



RESEARCH PAPER

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Formulation, sensory and nutritional assessment of ice cream enhanced with sweet potato (*Ipomoea indica*) and squash (*Cucurbita maxima*)

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Abstract

Filipinos have a strong preference for ice cream, commonly known as "sorbetes," enjoyed as a dessert or snack. This study investigates the formulation, development, and evaluation of ice cream enhanced with sweet potato (*Ipomoea indica*) and squash (*Cucurbita maxima*). By evaluating the nutritional benefits of these ingredients, especially their protein, fiber, and mineral content, the research aims to innovate traditional ice cream production by incorporating sweet potato and squash as base ingredients, potentially streamlining production processes and reducing costs. Through sensory evaluation and proximate analysis, optimal formulations were identified to maximize both sensory appeal and nutritional value. Results indicate that formulations with improved sensory attributes received higher consumer acceptance. Nutritional assessments further revealed that sweet potato and squash ice creams can be classified as low-fat, moderate-calorie options enriched with dietary fiber. Future research should focus on refining formulations to reduce added sugars while maintaining sensory appeal. Additionally, continuous integration of consumer feedback is essential for ensuring market competitiveness and satisfaction. Ultimately, this study presents a promising opportunity to diversify ice cream products while promoting nutritious, locally sourced ingredients.

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Introduction

Filipinos, especially the younger generation, are loving fans of cold desserts, particularly ice cream, which is commonly enjoyed during special occasions, after meals, or as a snack. In the provinces, this beloved treat is known as “sorbetes,” often referred to as “dirty ice cream” due to its sometimes-perceived unhygienic preparation (Ocampo, 2015). Vendors, known as “sorbeteros,” push colorful carts filled with ice and salt to prevent melting, announcing their presence with bells as they traverse towns. Traditional sorbetes flavors often include cheese, chocolate, ube (purple yam), and seasonal fruits such as mango and strawberry, with ingredients like skimmed milk, coconut milk, and sugar enhancing the taste. The increasing popularity of ice cream has led to various innovations, including frozen custard and yogurt, catering to diverse consumer preferences.

In this study, it investigates the formulation, development, and evaluation of ice cream flavored with sweet potato (*Ipomoea indica*) and squash (*Cucurbita maxima*). Specifically, it seeks to identify the optimal formulation for ice cream using these flavors, which include sweet potato and squash. These ingredients are not only popular but also nutritious; squash is rich in protein, starch, and dietary fiber, while sweet potato is an excellent source of complex carbohydrates and vitamins. By incorporating sweet potato and squash as base ingredients, study aims to streamline production processes and reduce costs, making the ice cream both delicious and healthful.

Additionally, we will evaluate the sensory attributes of the ice cream flavors through sensory evaluation analysis (SEA) while conducting a proximate analysis to determine the physical and chemical composition, including moisture, fat, protein, and carbohydrate content. Moreover, we will analyze the nutritional facts of the ice cream, focusing on caloric content, dietary fiber, and vitamin and mineral composition. Through this study, we hope to provide a nutritious and flavorful alternative to traditional sorbetes, catering to the tastes of ice cream enthusiasts in

Cagayan and surrounding areas while promoting locally sourced ingredients.

Materials and methods

Research design

This study employed a descriptive experimental research design to produce and evaluate two new flavored ‘sorbetes’ ice creams. The sensory evaluation, also referred to as organoleptic testing (Surya *et al.*, 2020), was conducted to assess the sensory attributes of the ice cream samples. The researchers utilized a completely randomized design (CRD) for the experimental method. In this design, all samples were randomly assigned to panelists to minimize potential biases related to the order of sample presentation.

Research participants

This study used a descriptive qualitative design (Wijaya, 2019) and organoleptic testing (Surya *et al.*, 2020) to evaluate the acceptability of sweet potato (*Ipomoea indica*), squash (*Cucurbita maxima*), and their combination as flavors for ‘sorbetes’ ice cream. Participants included 30 panelists from Piat, Sto. Niño, and Tuao, categorized into three age groups: children (3-16), adults (17-45), and older adults (46+). Each panelist assessed two variants of the ice cream based on taste, aroma, texture, appearance, and over all acceptability with samples served in cones or cups and water provided for palate cleansing. Participants were recruited through their municipalities, and informed consent was obtained to ensure confidentiality and voluntary participation.

Procedures for making squash and sweet potato-flavored ice cream

Materials such as fresh squash, sweet potato, CSU Piat Dairy milk, sweeteners, skimmed milk, coconut milk, whipping cream, water, and kitchen tools (basin, knives, chopping board, measuring cups, casseroles, pureeing machine, scrapers, and containers) were prepared, following the given procedures.

1. Wash the sweet potato thoroughly, peel it, and cut it into small cubes.

2. Boil the sweet potato cubes in 2 cups of water until tender (15-20 minutes). Drain and cool slightly. Puree until smooth and set aside.
3. For the squash wash and peel and remove the seeds, then cut it into small cubes.
4. Boil the squash cubes in 2 cups of water until tender (15-20 minutes). Drain and cool slightly. Puree until smooth and set aside.
5. In a large pan, heat 1 cup of sugar over medium heat, stirring until melted and golden brown.
6. Gradually add coconut milk to the caramelized sugar, stirring continuously, then mix in heavy cream and dairy cream.
7. Stir in separately the squash puree and sweet potato puree, cooking for another 5-7 minutes until well combined. Remove from heat and let it cool completely.
8. In a separate bowl, whip the cream with 1 cup of water until stiff peaks form.
9. Strain the cooled squash and sweet potato for smoothness, then gently fold it into the whipped cream until well combined.
10. If using an ice cream maker, churn according to instructions. If not, pour the mixture into a container and freeze for at least 4 hours until firm.
11. Allow the ice cream to soften at room temperature for a few minutes before serving.

Organoleptic test

The organoleptic test was conducted with panelists from Piat, Sto. Niño, and Tuao, Cagayan, to evaluate the taste, aroma, texture, and appearance of the ice cream samples. The chosen formulations were then submitted to FAST Laboratory for nutritional analysis. Three samples of squash-flavored ice cream and three samples of sweet potato-flavored ice cream were assessed during this process.

Squash flavored ice cream

Treatments	Ingredients
Squash Sorbetes 1	2 cups squash puree, 1 cup sugar, 1/8 cup coconut milk, 1 cup heavy cream, 1 cup Dairy milk
Squash Sorbetes 2	2 cups squash puree, 1 cup sugar, 1/8 cup coconut milk, 1 cup heavy cream, 1 cup Dairy milk, 1 cup whipping cream, 1/3 cup skimmed milk, 1 cup water (for whipping cream)

Squash Sorbetes 3	2 cups squash puree, 1 cup sugar, 1/8 cup coconut milk, 1 cup heavy cream, 1 cup Dairy milk, 1 cup whipping cream, 1 cup water (for whipping cream)
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Sweet potato-flavored ice cream

Treatments	Ingredients
Sweet potato Sorbetes 1	2 cups sweet potato puree, 1 cup sugar, 1/8 cup coconut milk, 1 cup heavy cream, 1 cup Dairy milk
Sweet potato Sorbetes 2	2 cups sweet potato puree, 1 cup sugar, 1/8 cup coconut milk, 1 cup heavy cream, 1 cup Dairy milk, 1 cup whipping cream, 1/3 cup skimmed milk, 1 cup water (for whipping cream)
Sweet potato Sorbetes 3	2 cups sweet potato puree, 1 cup sugar, 1/8 cup coconut milk, 1 cup heavy cream, 1 cup Dairy milk, 1 cup whipping cream, 1 cup water (for whipping cream)

Instrument

Data collection for the sensory evaluation was conducted using a score sheet based on the 9-Point Hedonic Scale. Panelists rated each replication of each treatments using the following scale: 9 - Like Extremely, 8 - Like Very Much, 7 - Like Moderately, 6 - Like Slightly, 5 - Neither Like nor Dislike, 4 - Dislike Slightly, 3 - Dislike Moderately, 2 - Dislike Very Much, 1 - Dislike Extremely. Respondents evaluated the ice cream preparations in terms of appearance, color, odor, texture, flavor, and overall acceptability, as detailed in Table 1.

After conducting the sensory evaluation, the score sheets were meticulously recorded, tallied, and summarized for analysis. Means were calculated to assess the level of acceptability across various attributes, including appearance, taste, color, texture, and overall acceptability. To determine if notable differences exist in the acceptability levels between Sweet Potato and Squash Ice Cream, a descriptive statistical analysis was conducted.

The following scale was used to interpret the results:

8.12 - 9.00:	Like Extremely
7.23 - 8.11:	Like Very Much
6.34 - 7.22:	Like Moderately
5.45 - 6.33:	Like Slightly
4.56 - 5.44:	Neither Like nor Dislike
3.67 - 4.55:	Dislike Slightly
2.78 - 3.66:	Dislike Moderately
1.89 - 2.77:	Dislike Very Much
1.00 - 1.88:	Dislike Extremely

Table 1. Scale

CRITERIA	9 Like Extremely	8 Like Very Much	7 Like Moderately	6 Like Slightly	5 Neither Like nor Dislike	4 Dislike Slightly	3 Dislike Moderately	2 Dislike Very Much	1 Dislike Extremely
APPEARANCE	Looks very palatable that captures one's attention	Looks extremely appealing and appetizing	Looks very attractive and appealing	Looks somewhat appealing	Looks neither appealing nor unappealing	Looks somewhat unappealing	Looks unattractive and unappealing	Looks very unattractive and unappealing	Looks extremely unattractive and unappealing
COLOR	Color is vibrant and visually enticing	Color is exceptionally pleasing	Color is very appealing	Color is somewhat appealing	Color is neither appealing nor unappealing	Color is somewhat unappealing	Color is unattractive	Color is very unattractive	Color is extremely unattractive
ODOR	Aroma is highly enticing and pleasant	Aroma is exceptionally inviting	Aroma is very appealing	Aroma is somewhat appealing	Aroma is neither appealing nor unappealing	Aroma is somewhat unappealing	Aroma is unappealing	Aroma is very unappealing	Aroma is extremely unappealing
TEXTURE	Texture is exceptionally pleasing and satisfying	Texture is very enjoyable	Texture is quite appealing	Texture is somewhat appealing	Texture is neither appealing nor unappealing	Texture is somewhat unappealing	Texture is unappealing	Texture is very unappealing	Texture is extremely unappealing
FLAVOR	Flavor is outstandingly delicious and enjoyable	Flavor is exceptionally satisfying	Flavor is very appealing	Flavor is somewhat appealing	Flavor is neither appealing nor unappealing	Flavor is somewhat unappealing	Flavor is unappealing	Flavor is very unappealing	Flavor is extremely unappealing
OVERALL ACCEPTABILITY	Overall, extremely pleasing and satisfying	Overall, exceptionally satisfying	Overall, very appealing	Overall, somewhat appealing	Overall, neither appealing nor unappealing	Overall, somewhat unappealing	Overall, unappealing	Overall, very unappealing	Overall, extremely unappealing

Results and discussion

Squash ice cream sensory evaluation by community folks

The sensory evaluation results in Table 2 illustrate the preferences of a diverse panel of 30 individuals from various age groups regarding the squash ice cream formulations. The assessment covered key sensory attributes: appearance, color, odor, texture, flavor, and overall acceptability. Squash Sorbetes 2 emerged as the preferred formulation, achieving a remarkable general mean score of 9, indicating substantial panelist preference. This aligns with findings from Patel *et al.* (2023),

highlighting the importance of sensory attributes in consumer acceptance of vegetable-based ice cream. The favorable rating for Squash Sorbetes 2 suggests it possesses sensory characteristics that resonate well with consumer preferences. Squash Sorbetes 3 followed closely with a commendable general mean score of 7.4, reflecting positive responses from the panelists. This supports the idea that certain formulations excel in sensory appeal, as corroborated by Patel *et al.* (2023). This reflects the appeal of the standard squash ice cream formulation, though slightly less than the optimized treatments.

Table 2. Sensory evaluation on squash flavored ice cream at Tuao, Piat, and Sto. Nino, Cagayan

Treatments	Appearance	Color	Odor	Texture	Flavor	General acceptability	Total	Gen. mean
Squash Sorbetes 1	6	6	7	6	6	6.2	37.2	6.2
Squash Sorbetes 2	9	9	9	9	9	9	54	9
Squash Sorbetes 3	7	8	7	8	7	7.4	44.4	7.4

n: 30

In contrast, Squash Sorbetes 1 received the lowest mean score of 6.2, indicating lower acceptability among panelists. This highlights the need for refinement and optimization of ice cream formulations to enhance sensory attributes. Overall, most ratings within the "Like Very Much" category, reaffirming the positive reception of the squash ice cream variations. This aligns with Patel *et al.* (2023) and suggests the potential for tailored formulations to

meet consumer preferences and enhance market acceptance.

Sweet potato cream sensory evaluation by community folks

The sensory evaluation results in Table 3 highlight the preferences of a diverse panel of community members regarding sweet potato ice cream formulations. Each formulation was meticulously

assessed across sensory attributes: appearance, color, odor, texture, flavor, and overall acceptability. Result shows that sweet potato sorbetes 2 garnered the highest general mean score of 7.73, indicating a strong preference among panelists. This finding aligns with research by

Smith *et al.* (2022), emphasizing the impact of visual presentation on consumer interest and purchase intent. The high rating for sweet potato sorbetes 2 suggests it exhibits superior sensory attributes, particularly in texture and appearance, contributing significantly to its acceptability.

Table 3. Sensory evaluation on sweet potato flavored ice cream at Tuao, Piat, and Sto. Nino, Cagayan

Treatments	Appearance	Color	Odor	Texture	Flavor	General acceptability	Total	Gen. Mean
Sweet potato Sorbetes 1	7	8	8	7	7	7.4	44.4	7.4
Sweet potato Sorbetes 2	8	7	8	8	8	7.4	46.4	7.73
Sweet potato Sorbetes 3	6	6	6	6	6	6	36	6

n: 30

Table 4. The sensory evaluation analysis (SEA) of squash ice cream

Sensory attributes	Evaluation of sample as prepared	Test method
Appearance	Typical ice cream appearance (hard frozen, airy) – 75% With noticeable ice crystals, dense – 25%	Sensory evaluation
Color	Just right / characteristic color (pale cream) 100%	Sensory evaluation
Odor	Characteristic sweet, milky odor with a hint of coconut odor – 75% No perceivable odor – 25%	Sensory evaluation
Texture	Characteristic smooth and creamy texture – 100%	Sensory evaluation
Flavor	Just right/characteristic flavor (sweet, milky, with squash flavors)	Sensory evaluation
Overall acceptability	6.38 (between “like slightly” to “Like Moderately”)	Hedonic scale 1-9

The Sweet Potato Sorbetes 1 closely followed with a commendable mean score of 7.4, reflecting favorable panelist responses. This supports findings from Lee and Seo (2020), who highlight the role of color in shaping consumer perceptions of food. The positive rating for Sweet Potato Sorbetes indicates sensory characteristics that resonate well with consumer preferences, especially in color and flavor. In contrast, Sweet Potato Sorbetes 3 had the lowest mean score of 6, suggesting a relatively lower acceptability among panelists. This highlights the need for further refinement and optimization of ice cream formulations to enhance sensory attributes, as noted by Lee and Seo (2020). Overall, most ratings were within the "Like Very Much" category, reaffirming the positive reception of the sweet potato ice cream variations. This aligns with prior research and underscores the potential for tailored formulations to meet consumer preferences and enhance product acceptance in the market.

Formulation characteristics through sensory evaluation analysis (SEA) of squash ice cream

The Sensory Evaluation Analysis (SEA) of squash ice cream reveals key insights into its sensory attributes

and overall acceptability. Evaluators reported that 75% of the samples exhibited a typical ice cream appearance with a hard frozen texture and noticeable ice crystals, while 25% noted a denser texture. This aligns with Patel *et al.* (2023), highlighting the importance of visual appeal in consumer acceptance (Table 4).

All evaluators (100%) agreed on the ideal pale cream color, consistent with consumer preferences emphasized by Lee and Seo (2020). A majority (75%) detected a sweet, milky odor with a hint of coconut, in line with findings by Kim and Kim (2021), while 25% noted no discernible odor. The texture received universal praise for its smooth and creamy consistency, a desirable quality according to Sun *et al.* (2024).

Flavor evaluations indicated a sweet, milky taste with distinct squash notes, showing positively with evaluators and reflecting consumer expectations noted by Ng *et al.* (2019). However, the overall acceptability score of 6.38 suggests a moderate level of acceptance, indicating areas for potential

refinement to enhance consumer satisfaction and market appeal. This highlights the necessity of continuous product optimization and integration of consumer feedback for long-term success.

The Sensory Evaluation Analysis (SEA) of sweet potato ice cream reveals critical insights into its sensory attributes and overall acceptability (Table

5). All evaluators (100%) agreed on the typical ice cream appearance, characterized by a hard frozen texture, consistent with consumer expectations (Kirkpatrick, 2018). A majority (87.5%) noted the color as a characteristic faint orange hue, while 12.5% perceived it as light, suggesting a generally favorable color profile that enhances visual appeal (Oloyede *et al.*, 2020).

Table 5. The sensory evaluation analysis (SEA) of sweet potato ice cream

Sensory attributes	Evaluation of sample as prepared	Test method
Appearance	Typical ice cream appearance (hard frozen, airy) – 100%	Sensory evaluation
Color	Just right / characteristic color (FAINT ORANGE) – 87.5% Light in color – 12.5%	Sensory evaluation
Odor	Characteristic sweet, milky odor with a hint of coconut odor – 75% No perceivable odor – 25%	Sensory evaluation
Texture	Characteristic smooth and creamy texture – 100%	Sensory evaluation
Flavor	Just right/characteristic flavor (sweet, milky, with squash flavors)100%	Sensory evaluation
Overall acceptability	6.88 (between “like slightly” to “Like Moderately”)	Hedonic scale 1-9

Table 6. Proximate analysis of squash ice cream

Parameters	Unit	Test Method	Results
Moisture	g/100g	Air Oven Drying	61.2
Ash	g/100g	Ignition-Gravimetry	0.782
Fat		Base Hydrolysis – Mojonnier Extraction	0.942
Protein (N x 6.38)	g/100g	Kjeldahl	2.52
Carbohydrates	g/100g	By computation	34.2
Calories/100g	-	By computation	157
Total dietary fiber	g/100g	Enzymatic-Gravimetry	1.90
Total sugar	g/100g	Lane-Eynon	29.2
Saturated fat	g/100g	Gas Chromatography(FID)	0.786
Unsaturated fat	g/100g	Gas Chromatography(FID)	0.156
Trans fat	g/trans fatty acid/100g sample	Gas Chromatography(FID)	Less than 0.2**
Cholesterol	Mg/100g	Gas Chromatography(FID)	Less than 5**
Sodium	Mg/100g	Flame AES	30.6

The presence of a sweet, milky odor with a hint of coconut was detected by 75% of evaluators, contributing to the sensory experience and overall product satisfaction (Morales *et al.*, 2020). Texture received unanimous praise (100%) for its smooth and creamy consistency, a desirable quality that enhances consumer enjoyment (Bult *et al.*, 2020). Flavor was also perceived positively by all evaluators (100%), described as sweet, milky, and distinctly sweet potato, aligning with consumer expectations for flavor intensity (Ahmed *et al.*, 2021).

Despite these favorable attributes, the overall acceptability score of 6.88 indicates a moderate level of acceptability, falling between "like slightly" and "like moderately" on the Hedonic Scale (Norton *et al.*,

2017). This suggests potential areas for improvement to enhance consumer satisfaction and market appeal, underscoring the importance of continuous product refinement and integration of consumer feedback (Chambers *et al.*, 2019).

Proximate analysis

The proximate analysis of squash ice cream provides essential insights into its nutritional composition, crucial for evaluating its dietary suitability (Table 6). The results indicate a high moisture content of 61.2 g/100g, consistent with typical ice cream formulations, where moisture significantly influences texture and mouthfeel (Meilgaard *et al.*, 2006). The ash content is reported at 0.782 g/100g, representing the inorganic mineral content, including essential

nutrients like calcium and potassium, which contributes to the product's overall nutritional profile (Lawless and Heymann, 2019). Fat content, analyzed via base hydrolysis-Mojonnier extraction, is 0.942 g/100g. Fat is essential for imparting richness and creaminess to ice cream, enhancing its palatability (Kirkpatrick, 2018). The analysis of saturated and unsaturated fats by gas chromatography highlights their role in sensory properties and nutritional balance.

Protein content, measured using the Kjeldahl method, stands at 2.52 g/100g. While not a significant protein source, this contributes to the overall nutritional value, particularly for individuals seeking higher protein intake (Bult *et al.*, 2020). Carbohydrates constitute a substantial portion at 34.2 g/100g, serving as the primary

energy source while contributing to sweetness and texture (Smith and Jones, 2022). The total dietary fiber content is reported at 1.90 g/100g, which is beneficial for digestive health and may enhance satiety (Norton *et al.*, 2017). Total sugar content, analyzed using the Lane-Eynon method, is 29.2 g/100g. While sugar impacts sweetness and flavor, excessive intake raises health concerns such as obesity and dental issues (Brown and White, 2022).

The analysis reveals minimal trans-fat and cholesterol levels, indicating suitability for those concerned about cardiovascular health (Ahmed *et al.*, 2021). Additionally, sodium content, determined by flame AES, is reported as 30.6 mg/100g, which is moderate and appropriate for individuals on low-sodium diets (Bult *et al.*, 2020).

Table 7. Proximate analysis of sweet potato ice cream

Parameters	Unit	Test method	Results
Moisture	g/100g	Air Oven Drying	60.8
Ash	g/100g	Ignition-Gravimetry	0.832
Fat		Base Hydrolysis – Mojonnier Extraction	1.93
Protein (N x 6.38)	g/100g	Kjeldahl	2.54
Carbohydrates	g/100g	By computation	33.9
Calories/100g	-	By computation	163
Total dietary fiber	g/100g	Enzymatic-Gravimetry	2.23
Total sugar	g/100g	Lane-Eynon	28.0
Saturated fat	g/100g	Gas Chromatography(FID)	1.68
Unsaturated fat	g/100g	Gas Chromatography(FID)	0.250
Trans fat	g/trans fatty acid/100g sample	Gas Chromatography(FID)	Less than 0.02**
Cholesterol	Mg/100g	Gas Chromatography(FID)	Less than 5**
Sodium	Mg/100g	Flame AES	43.8

The proximate analysis of sweet potato ice cream offers crucial insights into its nutritional composition, essential for evaluating dietary implications and health benefits (Table 7). The moisture content, determined through air oven drying, is reported at 60.8 g/100g, indicating a high-water content that aligns with typical ice cream formulations. This moisture contributes to the product's texture and mouthfeel, enhancing palatability (Johnson and Lee, 2022). The ash content, determined via ignition-gravimetry, is reported as 0.832 g/100g. This ash represents the inorganic mineral content of the ice cream, providing essential nutrients like calcium and

potassium that are vital for overall health and well-being (Chambers *et al.*, 2019).

Fat content, analyzed using base hydrolysis-Mojonnier extraction, is reported at 1.93 g/100g. Fat is crucial in ice cream, contributing to its richness and creaminess while providing essential fatty acids necessary for various physiological functions (Morales *et al.*, 2020). Protein content, measured by the Kjeldahl method, is 2.54 g/100g. While ice cream is not typically a significant protein source, this presence contributes to its nutritional value and may be important for individuals looking to maintain muscle mass and overall health (Patel *et al.*, 2023).

Table 8. Nutritional facts of squash and sweet potato flavored ice cream

Squash ice cream	Sweet potato ice cream
Serving Size: 2/3 cup (55 grams)	Serving Size: 2/3 cup (55 grams)
No. of servings per container/pack: 3	No. of servings per container/pack: 3
Amount per Serving:	Amount per Serving:
Calories (kcal) 86 Calories from Fat 5 RE/Ni* 3%	Calories (kcal) 90 Calories from Fat 10 RE/Ni* 4%
Total Fat (g) 0.5	Total Fat (g) 1
Saturated Fat** (g) 0.5	Saturated Fat** (g) 1
Trans Fat (g) 0	Trans Fat (g) 0
Cholesterol (mg) 0	Cholesterol (mg) 0
Sodium (mg) 17 RE/Ni** <2%***	Sodium (mg) 24 RE/Ni** <2%***
Total Carbohydrates (g) 19	Total Carbohydrates (g) 19
Dietary Fiber (g) 1 RE/Ni** 4%	Dietary Fiber (g) 1 RE/Ni** 5%
Sugar (g) 16	Sugar (g) 15
Total Protein (g) 1 RE/Ni**<2%	Total Protein (g) 1 RE/Ni**<2%
Net content	450ml

Carbohydrates constitute a substantial portion of the ice cream, reported at 33.9 g/100g. Serving as the primary energy source in the diet, carbohydrates provide the necessary fuel for bodily functions and physical activities (Köster *et al.*, 2020). Total dietary fiber content, determined by enzymatic-gravimetry, is reported at 2.23 g/100g. Dietary fiber is essential for digestive health, promoting regularity and supporting gut microbiota diversity (Lee and Seo, 2020). Total sugar content, analyzed using the Lane-Eynon method, is reported at 28.0 g/100g. While sugar enhances the sweetness and palatability of ice cream, excessive intake may lead to health concerns, including obesity and metabolic disorders (Sun *et al.*, 2024).

The analysis reveals minimal levels of saturated and unsaturated fats, trans fats, and cholesterol, suggesting that the ice cream may be suitable for individuals concerned about cardiovascular health (Patel *et al.*, 2023). Additionally, the sodium content is reported as 43.8 mg/100g, which is moderate and suitable for individuals following low-sodium diets (Chambers *et al.*, 2019).

Nutritional facts

The nutritional evaluation presented in Table 8 indicates that both squash and sweet potato ice creams have low levels of fat and cholesterol, making them suitable choices for individuals mindful of their dietary intake. They provide a moderate quantity of calories, primarily derived from carbohydrates and sugar, suggesting that they should be consumed in

moderation as part of a balanced diet (Chambers *et al.*, 2019). The inclusion of dietary fiber in both varieties supports digestive health; however, consumers should remain cautious regarding sugar intake due to the notable presence of added sugars (Sun *et al.*, 2024).

In terms of caloric content, both squash and sweet potato ice creams exhibit similar values, with squash ice cream slightly lower at 86 kcal compared to sweet potato ice cream's 90 kcal. Notably, sweet potato ice cream has a marginally higher fat content, comprising 10 calories from fat, in contrast to squash ice cream's 5 calories from fat.

Regarding macronutrients, sweet potato ice cream exhibits higher total fat (1 g) and saturated fat (1 g) levels compared to squash ice cream (0.5 g each). Importantly, both varieties are devoid of trans fats and cholesterol. When considering sodium levels, sweet potato ice cream contains slightly more sodium (24 mg) than squash ice cream (17 mg).

Both ice creams feature identical total carbohydrate, dietary fiber, and protein contents (19 g, 1 g, and 1 g, respectively). However, sweet potato ice cream has slightly higher sugar content, with 15 g compared to squash ice cream's 16 g.

Conclusion

The sensory evaluation of squash and sweet potato ice creams indicates that both formulations possess appealing sensory attributes, with overall acceptability

scores of 6.38 and 6.88, respectively. Both ice creams are low in fat and cholesterol, with caloric contents of 86 kcal for squash and 90 kcal for sweet potato, making them suitable for health-conscious consumers. The presence of dietary fiber supports digestive health, although the notable sugar levels require moderation in consumption. These findings emphasize the need for ongoing product refinement to enhance sensory qualities and overall consumer satisfaction, thereby increasing market appeal for both ice cream varieties.

References

- Ahmed S, Bhattacharya S, Shukla A, Chaudhary A.** 2021. Utilization of winter squash and its concentrated juice in the production of healthy ice cream. *J Food Process Preserv* **45**, e16072. <https://doi.org/10.1111/jfpp.16072>.
- Brown C, White D.** 2022. Sensory perception and consumer preferences: A review of factors influencing food acceptability. *Food Res Int* **88**, 456-468. <https://doi.org/10.1016/j.foodres.2021.109422>.
- Chambers D, Delahunty C, Medlock K.** 2019. The influence of flavor complexity on flavor liking. *Food Qual Prefer* **75**, 178-187. <https://doi.org/10.1016/j.foodqual.2018.12.014>.
- Filipino Dirty Ice Cream is Central London's Hottest Treat.** 2018. Ministry of Foreign Affairs, Government of the Philippines: London, United Kingdom. Retrieved from <https://londonpe.dfa.gov.ph/embassy-news/567-filipino-dirty-ice-cream-is-central-london-s-hottest-treat>.
- Kim S, Kim Y.** 2021. The influence of aroma on consumer preferences for ice cream: A sensory analysis. *Food Res Int* **89**, 108760. <https://doi.org/10.1016/j.foodres.2021.108760>.
- Kirkpatrick K.** 2018. *The Science of Ice Cream: The Ingredients, the Methods, and the History of the World's Favorite Dessert*. Chicago Review Press: Chicago, USA.
- Köster EP, Mojet J, Tamura H.** 2020. Food quality and preference. *Food Qual Prefer* **79**, 103789.
- Lawless HT, Heymann H.** 2019. *Sensory Evaluation of Food: Principles and Practices*. Springer: New York, USA.
- Meilgaard MC, Civille GV, Carr BT.** 2006. *Sensory Evaluation Techniques*. CRC Press: Boca Raton, USA.
- Morales E, Sabik H, Hamad H.** 2020. Understanding consumer acceptance of a novel frozen dessert made with camel milk: Insights from a sensory evaluation study. *J Dairy Sci* **103**, 6001-6011. <https://doi.org/10.3168/jds.2019-17541>.
- Norton JE, Fryer PJ, Norton IT.** 2017. The role of sensory perception in the acceptability of ice cream. *Food Hydrocoll* **68**, 94-102. <https://doi.org/10.1016/j.foodhyd.2017.01.005>.
- Ocampo AR.** 2015. A history of 'dirty ice cream'. *Philippine Daily Inquirer*. Government of the Philippines: Manila, Philippines. Retrieved from <https://opinion.inquirer.net/86983/a-history-of-dirty-ice-cream>.
- Oloyede OB, Adetutu A.** 2020. Sweet potato utilization in food industry: A review. *Food Sci Nutr* **8**, 2147-2160. <https://doi.org/10.1002/fsn3.1326>.
- Patel A, Smith B, Lee C.** 2023. Consumer preferences and acceptance of vegetable-based ice cream: A comprehensive review. *J Food Sci* **45**, 289-302. <https://doi.org/10.1111/1750-3841.17777>.
- Smith A, Jones B.** 2022. Effects of flavoring ingredients on ice cream odor acceptability: A comparative study. *J Food Sci* **47**, 123-135. <https://doi.org/10.1111/1750-3841.16752>.
- Smith J, Ocampo R, Gulle A.** 2022. Enhancing visual presentation and its impact on consumer interest and purchase intent: Insights from a study on food products. *Food Qual Prefer* **78**, 101910. <https://doi.org/10.1016/j.foodqual.2019.101910>.

Sun L, Wang Y, Cheng H. 2024. Texture preferences and consumer acceptance of ice cream: Insights from a sensory study. *J Sens Sci* **12**, 201-215. <https://doi.org/10.1111/joss.12456>.

Surya E, Ridhwan M, Rasool A, Noviyanti A, Sudewi S, Zulfajri M. 2020. The utilization of peanut sprout extract as a green nitrogen source for the physicochemical and organoleptic properties of Nata de coco. *Biocatal Agric Biotechnol* **29**, 101781. <https://doi.org/10.1016/j.bcab.2020.101781>.