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Acceptability of Puto Using Sweet Potato Flour (Sweet Potato Rice Cake)

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Abstract

This experimental study aimed to determine the level of acceptability of puto using sweet potato flour as to color, texture, flavor, aroma, and general acceptability. It also determined the significant difference in the level of acceptability when respondents are grouped as students, teachers and homemakers. The finished product was evaluated by 15 HRM Students, 15 Teachers, and 15 Homemakers through purposive sampling technique. The sensory evaluation score sheet using the modified five-point Hedonic scale was used in gathering the needed data while mean was employed to determine sensory evaluation ratings across respondent groups. The Kruskal-Wallis test was used to assess significant differences in acceptability. Findings revealed that the group of evaluators "Liked Extremely" the puto using sweet potato flour as to aroma, color, flavor, texture and general acceptability. It was also found that there was no significant difference in the level of acceptability of puto using sweet puto flour as to aroma, color, flavor, texture and general acceptability when respondents were grouped as to students, teachers and homemakers.

Keywords: puto (rice cake), sweet potato flour, acceptability, color, texture, flavor, aroma, Hendonic scale

INTRODUCTION

Food played a crucial role in human survival, culture, and identity. It served as a source of nourishment, sustenance, and social connection, with various civilizations developing unique culinary traditions based on available resources (Fernandez, 2019). In many cultures, staple foods such as rice formed the foundation of daily diets, providing essential carbohydrates and nutrients. In the Philippines, rice was not only a dietary staple but also a cultural symbol, deeply embedded in traditional celebrations and rituals (Garcia & Reyes, 2020). Among the many rice-based delicacies in the country, puto was one of the most well-loved rice cakes, commonly served during gatherings, fiestas, and even as an everyday snack.

Puto was a traditional Filipino steamed rice cake made primarily from glutinous rice flour, water, and leavening agents, often enhanced with flavors such as cheese or coconut milk. Over time, innovations in food preparation introduced alternative ingredients to improve the nutritional value and sensory qualities of traditional dishes. One such ingredient was sweet potato (Ipomoea batatas), a highly nutritious root crop known for its dietary fiber, antioxidants, and high vitamin content (Merriam-Webster). Sweet potatoes had been widely used in various food products due to their natural sweetness, vibrant color, and health benefits (Grace, 2024).

The incorporation of sweet potato flour as a substitute for rice flour in puto presented an opportunity to enhance its nutritional profile while maintaining its cultural relevance. According to Soriano (1986), modifying traditional recipes with nutrient-rich alternatives improved dietary diversity and increased consumer acceptance of healthier food choices. Additionally, previous studies demonstrated that sweet potato flour positively influenced the texture, flavor, and overall acceptability of baked and steamed goods, making it a promising alternative for puto production (Garcia & Reyes, 2020).

Statement of the Problem. This study aimed to evaluate the acceptability of puto using sweet potato flour based on sensory attributes such as color, texture, flavor, aroma, and overall acceptability. It also sought to determine whether significant differences existed in consumer preferences when grouped into students, teachers, and homemakers. By exploring the potential of sweet potato flour as a viable ingredient for puto, this research contributed to the innovation of traditional Filipino rice cakes, promoting healthier and more sustainable food options. Specifically, the study sought answers to the following questions:

1. What is the level of acceptability of puto using sweet potato flour as to aroma, color, flavor, texture and general acceptability?

2. Is there a significant difference in the level of acceptability of puto using sweet potato flour as to aroma, color, flavor, texture and general acceptability when respondents were grouped as students, teachers and homemakers?

Conceptual Framework. The conceptual framework of this study followed a structured approach where the input, process, and output were interconnected to assess the level of acceptability of puto using sweet potato flour.

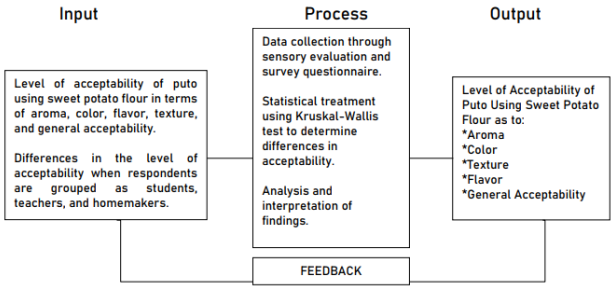

Figure 1
Research Paradigm of the Study

The input focused on evaluating the sensory attributes of puto in terms of its aroma, color, flavor, texture, and general acceptability, while also considering differences in acceptability among respondents grouped as students, teachers, and homemakers. The process involved data collection through sensory evaluation and survey questionnaires, which provided quantitative and qualitative assessments of the product. Gathered data were subjected to statistical treatment using mean to yield descriptive results while Kruskal-Wallis test determined whether significant differences existed among groups. The output of the study revealed the level of acceptability of puto based on identified sensory characteristics. The findings established whether sweet potato flour was a viable alternative ingredient in traditional puto production.

LITERATURES

The various regional variants of puto reflect the Philippines' rich culinary diversity, shaped by local ingredients and traditional preparation methods. Puto Bumbong, for example, is a well-known delicacy during the Christmas season, made from glutinous purple rice (pirurutong) and steamed in bamboo tubes, highlighting the cultural significance of rice-based dishes (Dacumos, 2012). Similarly, Puto Lanson, a unique Iloilo variant, utilizes grated cassava instead of rice, demonstrating the adaptability of traditional recipes to locally available crops (Besa & Dorotan, 2016). Puto Manapla, which incorporates banana leaves for additional flavor, and Puto Mamón, which resembles sponge cake rather than the usual rice-based texture, further illustrate how variations arise due to regional preferences and available ingredients. Additionally, Puto Maya, made from violet glutinous rice, and Puto-Pao, which integrates a savory siopao-style filling, highlight the innovative fusion of flavors within Filipino rice cake traditions. Meanwhile, Puto Seco, a dry biscuit-like version, serves as an example of how traditional steamed puto can be transformed into a long-lasting, portable snack (Fernandez, 1994).

Beyond puto, rice cakes play a significant role in Philippine gastronomy, paralleling similar dishes across different cultures. Variants like bibingka and suman underscore the importance of rice as a staple ingredient, while puto kutsinta, sapin-sapin, and maja blanca reflect the integration of rice flour, coconut milk, and

sweeteners to create a variety of textures and flavors (Besa & Dorotan, 2016). These traditional delicacies align with related literature emphasizing the nutritional value and cultural relevance of rice-based food products, reinforcing their role in Filipino cuisine.

The nutritional benefits of rice and sweet potatoes further support their widespread use in traditional and modern food production. Rice, consumed by over half of the global population, provides immediate energy and essential nutrients, including Vitamin B1, and possesses digestive and anti-inflammatory properties (Juliano, 2019). In contrast, sweet potatoes are rich in beta-carotene, Vitamin C, and dietary fiber, contributing to improved skin health, liver detoxification, and antioxidant benefits (USDA, 2022; Lobo et al., 2010). These nutritional properties explain the increasing interest in incorporating sweet potato flour into traditional Filipino snacks, including puto and other rice-based delicacies, as healthier alternatives.

In terms of production and cultivation trends, rice flour serves as an essential ingredient in gluten-free baking and as a thickening agent in refrigerated or frozen food products (Tao & Li, 2018). The growing demand for rice flour highlights the need for alternative sources, particularly for individuals with gluten intolerance. Meanwhile, sweet potato cultivation is a major agricultural activity in tropical and subtropical regions, with China leading global production (Food and Agriculture Organization [FAO], 2024). The crop's resilience and adaptability make it a promising raw material for flour production, aligning with related studies that explore alternative flour sources in food innovation.

Previous local studies have examined the feasibility of utilizing alternative flour sources in traditional Filipino baked goods. Gaborne (2012) found that kamote flour enriched with malunggay leaves was moderately accepted in polvoron production, indicating its potential for wider application. Demegillo (2006) demonstrated that kamote flour in tart making was well-received, particularly in terms of color and flavor, reinforcing its viability as a substitute for wheat flour. Similarly, Navasques and Valencia (2013) studied sweet potato flour in drop cookies, finding high acceptability among respondents. These findings suggest that sweet potato flour can serve as a sustainable and nutritious alternative in rice-based products like puto, enhancing both nutritional value and local agricultural utilization.

METHODOLOGY

Research Design. This study employed the experimental method of research to assess the acceptability of the developed product. According to Ariola (2010), the experimental research method is a systematic procedure used to discover new knowledge or verify existing information. It is primarily conducted to determine causal relationships between variables, making it an effective approach for establishing cause-and-effect dynamics and providing accurate behavioral descriptions. In this study, the experimental method was applied to evaluate the sensory attributes of the product through structured observation and analysis.

Ingredients. The following ingredients were used in the preparation of the developed puto variant:

Primary Base: Sweet potato flour
Leavening Agent: Baking powder
Sweetener: White sugar or muscovado
Liquid Component: Coconut milk or fresh milk
Flavor Enhancers: Grated cheese, vanilla extract (optional)
Additional Ingredients: Butter, salt, and egg (for texture enhancement)

Materials and Equipment. The materials and equipment used in the experiment include the following:
Mixing Tools: Measuring cups, mixing bowls, whisks
Steaming Equipment: Traditional puto steamer, bamboo steamer, or electric steamer
Molding Tools: Silicone molds, banana leaves (for specific variants)

Measuring Instruments: Digital weighing scale, timer, and thermometer

The experiment was conducted at the HRM Food Laboratory in Iloilo State University of Fisheries Science and Technology, Iloilo City, Philippines, ensuring controlled conditions to maintain consistency in preparation and evaluation.

Cooking Procedures. The preparation and cooking procedures followed a standardized process:

Step 1. Ingredient Preparation

1. Measure all ingredients based on the standardized formulation.
2. Prepare sweet potato flour (if applicable) by drying and grinding fresh sweet potatoes.

Step 2. Batter Preparation

1. Combine dry ingredients (flour, baking powder, sugar, salt) in a mixing bowl.
2. Gradually add liquid ingredients (coconut milk, egg, vanilla extract) while mixing to achieve a smooth batter.

Step 3. Steaming Process

1. Grease puto molds and poured the batter evenly.
2. Arrange the molds inside a preheated steamer.
3. Steam for 15–20 minutes or until a toothpick inserted in the center came out clean.

Step 4. Final Presentation

1. Allow the puto to cool before transferring to serving plates.

Population, Setting and Sampling Technique. The study was conducted at Iloilo State University of Fisheries Science and Technology - Dumangas Campus, Dumangas, Iloilo, and in Barangay Ilaya 1st, Dumangas, Iloilo. The respondents included 15 students and 15 teachers from Iloilo State University of Fisheries Science and Technology - Dumangas Campus, as well as 15 homemakers from Barangay Ilaya 1st. A purposive sampling technique was used to select the participants. According to Cardonigara (2002), purposive sampling involves selecting individuals based on specific criteria relevant to the study, allowing researchers to exercise personal judgment in choosing participants who can provide meaningful and reliable data. This approach ensured that the respondents had relevant experiences and backgrounds necessary for evaluating the product.

Survey Instrument. To assess the acceptability of the product, the study utilized a sensory evaluation score sheet based on a modified five-point Hedonic Scale, which has been widely adopted in experimental research focusing on consumer preference and product acceptability. The Hedonic Scale is a commonly used tool in sensory evaluation research, allowing panelists to rate their degree of liking or disliking of a product based on specific attributes such as appearance, texture, taste, aroma, and overall acceptability (Meilgaard, Civille, & Carr, 2016).

In this study, the scale was modified to include descriptive anchors for each numerical rating, ensuring clarity and consistency in responses. Table 1 presents the scale ratings as follows:

Table 1
Five-point Modified Hedonic Scale

Scale	Range	Interpretation
5	4.21-5.00	Like Extremely
4	3.41-4.20	Like Very Much
3	2.61-3.40	Like Moderately
2	1.81-2.60	Dislike Very Much
1	1.00-1.80	Dislike Extremely

Upon approval from the research adviser, the instrument was presented to a panel of experts for validation. Their recommendations and suggestions were incorporated into the final version of the instrument to enhance its reliability and effectiveness. The five-point Hedonic Scale included the following categories: Liked Extremely (LE), Liked Moderately (LM), Liked Slightly (LS), Disliked Moderately (DM), and Disliked Extremely (DE). This scale facilitated a structured and objective assessment of the product's sensory attributes,

providing valuable insights into its overall acceptability among different respondent groups.

Data Analysis. The data gathered were analyzed using appropriate quantitative statistical tools to ensure accurate interpretation of results. Mean was used to determine the level of sensory evaluation of Sweet Potato Rice Cake based on specific attributes when respondents were grouped into students, teachers, and homemakers. This provided an overall measure of acceptability across different respondent categories.

To determine the significant difference in the level of acceptability of Sweet Potato Puto, the Kruskal-Wallis H test was employed. This non-parametric statistical test assessed whether there were significant variations in the responses among the three groups (students, teachers, and homemakers). The Kruskal-Wallis test was chosen as it effectively compares the ranked data across multiple independent groups, making it suitable for analyzing differences in sensory perceptions when the assumption of normality is not met.

These statistical methods were applied using SPSS to process and interpret the results systematically, ensuring accuracy and reliability in data analysis.

RESULTS AND DISCUSSIONS

Level of Acceptability of Sweet Potato Puto as to Certain Categories. Table 2 shows the level of acceptability of sweet potato puto as to aroma, color, flavor, texture, and general acceptability. Generally, the result of the evaluation revealed that level of acceptability of sweet potato puto as to aroma, color, flavor, texture, and general acceptability were "Liked Extremely" (GM=4.5) by the respondents. The respondents "Liked Extremely" the aroma (M=4.49), color (M=36), flavor (M=44), texture (M=40) and general acceptability (M=4.58). These results imply that sweet potato puto was accepted by the respondents.

Table 2

Mean Distribution on the Acceptability of Sweet Potato Puto when Respondents were Grouped as Teachers, Students, and Homemakers.

Categories	Students		Teachers		Homemakers		Grand Mean	Description
	Mean	Description	Mean	Description	Mean	Description		
1. Aroma	4.40	LE	4.20	LVM	4.87	LE	4.49	LE
2.Color	4.67	LE	3.93	LVM	4.47	LE	4.36	LE
3.Flavor	4.40	LE	4.07	LVM	4.87	LE	4.44	LE
4.Texture	4.07	LVM	4.40	LE	4.73	LE	4.40	LE
5.General Acceptability	4.53	LE	4.20	LVM	5.00	LE	4.58	LE
Average Mean:	4.41	LVM	4.16	LVM	4.79	LE	4.45	LVM

Results in Table 2 also revealed that student respondents "Liked Extremely" the sweet potato puto as to aroma, color, flavor and general acceptability with a mean rating of 4.40, 4.67, 4.40 and 4.53 respectively while "Liked Very Much" (M= 4.07) the texture. The teacher respondents "Liked Extremely" the texture with a mean rating of 4.40 while "Liked Very Much" the aroma, color, flavor and general acceptability with a mean rating of 4.20. 3.93. 4.07 and 4.20 respectively. The homemaker respondents "Liked Extremely" the aroma, color, flavor, texture and general acceptability with a mean rating of 4.87, 4.47, 4.87, 4.73 and 5.00 respectively. This implies that respondents vary in their judgment in their level of acceptability of sweet potato puto in all categories.

Difference in the Level of Acceptability of Puto Using Sweet Potato Flour when Respondents were Grouped as Students, Teachers and Homemakers. The Kruskal-Wallis test result reveals that there was no significant difference in the level of acceptability of puto using sweet potato flour as to aroma, color, flavor, texture and general acceptability when respondents were grouped as students, teachers and homemakers with chi- square value of 4.794, 4.756, 8.186, 6.430 and 8.824 respectively. The probability of 0.091, 0.093, 0.017, 0.040 and 0.012 were greater than the set alpha level of 0.01 respectively.

Table 2
Kruskal-Wallis Test on the Acceptability of Puto Using Sweet Puto Flour when Respondents are Grouped as Students, Teachers and Homemakers

Category		df	Mean Rank	X2	Significance
1. Aroma					
	students		20.87		
	teachers	2	20.10	4.794	0.091*
	homemakers		28.03		
2.Color					
	students		27.70		
	teachers	2	18.40	4.756	0.093*
	homemakers		22.90		
3.Flavor					
	students		21.93		
	teachers	2	17.60	8.186	0.017*
	homemakers		29.47		
4.Texture					
	students		17.73		
	teachers	2	22.60	6.430	0.040*
	homemakers		28.67		
5.General Acceptability					
	students		21.87		
	teachers	2	18.13	8.824	0.012*
	homemakers		29.00		

*NS *p*>.01 alpha*

CONCLUSIONS

Based on the findings of the study, it was concluded that puto made with sweet potato flour was highly acceptable to the respondents in terms of aroma, color, flavor, texture, and overall acceptability. The statistical analysis further confirmed that there was no significant difference in the level of acceptability among the three respondent groups (students, teachers, and homemakers), indicating that the product appeals to a diverse consumer base.

Moreover, the study revealed that the finished product possessed an appetizing appearance and a palatable flavor, making it an attractive alternative to traditional rice-based puto. These findings suggest that sweet potato flour can be effectively used in puto production without compromising its sensory qualities. Given the high acceptability ratings, it can be inferred that this innovation has strong potential for consumer acceptance in the broader market.

From a business perspective, the results imply that puto made with sweet potato flour is feasible for commercialization. If introduced into the local market, it is likely to be well-received by consumers, particularly as a nutritious and unique variation of the traditional Filipino delicacy. This finding supports opportunities for entrepreneurship and small-scale food businesses, especially those catering to health-conscious consumers looking for an alternative to rice-based products.

In light of the study's findings, the researchers recommend the adoption and promotion of puto made with sweet potato flour within the community. This product offers various health benefits, as sweet potatoes are a rich source of vitamins, minerals, potassium, iron, and copper. Unlike commercially available puto, this variation provides higher nutritional value due to its sweet potato content, which is known for its antioxidant properties and dietary fiber. Furthermore, the product is easy to prepare, making it a convenient and practical food option.

Additionally, the researchers encourage homemakers and aspiring entrepreneurs to consider puto using sweet potato flour as an income-generating venture. Given its high acceptability and market feasibility, this product presents an opportunity to augment family income through small-scale production and local sales. Future studies may explore different formulations, shelf-life stability, and marketability strategies to further enhance the product's commercial potential.

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