

Sensory Evaluation of Taro- Squash Ketchup

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Abstract

This study investigates the sensory attributes of Taro-Squash Ketchup, focusing on its color, scent, texture, flavor, and general acceptability. Taro (*Colocasia esculenta*) and squash (*Cucurbita maxima*), both known for their nutritional value, were employed to develop novel ketchup compositions. Three treatments with different taro and squash proportions were tested by a panel of semi-trained evaluators and 50 consumer volunteers. Treatment 3 received the best scores in overall acceptability, texture, and scent, but no

significant variations in color or aroma were identified between treatments. Despite similar color and aroma, texture and overall acceptance varied, showing that product modifications may improve marketability. Recommendations include refining the color using natural food coloring, increasing scent balance, and achieving a smooth texture. The study implies that more adjustments and greater market testing could lead to commercial success.

Keywords: *sensory evaluation, Taro, Squash, Ketchup, Consumer acceptance, Food product innovation*

INTRODUCTION

Product development is the process of creating products with new or different qualities that provide new or additional benefits to consumers. Sensory evaluation is crucial in this process because it determines how customers perceive product features like taste, texture, scent, and appearance. These sensory features have a substantial impact on product adoption in the market (Kostyra et al., 2016). When designing a novel product, such as Taro-Squash ketchup, sensory research is critical to determining its potential appeal to various customer segments.

Ketchup, a globally renowned condiment, has undergone numerous adaptations and inventions that include novel ingredients to boost nutritional value and taste. One such invention is the use of taro (*Colocasia esculenta*) and squash (*Cucurbita maxima* L.) to create ketchup, a product with increased sensory appeal

and nutritional value. This study examines the sensory acceptability of a taro-squash-based ketchup using characteristics such as color, scent, texture, and overall consumer appeal.

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Squash, notably *Cucurbita maxima*, is another healthy crop that is widely grown around the world, particularly in the Americas where it originated (Armesto et al., 2020). Squash is known for its high quantities of tocopherols and carotenoids, which contribute to its brilliant color and antioxidant potential (Cuco et al., 2019). The flesh of the squash is high in Vitamin A and C, which boosts the health benefits of products containing this ingredient. The addition of taro and squash to ketchup improves its nutritional profile while also providing a distinct flavor and color, all of which are important factors in customer appeal.

Food's sensory properties, including color, aroma, texture, and overall appeal, are crucial to consumer happiness and commercial success. According to research, consumers equate color with taste, and the visual aspect of food effects their sense of flavor and quality (Endrizzi et al. 2015). Aroma, a key component of flavor perception, influences consumers' perceptions even before they taste the food (Cho Yoon et al., 2016). Furthermore, texture, defined as the sensory manifestation of a product's mechanical and structural attributes, has a major impact on consumer perceptions of food's satiating qualities (De Barros and Cardoso, 2016). To achieve consumer expectations, ketchup must maintain its smooth and thick texture while integrating novel ingredients.

Objectives of the Study

This study was conducted by testing the sensory attributes of a taro-squash-based ketchup, including appearance, aroma, texture, and consumer satisfaction. Understanding these sensory elements not only help with product development, but also provide insight into the potential of taro and squash as major ingredients in condiments. By investigating the sensory evaluation of taro-squash ketchup, this study provides the groundwork for future advances in food product creation that balance health advantages with consumer appeal.

MATERIALS AND METHODS

Research Design

This study utilizes an experimental research approach to examine the sensory profile of Taro-Squash ketchup in terms of color, aroma, texture, taste, and overall acceptability. The experiment modifies the

proportions of taro and squash to generate different formulations and assesses the results using sensory evaluations from various demographic groups.

Sampling Technique

Purposive sampling is utilized for sensory evaluation, which selects individuals based on certain research features. The evaluation panel consists of semi-trained assessors for sensory evaluation and 50 customer respondents separated by age group to assess the product's acceptability.

Locale of the study

The sensory evaluation was conducted at Eastern Samar State University, Arteche Extension Campus, specifically in the College of Hospitality Management at ESSU Arteche Campus, Arteche, Eastern Samar, Philippines.

Research Instruments

A questionnaire-based sensory evaluation form using a 9-point hedonic scale was employed. Respondents rated the product on a scale from 1 (Dislike Extremely) to 9 (Like Extremely) for each sensory attribute, the color, aroma, texture, taste, and overall acceptability.

Data Gathering Procedure

This study's data collection took place in two parts. First, the Taro-Squash ketchup was made using a standardized procedure, with three distinct formulas altering the quantities of taro and squash. After preparing the ketchup, it was tagged and packed for examination. In the first step, a panel of 15 semi-trained evaluators, consisting of ESSU, Arteche faculty members, evaluated the product's sensory characteristics, such as color, aroma, texture, taste, and acceptability. Each panelist completed a sensory assessment questionnaire based on a 9-point hedonic scale.

The second phase included a consumer acceptance test with 50 participants divided into five age groups: children (10-12 years old), teens (13-18 years old), young adults (19-25 years old), adults (26-59 years old), and senior citizens (60 years old and over). Each responder tried the ketchup and assessed it using the same sensory qualities. To investigate differences in preferences, demographic information about respondents was obtained, including age, gender, and ketchup consumption patterns.

Analysis of the Data

The data from the sensory evaluation forms were examined using descriptive and inferential statistics. The weighted mean was used to get the average scores for each sensory characteristic, resulting in an overall evaluation of the product's color, aroma, texture, taste, and acceptance. An Analysis of Variance (ANOVA) was used to see if there were any significant variations in sensory assessment ratings across demographic groups. This investigation assessed if age, gender, and ketchup eating patterns impacted sensory evaluations. Hypothesis testing ($\alpha = 0.05$) was used to determine statistical significance of observed

differences. This technique enabled a detailed examination of how demographic variables influence the sensory perception of Taro-Squash ketchup

RESULTS AND DISCUSSION

The sensory evaluation of Taro-Squash Ketchup sought to establish its sensory profile, which included color, aroma, texture, taste, and overall acceptability. A panel composed of experienced and semi-trained faculty members assessed three regimens with varied taro-squash ratios.

Table 1. Score Range

RANGE	COLOR	AROMA	TEXTURE	GENERAL ACCEPTABILITY
8.51-9.00	Dark red	Very strong odor	Extremely soft	Like extremely
7.51-8.50	Slightly dark red	Strong odor	Very soft	Like very much
6.51-7.50	Very dark red	Moderately strong odor	Moderately soft	Like moderately
5.51-6.50	Extremely dark	Slightly strong odor	Slightly soft	Like slightly
4.51-5.50	Dark orange	Odorless	Uneven	Neither like or dislike
3.51-4.50	Slightly dark orange	slightly odorless	Slightly uneven	Dislike slightly
2.51-3.50	Light orange	Moderately odorless	Moderately uneven	Dislike moderately
1.51-2.50	Very light orange	Very odorless	Very uneven	Dislike very much
1.00-1.50	Extremely orange	Strong odorless	Extremely uneven	Dislike extremely

Table 2. Sensory Evaluation of Taro-Squash Ketchup in terms of Color, Aroma, Texture and General Acceptability

SENSORY INDICATO R	MEAN			
	Treatment 1	Treatment 2	Treatment 3	Control
Color	6.13	5.37	5.73	6.4
Aroma	6.06	5.8	6.8	6.4
Texture	5.66	6.6	6.8	6.4
General Acceptability	5.37	6.28	7.66	7.7
Overall Mean	5.89	6.10	6.64	6.8

As shown in the table above, the sensory evaluation of the developed Taro Squash Ketchup was performed by five (5) trained and ten (10) semi-trained faculty members.

Sensory characteristics such as Color, whereby Treatment 1 obtained the highest weighted mean of 6.13 “Extremely dark” compared to Treatment 2 5.37 “Dark Orange” got the lowest mean. The first time we made our product taro-squash ketchup, it was rich in natural color, but the panelists suggested that we add some red food coloring to achieve the optimum color of ketchup. According to Ken Philips (2023), manufacturers strive for vibrant red ketchup as a key aspect of their production process. They aim to maintain consistent color to uphold high quality and foster customer loyalty. Developing a highly efficient system for condiment production can ensure the desired appearance and quality of the final product.

In the present study, one of the panelists suggested that we should still consider the original color of the ketchup. This recommendation arose from the fact that the resulting ketchup appeared yellow due to the raw materials we utilized.

In terms of Aroma, Treatment 3 has gained the highest mean value, which is 6.8 “slightly strong odor” whereas Treatment 2 with 5.8 weighted mean “Odorless” The panelists prefer the smell of treatment 3 because it has a slightly strong smell. Moreover, the sweetness from the squash complements the savory essence of taro, providing a well-balanced aromatic profile. According to Zeng et al., 2022, aroma is an essential indicator of food quality and consumers are willing to pay a premium for products with good flavour.

In the present study, the result of the smell of our ketchup is good, just follow the proper procedure to maintain its good smell, a panellist recommended that such an aroma is acceptable.

As regards the result of Texture in sensory evaluation, Treatment 3 has the highest general weighted mean of 6.8 "Slightly soft" and treatment 1 as the least with a 5.66 general weighted mean "slightly soft" obtained the lowest mean. Complements from the panellist, its texture is good, it is smooth because we use a blender to puree the pulp of taro and squash. According to Bhattacharya (2010), the viscosity of ketchup is an essential factor in its acceptance by the consumer; therefore, it is also considered in the commercial production of ketchup

In the present study, all the panelists liked the texture of the ketchup, its taste is perfect, and the result is better than the original ketchups, so they endorse the taro-squash ketchup for some reason that it can be released in the commercial.

Though most of the panelists gave a good rating on the evaluation of the product, for the Overall General acceptability of mean rating for three (3) treatments. Treatment 1 (5.89), Treatment 2 (6.10), and Treatment 3 (6.64) Our results suggest that a good choice of Taro-Squash Ketchup could highly enhance the sensory scores, especially the color, aroma, texture, and general acceptability. The overall mean of the 3 treatments receives a satisfactory rating on the 9-hedonic scale. It was also observed that taro squash had a good influence on the panelists' preference for ketchup.

According to Piqueras-Fiszman and Spencer (2015), sensory attributes like color, aroma, and texture significantly impact food acceptability. In our study, we evaluated the overall acceptability of our ketchup based on consumer responses and preferences. When consumers taste food products and encounter their sensory characteristics, they can determine whether they enjoy or dislike the product. These sensory attributes, color, aroma, and texture—play a crucial role in shaping consumers' preferences for food substances (Kostyra et al., 2016).

Table 3. Analysis of Taro-Squash Ketchup with the Control

QUALITIES	F	P-VALUE	F- CRITICAL	INTERPRETATION
COLOR	0.374881517	0.771439872	2.769430932	No significant difference
AROMA	0.925846702	0.434348667	2.769430932	No significant difference
TEXTURE	3.653958944	0.17746208	2.769430932	No significant difference
GENERAL ACCEPTABILITY	6.16872428	0.001067471	2.769430932	Significantly difference

*Not Significant ≥ 0.05 *

*Significant ≤ 0.05

Table 3 presents the analysis of variance (ANOVA) results comparing the sensory qualities of the developed Taro–Squash Ketchup with the control. The evaluation focused on color, aroma, texture, and general acceptability.

For color, the obtained p-value (0.7714) is greater than the significance level of 0.05, and the F-value (0.3749) is less than the F-critical value (2.7694). This indicates that there is no significant difference among treatments in terms of color, and the null hypothesis is retained.

For aroma, the p-value (0.4343) likewise exceeds the 0.05 threshold, with an F-value (0.9258) lower than the F-critical value. This result shows that the treatments do not differ significantly in terms of aroma, and the null hypothesis is also retained.

For texture, the results depend on the accurate p-value recorded. If the correct p-value is 0.1775 (as shown in the table), then it is greater than 0.05, and the treatments do not significantly differ in terms of texture. However, if the true value is 0.0177 (as indicated in the narrative), then it is below 0.05 and, together with the F-value (3.6540) exceeding the F-critical value, it would indicate a significant difference in texture across treatments.

Finally, for general acceptability, the p-value (0.0011) is well below the 0.05 significance level, and the F-value (6.1687) is higher than the F-critical value. This confirms a significant difference among treatments in terms of overall acceptability, leading to the rejection of the null hypothesis.

In summary, the results show that the developed Taro–Squash Ketchup does not differ significantly from the control in terms of color and aroma, while general acceptability exhibits a highly significant difference. The interpretation for texture must be verified depending on the correct p-value reported.

Conclusions

Based on the sensory evaluation of the Taro-Squash Ketchup, it is possible to infer that this unique product exhibits promising sensory features such as color, aroma, texture, and general acceptability. The findings suggest that combining taro and squash in ketchup has the potential to create a unique product with increased nutritional value. Although some treatments scored higher in specific aspects, the sensory evaluations were generally positive, notably for Treatment 3, which received the highest marks in multiple categories, including scent and texture.

The statistical analysis found substantial differences in texture and overall acceptability between the treatments, implying that formulation changes could improve customer satisfaction. However, there were

no significant variations in color or scent between treatments, showing consistency in these sensory qualities.

In conclusion, the Taro-Squash Ketchup was well welcomed by both trained and semi-trained panelists, indicating that it has commercial appeal. Further modifications, notably to the color and aroma, could increase its market appeal.

Recommendations

Based on the sensory evaluation results, the Taro-Squash Ketchup has a high potential for consumer acceptance and marketability, thanks to its unique combination of taro and squash, which provides added nutritional benefits. However, numerous modifications are advised to enhance the product's attractiveness. First, the color should be modified, such as by adding natural food coloring

agents to create the ideal red hue associated with traditional ketchup, as several panelists commented that the color was not optimal. Furthermore, while the aroma got mostly good feedback, a more balanced augmentation of the ketchup's scent profile might be investigated in order to appeal to a wider spectrum of consumers. Texture enhancements should continue to be adjusted to ensure that the product has a smooth, constant feel, which is critical for ketchup products. To corroborate the results, additional sensory testing could be undertaken on a bigger scale with a more diverse population. Finally, it is recommended to investigate commercial production options and market testing to assess the product's acceptance in a real-world setting.

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