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Research Article

Product Development and Acceptability of Pili Cheese Cupcake Enriched with Pili Pulp

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Abstract:

This study aimed to develop and evaluate the acceptability of a Pili Cheese Cupcake enriched with pili pulp, an innovative bakery product made with local ingredients. A descriptive research design was employed, and sensory evaluation was conducted among 25 respondents composed of students, teachers, and consumers using a 5-point Likert scale. The product was assessed for appearance, aroma, taste, texture, and overall acceptability. Results of the quantitative descriptive analysis revealed that all sensory attributes were rated "Excellent," with taste obtaining the highest mean score (4.58), followed by appearance (4.35), texture (4.33), and aroma (4.28). In terms of acceptability, the cupcake achieved a composite mean of 4.25, interpreted as "Highly Acceptable." Findings indicate that incorporating pili pulp enhanced the flavor profile without compromising other sensory qualities. The study demonstrates the potential of pili as a value-added ingredient in bakery products and supports their use to promote local agricultural resources and culinary innovation.

Keywords: Pili nut, product development, sensory evaluation, acceptability, bakery innovation

Introduction

Cupcakes are widely consumed bakery products due to their affordability, convenience, and appealing taste. They are popular among students, professionals, and consumers of all ages, making them a common choice for snacks and desserts. Among the various cupcake flavors available in the market, cheese cupcakes have gained popularity because of their rich flavor, moist texture, and balanced sweet–savory profile. However, many commercially available cheese cupcakes rely on conventional ingredients and imported flavorings, limiting the utilization of local agricultural products.

The Philippines is rich in indigenous food resources, one of which is the *pili nut* (*Canarium Ovatum*), predominantly cultivated in the Bicol Region. Pili nuts are known for their buttery texture, distinctive flavor, and nutritional value. Traditionally, pili nuts are consumed roasted, candied, or processed into spreads and pastries. Despite their versatility, the incorporation of pili into modern bakery products remains limited, particularly in cupcake formulations.

To enhance product innovation and promote local ingredients, the researchers developed a *Pili Cheese Cupcake enriched with pili pulp.* Unlike conventional cheese cupcakes that rely solely on cheese for flavor, this product incorporates chopped pili nuts and a minimal amount of pili pulp directly into the batter. The addition of pili pulp intensifies the natural pili flavor, making it more pronounced and distinctive, thereby differentiating the product from other cheese cupcakes available in the market.

The development of this product highlights the potential of pili as a value-added ingredient in bakery products while supporting local agriculture. Thus, this study aims to develop a Pili Cheese Cupcake enriched with pili pulp and evaluate its acceptability in terms of appearance, aroma, taste, texture, and overall acceptability among students, teachers, and consumers.

Statement of The Problem

This study aimed to determine the acceptability of the Pili Cheese Cupcake enriched with pili pulp.

Specifically, it sought to answer the following questions:

1. What is the sensory characteristics of the Pili Cheese Cupcake in terms of:
a. Appearance
b. Aroma
c. Taste
d. Texture
2. What is the level of acceptability of the Pili Cheese Cupcake in terms of:
a. Appearance
b. Aroma
c. Taste
d. Texture
3. What innovative recipe can be proposed based on the findings of the study?

Review of Related Literature and Studies

In recent years, there has been an increasing demand for innovative bakery products that incorporate local and functional ingredients. This trend has encouraged researchers and food developers to explore the use of indigenous crops to enhance both product quality and cultural identity.

The *pili nut* (*Canarium ovatum Engler*)* is a native tree nut primarily cultivated in the Bicol Region of the Philippines. It is renowned for its nutritional richness, culinary versatility, and unique flavor profile. Pili kernels are high in monounsaturated fats, proteins, and essential minerals such as potassium, phosphorus, and magnesium, which make them a promising ingredient for functional foods and bakery products (ScienceDirect, 2018). Its nutritional composition and bioactive components have attracted attention in food science and culinary applications.

Research shows that pili nuts offer numerous health benefits. The oil extracted from pili nuts is comparable to other heart-healthy oils due to its fatty acid composition, while its protein and antioxidant content suggest potential nutraceutical applications. Pili nut proteins have demonstrated antioxidant and antihypertensive properties, highlighting their functional value in human nutrition (UPLB OVCR, 2019).

In food product development, pili flour has been successfully incorporated into baked goods. Studies on cookies enriched with pili flour revealed that increasing its proportion improved protein, fat, fiber, and energy content without compromising sensory appeal (UMS Journal, 2020). Similarly, research on cakes developed with pili pulp and nuts showed that such products could achieve acceptable texture, flavor, and moisture content, indicating the suitability of pili ingredients for bakery innovations (IJISRT, 2021).

Beyond nutritional benefits, pili nuts hold cultural and traditional significance in Filipino cuisine. Archival and culinary sources highlight their use in various desserts such as brittle, tarts, polvoron, and pies (PhilStar, 2009). This cultural acceptance emphasizes the feasibility of integrating pili ingredients into contemporary pastries like cupcakes.

Consumer acceptability is a key factor in developing pili-based bakery products. Studies on pilinut-enriched spreads and bakery items report favorable evaluations in terms of taste, texture, aroma, and overall preference, suggesting that pili cupcakes could appeal to a broad audience (JETIR, 2021). Moreover, pre-processing techniques such as soaking or germination have been shown to improve nutrient availability and affect textural properties, which is crucial for optimizing cupcake formulations (Philippine Journal of Science, 2025).

From an economic perspective, the utilization of pili in value-added products can enhance local livelihoods. Incorporating underutilized by-products such as pili pulp into bakery products offers sustainable production opportunities while promoting innovation in the food industry (JEMAD, 2020).

The sensory attributes of pili—its buttery texture, subtle sweetness, and nutty flavor—make it particularly suitable for cupcakes. Adjusting the ratio of pili flour to traditional wheat flour allows bakers to balance taste, texture, and mouthfeel, creating products that are both nutritious and enjoyable (Philippine Morning Post, 2022).

Despite these promising findings, there is a notable gap in formal research specifically addressing pili cupcakes. Most studies focus on cookies, cakes, or spreads, leaving an opportunity for targeted investigation into formulation, sensory evaluation, and consumer acceptance of pili-based cupcakes. Addressing this gap could contribute to culinary innovation, nutritional enhancement, and the promotion of locally sourced ingredients in bakery products.

In summary, the reviewed literature supports the potential of pili nuts and flour as functional, nutritious, and culturally accepted ingredients in cupcake production. Further research focusing specifically on pili cupcakes is needed to establish optimal formulations and validate consumer appeal.

Sensory Characteristics Evaluation

Sensory evaluation is a standard method used to assess consumer perception of food products. The 5-point Likert scale is commonly applied in food studies to measure acceptability based on specific sensory attributes such as appearance, aroma, taste, texture, and overall acceptability. Stone et al. (2012) emphasized that structured sensory evaluation provides reliable data for product improvement and validation.

Methodology

A. Research Method

This study employed a descriptive research design to determine the acceptability of the Pili Cheese Cupcake enriched with pili pulp. Sensory evaluation was conducted to assess the product's appearance, aroma, taste, texture, and overall acceptability using a structured evaluation questionnaire.

B. Respondents/Participants of the Study

The respondents of the study consisted of 25 individuals, composed of students, teachers, and consumers. A mixed group of respondents was selected to obtain varied perspectives regarding the acceptability of the product.

C. Sampling Technique

The study utilized *non-probability sampling*, specifically convenience sampling. This technique was chosen because it allowed the researchers to easily gather data from respondents who were readily available and willing to participate in the sensory evaluation.

D. Research Instrument

The primary research instrument used was an *evaluation questionnaire* employing a *5-point Likert scale*. The questionnaire measured respondents' perceptions of the product in terms of appearance, aroma, taste, texture, and overall acceptability. The scale ranged from *Highly Acceptable, Acceptable, Least Acceptable, to Not Acceptable.*

E. Data Gathering Procedures

The data gathering was conducted in three phases:

Phase I – Product Preparation. The Pili Cheese Cupcake was prepared using standardized procedures. Chopped pili nuts and a minimal amount of pili pulp were incorporated into the cupcake batter to enhance the pili flavor.

Phase II – Sensory Evaluation. The sensory evaluation was conducted within the campus and outside the campus. Respondents were given samples of the Pili Cheese Cupcake and were instructed to evaluate the product based on the given criteria.

Phase III – Data Collection. After tasting the product, respondents completed the evaluation questionnaire. All responses were collected, tabulated, and prepared for analysis.

F. Statistical Treatment

To analyze the data gathered, the *weighted mean* was computed to determine the level of acceptability for each sensory attribute. The *composite mean* was also calculated to determine the overall acceptability of the product. The formula is shown below, where $\overline{x}$ is the weighted mean, *w* the weight of each data point, and *x* is value of each data point.

$$\overline{x} = \frac{\sum W_n x_n}{\sum W_n}$$

The scale categories used for level of acceptability are as follows:

Scale Range	Verbal Interpretation
4.21 – 5.00	Highly Acceptable
3.41 – 4.20	Acceptable
2.61 – 3.40	Moderately Acceptable
1.81 – 2.60	Slightly Acceptable
1.00 – 1.80	Not Acceptable

The scale categories used for Quantitative Descriptive Analysis are as follows:

Scale Range	Verbal Interpretation	Description
4.21 – 5.00	Excellent	The product characteristic is strongly liked and very satisfactory.
3.41 – 4.20	Very Good	The product characteristic is liked and acceptable.
2.61 – 3.40	Good	The product characteristic is somewhat liked but may need improvement.
1.81 – 2.60	Fair	The product characteristic is less liked and needs improvement.
1.00 – 1.80	Poor	The product characteristic is disliked and unacceptable.

Results and Discussion

A. Sensory Characteristic Evaluation

Based on the results of the quantitative descriptive analysis in table 1, all sensory attributes of the Pili Cheese Cupcake fall within the 4.21–5.00 scale range, which is interpreted as Excellent, meaning that the product characteristics are strongly liked and very satisfactory by the respondents.

Specifically, appearance obtained a mean score of 4.35, which is interpreted as Excellent, indicating that the cupcake is visually appealing and well-presented. Aroma received a mean of 4.28, also interpreted as Excellent, suggesting that the cheese–pili aroma is pleasant and inviting to the respondents. Taste recorded the highest mean score of 4.58, which is likewise Excellent, indicating that the intensified and pronounced pili flavor is strongly liked. Lastly, texture obtained a mean score of 4.33, interpreted as Excellent, showing that the cupcake has a soft, moist, and desirable consistency.

Overall, the results indicate that the Pili Cheese Cupcake demonstrates excellent sensory qualities, as all evaluated attributes were strongly liked and found very satisfactory by the respondents.

Table 1: Quantitative Descriptive Analysis

Sensory Attribute	Mean	Verbal Interpretation
Appearance	4.35	Excellent
Aroma	4.28	Excellent
Taste	4.58	Excellent
Texture	4.33	Excellent

B. Acceptability Level of the Pili Cheese Cupcake

Using the 5-point Likert scale, the results in table 2 show that the Pili Cheese Cupcake is generally *highly acceptable* to the respondents, as indicated by the composite mean of *4.25*. Among the quality attributes, taste obtained the highest weighted mean (4.47), indicating that respondents strongly liked the flavor of the product. Texture also received a high rating (4.21), suggesting that the cupcake has a desirable consistency. Meanwhile, appearance (4.18) and aroma (4.12) were rated acceptable, showing that these attributes were still positively perceived by the respondents. Overall, the findings suggest that the product is *well accepted in terms of its sensory qualities.*

The findings suggest that incorporating pili pulp into the cupcake batter enhances flavor without negatively affecting other sensory attributes. This supports previous studies emphasizing the importance of flavor innovation and local ingredient utilization in product development.

Table 2: Quantitative Descriptive Analysis

Quality Attribute	Weighted Mean	Verbal Interpretation
Appearance	4.18	Acceptable
Aroma	4.12	Acceptable
Taste	4.47	Highly Acceptable
Texture	4.21	Highly Acceptable
Composite Mean	**4.25**	**Highly Acceptable**

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