

Development and Acceptability of Taro-Based Pasta as a Functional Food

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Abstract:

This study aimed to develop taro-based pasta as a functional food alternative and evaluate its sensory characteristics and consumer acceptability. A descriptive quantitative research design was employed involving 30 adult respondents familiar with pasta products. Sensory evaluation of the taro pasta was conducted using a Visual Analogue Scale (VAS) focusing on appearance, aroma, taste, and texture, and the data were analyzed using descriptive statistics, including weighted and composite means. Results showed high sensory ratings across all attributes, with appearance and taste rated as highly acceptable, while aroma and texture were rated as acceptable. The overall composite means indicated general consumer acceptability of the product. The findings suggest that taro flour is a viable alternative ingredient for pasta production, supporting the potential of taro-based pasta as a gluten-free and functional food product suitable for further development and market consideration.

Keywords: taro pasta, functional food, sensory evaluation, consumer acceptability, gluten-free

1. INTRODUCTION

Pasta is one of the most widely consumed staple foods worldwide due to its affordability, convenience, and versatility. It is often chosen by students, working individuals, and families as a quick meal option that can easily be paired with different sauces and ingredients [1]. Traditionally, pasta is produced using wheat flour; however, the growing demand for healthier and gluten-free food products has encouraged bakers and food innovators to explore alternative flours [2]. One promising substitute is taro flour, a root-crop flour derived from *Colocasia esculenta*, which can be processed and used in a variety of food applications [1, 2].

Taro flour has gained attention because it contains beneficial nutrients, such as high carbohydrate content, and when used in composite flour or alternative food formulations, it can contribute to an improved nutritional profile and offer functional-food potential. Taro flour exhibits antioxidant activity and favorable rheological (pasting) properties, making it suitable as a carbohydrate source in functional food development [3]. Additionally, being naturally gluten-free, taro flour is a good option for individuals with celiac disease or gluten intolerance [2].

However, replacing wheat flour with taro flour can alter the properties of pasta. Because taro lacks gluten, the protein responsible for dough elasticity and structure — using taro flour alone requires technological aids (e.g., protein addition or enzymes) to achieve acceptable pasta structure. As a result, pasta made with taro flour may exhibit differences in cooking behavior and textural properties compared

to wheat-based pasta. These changes may influence consumer perception and acceptability of the product in terms of appearance, texture, and overall quality, even if nutritionally beneficial.

For that reason, evaluating consumer acceptance is essential when developing taro-based pasta. Sensory evaluation will help determine whether healthier pasta alternatives made from taro flour can satisfy consumer preferences and be viable for market introduction. Thus, this study aims to produce pasta from taro flour and assess its acceptability in terms of appearance, aroma, taste, texture (firmness and bite), and overall liking — compared with traditional pasta.

2. LITERATURE REVIEW

In recent years, there has been a growing consumer shift toward healthier food alternatives, including staple foods such as pasta. This trend has encouraged food manufacturers and researchers to explore the use of non-traditional and gluten-free flours to improve nutritional quality while still meeting consumer expectations for taste and texture. Among these alternatives, taro flour has gained increasing attention for its potential to enhance both health value and product innovation in pasta formulations.

Taro (*Colocasia esculenta*) was recognized for its rich nutritional content, including dietary fiber, essential vitamins, minerals, and bioactive compounds that contribute to digestive health and disease prevention [4]. Mendoza (2021) highlighted taro's natural gluten-free property, making it suitable for consumers with celiac disease or gluten intolerance [5]. Additionally, the presence of antioxidants in taro may aid in reducing oxidative stress and promoting better overall wellness, positioning taro-based products within the growing functional-food market [6].

Despite its health benefits, the use of taro flour in pasta production presents several formulation challenges. Wheat flour naturally contains gluten, which plays a critical role in dough elasticity, firmness, and structural integrity. Replacing this component with gluten-free taro flour can result in pasta that cooks softer and becomes less firm, which may affect product quality [7]. Santos and Dizon (2022) also observed that taro flour may alter sensory characteristics, including the product's color, flavor, and texture, potentially influencing consumer acceptance [8].

Consumer perception is a crucial factor in the success of healthier pasta alternatives. Reyes (2021) suggested that even if a food product has enhanced nutritional value, consumers may resist purchasing it if sensory attributes deviate significantly from the expected qualities of traditional wheat-based pasta [9]. This aligns with Rivera and Cruz (2018), who indicated that consumers typically prefer innovative food products that remain familiar in taste and texture [10].

For this reason, conducting sensory evaluation is vital in taro pasta development. Eirene (2023) noted that sensory evaluation plays a critical role in food product development by systematically measuring consumer perceptions of key attributes such as appearance, aroma, taste, and texture. According to Stone, Bleibaum, and Thomas (2012), structured sensory methods such as quantitative descriptive analysis allow researchers to obtain reliable and reproducible data that guide product refinement and quality assessment. Such assessments guide researchers in refining formulations to balance both nutritional benefits and enjoyable eating experiences [11].

Furthermore, the introduction of taro-based pasta may generate benefits beyond consumer health. Increased demand for taro can contribute to agricultural sustainability and economic opportunities for local farmers, especially in regions where taro is widely cultivated [4]. Thus, research on taro pasta does not only address dietary innovation but also support community-based agricultural development.

Overall, existing literature highlights the significant potential of taro flour as a nutritious and gluten-free ingredient in pasta products. However, its impact on sensory properties must be carefully examined. The present study seeks to fill this need by evaluating the acceptability of taro-based pasta, providing insights that can support future product development aligned with both consumer preferences and nutrition-driven market trends.

3. STATEMENT OF THE PROBLEM

This study seeks to evaluate the sensory characteristics of taro-based pasta as an alternative food product. Specifically, it aims to describe the sensory attributes of taro pasta in terms of appearance, aroma, taste, and texture as perceived by consumers.

In addition, the study aims to determine the level of acceptability of taro-based pasta based on the same sensory attributes, namely appearance, aroma, taste, and texture. Assessing consumer acceptability is essential in determining the potential of taro pasta as a viable alternative to traditional wheat-based pasta products.

Furthermore, the study seeks to identify possible recommendations and suggestions based on the findings of the sensory evaluation and acceptability assessment. These recommendations may serve as a basis for improving taro-based pasta formulation and for guiding future research and product development.

4. METHODOLOGY

This section describes the research design, participants, sampling technique, instruments, data gathering procedures, and statistical treatments used to assess the sensory characteristics and acceptability of taro-based pasta. The methods were structured to ensure systematic data collection and reliable evaluation of appearance, aroma, taste, and texture based on consumer responses.

Research Method

This study employed a *descriptive quantitative research design* to examine the sensory characteristics of taro pasta and determine its level of acceptability in terms of appearance, aroma, taste, and texture. Since sensory evaluation involves human perception, a quantitative approach is used to systematically measure participants' responses through structured instruments. Guided tasting sessions and a standardized survey questionnaire were conducted, wherein participants rated specific sensory attributes—such as taste, aroma, texture, and overall acceptability—using numerical scales. The collected data will then be subjected to statistical analysis to determine preferences, levels of acceptance, and differences among the evaluated products [12].

Respondents/Participants/Subject of The Study

The study involved 30 respondents who participated in the sensory evaluation of taro-based pasta. The respondents were adult consumers who were familiar with pasta products and were willing to take part in the tasting and evaluation sessions.

Sampling Technique

This study utilized a non-probability sampling technique, specifically *convenience sampling*, to select the 30 participants who evaluated the sensory characteristics of the taro pasta. Convenience sampling was chosen because it allows for efficient and timely data collection from individuals who were readily available and willing to participate in the tasting sessions. Given the descriptive quantitative nature of the study, this sampling method is appropriate for obtaining measurable sensory data from accessible

consumers who meet the basic criterion of being familiar with pasta products. The selected participants evaluated the appearance, aroma, taste, and texture of the taro pasta using numerical rating scales, and their responses contributed to the statistical analysis of the product's overall acceptability [13].

Research Instrument

The study employed the *Visual Analogue Scale (VAS)* as the primary research instrument to assess participants' perceptions of the sensory characteristics of taro-based pasta. The VAS is a continuous measurement tool commonly used in sensory and consumer research, allowing respondents to indicate the intensity of their perception along a straight line rather than selecting discrete categories [14].

In this study, a 6-inch VAS was utilized for evaluating appearance, aroma, taste, and texture. Respondents were instructed to mark a point on the line corresponding to their perceived intensity or level of acceptability for each sensory attribute. The distance from the scale origin to the marked point was measured and recorded as a numerical value, allowing quantitative analysis of sensory responses. The use of VAS enabled the capture of subtle differences in perception among respondents.

Data Gathering Procedures

The data gathering procedures of this study were carried out in three systematic phases to ensure that the research instruments were appropriate, the sensory evaluation was reliable, and the information collected accurately reflected participants' perceptions of taro pasta. These phases included: *Phase I – Conceptualization*, *Phase II – Pilot Testing and Revision of the Research Instrument*, and *Phase III – Survey Data Collection*. Each phase played a critical role in refining the process and strengthening the validity of the study's findings.

a. Phase I: Conceptualization

During the conceptualization phase, the researchers formulated the overall framework of the study and identified the key sensory attributes to be evaluated, specifically the appearance, aroma, taste, and texture of the taro pasta. Relevant literature on sensory evaluation, pasta quality, taro-based products, and qualitative and quantitative assessment tools was reviewed to guide the development of the initial research instruments. The construction of the Visual Analogue Scale (VAS) and the qualitative prompts were also undertaken in this phase, ensuring they aligned with the research objectives and captured the essential sensory characteristics of the product. The preparation protocol for the taro pasta samples—including cooking procedures, portion sizes, and serving conditions—was established to maintain consistency during the evaluation.

b. Phase II: Pilot Test and Revision of the Research Instrument

In the second phase, the initial version of the research instrument, which included the VAS and descriptive questions, was subjected to a pilot test involving a small group of participants like the target respondents. The purpose of this pilot test was to determine the clarity, usability, and reliability of the instrument. Participants provided feedback on the wording of the items, the length of the scale, and the overall experience of evaluating the taro pasta. Their responses were analyzed to identify any ambiguous statements, confusing instructions, or technical issues that might affect data quality. Based on the insights gathered, necessary revisions were made to improve the instrument's clarity, flow, and effectiveness before its full deployment.

c. Phase III: Survey Data Collection

The final phase involved the actual administration of the revised research instrument to the study's 30 respondents using convenience sampling. Participants were invited to a controlled tasting session where taro pasta samples were prepared according to standardized procedures to ensure consistency in

appearance, aroma, taste, and texture. After tasting, participants completed the Visual Analogue Scale and provided qualitative descriptions reflecting their sensory experiences and overall acceptability. All responses were collected, organized, and stored for subsequent analysis. This systematic data collection ensured that the gathered information accurately represented the consumers’ sensory perceptions and acceptability levels of taro pasta.

Statistical Treatment of Data

The data gathered from the sensory evaluation were analyzed using *descriptive statistical methods*. Frequency counts and percentages were used to describe the demographic profile of the respondents. Percentages were computed by dividing the frequency by the total number of respondents and multiplying by 100.

To quantify the sensory evaluation data, the *weighted mean* was employed to summarize the respondents’ ratings for each sensory attribute, namely appearance, aroma, taste, and texture [15]. The ratings were obtained using a *Visual Analogue Scale (VAS)*, where respondents indicated their level of acceptability along a continuous scale. The VAS scores were measured and converted into numerical values to allow statistical treatment and comparison across sensory attributes.

To facilitate interpretation of the VAS-derived numerical values, the continuous scores were converted into a five-point hedonic scale. This conversion was performed by dividing the VAS range into equal intervals corresponding to verbal acceptability descriptors. The five-point scale was used solely as an interpretive guide and did not replace the original VAS measurement, thereby preserving the continuous nature of the data.

The interpretation ranges were defined as follows: 4.21–5.00 as *Highly Acceptable*, 3.41–4.20 as *Acceptable*, 2.61–3.40 as *Moderately Acceptable*, 1.81–2.60 as *Slightly Acceptable*, and 1.00–1.80 as *Not Acceptable* [16][17]. This approach allowed for clearer presentation and discussion of acceptability levels of the taro-based pasta.

Table 1
Scale categories for sensory description of taro-based pasta

Scale Value	Range (VAS)	Appearance	Aroma	Taste	Texture
1	0.00–2.01	Pale yellow	Faint	Low taro flavor	Soft
2	2.01–4.00	Light–medium yellow	Moderate	Moderate taro flavor	Firm
3	4.01–6.00	Deep yellow	Strong	Pronounced taro flavor	Very firm

Note. Sensory descriptions were derived from the Visual Analogue Scale (VAS) scores for descriptive interpretation only.

Finally, the **overall acceptability** of the product was determined by computing the average of the weighted means of all sensory attributes evaluated. These statistical treatments provided structured, quantifiable insights that complemented the qualitative descriptions of participants’ sensory experiences and ensured a clear interpretation of consumer acceptability results (Wiersma & Jurs, 2009). The application of Visual Analogue Scales in sensory evaluation is recommended for capturing continuous intensity judgments and subtle perceptual differences among respondents, particularly in food quality assessment (Stone et al., 2012).

5. RESULTS AND DISCUSSION

a. Quantitative Descriptive Analysis using Visual Analogue Scale (VAS)

To evaluate the sensory characteristics of the developed product, a Quantitative Descriptive Analysis (QDA) was conducted using a Visual Analogue Scale (VAS). The result below revealed consistently high sensory evaluations across all measured attributes.

The sample's appearance obtained the highest mean score of 4.61, characterized as “*deep yellow*,” indicating strong visual acceptability and uniform color development. Aroma received a mean score of 4.51 and was described as “*strong*,” suggesting that the product exhibited a clearly perceptible and favorable aromatic profile. Taste achieved a mean of 4.45, with respondents identifying a “*pronounced taro flavor*,” which confirms that the intended flavor was effectively conveyed and positively received. Texture, with a mean rating of 4.29 and described as “*very firm*,” reflects desirable structural integrity and consistency in the product. Overall, the VAS results suggest that the product was favorably evaluated across sensory attributes, reflecting good quality and consumer acceptability.

Table 2
Quantitative descriptive analysis of taro-based pasta using VAS

Sensory Attribute	Mean	Description
Appearance	4.61	Deep yellow
Aroma	4.51	Strong
Taste	4.45	Pronounced taro flavor
Texture	4.29	Very firm

b. Acceptability Level of The Taro Pasta

The acceptability of the product was interpreted using a five-point hedonic scale derived from the Visual Analogue Scale (VAS) scores to facilitate meaningful verbal interpretation of the results. This instrument allowed respondents to rate specific quality attributes—Appearance, Aroma, Taste, and Texture—based on their sensory evaluation. The quantitative data gathered through this method provided a systematic and measurable way to determine how well the product met consumer expectations. The results of the Quantitative Descriptive Analysis are summarized in the table below.

The findings of the quantitative descriptive analysis reveal that the respondents generally evaluated the product favorably across all sensory attributes. Appearance received a weighted mean of 4.26, interpreted as Highly Acceptable, indicating that the product's visual quality met or exceeded consumer expectations. Aroma obtained a weighted mean of 4.14, corresponding to Acceptable, suggesting that its scent was satisfactory to most respondents. Taste garnered the highest weighted mean at 4.28, also interpreted as Highly Acceptable, showing that the product's flavor was one of its strongest attributes. Texture received a weighted mean of 4.14, falling under Acceptable, which means that the mouthfeel and consistency were perceived positively but with slightly less enthusiasm compared to taste and appearance. Overall, the composite mean of 4.21, interpreted as Acceptable, indicates that the product was generally well received, demonstrating its potential suitability for consumer preference and market acceptance.

Table 3
Acceptability level of taro-based pasta

Quality Attributes	Weighted Mean	Verbal Interpretation
Appearance	4.26	Highly Acceptable
Aroma	4.14	Acceptable
Taste	4.28	Highly Acceptable
Texture	4.14	Acceptable
Composite Mean	4.21	Acceptable

Note. Verbal interpretations were based on the five-point hedonic scale derived from VAS scores.

The consistently high sensory ratings observed in this study align with the principles of consumer-based sensory evaluation described by Stone et al. (2012), which emphasize the importance of clear attribute definition and standardized evaluation conditions in achieving reliable acceptability results.

DECLARATIONS

Use of AI Technology

Artificial intelligence tools, including ChatGPT and Grammarly, were used solely for language editing, grammar checking, and improvement of clarity during manuscript preparation. The study design, data collection, data analysis, interpretation of results, and conclusions were conducted entirely by the authors.

Conflicts of Interest

All authors declare that they have no conflicts of interest.

Informed Consent

This study involved human participants for sensory evaluation purposes. Informed consent was obtained from all participants prior to their participation in the study.

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