Business Fora: Business and Allied Industries International Journal
2026, Vol. 6, No.2, 18 – 26 | ISSN Online: 3028-1326 | ISSN Print: 3028-1334
DOI: https://doi.org/10.62718/vmca.bf-baiij.6.2.SC-1125-026

Acceptability of Jackfruit Seed (Artocarpus heterophyllus) Flour as Enrichment for Muffins

Article History:
Received: 18 November 2025
Accepted: 03 January 2026
Published: 17 January 2026

Michelle B. Pahayculay, DBM-HM, ORCID No. 0009-0005-0535-6764
Associate Professor 5, Iloilo State University of Fisheries Science & Technology, Dumangas Campus, Iloilo, Philippines

Abstract

Food is fundamental to sustaining human life, as it provides the essential nutrients, energy, and vitamins needed for growth and well-being. Among the many food products enjoyed worldwide, muffins stand out as a popular bakery item that has been continuously innovated with diverse flavors to satisfy consumer preferences. In the Philippines, one promising ingredient for such innovations is the jackfruit (Artocarpus heterophyllus), locally known as "Langka" or "Nangka," a highly versatile fruit whose seeds are often overlooked and discarded despite their significant nutritional value. Hence, this study investigated the incorporation of jackfruit seed flour into muffins as a sustainable and value-added bakery product. An experimental research design was employed, involving three muffin formulations containing varying levels of jackfruit seed flour (1 cup, ½ cup, and ¼ cup). Sensory evaluation was conducted to assess the level of acceptability of the muffins in terms of color, aroma, texture, flavor, and general acceptability using a standardized sensory evaluation tool. The findings revealed that muffins containing ¼ cup jackfruit seed flour (Formulation C) obtained the highest sensory ratings, particularly in color, aroma, texture, and general acceptability, which were interpreted as Extremely Acceptable. Significant differences were observed in texture and flavor among the formulations, indicating that the proportion of jackfruit seed flour influenced these attributes, while no significant differences were found in color, aroma, and general acceptability. Overall, the results demonstrate that jackfruit seed flour can be successfully incorporated into muffin formulations without compromising consumer acceptability. The study concluded that jackfruit seed flour can effectively enhance the nutritional profile of muffins while maintaining consumer acceptability, offering a practical approach to food innovation and sustainable utilization of fruit by-products.

Keywords: jackfruit seed, muffin, sensory evaluation, acceptability, functional food, flour substitution, experimental design

INTRODUCTION

Food is a fundamental human necessity, providing the energy, nutrients, and bioactive compounds required to sustain bodily functions and promote overall well-being (Whitney & Rolfes, 2019). As consumers become increasingly health-conscious, there is a growing demand from consumers for nutritious food products that offer both quality and functional benefits.

In the baking industry, muffins have gained global popularity due to their versatility, accessibility, and ability to incorporate a wide variety of flavor innovations (Gisslen, 2018). Traditionally, muffins are prepared using basic ingredients such as flour, water, oil, milk, and eggs; however, recent trends highlight the integration of alternative flour sources to enhance their nutritional value and consumer appeal (Adeleke & Odedeji, 2010).

Jackfruit (Artocarpus heterophyllus), locally known as "langka" or "nangka," is one of the most widely cultivated fruit species in the Philippines, owing to its adaptability and year-round availability. It is valued not only for its sweet, aromatic flesh but also for its various utilitarian parts, including the leaves, trunk, latex, and seeds (Ranasinghe et al., 2019). Jackfruit production in several regions of the country has steadily increased, enabling distribution to major urban markets and supporting its role as an economically significant fruit crop (BPI, 2020).

Among its components, jackfruit seeds are often discarded despite being rich in carbohydrates, protein, fiber, and essential minerals, making them a promising ingredient for food product development (Ocloo et al., 2010). These seeds can be processed into flour through cleaning, boiling, drying, and grinding—a method utilized by the researcher to produce jackfruit seed flour specifically for this study. The processing conducted by the researcher ensures the novelty of the product and highlights the potential of jackfruit seed flour as a sustainable, value-added ingredient.

In line with the increasing interest in functional baked goods, this study explores the acceptability of jackfruit seed flour as an enrichment ingredient for muffins. By incorporating a flour source that is both nutritious and locally abundant, the study aims to develop a new muffin variant that not only offers potential health benefits but also promotes waste reduction and the utilization of underused agricultural by-products. Furthermore, the use of jackfruit seed flour presents an affordable and innovative alternative to commercial wheat flour, addressing both nutritional and economic considerations in food production.

Statement of the Problem. This study aimed to find out the level of Acceptability of Jackfruit Seed (Artocarpus heterophyllus) Muffins. Specifically, it sought answers to the following questions:

1. What is the level of acceptability of jackfruit seed muffin based on the following formulations:
   1.1 (A) with 1 cup of jackfruit seed flour;
   1.2 (B) with ½ cup of jackfruit seed flour; and,
   1.3 (C) with ¼ cup of jackfruit seed flour?

2. Is there a significant difference in the level of acceptability of jackfruit seed muffin when assessment is grouped according to the three formulations?

Conceptual Framework. This study investigates the level of acceptability of muffins enriched with jackfruit seed flour using three different formulations. The input of the study consists of the varying proportions of jackfruit seed flour incorporated into the muffin batter: Formulation A (1 cup jackfruit seed flour), Formulation B (½ cup jackfruit seed flour and ½ cup all-purpose flour), and Formulation C (¼ cup jackfruit seed flour and ¾ cup all-purpose flour). Each formulation is evaluated based on five sensory attributes aroma, color, flavor, texture, and general acceptability to determine which proportion yields the most favorable sensory quality. The study further aims to identify significant differences in the acceptability ratings among the three formulations.

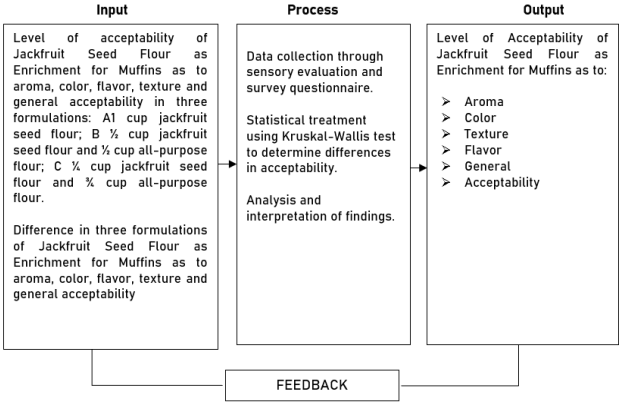

Figure 1
The research paradigm

The study focuses on determining the level of acceptability of muffins enriched with jackfruit seed flour using three formulations: Formulation A (1 cup jackfruit seed flour), Formulation B (½ cup jackfruit seed flour and ½ cup all-purpose flour), and Formulation C (¼ cup jackfruit seed flour and ¾ cup all-purpose flour). The acceptability of these formulations is assessed based on five sensory attributes aroma, color, flavor, texture, and general acceptability to determine how variations in jackfruit seed flour influence the sensory qualities of the product.

Data collection is carried out through sensory evaluation and a survey questionnaire, enabling participants to rate each formulation according to the established sensory attributes. To analyze the results, the study employs the Kruskal–Wallis test, a nonparametric statistical tool used to determine whether significant differences exist among the acceptability

ratings of the three formulations. The gathered data are then analyzed and interpreted to identify which formulation demonstrates the highest level of acceptability.

The output of this systematic process is a comprehensive evaluation of the level of acceptability of jackfruit seed flour as an enrichment ingredient for muffins, specifically in terms of aroma, color, flavor, texture, and general acceptability. Through this approach, the study aims to identify the most preferred formulation and provide valuable insights into the optimal ratio of jackfruit seed flour and all-purpose flour for producing an acceptable and potentially marketable muffin product.

LITERATURE REVIEW

The bakery industry continues to evolve as consumers increasingly prefer food products that balance health, convenience, and sensory appeal. Recent market analyses show that bakery manufacturers are responding to these preferences by developing items made with natural ingredients and nutrient-enriched components (Report Linker, 2023). Among the most adaptable bakery products are muffins, which remain popular due to their versatility, ease of preparation, and wide range of flavor profiles. Unlike cupcakes, which are typically sweet and frosted, muffins may be sweet or savory and are commonly consumed as breakfast or snack items across different cultures. Variants such as blueberry, chocolate chip, lemon, and cheese muffins highlight the product's flexibility in accommodating various ingredients and consumer preferences. Muffins remain among the most adaptable bakery products, valued for their ease of preparation and capacity to support a broad range of flavor profiles. They are widely consumed as breakfast, snacks, or desserts, and can feature either sweet or savory ingredients from blueberries and chocolate chips to cheese or herbs reflecting evolving consumer preferences globally (American Society of Baking,n.d).

Given the expanding interest in functional baked products, researchers have explored the use of alternative flours as enrichment ingredients to improve nutritional value. Various studies demonstrate that locally sourced, plant-based materials can be successfully incorporated into muffin formulations. For instance, soybean flour, taro, and vegetable-based mixtures have been tested and found acceptable in terms of sensory attributes such as color, flavor, texture, and overall acceptability (Gaborne & Dormitorio, 2013; Tamayo, 2012; Sitchon, 2012). However, despite growing research on alternative ingredients, the use of jackfruit seed flour in muffins remains underexplored. This gap highlights the potential of jackfruit seeds—an abundant and often discarded by-product—as a valuable ingredient for food product development.

Jackfruit (Artocarpus heterophyllus) is a tropical fruit tree widely cultivated in Southeast Asia, known for producing one of the largest edible fruits among tree-bearing species. It thrives in humid lowland areas and yields large, sweet-smelling fruits composed of numerous edible bulbs. The fruit comes in several cultivated varieties, each differing in size, texture, aroma, and suitability for processing (Rahman et al., 1995). Although the fruit is commonly used in fresh desserts, preserves, and savory dishes, its seeds are frequently discarded despite their rich nutritional profile.

Jackfruit seeds contain significant amounts of starch, protein, iron, and phytonutrients such as lignans, isoflavones, and saponins—compounds associated with antioxidant, antimicrobial, and potential anti-cancer effects (Swami et al., 2012). Studies show that the seeds also possess polyphenols and flavonoids that contribute to improved digestion and overall wellness. Because of these health-promoting components, jackfruit seeds present a promising raw material for developing nutrient-enriched flour.

Research demonstrates that jackfruit seeds can be processed into flour with desirable functional properties for baking. Tulyathan et al. (2004) found that jackfruit seed flour yields around 36% usable product and exhibits characteristics suitable for food applications,

including baked goods. This provides scientific support for using jackfruit seed flour as a partial substitute for wheat flour. Additionally, product development studies such as those by Rudrawar et al. (2013), which formulated fruit-based muffins with positive sensory outcomes, further suggest the feasibility of integrating non-traditional ingredients into muffin production.

Overall, existing literature indicates strong potential for jackfruit seed flour as an enrichment ingredient in muffins. Its nutritional value, availability as a local agricultural by-product, and underutilization in commercial baking make it an ideal candidate for innovation. Exploring its acceptability in muffins not only addresses food waste reduction but also contributes to the development of affordable and nutritious bakery products which in turn conforms with the evolving public consumer demands.

METHODOLOGY

Design. This study utilized an experimental research design, which is commonly employed in food science investigations to determine the cause-and-effect relationship between variables. In this experiment, the independent variable was the proportion of jackfruit seed flour substituted for wheat flour, while the dependent variable was the level of sensory acceptability in terms of aroma, color, texture, flavor, and overall acceptability. The experimental method was appropriate for this study because it involved the deliberate manipulation of one variable—jackfruit seed flour substitution—while controlling other factors to assess its effect on the final product's sensory qualities. This design ensured that any observed variations in the respondents' ratings could be attributed directly to the manipulation and control of jackfruit seed flour levels (Bhaskaran, 2022).

Ingredients. The preparation of the jackfruit seed muffins followed three different formulations that varied in the ratio of jackfruit seed flour to all-purpose wheat flour. The ingredients included the following:

Primary Base: Jackfruit seed flour and all-purpose flour (Formulation A – 1C jackfruit seed flour; Formulation B – ½ C jackfruit seed flour; and Formulation C – ¼ C jackfruit seed flour).

Flavor Enhancers: Sugar, salt, and vanilla extract.
Leavening Agents: Baking powder and baking soda.

Binding Agents: Eggs and milk.

Liquid Component: Water or fresh milk, depending on the consistency of the batter.

Additional Ingredients: Cooking oil or butter for moisture and richness.

Materials and Equipment. The materials and equipment used in the experiment included measuring cups and spoons, mixing bowls, spatulas, electric mixers, muffin pans, and oven thermometers. A digital weighing scale was also used for precise measurement of ingredients, while a timer ensured uniform baking time. The preparation and baking of the muffins were conducted in the Hospitality Management Food Laboratory of Iloilo State University of Fisheries Science and Technology, located at Ilaya first, Dumangas, Iloilo, a controlled setting that ensured consistency and standardization during the experimentation and sensory evaluation phases.

Preparation and Baking Procedures. The muffin preparation process followed standardized steps to ensure consistency across all formulations.

1. ***Ingredient Preparation.*** Jackfruit seeds were boiled, peeled, sun-dried, and ground into fine flour. All other ingredients were measured according to the specific formulation.

2. ***Batter Preparation.*** The dry ingredients—jackfruit seed flour, wheat flour, baking powder, and salt—were combined in a mixing bowl. In a separate bowl, the wet ingredients—eggs, sugar, milk, and oil—were mixed until smooth. The wet mixture was

gradually incorporated into the dry ingredients, and the batter was stirred until a uniform consistency was achieved.

3. ***Baking Process.*** The muffin batter was poured into greased muffin pans, filling each mold about three-fourths full. The muffins were baked in a preheated oven at 180°C for 25 to 30 minutes, or until golden brown and cooked through. After baking, the muffins were cooled at room temperature before evaluation.

Sensory Evaluation. After cooling, the muffins were presented for sensory evaluation, where respondents assessed their aroma, color, texture, flavor, and general acceptability using a standardized sensory evaluation form. Each attribute was rated on a 5-point hedonic scale, ranging from "Dislike Extremely" to "Like Extremely." This scale is widely adopted in experimental research focusing on consumer preference and product acceptability. According to Meilgaard, Civille, and Carr (2016), 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.

Population, Setting, and Sampling Technique. The respondents consisted of 45 purposively selected individuals, composed of 15 Hospitality Management students, 15 homemakers, and 15 local bakers or vendors from Dumangas, Iloilo. These groups were chosen based on their familiarity with food preparation, sensory characteristics, and consumer preferences.

A purposive sampling technique was used to ensure that the participants had relevant experience and could provide meaningful and reliable evaluations of the product. According to Palinkas et al. (2020), purposive sampling enables researchers to intentionally select participants who possess specific characteristics or knowledge relevant to the study's objectives. This ensured that the results accurately reflected the acceptability of the jackfruit seed muffin formulations.

Survey Instrument. To assess the acceptability of the jackfruit seed flour in making muffins, the study utilized a sensory evaluation score sheet based on a modified five-point Hedonic Scale. The use of this standardized instrument ensured objective data collection and facilitated the statistical analysis of consumer perception regarding the different formulations of acceptability of jackfruit seed (Artocarpus heterophyllus) as enrichment for muffins. The scale was modified to include descriptive anchors for each numerical rating, ensuring clarity and consistency in responses (Table 1).

Table 1
Acceptability rating scale

Scale	Range	Responses
5	4.21 – 5.00	Extremely Acceptable (EA)
4	3.41 – 4.20	Very Acceptable (VA)
3	2.61 – 3.40	Moderately Acceptable (MA)
2	1.81 – 2.60	Slightly Acceptable (SA)
1	1.00 – 1.80	Not Acceptable (NA)

The instrument was content validated by a panel of experts, consisting of four members, who reviewed the items for clarity, relevance, and appropriateness to the study's objectives. Their feedback and suggestions were incorporated into the revised version of the instrument. Following the content validation, the instrument was pilot tested in three respondent's categories (15 HRM students, 15, Home Makers and 15 Teachers) within the study area to assess its construct validity and reliability. Factor analysis was conducted using the Statistical Package for Social Sciences (SPSS) software to evaluate the scale's validity.

Data Analyses. The data collected from the sensory evaluation of jackfruit seed (Artocarpus heterophyllus) muffins were analyzed using appropriate quantitative statistical tools to ensure accurate interpretation of results. The mean was used to determine the level of acceptability of the muffins based on specific sensory attributes—aroma, color, texture, flavor, and general acceptability—as evaluated by Hospitality Management students, homemakers, and local bakers. This measure provided an overall indication of the product's acceptability.

Three formulations of the jackfruit seed muffin were done to determine if significant differences exist among the formulations:

1. Formulation A – 25% jackfruit seed flour and 75% wheat flour

2. Formulation B – 50% jackfruit seed flour and 50% wheat flour

3. Formulation C – 75% jackfruit seed flour and 25% wheat flour

The Kruskal–Wallis H test was employed. This non-parametric statistical test was selected because it effectively compares ranked data across multiple independent samples and is appropriate for sensory evaluation studies where data may not follow a normal distribution.

RESULTS AND DISCUSSION

Level of acceptability of jackfruit seed muffin in three formulations as to color, aroma, texture, flavor and general acceptability. Table 1 presents the level of acceptability of jackfruit seed (Artocarpus heterophyllus) muffins in three formulations. The results show that Formulation C (¼ cup jackfruit seed flour) obtained the highest mean ratings in most sensory attributes, particularly in color (4.27), aroma (4.33), texture (4.29), and general acceptability (4.31), all of which were interpreted as Extremely Acceptable (EA). This indicates that a lower level of jackfruit seed flour substitution produced the most favorable sensory characteristics based on evaluation.

Table 1
Mean distribution of acceptability level of jackfruit seed (Artocarpus heterophyllus) muffins in three formulations

Criteria	Formulation A (1 cup Jackfruit Seed Flour)		Formulation B (½ cup Jackfruit Seed Flour)		Formulation C (¼ cup Jackfruit Seed Flour)	
	Mean	Desc.	Mean	Desc.	Mean	Desc.
Color	4.11	VA	4.15	VA	4.27	EA
Aroma	3.96	VA	3.20	MA	4.33	EA
Texture	3.93	VA	3.10	MA	4.29	EA
Flavor	4.16	VA	4.16	VA	4.16	VA
General Acceptability	4.09	VA	4.20	VA	4.31	EA

On the other hand, Formulation A (1 cup jackfruit seed flour) consistently received ratings described as Very Acceptable (VA) across all criteria, suggesting that while acceptable, higher substitution levels may slightly affect sensory preference. Formulation B (½ cup jackfruit seed flour) yielded mixed results, with moderate acceptability (MA) in aroma (3.20) and texture (3.10), but very acceptable (VA) ratings in color, flavor, and general acceptability.

Overall, the findings suggest that muffins incorporated with jackfruit seed flour are acceptable in terms of color, aroma, texture, flavor, and general acceptability, with Formulation C emerging as the most preferred formulation, followed by Formulation A, while Formulation B showed comparatively lower sensory ratings in specific attributes.

Difference in the level of acceptability of jackfruit seed muffin when assessment is grouped according to the three formulations. As presented in Table 2, the Kruskal-Wallis H test revealed that there were significant differences in the texture (H = 9.21, p = 0.027) and flavor (H = 8.94, p = 0.030) among the three muffin formulations. This implies that participants distinct variations in the mouthfeel and taste of the muffins depend on the amount of jackfruit seed flour used. In contrast, color, aroma, and general acceptability yielded p-values greater than 0.05, indicating no significant difference among the formulations. Results suggest that, while the appearance and aroma of the muffins were similarly rated, sensory qualities related to texture and flavor were notably influenced by the proportion of jackfruit seed flour.

Table 2
Difference in the level of acceptability of jackfruit seed muffin as to three formulation as to color, aroma, texture, flavor and generally acceptability

Criteria	Kruskal–Wallis H	p-value	Decision
Color	4.82	0.184	Not Significant
Aroma	6.73	0.081	Not Significant
Texture	9.21	0.027	Significant
Flavor	8.94	0.030	Significant
General Acceptability	7.16	0.067	Not Significant

**p>.05 alpha*

Conclusions. The sensory evaluation of jackfruit seed (Artocarpus heterophyllus) muffins revealed that all three formulations—

Formulation A (1 cup), Formulation B (½ cup), and Formulation C (¼ cup jackfruit seed flour)—were generally acceptable to respondents across the sensory attributes of color, aroma, texture, flavor, and general acceptability. The verbal descriptions ranged from Moderately Acceptable (MA) to Extremely Acceptable (EA), indicating positive consumer response to muffins incorporated with jackfruit seed flour.

Among the three formulations, Formulation C (¼ cup jackfruit seed flour) consistently obtained the highest mean ratings in most sensory attributes, particularly in color (4.27), aroma (4.33), texture (4.29), and general acceptability (4.31), all interpreted as Extremely Acceptable (EA). This suggests that a lower level of jackfruit seed flour substitution resulted in the most favorable balance of sensory qualities, making Formulation C the most preferred formulation among respondents.

Formulation A (1 cup jackfruit seed flour) was rated Very Acceptable (VA) across all criteria, demonstrating that a higher level of substitution remains acceptable but may slightly affect sensory preference. In contrast, Formulation B (½ cup jackfruit seed flour) showed mixed acceptability results, with Moderately Acceptable (MA) ratings in aroma and texture, indicating that this level of substitution may have negatively influenced certain sensory characteristics.

The results of the Kruskal–Wallis H test further revealed that there were significant differences in texture ($H = 9.21$, $p = 0.027$) and flavor ($H = 8.94$, $p = 0.030$) among the three formulations. This indicates that the proportion of jackfruit seed flour significantly influenced the mouthfeel and taste of the muffins. However, no significant differences were found in color, aroma, and general acceptability, suggesting that these attributes remained relatively consistent regardless of the level of jackfruit seed flour substitution.

In conclusion, the incorporation of jackfruit seed flour enhanced the sensory quality of muffins, particularly in terms of texture and flavor, without adversely affecting color, aroma, and overall acceptability. Formulation C (¼ cup jackfruit seed flour) emerged as the optimal formulation, offering superior sensory acceptability. These findings demonstrate that jackfruit seed flour can serve as a viable, nutritious, and acceptable alternative ingredient in muffin production, contributing to food innovation and the reduction of agricultural waste.

Limitations of the Study. While the findings provide valuable insights, certain limitations must be acknowledged. First, the study involved a limited number of formulations and sensory attributes, which may not fully capture the broader potential of jackfruit seed flour in bakery applications. Second, the sensory evaluation relied on the subjective perceptions of a specific group of respondents; results may vary with different demographic profiles or larger sample sizes. Additionally, the study did not analyze the nutritional composition, shelf life, or consumer purchase intent, which could affect the commercial and market viability of the product.

Recommendations for Future Research. In light of these limitations, future research may explore the following areas:

1. Nutritional analysis of jackfruit seed flour–based muffins to determine their comparative health benefits.

2. Shelf-life studies to assess product stability, moisture retention, and microbial safety over time.

3. Cost analysis and market acceptability studies to evaluate commercial feasibility and consumer buying behavior.

4. Experimentation with additional formulations, incorporating spices, sweeteners, or alternative fats to further enhance sensory qualities.

5. Comparative studies using other fruit seed flours (e.g., mango seed flour, avocado seed flour) to evaluate their potential in bakery items.

6. Analysis of textural properties using instrumental methods (e.g., texture profile analyzer) to support sensory panel data.

REFERENCES

Adeleke, R. O., & Odedeji, J. O. (2010). Functional and physicochemical properties of wheat and sweet potato flour blends. *Pakistan Journal of Nutrition, 9*(6), 535–538.

American Society of Baking. (n.d.). Muffins: Versatile baked products for modern consumers. https://asbe.org

Bhaskaran, S. (2022). Experimental research design in food science and nutrition studies. *Journal of Food Research and Technology, 9*(3), 45–53.

Bureau of Plant Industry [BPI]. (2020). *Jackfruit industry performance report.* Department of Agriculture.

Gaborne, D. M., & Dormitorio, J. M. (2013). *Acceptability of dried soya beans in muffin preparation [Undergraduate thesis, University of the Philippines Los Baños].*

Gisslen, W. (2018). *Professional baking (7th ed.).* Wiley.

Meilgaard, M., Civille, G. V., & Carr, B. T. (2016). *Sensory evaluation techniques (5th ed.).* CRC Press.

Ocloo, F. C. K., Bansa, D., Boatin, R., Adom, T., & Agbemavor, W. S. (2010). Physicochemical, functional and pasting characteristics of flour produced from jackfruit (Artocarpus heterophyllus) seeds. *Agricultural and Biological Journal of North America, 1*(5), 903–908.

Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2020). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health and Mental Health Services Research, 47*(3), 486–499. https://doi.org/10.1007/s10488-019-00977-1

Rahman, M. M., Nahar, N., & Mian, A. J. (1995). Variability of physicochemical characteristics of jackfruit (Artocarpus heterophyllus Lam.). *Food Chemistry, 52*(4), 405–410.

Ranasinghe, R. A. S. N., Maduwanthi, S. D. T., & Marapana, R. A. U. J. (2019). Nutritional and health benefits of jackfruit (Artocarpus heterophyllus Lam.): A review. *International Journal of Food Science,* 1–12. https://doi.org/10.1155/2019/4327183

Report Linker. (2023). *U.S. bakery market analysis.* ReportLinker.

Rudrawar, A. B., Jadhav, V. J., & Raskar, S. S. (2013). Development and sensory evaluation of spicy banana muffins. *International Journal of Food and Nutritional Sciences, 2*(3), 45–49.

Sitchon, C. R. (2012). *Acceptability of vegetable muffins among selected consumers [Undergraduate thesis, Bulacan State University].*

Swami, S. B., Thakor, N. J., Haldankar, P. M., & Kalse, S. B. (2012). Jackfruit: A review on its nutritional and medicinal properties. *Comprehensive Reviews in Food Science and Food Safety, 11*(6), 565–576.

Tamayo, M. J. (2012). *Acceptability of gabi (taro) muffins among selected consumers [Undergraduate thesis, University of the Visayas].*

Tulyathan, V., Tananuwong, K., Songjinda, P., & Jaiboon, N. (2004). Some physicochemical properties of jackfruit (Artocarpus heterophyllus Lam) seed flour and starch. *ScienceAsia, 30*(4), 390–395.

https://doi.org/10.2306/scienceasia1513-1874.2004.30.390

Whitney, E., & Rolfes, S. R. (2019). *Understanding nutrition (15th ed.).* Cengage.