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Development and Acceptability of Squash Flowers (Cucurbita Pepo) Muffin Fortified with Malunggay (Moringa Oleifera)

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ABSTRACT

This study aimed to develop and evaluate the sensory acceptability of squash flower (Cucurbita pepo) muffins fortified with malunggay (Moringa oleifera) as a nutritious and locally sourced baked product. Using a developmental research design, three muffin formulations were prepared at the Surigao del Norte State University food laboratory and evaluated by 99 consumers and 21 food experts using a 9-point hedonic scale. The participants varied in age, sex, civil status, and educational attainment, offering diverse perspectives in evaluating the products. Statistical analyses, including MANOVA and ANOVA, revealed significant differences in sensory attributes across the three formulations. Among them, Formulation C emerged as the most acceptable in terms of appearance, aroma, taste, texture, and overall appeal. Furthermore, participant profile influenced the perception of sensory qualities: younger individuals favored taste and texture, while older participants appreciated aroma more. Male participants rated appearance and aroma higher, while single and more educated participants preferred taste and texture. Nutritional analysis showed that Formulation C contained 6.7% crude protein and 3.9% fat, confirming its nutritional viability alongside sensory appeal. The results underscore the potential of squash flower and malunggay as functional ingredients in bakery products.

Keywords: Sensory evaluation, Squash flower muffin, Malunggay, formulation development, Nutritional profile

INTRODUCTION

The demand for nutrient-dense and functional foods has increased as consumers become more health-conscious and seek alternatives to conventional processed foods. One such area of interest is the fortification of baked products with bioactive ingredients that not only enhance nutritional value but also promote overall health. Among the essential nutrients required for maintaining optimal health, calcium stands out as a key mineral, contributing to bone health, muscle function, and various metabolic processes. Squash flowers are a good source of carotenoids, vitamins, dietary fiber, minerals, and phenolic compounds and have several nutritional benefits. They are also low in calories and fiber, making them a healthy addition to any diet.The health benefits associated with the consumption of edible flowers are believed to be due to the content of natural bioactive compounds with pro-health properties, including phenolic acids; flavonoids; anthocyanin's; and other phenolic compounds with proven antioxidant, antimicrobial, and antibacterial properties. One of the vegetables belonging to cucurbits is squash

(Cucurbita Pepo) also known as zucchini or summer squash. Squash fruits are widely used for direct consumption as well as for processing purposes. Along with consumers 'interest in fresh vegetables such as squash, the demand for high-quality produce is also growing.

Moreover, squash blossom (*Cucurbita pepo* L.) is a species native to Mesoamerica and is probably one of the most gastronomically important edible flowers worldwide due to the number of recipes that include it and its year-round availability (Cáceres and Cruz, 2019, Mulík et al., 2022). However, Moringa has many important vitamins and minerals. The leaves have about as much potassium as a banana, and about the same amount of vitamin C as an orange. It also has calcium, protein, iron, and amino acids, which help your body, heal and build muscle. It is also packed with antioxidants, substances that can protect cells from damage and may boost your immune system. There is some evidence that some of these antioxidants can also lower blood pressure and reduce fat in the blood and body. Proteins found in malunggay may help lower blood sugar.

The orientation of agricultural development towards more environmentally friendly options is thus necessary. These problems have been addressed in the 2030 Agenda for Sustainable Development of the United Nations, and the development of sustainable consumption and production patterns is a key target of SDG12. This research study will focus on baked products and its nutritional dietary fiber properties as Squash flower is incorporated into flour with malunggay, which are considered an alternative way to dietary fiber for serving a snack, especially for kids. They enjoy eating Cakes and sweets, but they do not enjoy eating vegetables, which are considered high nutrient content and have positive effects on human.

Conceptual Framework

This study will focus on developing baked product in incorporating Squash flower muffin including the right combination of an accurate process was observed. The goods' quality and nutritional value were preserved through cooking preparation and process. As well as the output of product. The finished product was subjected to sensory evaluation in terms of appearance, texture, color, taste, aroma, and nutritive value. The output of the study was the finished product that was the muffin out of squash flower powder with malunggay as part of the ingredients in the finished product.

The researcher gathered some suggestions from the respondents for the improvement of baked product from squash flower and malunggay. The paradigm which was also includes a diagram of conceptual frameworks, demonstrates the frameworks methodical approach to conveying the INPUT, PROCESS, OUTPUT

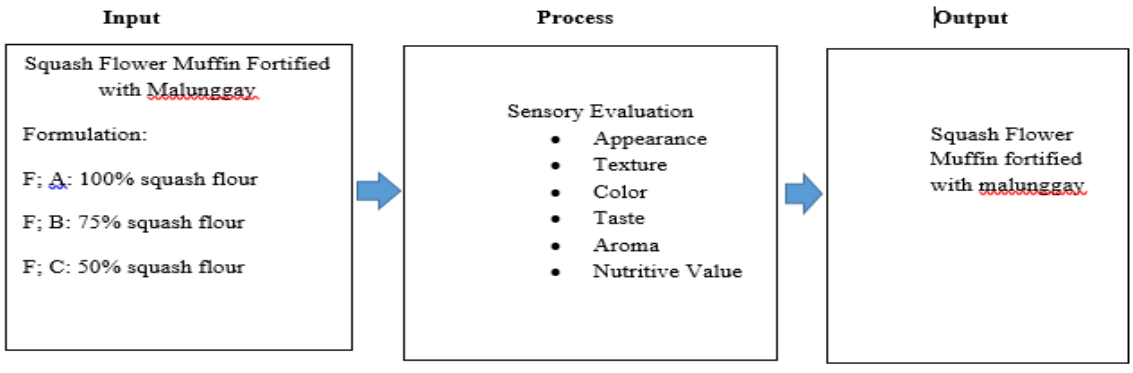

Fig.1 Framework of the study

Statement of the Problem

This study aimed to develop a muffin using squash flowers (cucurbita pepo) fortified with malunggay *(Moringa oleifera)as the main ingredients*. Specifically, it sought to answer the following questions:

1. What is the profile of the participants in terms of

1.1 age,
1.2 sex,
1.3 civil status, and
1.4 highest educational attainment?

2. What is the level of acceptability of the sensory attributes of the three formulations of developed squash flowers muffin fortified with malunggay in terms of:

2.1 Appearance
2.2 Aroma
2.3 Taste
2.4 Texture
2.5 Composite appeal?

3. Is there a significant difference on the sensory attributes of the three formulations of the developed squash flowers muffin fortified with malunggay?
4. Is there a significant difference on the level of acceptability of the sensory attributes of the most preferred formulation of developed squash flowers muffin fortified with malunggay based on the profile of the participants?
5. What are the nutritional components of the most preferred developed squash flowers muffin fortified with malunggay?

METHODS

Research Design

The research on squash flower and malunggay to be developed as flour, mainly used experimental and developmental cooking. Experimental design is the process of carrying out research in an objective and controlled fashion so that precision is maximized and specific conclusions can be drawn. However, this study supports series of experimental trials that extent to the effectivity of the different variety of squash flower as incorporated into flour.

Research Environment

The research was conducted at the Surigao Norte State University Food Laboratory, while the researcher will also carry out studies in three specific areas within the municipality of Socorro, Surigao del Norte. The output of the baked product, squash flower muffin fortified with malunggay, will be subjected to sensory evaluation, assessing aspects such as appearance, taste, aroma, texture, and nutritive value.

Research Respondents

The respondents of this study are the selected participants in the municipality of Socorro, Surigao del Norte. The participants are selected through purposive sampling, to ensure that all perceptions are being represented.

Research Instrument

The instrument used in this study is a questionnaire (Appendix A). The questionnaire addressed the analysis and evaluation, which the respondents answered and rated accordingly.The researcher informed the targeted respondents about potential food allergens in ingredients such as squash and Malunggay.

Respondents with known allergies to squash will be excluded from participating in the sensory testing of the finished product to ensure their safety.

Data Analysis

To analyze this study, the following statistical tools were utilized.

Frequency Count and Percent. These tools were used to determine the profile of the participants in terms of age, sex, civil status, and highest educational attainment.

Mean and Standard Deviation. These tools were used to determine the acceptability of the squash muffin enhanced with malunggay in terms of appearance, aroma, flavor/taste, and texture.

Multivariate Analysis of Variance (MANOVA) for Repeated Measures and Bonferroni's Test. These tools were used to compare the three formulations of squash muffin enhanced with malunggay terms of the four sensory attributes: appearance, aroma, taste, and texture.

One-Way Analysis of Variance (ANOVA) and Scheffe's Test. These were used to compare the ratings of the participants on the most preferred formulation of squash muffin enhanced with malunggay terms of their profile such as age, sex, and civil status.

RESULTS AND DISCUSSIONS

PROFILE OF PARTICIPANTS

Table 2

Profile of Raters of Squash Flowers (*Cucurbita pepo*) Muffin Fortified with Malunggay (*Moringa oleifera*)

Profile		f(n=120)	Percent
Age	21-30	55	45.8
	31-40	18	15.0
	41-50	47	39.2
Sex	Male	15	12.5
	Female	105	87.5
Civil Status	Single	19	15.8
	Married	101	84.2
Highest Educational Attainment	College Level/Graduate	93	77.5
	Master's Level/Graduate	27	22.5

In terms of age, the largest group of participants fell within the 21–30 age bracket, comprising 45.8% of the total respondents. This was followed by those aged 41–50 years, accounting for 39.2%, while the smallest age group was those aged 31–40 years, making up 15.0% of the sample.

Regarding sex, a significant majority of the raters were female, representing 87.5% of the respondents, while only 12.5% were male. As for civil status, the data show that 84.2% of the participants were married, whereas 15.8% were single. In terms of educational attainment, most of the raters were either college level or college graduates, comprising 77.5% of the group. Meanwhile, 22.5% had attained or were pursuing a master's degree. This profile suggests that the evaluators were generally mature, well-educated individuals, predominantly female, and mostly married.

Table 3
Acceptability of Appearance of Squash Flowers (*Cucurbita pepo*) Muffin Fortified with Malunggay (*Moringa oleifera*) Formulations

Statement	Formulation A			Formulation B			Formulation C		
	M	SD	*D*	M	SD	*D*	M	SD	*D*
1. The color of the product looks appealing.	3.66	0.59	***DS***	4.55	0.84	***NLND***	7.23	0.42	***LM***
2. The color is vibrant and fresh.	3.73	0.58	***DS***	4.33	0.52	***DS***	7.18	1.07	***LM***
3. The product's color is consistent and uniform.	4.04	0.70	***DS***	3.72	0.81	***DS***	7.33	0.60	***LM***
4. The color of the product is suitable for its type.	4.18	0.39	***DS***	4.49	0.50	***DS***	7.34	0.59	***LM***
5. The product's color matches my expectations for this type of product.	3.49	0.50	***DM***	4.72	0.81	***NLND***	7.49	0.50	***LM***
Average	3.82	0.18	***DS***	4.36	0.33	***DS***	7.31	0.43	***LM***

The evaluation focused on color-related attributes, with results expressed in terms of mean (M), standard deviation (SD), and descriptive interpretation (D). Formulation A received the lowest average mean score of 3.82, interpreted as "Dislike Slightly" (DS). This rating indicates a generally low visual appeal, with individual item scores ranging from 3.49 to 4.18, suggesting that the raters were not particularly attracted to the product's color, describing it as only slightly appealing, vibrant, and consistent.

Formulation B showed a moderate improvement with an average mean of 4.36, which also falls under the "Dislike Slightly" (DS) category. Although still within the same descriptive interpretation, certain statements, particularly on product expectations and appeal, leaned closer to "Neither Like Nor Dislike" (NLND), implying that some aspects of the product's appearance were relatively more acceptable to the raters.

In contrast, Formulation C received the highest acceptability in terms of appearance, with an average mean score of 7.31, interpreted as "Like Moderately" (LM). All five indicators for this formulation received mean scores ranging from 7.18 to 7.49, showing consistent approval from the raters.

Table 4 displays the acceptability ratings for the aroma of three formulations of squash flower (Cucurbita pepo) muffin fortified with malunggay (Moringa oleifera).

Table 4
Acceptability of Aroma of Squash Flowers (*Cucurbita pepo*) Muffin Fortified with Malunggay (*Moringa oleifera*) Formulations

Statement	Formulation A			Formulation B			Formulation C		
	M	**SD**	***D***	**M**	**SD**	***D***	**M**	**SD**	***D***
1. The product has an appealing odor.	4.80	1.33	***NLND***	4.49	0.50	***DS***	4.41	1.46	***DS***
2. The product's odor is pleasant and not overpowering.	3.72	0.81	***DS***	4.96	0.70	***NLND***	6.18	1.07	***LS***
3. The product has a natural odor.	4.04	0.70	***DS***	3.96	0.70	***DS***	7.41	0.49	***LM***
4. The odor of the product is pleasant enough to encourage consumption.	4.73	0.44	***NLND***	5.47	0.89	***NLND***	7.45	0.50	***LM***
5. The product's odor is consistent with its intended flavor.	4.00	0.00	***DS***	4.73	0.44	***NLND***	7.69	0.59	***LVM***
Average	4.26	0.34	***DS***	4.72	0.50	***NLND***	6.63	0.58	***LM***

Formulation A received an overall average mean score of 4.26, interpreted as "Dislike Slightly" (DS). The individual item scores ranged from 3.72 to 4.80, suggesting that while some attributes such as having an appealing odor and encouraging consumption were close to neutral, the general perception was slightly negative, especially regarding its pleasantness and natural aroma.

Formulation B showed a slightly higher acceptability with an average mean of 4.72, interpreted as "Neither Like Nor Dislike" (NLND). This suggests that the aroma of this formulation was more tolerable or acceptable to the raters compared to Formulation A. Most descriptors, including the odor's consistency with flavor and its pleasantness, received neutral responses, with only one indicator—its odor being pleasant and not overpowering—slightly falling under "Dislike Slightly."

Formulation C emerged as the most aromatic and acceptable among the three, with an average mean score of 6.63, interpreted as "Like Moderately" (LM). The scores for this formulation ranged from 4.41 to 7.69, with descriptors such as "natural odor," "pleasant odor encouraging consumption," and "odor consistent with flavor" receiving notably high ratings, reaching interpretations such as "Like Very Much" (LVM).

Table 5 presents the acceptability ratings of the taste of three formulations of squash flower (Cucurbita pepo) muffin fortified with malunggay (Moringa oleifera).

Table 5
Acceptability of Taste of Squash Flowers (*Cucurbita pepo*) Muffin Fortified with Malunggay (*Moringa oleifera*) Formulations

Statement	Formulation A			Formulation B			Formulation C		
	M	SD	*D*	M	SD	*D*	M	SD	*D*
1. The taste of the product is enjoyable.	4.76	0.85	***NLND***	4.96	0.70	***NLND***	7.04	0.70	***LM***
2. The product has a balanced taste.	5.25	1.32	***NLND***	4.36	0.70	***DS***	6.49	0.50	***LS***
3. The taste of the product is unique and refreshing.	3.72	0.81	***DS***	4.37	0.48	***DS***	7.49	0.50	***LM***
4. The product has the right level of sweetness or saltiness.	4.27	0.44	***DS***	5.28	0.81	***NLND***	7.68	0.52	***LVM***
5. The aftertaste of the product is pleasant.	3.49	0.50	***DM***	4.62	0.58	***NLND***	7.31	0.46	***LM***
Average	4.30	0.73	***DS***	4.72	0.26	***NLND***	7.20	0.21	***LM***

Formulation A received an average mean score of 4.30, interpreted as “Dislike Slightly” (DS). Individual statement ratings varied, with the highest score of 5.25 for taste balance, though still within the neutral range. However, low scores such as 3.49 for aftertaste (“Dislike Moderately” or DM) and 3.72 for uniqueness indicate a generally unfavorable perception of the taste.

Formulation B showed slightly better performance, with an average mean score of 4.72, falling under the “Neither Like Nor Dislike” (NLND) category. This suggests that the flavor was acceptable but did not particularly stand out. Taste enjoyment, balance, and aftertaste hovered near neutrality, and although no statements reached positive descriptors, the formulation was not strongly disliked either.

Formulation C received the highest ratings among the three, with an overall average mean of 7.20, interpreted as “Like Moderately” (LM). Each statement scored above 6.49, with the sweetness or saltiness rating reaching 7.68, interpreted as “Like Very Much” (LVM). These results highlight a strong preference for Formulation C’s flavor, which was described as enjoyable, balanced, and refreshing, with a pleasant aftertaste.

Table 6 presents the acceptability ratings for the texture of three formulations of squash flower (Cucurbita pepo) muffin fortified with malunggay (Moringa oleifera), as assessed by the raters using five descriptive indicators.

Table 6 Acceptability of Texture of Squash Flowers (*Cucurbita pepo*) Muffin Fortified with Malunggay (*Moringa oleifera*)Formulations

Statement	Formulation A			Formulation B			Formulation C		
	M	SD	*D*	M	SD	*D*	M	SD	*D*

1. The texture of the product is smooth and pleasant.	3.59	0.49	***DS***	4.51	0.50	***NLND***	7.35	0.53	***LM***
2. The product has the right amount of crunch or softness.	3.49	0.50	***DM***	5.28	0.81	***NLND***	7.61	0.58	***LVM***
3. The texture is consistent throughout the product.	4.40	0.49	***DS***	4.41	0.84	***DS***	7.76	0.85	***LVM***
4. The texture makes the product enjoyable to eat.	4.39	0.83	***DS***	4.22	0.57	***DS***	7.36	0.56	***LM***
5. The texture is suitable for the type of product.	4.16	0.61	***DS***	4.68	0.52	***NLND***	7.48	0.52	***LM***
Average	4.01	0.24	***DS***	4.62	0.40	***NLND***	7.51	0.34	***LVM***

Formulation A received an overall average mean score of 4.01, interpreted as “Dislike Slightly” (DS). While some statements such as consistency and suitability scored above 4.00, others, particularly the right amount of crunch or softness and the smoothness of texture, received lower scores, with one reaching “Dislike Moderately” (DM). These results suggest that Formulation A’s texture was generally unsatisfactory to the raters.

Formulation B showed a moderate improvement, with an average mean score of 4.62, falling under the “Neither Like Nor Dislike” (NLND) interpretation. Most of the individual statements were rated close to or slightly above the neutral range, indicating a more acceptable but still not fully satisfying texture. Only one indicator — the product's consistency — received a “Dislike Slightly” rating, suggesting some inconsistency in texture was still noted.

Formulation C received the highest acceptability ratings in terms of texture, with an average mean of 7.51, interpreted as “Like Very Much” (LVM). All indicators scored well above 7.00, with particularly high ratings for the product’s crunch or softness, and consistency. These responses indicate that the raters found Formulation C’s texture to be smooth, pleasant, and suitable for the product type, greatly enhancing its overall eating experience.

Table 7 summarizes the acceptability of the composite appeal of the three formulations of squash flower (Cucurbita pepo) muffin fortified with malunggay (Moringa oleifera).

Table 7

Acceptability of the Composite Appeal of Squash Flowers (*Cucurbita pepo*) Muffin Fortified with Malunggay (*Moringa oleifera*)Formulations

Product	**M**	**SD**	***Description***
Formulation A	4.10	0.37	***Like Moderately***
Formulation B	4.60	0.37	***Neither Like nor Dislike***
Formulation C	7.16	0.39	***Like Moderately***

The composite appeal represents the overall impression of each formulation, integrating aspects such as appearance, aroma, taste, and texture. Formulation A received a mean score of 4.10 with a standard deviation of 0.37, interpreted as “Like Moderately.” Despite this positive description, the score is at the lower end of the "like" range, indicating limited but present appeal among the raters.

Formulation B, on the other hand, obtained a mean score of 4.60, also with a standard deviation of 0.37, and was interpreted as "Neither Like nor Dislike." This neutral rating suggests that the product was generally acceptable but failed to leave a strong positive impression on the raters. It reflects a middling performance compared to the other two formulations.

Formulation C stood out with the highest composite appeal, garnering a mean score of 7.16 and a standard deviation of 0.39, which falls within the "Like Moderately" category but is much closer to the upper end of the scale. This indicates that Formulation C was consistently well-received and preferred over the other two formulations, reflecting its superior performance in terms of overall sensory quality.

Comparisons of Acceptability of Sensory Attributes of Squash Flowers (*Cucurbita pepo*) Muffin Fortified with Malunggay (*Moringa oleifera*)

Table 8 presents the results of a multivariate analysis of variance (MANOVA) for repeated measures conducted to determine whether there were significant differences among the three formulations of squash flower (Cucurbita pepo) muffin fortified with malunggay (Moringa oleifera) in terms of sensory attributes: appearance, aroma, taste, and texture.

Table 8
Significant Difference on Sensory Attributes of Squash Flowers (*Cucurbita pepo*) Muffin Fortified with Malunggay (*Moringa oleifera*)

Attribute	F	p	Decision on Ho	Interpretation
Appearance	6641.21	<0.01	Rejected	Significant
Aroma	885.87	<0.01	Rejected	Significant
Taste	1286.55	<0.01	Rejected	Significant
Texture	4130.12	<0.01	Rejected	Significant

Wilks' Lambda Λ= 0.004, F=840.742, p<0.01

The analysis began with a multivariate test using Wilks' Lambda, which yielded a very small value ($\Lambda = 0.004$), an F-ratio of 840.742, and a p-value less than 0.01. This result indicates a statistically significant overall difference among the formulations when all sensory variables are considered simultaneously.

Following this, univariate tests were conducted for each individual attribute. For appearance, the F-value was 6641.21 with a p-value of less than 0.01, leading to the rejection of the null hypothesis and confirming a significant difference among the formulations in terms of visual appeal. Aroma also showed a significant difference with an F-value of 885.87 and a p-value below 0.01. Similarly, taste ($F = 1286.55$, $p < 0.01$) and texture ($F = 4130.12$, $p < 0.01$) both exhibited statistically significant differences among the muffin formulations. These findings affirm that the three muffin formulations differed substantially across all sensory attributes, supporting the conclusion that formulation changes had a marked effect on the product's overall sensory quality.

Table 9 provides the results of the pairwise comparisons conducted following the significant findings from the repeated measures MANOVA in Table 8. These comparisons were performed to identify which specific pairs of formulations differed significantly in terms of each sensory attribute

Table 9
Pairwise Comparisons on Sensory Attributes of Squash Flowers (*Cucurbita pepo*) Muffin Fortified with Malunggay (*Moringa oleifera*) Formulations

Attribute	Formulation (Mean)		p	Decision on Ho	Interpretation
Appearance	A (M=3.82)	B (M=4.36)	<0.01	Rejected	Significant
	A (M=3.82)	C (M=7.31)	<0.01	Rejected	Significant
	B (M=4.36)	C (M=7.31)	<0.01	Rejected	Significant
Aroma	A (M=4.26)	B (M=4.72)	<0.01	Rejected	Significant
	A (M=4.26)	C (M=6.63)	<0.01	Rejected	Significant
	B (M=4.72)	C (M=6.63)	<0.01	Rejected	Significant
Taste	A (M=4.3)	B (M=4.72)	<0.01	Rejected	Significant
	A (M=4.3)	C (M=7.2)	<0.01	Rejected	Significant
	B (M=4.72)	C (M=7.2)	<0.01	Rejected	Significant
Texture	A (M=4.01)	B (M=4.62)	<0.01	Rejected	Significant
	A (M=4.01)	C (M=7.51)	<0.01	Rejected	Significant
	B (M=4.62)	C (M=7.51)	<0.01	Rejected	Significant

For appearance, all pairwise comparisons between Formulation A (M = 3.82), Formulation B (M = 4.36), and Formulation C (M = 7.31) yielded p-values less than 0.01, leading to the rejection of the null hypothesis in all cases. This confirms that each formulation was perceived significantly differently in terms of visual appeal, with Formulation C being far more acceptable than both A and B.

Similar trends were observed for aroma, where the mean scores for Formulations A, B, and C were 4.26, 4.72, and 6.63, respectively. Again, all comparisons showed significant differences ($p < 0.01$), indicating that each formulation had a distinct aromatic profile, with Formulation C standing out positively.

The attribute of taste also exhibited significant differences among all formulation pairs. Formulation A (M = 4.30) and Formulation B (M = 4.72) differed significantly from Formulation C (M = 7.20), which was rated much higher. Although A and B had closer scores, their difference was still statistically significant, suggesting that even small improvements in taste were perceptible to the panelists.

In terms of texture, Formulation A (M = 4.01), B (M = 4.62), and C (M = 7.51) also differed significantly from each other ($p < 0.01$). These findings reinforce the results from Table 8, emphasizing that each formulation offered a unique sensory experience and that Formulation C was consistently rated as significantly superior in all four sensory domains.

The pairwise comparison results support the earlier MANOVA findings by showing that all three formulations differed significantly from one another, with Formulation C consistently achieving the highest ratings in appearance, aroma, taste, and texture. This confirms that formulation adjustments had a substantial and measurable impact on consumer acceptability.

Table 10 presents the results of an analysis examining whether the sensory acceptability ratings for Formulation C of the squash flower (Cucurbita pepo) muffin fortified with malunggay (Moringa oleifera) varied significantly based on the profile of participants, specifically their age, sex, civil status, and highest educational attainment.

Table 10
Significant Difference on Sensory Attributes of Squash Flowers (*Cucurbita pepo*) Muffin Fortified with Malunggay (*Moringa oleifera*)Formulation C based on Profile of Participants

Profile	Attribute	F	p	Decision on Ho	Interpretation
Age	Appearance	6.54	0.98	Not Rejected	Not Significant
	Aroma	23.65	<0.01	Rejected	Significant
	Taste	35.07	<0.01	Rejected	Significant
	Texture	16.13	<0.01	Rejected	Significant
Sex	Appearance	22.46	<0.01	Rejected	Significant
	Aroma	1.28	<0.01	Rejected	Significant
	Taste	0.77	0.26	Not Rejected	Not Significant
	Texture	0.10	0.38	Not Rejected	Not Significant
Civil Status	Appearance	3.24	0.75	Not Rejected	Not Significant
	Aroma	4.51	0.07	Not Rejected	Not Significant
	Taste	2.89	0.04	Rejected	Significant
	Texture	0.97	0.09	Not Rejected	Not Significant
Highest Educational Attainment	Appearance	3.98	0.33	Not Rejected	Not Significant
	Aroma	5.02	0.05	Rejected	Significant
	Taste	8.69	0.03	Rejected	Significant
	Texture	0.00	<0.01	Rejected	Significant

When grouped by age, the ratings for aroma, taste, and texture all showed statistically significant differences ($p < 0.01$), indicating that perceptions of these attributes were influenced by the respondents' age. However, for appearance, the difference was not significant ($p = 0.98$), suggesting that age did not affect how visually appealing Formulation C was perceived to be.

In terms of sex, significant differences were observed in ratings for appearance ($F = 22.46$, $p < 0.01$) and aroma ($F = 1.28$, $p < 0.01$), meaning male and female raters differed in how they assessed these attributes. However, taste ($p = 0.26$) and texture ($p = 0.38$) showed no significant difference based on sex, implying that both male and female respondents rated these attributes similarly.

When analyzed by civil status, only taste showed a statistically significant difference ($p = 0.04$), suggesting that married and single participants had varying preferences in flavor. Ratings for appearance, aroma, and texture were not significantly influenced by civil status, as all corresponding p-values exceeded the 0.05 threshold.

Based on educational attainment, significant differences were found for aroma ($p = 0.05$), taste ($p = 0.03$), and texture ($p < 0.01$), indicating that participants' level of education influenced how they perceived the product's aroma, flavor, and mouthfeel. Appearance, however, was not significantly affected by educational background ($p = 0.33$).

Tables 11 and 12 collectively present a detailed analysis of how participant profiles influenced the sensory evaluations of Formulation C of squash flower (Cucurbita pepo) muffins fortified with malunggay (Moringa oleifera), focusing on the attributes of aroma, taste, and texture, which were found to be significantly affected by profile variables in Table 10.

Table 11
Pairwise Comparisons on Sensory Attributes of Squash Flowers (*Cucurbita pepo*) Muffin Fortified with Malunggay (*Moringa oleifera*) Formulation C based on Age

Attribute	Age (Mean)		p	Decision on Ho	Interpretation
Aroma	21-30(M=6.43)	31-40(M=6.8)	.052	Not Rejected	Not Significant
	21-30(M=6.43)	41-50(M=6.8)	<0.01	Rejected	Significant
	31-40(M=6.8)	41-50(M=6.8)	1.000	Not Rejected	Not Significant
Taste	21-30(M=7.32)	31-40(M=7.09)	<0.01	Rejected	Significant
	21-30(M=7.32)	41-50(M=7.11)	<0.01	Rejected	Significant
	31-40(M=7.09)	41-50(M=7.11)	.938	Not Rejected	Not Significant
Texture	21-30(M=7.73)	31-40(M=7.37)	<0.01	Rejected	Significant
	21-30(M=7.73)	41-50(M=7.31)	<0.01	Rejected	Significant
	31-40(M=7.37)	41-50(M=7.31)	.723	Not Rejected	Not Significant

Table 11 offers pairwise comparisons to identify exactly where those differences lie. For aroma, significant differences were found between the 21–30 and 41–50 age groups ($p < 0.01$), but not between the other pairs. This suggests that older participants (41–50) rated the aroma of Formulation C more favorably than younger participants (21–30), while the middle group (31–40) showed no notable deviation from either. In terms of taste, both comparisons involving the youngest group (21–30) showed significant differences compared to the older groups, with the 21–30 group giving the highest mean rating (M = 7.32). This implies that younger participants found the muffin tastier than those in older age brackets. A similar trend is observed for texture, where the 21–30 group again rated the product more highly than those aged 31–40 and 41–50, and the differences were statistically significant. This suggests that younger consumers may be more receptive to the product's sensory characteristics, especially taste and texture.

Table 12
Acceptability of Aroma of Squash Flowers (*Cucurbita pepo*) Muffin Fortified with Malunggay (*Moringa oleifera*) Formulation C based on Sex, Civil Status, and Highest Educational Attainment

Profile		Appearance	Aroma	Taste	Texture
Sex	Male	7.71	7.24	-	-
	Female	7.26	6.54	-	-
Civil Status	Single	-	-	7.29	-
	Married	-	-	7.19	-
Highest Educational Attainment	College Level/Graduate		6.57	7.23	7.56
	Master's Level/Graduate		6.82	7.13	7.35

Table 12 complements the findings in Table 10 by presenting the mean scores of sensory attributes across sex, civil status, and educational attainment. According to Table 10, sex significantly affected aroma and appearance. Table 12 reveals that males rated the aroma higher (M = 7.24) than females (M = 6.54), aligning with the notion of sex-based variation in perception.

When comparing civil status, Table 10 found taste to be significantly influenced (p = 0.04). Table 12 supports this by showing that single participants rated taste slightly higher (M = 7.29) than married participants (M = 7.19), although the difference is small, it aligns with the statistical result in Table 10.

Regarding educational attainment, Table 10 reported significant differences in aroma, taste, and texture. Table 12 further illustrates this with numerical comparisons: those with a master's level education rated aroma slightly higher (M = 6.82) than those with only college-level education (M = 6.57). In terms of taste, college-level participants rated higher (M = 7.23) than those at the master's level (M = 7.13), and the same pattern appears in texture (M = 7.56 vs. 7.35).

Physicochemical Analysis

Table 13 presents the physicochemical composition of the calcium-enriched muffin using Formulation C, which was previously established as the most preferred variant based on sensory evaluation.

Table 13 presents the physicochemical composition of the Squash Flowers (Cucurbita pepo) Muffin Fortified with Malunggay (Moringa oleifera) (Formulation C), focusing on two key nutritional components: crude protein and total fat.

Table 13

Physicochemical Composition of the Squash Flowers (*Cucurbita pepo*) Muffin Fortified with Malunggay (*Moringa oleifera*)Formulation C

Analysis	Method	Results
Crude Protein (N × 6.25)	Kjeldahl	6.7
Total Fat	Soxhlet	3.9



The analysis reveals that the muffin contains 6.7% crude protein, determined through the Kjeldahl method, indicating a fair amount of protein likely contributed by the malunggay and squash flowers. Additionally, the total fat content is measured at 3.9% using the Soxhlet extraction method, reflecting a relatively low-fat formulation suitable for health-conscious consumers. These results suggest that the product is not only sensory acceptable but also nutritionally beneficial.

RECOMMENDATIONS

Students. To encourage increased vegetable intake, schools and educational institutions can incorporate Formulation C of the squash flower muffin fortified with malunggay into their feeding programs or

cafeteria offerings, as it is both highly acceptable across various age and gender groups and nutritionally beneficial.

Society and Community. Community-based livelihood programs and cooperatives can be encouraged to produce and promote Formulation C muffins, which not only support healthy eating habits but also create economic opportunities using locally sourced squash flowers and malunggay, promoting sustainability and community engagement.

Future Researchers. Future researchers are encouraged to explore formulation adjustments tailored to specific demographic preferences—such as enhancing aroma for older adults or optimizing texture for younger consumers—while continuing to investigate other nutritional and functional ingredients that could further improve the product.

Food Establishment Owners. Bakery and food business owners should consider adopting Formulation C in their product line to cater to health-conscious consumers, as it meets consumer preferences across sensory attributes and contains essential nutrients like protein and fat while also aligning with the trend toward plant-based, functional ingredients.

Nutritionists. Nutritionists are recommended to integrate this product into dietary plans for individuals needing improved nutrient intake, particularly calcium and protein, and to work on further improving the formulation by reducing sugar or incorporating other fortifying ingredients while preserving sensory appeal.

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