materials. In Japan, natto is often sold in opaque containers. In this study, we conducted an impression evaluation of natto packages to visualize the packages' vague impressions and investigate the relationship between the characteristics of the packages and their colors and the willingness to purchase. In the previous studies, we have investigated the relationship between the impression of natto packages and their colors. In addition, we also investigated the relationship between the color of the package and the willingness to buy. We do the SD method with a total of 15 adjective pairs. Factor analysis resulted in 10 adjective pairs

Table 1. Results of factor analysis.

Adjective pairs		Factor 1	Factor 2	Factor 3	Factor 4
Healthy	Unhealthy	0.700	0.080	-0.154	-0.030
Tasty	Not Tasty	0.671	0.017	0.090	0.000
Childish	Mature	-0.246	0.644	-0.051	0.191
Soft	Hard	0.101	0.603	0.054	0.029
Warm	Cold	0.228	0.569	0.243	-0.014
Thick	Thin	0.092	0.074	0.651	0.151
Light	Heavy	0.101	-0.078	-0.649	-0.067
Fancy	Subdued	0.162	0.145	0.192	0.626
Unique	Ordinary	-0.088	0.036	0.120	0.561
Artificial	Natural	-0.326	-0.009	-0.104	0.372
Contribution		1.222	1.144	1.004	0.911
Contribution ratio		0.122	0.114	0.100	0.091
Cumulative contribution ratio		0.122	0.237	0.337	0.428

and four factors remaining. The results of the SD method and factor analysis (Table 1) showed that we could obtain four factors: “nature as food,” “stubbornness,” “blandness,” and “common sense. Among these factors, the factor of “stubbornness” was found to be related to color. The results of the normalized ranking method showed that there was no clear relationship between color and willingness to buy. However, there was a relationship between the SD method and the factor “nature as a food” obtained from factor analysis results. Therefore, it became clear that information obtained from the package, such as the impression that the food is healthy and looks delicious, leads to a desire to purchase.

In this study, we will use the SD method, factor analysis, and the normalized ranking method to conduct more detailed research. In addition, based on the questionnaire results obtained by the normalized ranking method, text mining will be used to investigate what purchasers specifically think about the purchase of natto.

Color Analysis

To objectively judge the color of the package, the area used for the package was investigated and visualized. In addition, the factor scores obtained from the factor analysis results were clustered to investigate whether there is a relationship with color.

Fig. 1 is a graph showing the percentage of color in each package, with one pixel representing 1%, and Fig. 2 is a bar graph showing the percentage to one decimal place. As a result of this analysis, black was emphasized subjectively in the package of “Nio-wa-Natto” (G), but the percentage of black and white was about half.

Fig. 3 shows the results of the cluster analysis. The left graph shows the package in the cluster analysis, and the right graph shows the package as a percentage square. The clusters are B and E, F, A and D, and G, C, and H when separated by a height of 1.5. The yellow package of F was included in the cluster of A and D, and G was included in the achromatic group.



Figure 1: Percentage of colors in each package (squares).

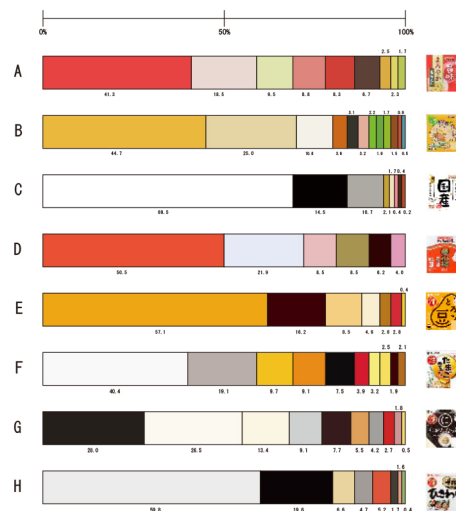


Figure 2: Percentage of colors in each package (%).

From the packages of F and G, it was found in this study that other colors are emphasized more than white, and white appears to be less than the actual ratio. However, by examining the ratios, it became possible to use a more objective criterion for the investigation rather than concluding by visual confirmation. In addition, it was found that overall, warm, and achromatic colors were the most common types of natto packages.

Based on the results of the factor scores obtained from the factor analysis, we conducted a cluster analysis and found that the impression of the package had something to do with the color.

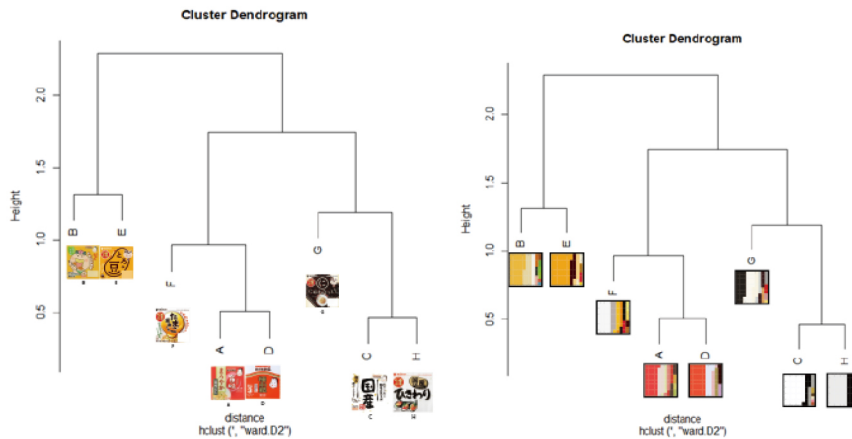


Figure 3: Results of cluster analysis.

Text Mining

Text mining was conducted based on why the respondents answered they wanted to buy the most by the normalized ranking method. The purpose is to investigate and visualize what words are frequently used and essential in choosing the most wanted to buy natto. The text mining tools KHCoder, and AI text mining were used for the analysis. The analysis was conducted using text data of 76 people as in the normalized ranking method. Then, some modifications were made not to change the semantic content. (Example. In addition, KHCoder performs forced extraction to extract compound words during preprocessing. (e.g., “Hika”, “Wari” → “Hikariwari”) This study investigated what words frequently appeared in the word cloud and what words appeared together in the hierarchical cluster analysis.

First, we created a word cloud and visualized the entire text data. The results are shown in Figure 4, sorted by frequency of occurrence. The colors of the words differ according to the part of speech: blue represents nouns, red represents verbs, and the green represents adjectives. In the graph ordered by frequency of occurrence (Figure 4), the words “delicious,” “eat,” and “package” appear frequently. Then, we created a word cloud for each brand. Figure 5 shows the results for Okame Natto in order of frequency of occurrence, and Figure 6 shows the results for the Kin-no-Tsubu series in order of frequency of occurrence. From Figs. 5 and 6, the words “eat,” “buy,” and “feel” appeared more frequently for Okame Natto, and the words “delicious,” “package,” and “eat” appeared more frequently for Kin-no-Tsubu.

The hierarchical cluster analysis (Fig. 7) resulted in the extraction of six clusters. Each cluster was then given a name to determine what kind of cluster it was. The words “good,” “product,” and “front” were used to denote the “goodness of the product. From the word “luxury,” “high quality. The words “package,” “look,” “eat,” “feel,” and “image” or “buyer’s impression of the package. The words “taste,” “think,” “buy,” “best,” and “see” indicate the “buyer’s point of view. Attributes of natto” from the words “big,” “grain,”

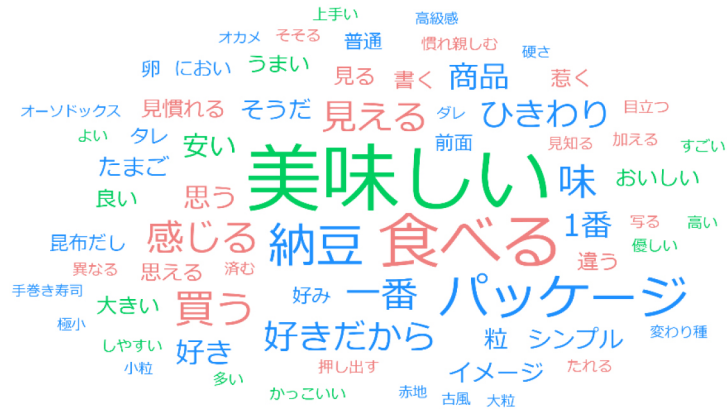


Figure 4: Results of word cloud (in order of frequency of occurrence).

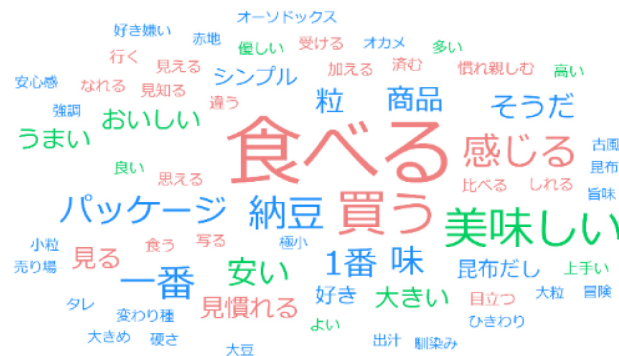


Figure 5: Word cloud by brand (Okame natto).

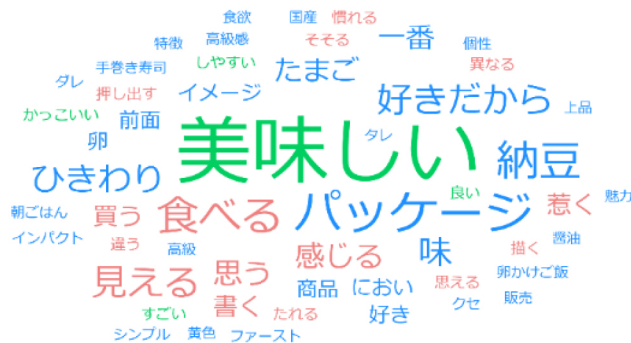


Figure 6: Word cloud by brand (Kin-no-Tsubu).

and “small grain.” The words “other,” “different,” “tare,” “normal,” and “attract” were used to name the “individuality of the product.” Therefore, we interpreted each cluster as “product quality,” “luxury,” “impression of the package by the buyer,” “buyer’s point of view,” “attributes of natto,” and “individuality as a product.” It became clear that these clusters influenced the purchase.

The graph (Fig. 4) in the order of frequency of occurrence shows that the words “delicious,” “eat,” and “package” appear frequently. However, the

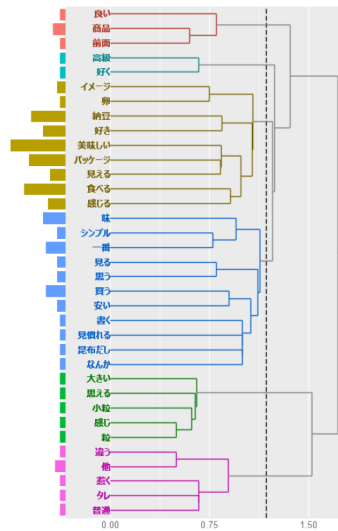


Figure 7: Hierarchical cluster analysis.

Table 2. Interpretation results for each cluster in hierarchical cluster analysis.

Words in Clusters	Interpretation
“Good,” “ Product,” “ Front”	Product quality
“Luxury”	Luxury
“Package,” “ Look,” “ Eat,” “ Feel,” “ Image”	Buyer’s impression
“Taste,” “ Think,” “ Buy,” “ Best,” “ See”	Buyer’s viewpoint
“Big,” “ Grain,” “ Small grain”	Natto attributes
“Other” “ Different,” “ sauce,” “ Normal,” “ Attract”	Product individuality

words “look,” “feel,” and “image” also appeared frequently, suggesting that making it easy to imagine what kind of product the natto is and how it tastes when eaten is related to purchasing. By brand (Figs. 5 and 6), it was suggested that there was a difference in the purpose of purchase: for Okame Natto, people buy natto to eat it, and for Kin-no-Tsubu, people buy natto because this natto looks delicious when they see the package.

The results of the hierarchical cluster analysis can be divided into two categories: “Product quality,” “Luxury,” “Natto attributes,” and “Product individuality” were strongly influenced by the package and natto itself. In contrast, “Buyer’s impression of the package” and “Buyer’s viewpoint” were strongly influenced by the buyer’s sensitivity. Table 2 summarizes the interpretation results of each cluster in the hierarchical cluster analysis

CONCLUSION

Finally, we will introduce the main results obtained in this study. In the color analysis, we investigated what colors are used in natto packages by visualizing the ratio of colors and whether the colors affect the natto packages. As a result, we found a relationship between the two. Text mining suggested that buyers’ impressions of the product and the purpose of purchase changed depending on the brand. The results of Experiment 2 suggested that

the buyer's impression of the product and the purpose of purchase changed depending on the brand. It was also suggested that the buyer's thoughts on the "best of the product," "luxury," "impression of the package," "buyer's viewpoint," "attributes of natto," and "personality of the product" affect the purchase. However, in this study, the analysis was conducted on commercially available packages of natto, so it was impossible to clarify which specific color affected which sensitivity. Therefore, we will continue these studies and investigate how other Japanese food materials will be affected.

REFERENCES

- Akamine, T., Kobayashi, E., Shibukawa, M., Funada, T., Funada, M., and Futamiya, R., A study on the effect of the impression of tea package on consumption behavior, *Ergonomics*, 2006, (Vol.42) supplement issue, p. 114–115, (In Japanese)
- Ishii, H., and Onzo, N., Package Design Strategy from a Value Perspective, *Marketing Journal*, 2010, Vol. 30, No. 2, pp. 31–34, (In Japanese).
- Ito, K. Kiriya, K. Ohara, Y., Tamagaki, Y., and Miyazaki, Y, Impressions that Sake Packages Give to Users, *Journal of Design Studies*, 2007 (Vol. 54, No. 2), pp. 19–26, (In Japanese).
- Kurita, A., and Iwanaga, M., The relationship between color elements that define the luxury of product packages and purchase intention, The 81st Annual Meeting of the Japanese Psychological Association, 2017, Vol. 81, 1A-050-1A-050, (In Japanese).
- Maeda, Y., Kondo, T., Sasaki, T. Yoshida, N., Kitabayashi, H., and Nagano, M., Effects of package color on the product image and willingness to buy: A case study of chocolate packages, *Journal of Kyoto Tachibana University*, 2016, No. 43, pp. 203–218, (In Japanese).
- Nagase, H., and Suzuki, S., A Practical Marketing Method for Creating Sensory Value in Product and Brand Creation: A Case Study of Package Design for Processed Agricultural Foods, Research Report, 2011, No. 4, pp. 27–30. Nagano Prefectural Industrial Technology Center, Research Report, 2011, No. 4, pp. 27–30, (In Japanese)
- The Deliciousness of Japanese Food, Kobayashi Shokuhin Co., Japanese Food Attracts Worldwide Attention, Features of Why Japanese Food was Registered as an Intangible Cultural Heritage of UNESCO, <https://www.kobayashi-foods.co.jp/wa-shoku-no-umami/> (last viewed on June 30, 2021), (In Japanese).