

Rum-Infused Cupcakes: Improving Flavor Profiles and Texture in Baked Goods

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Abstract: This study entitled “*Rum-Infused Cupcakes: Improving Flavor Profiles and Texture in Baked Goods*” aimed to determine how different amounts of rum affect the flavor, aroma, texture, appearance, and overall acceptability of cupcakes. The study also sought to identify the right amount of rum that could improve the quality of cupcakes without making the flavor too strong.

An experimental research design was used in the study. Four cupcake treatments were prepared with different rum concentrations: T0 (0 mL), T1 (5 mL), T2 (10 mL), and T3 (15 mL). The cupcakes were evaluated by 30 panelists using the 9-point Hedonic Scale to measure their level of acceptability based on taste, aroma, texture, and appearance.

The results showed that Treatment 1 with 5 mL of rum received the highest overall mean score of 8.32, interpreted as “Like Very Much.” It also gained the highest ratings in taste, aroma, texture, and appearance among all treatments. The control treatment without rum also received high ratings, while treatments with higher rum concentrations obtained lower scores. This indicates that adding a small amount of rum can improve the sensory qualities of cupcakes, but too much rum may affect the flavor and texture negatively.

The study concluded that 5 mL of rum is the most suitable amount for producing rum-infused cupcakes with high consumer acceptability. The findings of the study may help bakers and food entrepreneurs develop more innovative and flavorful baked products.

Keywords: *Rum-Infused Cupcakes, Cupcakes, Baked Goods, Flavor Enhancement, Texture, Sensory Evaluation, Consumer Acceptability, Food Innovation, Rum, Bakery Products.*

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I. INTRODUCTION

The Philippines is renowned for its rich cultural heritage, and its diverse food traditions are an integral part of its identity. Among the many culinary innovations, baking, especially cupcakes and other sweet pastries, has become an increasingly popular industry segment, especially in urban areas where there is a growing demand for unique and innovative food products. In the Philippines, baking has long been influenced by local ingredients and flavors, but there remains a significant opportunity to blend these with global influences, creating new flavors that resonate with both local and international tastes.

Rum is a product that is deeply ingrained in Philippine culture. The Philippines is one of the world’s largest producers of rum, with brands like Tanduay, Emperador, and Don Papa gaining recognition not only locally but globally. The traditional use of rum in cocktails and desserts, particularly in Filipino classics like leche flan and

bibingka, demonstrates its versatility as an ingredient in the culinary world. However, there is limited research and exploration into the potential of rum as an infusing agent in modern baked goods, specifically in cupcakes.

The Philippines has a longstanding tradition of rum production. By incorporating rum into cupcakes, this research taps into a local product that could deepen consumer connection with the product. Filipino consumers may be more willing to embrace rum-infused cupcakes due to their familiarity with the ingredient, as well as the opportunity to elevate traditional baked goods with a uniquely Filipino touch.

Rum is known for its rich, complex flavors ranging from sweet and fruity to spiced or even smoky, depending on the variety. This seeks to explore how different types of rum can enhance the flavor profile of cupcakes, creating a novel flavor experience. Infusing rum into cupcakes could elevate the dessert from a simple treat to a more

sophisticated, artisanal product, appealing to consumers who are looking for innovative and gourmet desserts.

In baking, alcohol such as rum can contribute to a moist and tender texture in cakes and cupcakes. Alcohol evaporates during baking, leaving behind a subtle, flavorful richness that complements the sweetness of the batter. By studying the precise impact of rum infusion on the texture and overall quality of cupcakes, this research can potentially lead to the creation of cupcakes with better moisture retention, improved crumb structure, and a longer shelf life.

II. OBJECTIVES/STATEMENT OF THE PROBLEM/ CONCEPTUAL FRAMEWORK AS NECESSARY FOR MULTI-DISCIPLINE/INTEGRATIVE STUDIES

The primary objective of this study is to evaluate the feasibility of utilizing rum as a key ingredient in enhancing the flavor profiles and texture of cupcakes. Specifically, the study aims to address the following research questions:

- What is the level of consumer acceptability of rum-infused cupcakes in terms of:
 - Taste
 - Aroma
 - Texture
 - Appearance
- What is the optimal amount of rum infusion that enhances the cupcake's flavor without overpowering it?
- How do rum-infused cupcakes compare with traditional non-alcoholic cupcakes in terms of consumer preference and sensory quality?

III. REVIEW OF LITERATURE

A study by Krol et al. (2020) titled "Impact of Alcohol on the Flavor Profile of Baked Goods" explored how alcohol-based ingredients, including rum, affect the sensory qualities of various baked products. The study found that alcohol, when added in appropriate amounts, significantly enhances the flavor of baked goods, providing a more complex and robust taste. The study suggested that rum, with its rich and multifaceted flavor profile, works particularly well in baked goods, contributing depth and warmth to the overall flavor experience. The study concluded that rum could act as an effective natural flavor enhancer without overwhelming the delicate balance of other ingredients in cakes and cupcakes.

Choi et al. (2021) in their study "Effect of Alcohol on the Texture and Moisture Content of Cakes" examined the role of different alcohols, including rum, in enhancing the texture and moisture of cakes and cupcakes. The study demonstrated that alcohol in small amounts helped retain moisture in the final product and improved the cake's softness and tenderness. Rum was specifically noted for its ability to impart a desirable moist crumb structure. The

researchers concluded that alcohol like rum could contribute to the preservation of cake texture, leading to a more enjoyable eating experience. However, they emphasized that excessive amounts could negatively affect the texture by making it too dense or wet.

Lopez et al. (2022) published a study "Consumer Preferences for Alcohol-Infused Baked Goods: A Case Study with Rum-Infused Cupcakes" in the *International Journal of Culinary Science*. This study focused on consumer acceptance of alcohol-infused cupcakes, including those made with rum. The researchers surveyed 200 participants to evaluate their preferences based on taste, texture, aroma, and overall appeal. The results showed that consumers were generally receptive to rum-infused cupcakes, with the majority of participants rating the flavor and aroma positively. However, the study also found that consumer acceptance varied by age group, with younger participants more likely to enjoy the rum flavor compared to older participants who preferred milder flavors. The study highlighted that rum-infused cupcakes, when paired with complementary flavors such as chocolate or vanilla, were particularly popular.

A study by De La Cruz et al. (2023) titled "Utilizing Rum in Filipino Desserts: A New Trend for Local Pastries" explored the integration of local rum brands into traditional Filipino desserts. The research showed that rum, being a significant part of Filipino culture and the food industry, could be utilized creatively in various baked goods, including cupcakes. The study emphasized the opportunity to create premium local products by infusing rum into pastries like cupcakes, offering a unique flavor that appeals to both local and international markets. The study's findings support the idea that rum-infused cupcakes could have strong market potential, particularly in the growing gourmet and artisanal baking sectors.

Johnson et al. (2022) conducted research on "Alcohol and Its Effects on the Shelf Life and Stability of Cakes". The study found that alcohol, including rum, could prolong the shelf life of baked goods by acting as a preservative. Alcohol helps reduce microbial growth due to its antiseptic properties, allowing rum-infused cupcakes to retain their freshness for a longer period compared to standard cupcakes. The research recommended that rum-infused cupcakes, when prepared with the right balance of alcohol content, could have a longer shelf life without compromising quality, making them a viable product for both local markets and export.

IV. CONCEPTUAL FRAMEWORK

➤ *Paradigm of the Study*

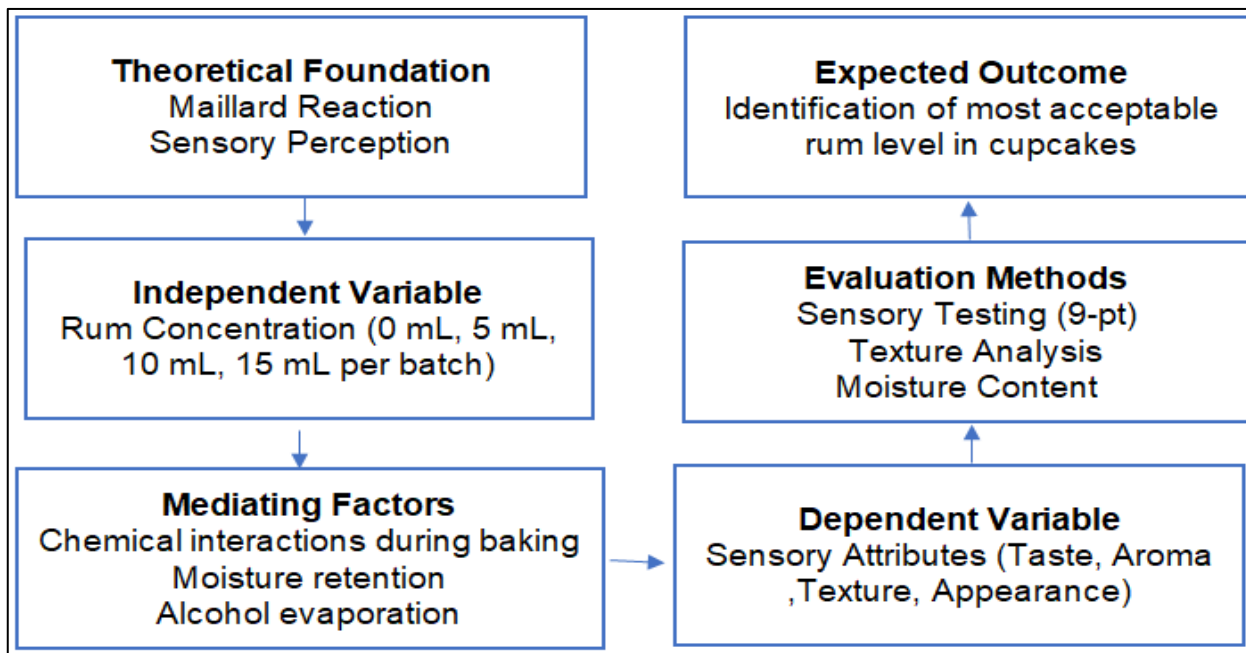


Fig 1 Conceptual Framework

V. PROCEDURE/METHODOLOGY

➤ *Research Design*

This study employs an experimental research design, specifically a complete randomized design, to determine the feasibility of using rum on the sensory properties and overall acceptability of cupcakes. In order to appreciate the use of statistics in the context, it is helpful to have some understanding of experimental design and how researchers conduct investigations.

In this study, four different cupcake formulations were prepared to examine the effect of varying rum concentrations on sensory properties and overall acceptability. These formulations served as the experimental treatments and were as follows:

- T0 (Control): Cupcake with 0% rum (no rum added).
- T1 (Low Rum Concentration): Cupcake with 5 mL of rum per batch.
- T2 (Medium Rum Concentration): Cupcake with 10 mL of rum per batch.
- T3 (High Rum Concentration): Cupcake with 15 mL of rum per batch.

The rum used in the study was of food-grade quality and added during the batter preparation stage.

➤ *Sample Preparation for Sensory Evaluation*

The cupcakes for each treatment were prepared using a standardized cupcake recipe to ensure consistency in texture, baking time, and ingredient ratios (excluding the rum

variable). The same brand and type of flour, sugar, eggs, butter, and other ingredients were used throughout.

Preparation steps:

- All ingredients were measured accurately using a digital scale.
- The base cupcake batter was mixed uniformly for all treatments.
- The designated amount of rum was added to each batch according to the treatment level (T0–T3).
- Cupcakes were baked in a preheated oven at 180°C for 20–25 minutes until a toothpick inserted came out clean.
- After baking, the cupcakes were cooled at room temperature for 30 minutes before evaluation.
- Each batch produced equal-sized cupcakes, and samples were coded with random three-digit numbers to prevent identification bias during the sensory test.

Before the evaluation, the panelists were instructed on how to use the 9-point hedonic scale and were provided with water to cleanse their palate between samples.

➤ *Respondents of the Study*

• *Instrumentation*

The researchers designed three treatments for the taste test as the data collection instrument for this study. Research instrument used in the study is a simple questionnaire to help the researchers determine the acceptability of rum infused cupcakes.

To ensure statistical reliability and validity of the sensory evaluation, the study employed 30 panelists. This number is based on commonly accepted standards in sensory research for consumer preference tests, where a sample size of at least 20–30 untrained panelists is recommended for hedonic testing (Stone, Bleibaum, & Thomas, 2012).

The minimum required sample size was calculated using a power analysis, considering:

- ✓ Effect size (f): 0.40 (moderate to large effect)
- ✓ Alpha level (α): 0.05
- ✓ Power (1 - β): 0.80
- ✓ Number of groups (treatments): 4

• *Selection Criteria:*

To ensure reliable and informed sensory evaluations, the following inclusion criteria were used in selecting panelists:

- ✓ Age: 18–45 years old
- ✓ No food allergies, especially to alcohol, dairy, or wheat
- ✓ No impairments in taste or smell
- ✓ Non-smokers (to minimize sensory interference)
- ✓ Must be willing to consume food items containing alcohol (rum)

Preferably with background knowledge or experience in food tasting, hospitality.

➤ *Statistical Treatment*

Data were analyzed using the 9- point hedonic scale which is presented below. Each of the rating score given by the panelist for each sensory evaluation category were tabulated and added to get mean score.

Table 1 Scale and Verbal Interpretation of 9-Point Hedonic Scale

Scale	Verbal Description
9	Like Extremely
8	Like Very much
7	Like Moderately
6	Like Slightly
5	Neither Like or Dislike
4	Dislike Slightly
3	Dislike Moderately

Each of the rating (scores) given by the panelist for each sensory evaluation category (taste, appearance and color) were tabulated and added to get the mean scores.

VI. RESULTS AND DISCUSSIONS

The table below shows the computed mean scores for each sensory attribute per treatment:

Table 2 Preference Test of Rum-Flavored Cupcakes

Treatment	Taste	Aroma	Texture	Appearance	Overall Mean	Verbal Interpretation
T0 (0 mL)	8.13	8.03	8.00	8.03	8.05	Like very much
T1 (5 mL)	8.27	8.20	8.27	8.53	8.32	Like very much (Highest)
T2 (10 mL)	7.50	7.37	7.50	7.47	7.46	Like moderately
T3 (15 mL)	7.60	7.53	7.20	7.13	7.37	Like moderately

The process of producing rum-infused cakes involved the following steps: measuring and incorporating the rum (0 mL, 5 mL, 10 mL, 15 mL) into the cake batter, mixing with the standard ingredients, baking, and conducting sensory evaluation. The evaluation was carried out by 30 panelists who assessed the samples based on taste, aroma, texture, and appearance using the 9-point Hedonic scale.

Table 2 shows that treatment 1 (5 mL rum) gave the highest rating on appearance, with a mean score of 8.53, interpreted as "Like very much". On taste and texture, the same treatment also received high mean ratings of 8.27, indicating strong consumer preference. In terms of aroma,

treatment 1 again achieved a high score of 8.20, slightly higher than the control.

The overall mean rating was highest for treatment 1, with a score of 8.32, followed by the control (treatment 0) with 8.05, both interpreted as "Like very much". Treatments 2 (10 mL rum) and 3 (15 mL rum) had lower overall scores of 7.46 and 7.37 respectively, corresponding to the interpretation "Like moderately". These results suggest that a moderate amount of rum (5 mL) enhances the sensory qualities of the cake, while higher concentrations may negatively affect appearance and texture.

VII. CONCLUSION AND RECOMMENDATIONS

This study investigated the impact of varying rum concentrations on the sensory properties and overall acceptability of cupcakes using a complete randomized experimental design. Sensory evaluation by 30 panelists revealed that cupcakes infused with a low concentration of rum (5 mL per batch) consistently received the highest scores for taste, aroma, texture, and appearance. The control cupcakes without rum were also well-liked but scored slightly lower compared to the low rum treatment. Higher rum concentrations (10 mL and 15 mL) tended to decrease the sensory appeal, possibly due to stronger alcohol flavor and changes in texture and appearance.

Thus, the inclusion of a moderate amount of rum enhances the sensory quality and consumer acceptability of cupcakes, while excessive rum addition negatively affects these attributes.

➤ *For Product Development:*

It is recommended to use 5 mL of food-grade rum per batch to optimize the sensory properties of rum-infused cupcakes.

➤ *Further Research:*

• *Future Studies may Explore:*

- ✓ The effect of different types of rum or other alcoholic flavors on cupcake quality.
- ✓ Shelf-life and storage stability of rum-infused cupcakes.
- ✓ Consumer acceptance tests with a larger and more diverse sample population.

➤ *Practical Application:*

Bakers and food manufacturers aiming to innovate in flavored baked goods can incorporate low levels of rum to enhance flavor complexity without compromising texture and appearance.

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