

Pink Ice Cream: Sensory Acceptability and Development of Flavored Ice Cream Using Mangosteen (*Garcinia Mangostana*) and Utilization of Red Dragon Fruit (*Hylocereus costaricensis*) and Alugbati (*Basella rubra*) Fruit as Sources of Significant Nutrients

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The popularity of ice cream is definitely unquestionable among consumers and it has been in the food industry for a very long time. It has brought a constant search for unique and desirable flavors. With this, the study aimed to develop ice cream using tropical fruits like mangosteen, dragon fruit, and alugbati fruit. Two formulations were created, formulation one with 50% mangosteen puree and 50% milk, and formulation two with 70% mangosteen puree and 30% milk. Both contained dragon fruit and Alugbati syrup. Twelve expert tasters evaluated the ice cream using a 9-point scale sensory evaluation questionnaire. The results showed no significant difference between the two formulations, and both were well-accepted. However, the result of preference test showed that formulation one was the most preferred. The researchers then submitted the preferred formulation (50% mangosteen puree and 50% milk) to a registered nutritionist for nutrition content computation and for its nutritional content and found it to be a good source of vitamin A, potassium, calcium, dietary fiber, and iron. The pH of the product was tested as well and level was slightly acidic at 4.66. Overall, the ice cream was found to be acceptable and the production of Pink Ice Cream is aligned with three Sustainable Development Goals: Zero Hunger, Responsible Consumption and Production, and Life on Land.

Key Words: Alugbati Fruit; Dragon Fruit; Ice Cream; Mangosteen; Product Development

1. INTRODUCTION

Ice cream is a frozen dessert that has been enjoyed for many years by people of all ages around the world. With countless flavors to choose from, it's understandable that consumers are constantly searching for fresh and unique options. It is anticipated that the ice cream will grow worldwide. (Gaikwad et al., 2020).

Mangosteen and dragon fruit are used to introduce new flavors of ice cream, as these fruits are well-known for their bright colors, sweet and tangy

flavor, and nutritional benefits (Ld., 2019). Researchers may provide consumers with a nutritious and more interesting dessert choice by adding them to ice cream.

The inclusion of alugbati fruit as a syrup for ice cream serves a dual purpose. First, alugbati brings unique and locally sourced ingredients to the product, contributing a distinctive flavor. Second, this exploration aligns with the researcher's commitment to innovation, aiming to create a product that captivates the palate and introduces consumers to new and unconventional culinary experiences.

Utilizing mangosteen, dragon fruit, and alugbati fruit in developing a flavored ice cream can help achieve UN Sustainable Development Goals. 2nd SDG is Zero Hunger, in which integrating tropical fruit into ice cream introduces nutritious and diverse food sources supporting sustainable agriculture. The 12th SDG is Responsible Consumption and Production, as using sustainably sourced production advocates responsible production practices that encompass ingredients ratios, technological support, and financial aspects. Lastly is SDG 15, Life on Land, as this initiative supports ecosystem health by advocating for the utilization of a variety of plants and fruits, thereby contributing to the preservation of plant genetic resources.

2. METHODOLOGY

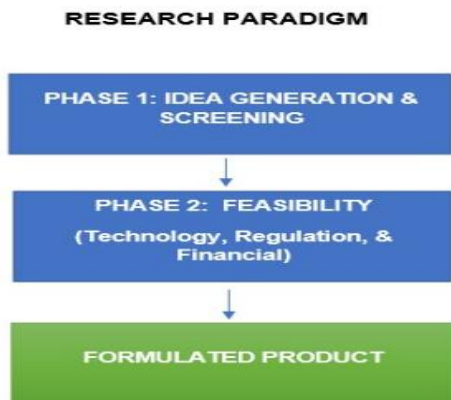


Figure. 1 Modified Framework based on Aramouni and Deschenes (2017), Process of Product Development

The framework of the study is based on Aramouni and Deschenes's (2017) Process of Product Development from Phase 1: Idea Generation and Screening, in which numerous product development research ideas are presented for approval. The mangosteen puree, dragon fruit and Alugbati fruit were the chosen products for the research. Phase 2: Feasibility, where various processes test the approved research idea to achieve the best product and end with the formulated product wherein the final formulation of the product is completed.

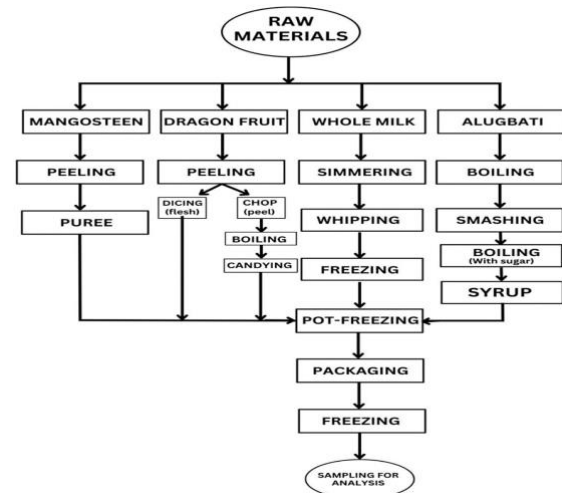


Figure 2. Process flow of Pink Ice Cream

This study used an experimental research design to develop mangosteen-dragon fruit ice cream with added Alugbati fruit as a syrup. It systematically creates and tests various formulations to optimize its taste and quality. The product samples undergo sensory evaluations conducted by selected experts or panels, employing standardized methods to assess flavor, texture, appearance, and overall preference. A completely randomized design (CRD) determined which formulation would produce the best sensory qualities and consumer approval. The main objective is to choose the best possible formula, highlighting the unique attributes of mangosteen and dragon fruit with added alugbati fruit, resulting in a flavorful and nutritious ice cream product.

3. RESULTS AND DISCUSSION

The Pink Ice cream involves systematically creating and testing various formulations to optimize its taste and quality. It includes different ratios of mangosteen, dragon fruit, and alugbati in combination with varying ingredients that produce distinct ice cream samples. The two formulations have the same ingredients but differ in the percentage of the two main ingredients. Formulation 1 contains 50% of mangosteen puree and 50% of whole milk, while

Formulation 2 contains 70% of mangosteen puree and 30% of whole milk.

	WHOLE MILK	MANGOSTEEN PUREE
FORMULATION 1	50%	50%
FORMULATION 2	30%	70%

Table 1. Formulation of Pink Ice Cream

The most acceptable and preferred formulation was the formulation 1. Other ingredients such as dragon fruit peel candy, dragon fruit bits, alugbati syrups, agar-agar powder, and skimmed milk have the same percentage within the two formulations.

The researchers noted that formulation 1 is sweeter than the other formulation. While formulation 2 has a slight taste of sweet and tangy flavor. Additionally, the two formulations have differences in sensory attributes, particularly the smoothness of the ice cream.

Sensory Parameters		t-Test Value	Mean Variable 1	Mean Variable 2	Degree of Freedom (df)	Alpha Value	Interpretation	Decision
Appearance	Color	0.3640	8.25	8.33	11	2.201	Without Significant Differences	Accept H0

Table 2. Summary Results of Appearance

Sensory Parameters		t-Test Value	Mean Variable 1	Mean Variable 2	Degree of Freedom (df)	Alpha Value	Interpretation	Decision
Aroma	Intensity	0.3206	7.91	8	11	2.201	Without Significant Differences	Accept H ₀
	Sweetness	0.5180	8.25	8.08	11	2.201	Without Significant Differences	Accept H ₀

Table 3. Summary Results of Aroma

Sensory Parameters		t-Test Value	Mean Variable 1	Mean Variable 2	Degree of Freedom (df)	Alpha Value	Interpretation	Decision
Flavor	Mangosteen	0.2664	7.91	8	11	2.201	Without Significant Differences	Accept H ₀
	Dragon Fruit	0.4838	7.91	8.08	11	2.201	Without Significant Differences	Accept H ₀
	Alugbati Fruit	1.0000	7.41	7.58	11	2.201	Without Significant Differences	Accept H ₀

Table 4. Summary Results of Flavor

Sensory Parameters		t-Test Value	Mean Variable 1	Mean Variable 2	Degree of Freedom (df)	Alpha Value	Interpretation	Decision
Mouthfeel	Creaminess	1.9149	8.66	8.16	11	2.201	Without Significant Differences	Accept H0
	Smoothness	2.5483	8.66	8.08	11	2.201	With Significant Differences	Reject H0

Table 5. Summary Results of Mouthfeel

Sensory Parameters		t-Test Value	Mean Variable 1	Mean Variable 2	Degree of Freedom (df)	Alpha Value	Interpretation	Decision
Taste	Sweetness	2.2444	8.58	8	11	2.201	With Significant Differences	Reject H0

Table 6. Summary Results of Taste

Sensory Parameters		t-Test Value	Mean Variable 1	Mean Variable 2	Degree of Freedom (df)	Alpha Value	Interpretation	Decision
Texture	Softness	1.1489	8.33	8.08	11	2.201	Without Significant Differences	Accept H0

Table 7. Summary Results of Texture

Sensory Parameters		t-Test Value	Mean Variable 1	Mean Variable 2	Degree of Freedom (df)	Alpha Value	Interpretation	Decision
Aftertaste	Persistency	0.3936	7.83	8	11	2.201	Without Significant Differences	Accept H0

Table 8. Summary Results of Aftertaste

The study evaluated two ice cream formulations, using dragon fruit, mangosteen and alugbati as flavor and colorants. Both formulations received high likability scores for color, intensity, sweetness, mangosteen flavor, and dragon fruit flavor, with no significant differences. While the smoothness and creaminess of both formulations were highly liked, formulation 1 scored significantly higher than formulation 2 for taste and smoothness, suggesting a preference for ice cream. The study also found no significant differences in softness and persistency between the two formulations. These findings support the acceptance of the null hypothesis for most sensory attributes, indicating that both formulations are comparable in overall quality, with formulation one favored slightly for taste and smoothness.

Sensory Parameters	t-Test Value	Mean Variable 1	Mean Variable 2	Degree of Freedom (df)	Alpha Value	Interpretation	Decision
Overall Quality	Acceptability	1.0000	8.41	8.16	11	2.201	Without Significant Differences Accept H0

Table 9. Summary Results of Overall Quality

According to Innova Market Insights (2023), People enjoy desserts and ice cream primarily for the pleasure of taste and indulgence. When seeking a satisfying treat, flavor plays a crucial role. Alongside the taste factor, a notable trend in the ice cream market is the growing desire for dairy-free alternatives. Formulation 1 got a mean score of 8.41, and Formulation 2 got a mean score of 8.16, which was interpreted as very much. Furthermore, the acceptability of the two formulations resulted in the computed T-test value of 1.0000 and no significant differences. Therefore, we accept the null hypothesis (H0).

Mangosteen Ice Cream Nutrition Facts			
Serving Size	100 grams		
Amount per serving			% RNI
Calories (kcal)	225.4		11%
Calories from Fat (kcal)	106.2		
Total Carbohydrate (g)	27.7		
Dietary Fiber (g)	1.2		5%
Sugar (g)	22.9		
Total Fat (g)	11.8		
Saturated Fat (g)	6.8		
Cholesterol (mg)	104.8		
Protein (g)	2.1		3%
Sodium (mg)	22.7		
Calcium 57.2 mg	7.6%	Iron 0.6 mg	5%
Potassium 63.9 mg	3.2%	Vitamin A 107.7 mcg	26.9%
Percent Recommended Energy and Nutrient Intakes (RNI) are based on PDRI 2015 reference requirement for 19-29 years old, Male.			

Findings:	
✓	A significant source of Vitamin A.
✓	A source of potassium, dietary fiber, iron, and calcium.
Not advisable for people with diabetes due to high sugar content.	

Figure 3. Results of Nutritional Value

Nutritional testing was conducted to assess the nutritional composition of a food product. A registered Nutritionist verified and computed the results. The process for nutrition testing began with identifying the preferred product from the two formulations developed. It involves conducting sensory evaluations to assess attributes such as taste, texture, and overall acceptability. Once the preferred

formulation was determined, the researchers determined the required serving size of the ice cream. Calculating the portion size to align with standard serving recommendations and consumer expectations.

After determining the serving size, the researchers started listing the ingredients with their corresponding formulation weight for the preferred formulation, including mangosteen puree, dragon fruit, milk, alugbati syrup, and other ingredients such as sweeteners or stabilizers. The test thoroughly records the amount of each ingredient used per serving, ensuring accuracy in ingredient measurement. The findings of the nutrition testing were compiled and analyzed. This included assessing the nutritional composition of the ice cream, including essential nutrients such as a significant source of vitamin A and a good source of potassium, calcium, dietary fiber and iron.

ATTEMPT	TEMPERATURE	RESULTS
Trial 1	82.1 F	4.62
Trial 2	81.9 F	4.67
Trial 3	81.9 F	4.69
AVERAGE		4.66

Table 10. Results of the pH Test of the Most Preferred Formulation

The pH test used to evaluate the quality and safety of food remains crucial. Measuring pH levels helps supervise and regulate acidity levels, which impact aspects such as taste, texture, microbial growth, and product stability (The Critical Role of pH Testing in the Food and Beverage Industry, 2024).

The pH level of mangosteen falls within the mildly acidic range, providing a good source of essential vitamins, minerals, and fiber (Ld., 2019). On the other hand, dragon fruit, also known as pitaya, tends to be less acidic. It typically has a more neutral to slightly sweet taste, and its pH level generally ranges from 4.0 to 6.0 in the pH scale. (Is Dragon Fruit Acidic? – the Garden Bug Detroit, 2024). The fusion of mangosteen and dragon fruit in ice cream was observed by conducting pH tests in three distinct batches, yielding varying results to attain the average pH level score. On the pH scale ranging from 1.00 to 9.00, where levels 1.00-4.00 are considered acidic, 5.00

is neutral, and 6.00-9.00 are alkaline, the pH testing yielded results of 4.62, 4.67, and 4.66, with an average score of 4.66. This outcome indicates a low level of acidity, approaching neutrality.

ATTRIBUTES	AVERAGE	INTERPRETATION
Appearance	8.09	Like very much
Aroma	8	Like very much
Taste/Flavor	8.03	Like very much
Texture	9	Extremely like
Overall Acceptability	8.26	Like very much

Table 11. Interpretation and Average of Sensory Attributes

Appearance

Consumers often form their initial impression of a product based on its visual appeal. Factors such as color, shape, and presentation play a significant role in influencing consumer perception. A visually attractive product is more likely to capture the attention and interest of consumers. The average appearance score resulted in 8.09 and is deemed as likely very much.

Aroma

The aroma of a product is a crucial element in consumer acceptability. A pleasant and enticing smell can enhance the overall experience, making the product more appealing. Conversely, an unpleasant or unappealing aroma may negatively impact consumer perception and willingness to try the product. The average aroma score resulted in 8 and is considered as likely very much.

Taste/Flavor

A product's taste or flavor highly influences consumer acceptability. The harmonious combination of flavors that pleases the palate is essential for overall satisfaction. Consumers are more likely to embrace products with a well-balanced and enjoyable taste. The average taste/flavor score was 8.03, and it is regarded as likely very much.

Texture

It refers to a product's mouthfeel and is a key factor in consumer preference. Whether a product is creamy, crunchy, or smooth significantly contributes to the overall eating experience. Achieving the right texture is crucial in ensuring consumer satisfaction and acceptability. The average texture score was 9, which is perceived as extremely like.

Overall Acceptability

Overall acceptability represents the culmination of various sensory attributes. It is a holistic judgment encompassing appearance, aroma, taste, and texture. Even if individual elements are favorable, the product's success hinges on achieving a high level of overall acceptability, which indicates consumers' general satisfaction with the entire product experience. The average overall acceptability score was 8.23, which is considered very likely.

4. CONCLUSIONS

The experimental research on pink ice cream identified formulation 1, which contains 50% whole milk and 50% mangosteen puree, as the most preferred formulation, demonstrating significant distinction from the other formulation. The study also explored the taste and color compatibility of mangosteen incorporating alugbati berries and dragon fruit as colorants, along with additional ingredients like agar-agar powder and skimmed milk to enhance overall palatability. The research emphasized the importance of pH testing for taste, texture, and safety. It highlighted the ice cream's nutritional richness while advising caution for individuals with diabetes due to its high sugar content.

5. ACKNOWLEDGMENTS

With all gratitude and appreciation, the researchers were humbly grateful to the people who helped and extended their hands for guidance and support and made this research—especially their parents, who never tired of understanding them and providing all their educational needs. The researchers are also thankful to Mr. Nathaniel Tolentino, who has shared his knowledge with the students.

The researchers are very thankful to the University where they're studying, Cavite State University—Carmona Campus, where they're taking a Bachelor of Science in Hospitality Management, for giving them an opportunity to conduct this research.

Most of all, the researchers are grateful and proud of themselves because they overcame and did well with all the challenges, they faced during the product development process. With this, they improve themselves and obtain more knowledge. These students sincerely appreciate everything, memories, or happy moments they've shared that contributed to this research.

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