INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print); 2222-5234 (Online)
Website: https://www.innspub.net
Email contact: info@innspub.net
Vol. 27, Issue: 6, p. 273-281, 2025

RESEARCH PAPER OPEN ACCESS

Sensory evaluation of melastoma (*Melastoma malabathricum*) fruit cupcake

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Key words: Melastoma, *Melastoma malabathricum*, Wild fruit utilization, Indigenous fruit, Tropical fruit

Received Date: December 15, 2025 **Published Date:** December 27, 2025

DOI: https://dx.doi.org/10.12692/ijb/27.6.273-281

ABSTRACT

The main thrust of the study is to determine the acceptability of melastoma fruit cupcakes in terms of color, texture, aroma flavor and general acceptability of the three treatments. The researchers noticed that melastoma are abundant and less utilized by many people. Researchers chose melastoma fruit extracts as one of the main flavoring ingredient in making cupcakes. Additionally, a descriptive design using rating sheet as the data collection was implemented. The study involved 30 purposive selected respondents from Bohol Island State University, Calape Campus. One-Way ANOVA was used to determine the difference of the acceptability of the different treatments of melastoma fruit cupcake. The initial treatment had equal color description, soft and fluffy texture, with very perceptible aroma, very perceptible taste and rate as like very much in the general acceptability. The second treatment was blue violet, with soft and fluffy texture, moderately perceptible aroma, moderately perceptible taste, and rate like extremely in the general acceptability. Lastly, the third treatment was dark blue violet, crumbly in texture, with very perceptible aroma, very perceptible taste and rate as like moderately in general acceptability. The overall acceptability of all the treatment was described as very much acceptable by the respondents. The statistical results showed that there is no significant difference among the three treatments. The result of the study indicated good potential for community extension program to introduce and promote melastoma fruit cupcake for public consumption, as well as an addition for source of income.

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INTRODUCTION

In the Philippines, Melastomataceae that is commonly found in the forest and mountains and a common herbal plant used in folklore remedies. It has a purple beautiful flower and a purple fruit that tastes sweet. Locally named "hantutuknaw", in the science world is called "*Melastoma malabathricum*". It is known as a singapore rhododendron in Singapore and Britain; pecuk kenduduk in Indonesia (Fazlin *et al*., 2002). Many fruits and other foods can be used as the main ingredients or flavoring in making such baked products. With the unique taste and texture of the melastoma fruit, this can be a very good ingredient. Melastoma fruit (*Melastoma malabathricum* L.) are technically classified as berries, when they are ripe, they break open irregularly to reveal the soft, dark purple, sweet but rather astringent-tasting pulp and numerous orange seeds. The seeds are tasteless and can be eaten, and they stain the tongue black. Its seeds are used in the famous "poh chi" pills to treat diarrhea in traditional Chinese medicine (Hugh Tan and Yeo, 2009). As for the health benefits of *Melastoma malabathricum*, it is a traditional medicine for the treatment of dysentery, wounds, high blood pressure, diabetes, and skin diseases in areas such as Malaysia, Taiwan, and China (Joffry *et al*., 2012).

Melastoma malabathricum L. (Melastomataceae) or Melastoma is one of the 22 species found in the Southeast Asian region and is considered native to tropical and temperature Asia and the Pacific Islands. It is very common throughout Malaysia in the lowland and mountain forests, chiefly in open places (Ling *et al*., 2009). In these areas, the plant petals and fruits are rich sources of flavonoid compounds, such as anthocyanins. Being beneficial to health, anthocyanins also have the potential as a natural food colorant.

Anthocyanins are water-soluble color pigments found in plants that are derivatives of anthocyanidins. Anthocyanins not only have various benefits in the food industry but have also been used as a natural colorant in various foods, cosmetics, and coating products, and as potential natural photosensitizers in solar cells. However, natural colorants are less stable, therefore it is necessary to test the stability of the anthocyanin pigments' color.

The incorporation of Melastoma extract into cupcake formulation represents an innovative approach to product development that highlights the dual value of indigenous plants as both functional and aesthetic ingredients. The natural anthocyanins present in the fruit not only provide a vibrant purple hue that enhances the visual appeal of baked goods, but also contribute potential health-promoting properties. By utilizing *Melastoma malabathricum* in a familiar product such as cupcakes, the research bridges traditional knowledge with modern food technology, creating a novel dessert that is both culturally rooted and nutritionally enriched. This application demonstrates how local biodiversity can be harnessed to diversify food products while promoting sustainable use of underutilized plant resources.

Statement of the problem

The main thrust of the study was to determine the sensory evaluation of "Melastoma (*Melastoma malabathricum*) Fruit Cupcake" in three treatments during the school year 2023-2024 as a basis for a proposed extension program of Bohol Island State University, Calape Campus.

Specifically, this study sought to answer the following questions:

1. What is the sensory description of Melastoma Fruit Cupcake in terms of color, texture, aroma, flavor, and general acceptability of the three treatments in terms of:
   1.1 color;
   1.2 texture;
   1.3 aroma; and
   1.4 flavor?
2. Is there a significant difference in the sensory evaluation of melastoma fruit cupcakes in terms of color, texture, aroma, flavor, and general acceptability in the three treatments?
3. What is the cost description of the three treatments of melastoma fruit cupcake?

4. What extension program can be proposed based on the results of the study?

Statement of the null hypothesis

There is no significant difference in the sensory evaluation of three (3) different treatments of Melastoma (*Melastoma malabathricum*) Fruit Cupcake in terms of color, texture, aroma, flavor and general acceptability.

MATERIALS AND METHODS

Design

The researchers used experimental and descriptive methods in conducting this study. This is to ascertain the respondents on the melastoma fruit cupcake. The researchers made another type of dessert similar to cupcakes out of the melastoma fruit using different processes that could similarly create the same preparation and ingredients in the making of cupcakes.

Experimental design was employed during the blending process in preparing the liquid of melastoma to create a cupcake. On the other hand, a descriptive method was used to determine the sensory evaluation of melastoma fruit cupcakes and different characteristics such as color, texture, aroma, flavor and general acceptability in three (3) different treatments.

Environment and participants

This study was conducted at Bohol Island State University – Calape Campus. The researchers chose the environment because the institution offers the Food Preparation Services and Technology Program related to the study, specifically, Bachelor of Science in Industrial Technology major in Food Preparation Services and Technology, and also the instructors of the College of Technology and Allied Sciences who are experts in the field were there. A purposive sampling technique was utilized in selecting the respondents involved in the study.

Research respondents

This study was composed of thirty (30) respondents including ten (10) Bread and Pastry Teachers, five (5) Pastry Makers, and fifteen (15) Food Preparation Services and Technology 2nd year students. They were properly selected to make sure each one of them is free from taste perception disorder, odor perception, color blindness, and denture effect which might affect the judgment of the product.

Research instrument

The study utilized the researchers-made instruments in gathering the data and in determining the sensory evaluation of melastoma fruit cupcakes in terms of color, texture, aroma, flavor and general acceptability. The gathered data served as a basis for the statistical analysis, evaluation, and interpretation. The 9-point hedonic scale was used in evaluating the product.

Statistical treatment

Mean (*M*) was computed to generally describe the sensory evaluation of melastoma fruit cupcakes in terms of color, texture, aroma, flavor and general acceptability. It is interpreted as follows:1.00–1.88 (Extremely Inacceptable), 1.89–2.77 (Very Much Inacceptable), 2.78–3.66 (Moderately Inacceptable), 3.67–4.55 (Slightly Inacceptable), 4.56–5.44 (Neither Like nor Dislike), 5.45–6.33 (Slightly Acceptable), 6.34–7.22 (Moderately Acceptable), 7.23–8.11 (Very Much Acceptable), and 8.12–9.00 (Extremely Acceptable).

Frequency (*f*) and percent (%) were used to determine the sensorial description of the Melastoma Fruit Cupcake such as color, texture, aroma, and flavor. One-way analysis of variance applying bootstrapping with 95% Bias corrected accelerated was used to test if there is significant difference on the acceptability of the three treatments of melastoma fruit cupcake in terms of color, texture, aroma, and flavor. Bootstrapping is robust estimation method for reducing bias associated with normality, homogeneity of variance, and sampling.

Explicitly, the *F*-statistic with corresponding between and within group degrees of freedom was determined which is defined as the ratio of the between-group variability to the within-group variability. Probability

values (*p)* are compared at .05 level of significance. The IBM SPSS Statistics Version 25 was used in data analysis.

RESULTS AND DISCUSSION

Sensory description of the melastoma fruit cupcake

Table 1 shows sensory description of the three treatments of melastoma fruit cupcake evaluated in terms of color, texture, aroma, flavor, and general acceptability. The goal is to provide a detailed and objective description of the sensory characteristics of the melastoma fruit cupcake.

Color is a critical visual cue that significantly influences consumer expectations and acceptance of food products (Spence, 2024). As detailed in Table 1, among the three treatments, Treatment 3, containing 100 grams of melastoma fruit, was most frequently described as dark blue violet (*f*=14, 46.6%). Typically, melastoma fruit usually contain antioxidants, vitamins, and natural pigments that influence their color (Refilda *et al.*, 2023). They possess a unique color that can affect the appearance of baked goods such as cupcakes.

In contrast, Treatment 2, which comprises 75 grams of melastoma fruit, predominantly exhibited a blue violet color (*f*=13, 43.3%). While still appealing, the color profile of Treatment 2 is slightly less intense compared to Treatment 3. The color changes from pale blue violet, blue violet to dark blue violet due to the increasing amount of melastoma fruits added.

Table 1. Sensory description of melastoma fruit cupcake (n = 30)

Attributes	Descriptions	Treatments					
		T1		T2		T3	
		50 grams of Melastoma fruit		75 grams of Melastoma fruit		100 grams of Melastoma fruit	
		f	%	*f*	%	*f*	%
Color	Dark blue violet	10	33.3	9	30.0	14	46.6
	Blue violet	10	33.3	13	43.3	4	13.3
	Pale blue violet	10	33.3	8	26.6	12	40.0
Texture	Soft and fluffy	19	63.3	15	50.0	6	20.0
	Crumbly	1	3.3	7	23.3	1	36.6
	Moist	8	26.6	6	20.0	8	26.6
	Dry	2	6.6	2	6.6	5	16.6
	Firm	0	0.0	0	0.0	0	0.0
Aroma	Very perceptible aroma of melastoma	11	36.6	9	30.0	14	46.6
	Moderately perceptible aroma of melastoma	9	30.0	10	33.3	13	43.3
	Slightly perceptible aroma of melastoma	9	30.0	10	33.3	1	3.3
	Just right	1	3.3	1	3.3	2	6.6
Flavor	Very perceptible taste of melastoma	11	36.6	10	33.3	14	46.6
	Moderately perceptible taste of melastoma	8	26.6	12	40.0	11	36.6
	Slightly perceptible taste of melastoma	9	30.0	6	20.0	4	13.3
	Just right	2	6.6	2	6.6	1	3.3

Note: Description with the highest *f* and % is used as descriptor for the treatment

The melastoma fruit are known for their deep purple to black shade, which can provide a vibrant color to foods they are added to usually in baked products. It can add a unique flavor and color to cupcakes. This implies that optimizing temperature and storage conditions could enhance the color stability and visual appeal of products containing melastoma fruit.

In terms of texture, Treatment 1 received the highest descriptive frequency (*f*=19, 63.3%), being frequently described as soft and fluffy. This suggests that Treatment 1's texture is highly appealing, may contribute to increased consumer satisfaction. Treatment 3 obtained the highest frequency for the secondary texture description, being described as crumbly. The Treatment 3 described as crumbly in texture due to the numerous seeds in melastoma fruit (Wong, 2015) these seeds create a slightly grainy texture and affect the moisture level of the fruit in baked goods. Large quantity of seeds used in the

mixture can absorb moisture from the batter, potentially leading to a slightly drier cupcake. This indicates that while Treatment 3 may still be appealing to some consumers, it may not be as universally preferred as the soft and fluffy texture of Treatment 1.

In aroma, Treatment 3, containing 100 grams of melastoma fruit, had the highest frequency of very perceptible aroma of melastoma (*f*=14, 46.6%). This suggests that the strong aroma of Treatment 3 could positively impact consumer perception. Melastoma fruit have mild, pleasant aroma, potentially with a slightly astringent quality (Koay, 2008). Treatment 1, with 50 grams of melastoma fruit, was perceived by 11 participants (36.6%) as having a very perceptible aroma of melastoma. This indicates that even with a lower quantity of fruit, the aroma remains a significant factor in consumer appeal.

In contrast, Treatment 2 with 75 grams of melastoma fruit was perceived by 10 participants (33.3%) as having a slightly perceptible aroma of melastoma. Aromatic compounds are indeed found in melastoma fruit. These compounds contribute to the fruit's fragrance and flavor profile, enhancing its overall sensory appeal. This implies that the aroma of melastoma could be attributed to the presence of tannins which contribute to a slightly bitter or astringent aroma. However, this aroma is less pronounced and may not be as effective in attracting consumers compared to the other treatments. The aroma of fresh melastoma fruits is particularly highlighted for its significance in product quality assessment (Cheng and Zhao, 2016).

In terms of flavor, treatment 3, which contained 100 grams of melastoma fruit, had the highest description frequency, with 14 participants (46.6%) perceiving it as having a very perceptible taste of melastoma. Treatment 1, with 50 grams of melastoma fruit, was perceived by 11 participants (36.6%) as having a very perceptible taste of melastoma. In contrast, Treatment 2, containing 75 grams of melastoma fruit, received the highest description frequency for a moderately perceptible taste of melastoma. These results imply that the intensity of the melastoma flavor varies with the amount of fruit used, affecting consumer perception. Treatments 3 more pronounced flavor likely contributes to higher perception rates, whereas Treatments 2 had moderate flavor that may appeal to those preferring a subtler taste.

Table 2 presents the results of the acceptability of melastoma fruit cupcakes based on color, texture, aroma, flavor, and general acceptability, analyzed using one-way analysis of variance (ANOVA).

In terms of color, all treatments (T1, T2, T3) were deemed very much acceptable, with composite means of 7.57, 7.50, and 7.67, respectively. A one-way ANOVA revealed no significant difference in the sensory evaluation of the three treatments in terms of color, $F(2, 87) = 0.144$, $p = 0.866$.

These findings suggest that the color of the melastoma fruit cupcakes is consistently well-received across different treatments, indicating that color uniformity. Color uniformity in the cupcakes is primarily attributed to the natural variations and properties of the ingredients used. Consumers seem to enjoy the cupcakes regardless of minor variations in color, indicating that other factors, such as taste or texture, are likely more important in their purchasing decisions. The significance of the dark blue violet color of melastoma fruit cupcakes attributed to anthocyanins, which provide a natural colorant.

In terms of texture, the results indicate that all three treatments were perceived as very much acceptable by the participants. Respondents found the cupcakes with 50 grams of melastoma fruit rates higher acceptability, likely due to the minimal presence of seeds. However, increasing amount of melastoma fruit would negatively affect the texture of the cupcakes. A one-way ANOVA revealed no significant difference in the sensory evaluation of the three treatments in terms of texture, $F(2, 87) = 2.279$, $p = 0.108$.

Table 2. Sensory acceptability and test of hypothesis of melastoma fruit cupcake (n = 30)

Sensory attributes	Treatments	Mean	Interpretation	F	*p*	Decision	Result
Color	50 grams of melastoma	7.57	Very much acceptable	.144	.866	Failed to reject null hypothesis	Ns
	75 grams of melastoma	7.50	Very much acceptable				
	100 grams of melastoma	7.67	Very much acceptable				
Texture	50 grams of melastoma	7.97	Very much acceptable	2.279	.108	Failed to reject null hypothesis	Ns
	75 grams of melastoma	7.73	Very much acceptable				
	100 grams of melastoma	7.33	Very much acceptable				
Aroma	50 grams of melastoma	7.50	Very much acceptable	1.213	.302	Failed to reject null hypothesis	Ns
	75 grams of melastoma	7.73	Very much acceptable				
	100 grams of melastoma	7.93	Very much acceptable				
Flavor	50 grams of melastoma	7.80	Very much acceptable	0.025	.975	Failed to reject null hypothesis	ns
	75 grams of melastoma	7.77	Very much acceptable				
	100 grams of melastoma	7.73	Very much acceptable				
General acceptability	50 grams of melastoma	7.80	Very much acceptable	2.8941	.0607	Failed to reject null hypothesis	ns
	75 grams of melastoma	8.13	Extremely acceptable				
	100 grams of melastoma	7.60	Very much acceptable				

Note: F-values were calculated with 2 degrees of freedom between groups and 87 degrees of freedom within groups, using bias-corrected and accelerated (BCa) bootstrap 95% confidence intervals based on 1,000 bootstrap samples. Unless otherwise noted, results are considered statistically significant when $p \leq 0.05$ (Reject H0); $p > 0.05$ indicates non-significance (Fail to reject H0).

These findings suggest that the texture of melastoma fruit cupcakes is uniformly acceptable across different formulations, implying that variations in the amount of melastoma fruit used do not significantly impact the perceived texture.

In terms of aroma, all three treatments were perceived as very much acceptable, with composite means ranging from 7.50 to 7.93. A one-way ANOVA revealed no significant difference in the sensory evaluation of the three treatments in terms of aroma, $F(2, 87) = 1.213$, $p = 0.302$. These findings imply that the aroma of melastoma fruit cupcakes is consistently well-received across different formulations, suggesting that variations in the amount of melastoma fruit used do not significantly affect the perceived aroma. This consistency is beneficial for product development, as it indicates that the pleasant aroma characteristic of melastoma fruit can be maintained across different recipes, thereby enhancing consumer satisfaction.

In terms of flavor, all three treatments were perceived as very much acceptable, with composite means ranging from 7.73 to 7.80. A one-way ANOVA revealed no significant difference in the sensory evaluation of the three treatments in terms of flavor, $F(2, 87) = 0.025$, $p = 0.975$.

These findings imply that the flavor of melastoma fruit cupcakes is consistently well-received across different formulations, indicating that variations in the amount of melastoma fruit used do not significantly impact the perceived flavor. This consistency in flavor acceptability suggests that the melastoma fruit's have the potential to be a delicious and versatile treat, flavor profile is robust

and can be effectively maintained in various product formulations, thereby ensuring consumer satisfaction.

In terms of general acceptability, Treatment 2 (75 grams of melastoma) received the highest mean score of 8.13, described as extremely acceptable. Treatment 1 (50 grams of melastoma) and Treatment 3 (100 grams of melastoma) received composite means of 7.80 and 7.60, respectively, described as very much acceptable. A one-way ANOVA revealed no significant difference in the sensory evaluation of the three treatments in terms of general acceptability, $F(2, 87) = 2.8941$, $p = 0.0607$. Middle amount with 75 grams of melastoma got the highest acceptability majority of the tasters. Adding more melastoma fruit could lead to flavor saturation, where the flavor might be too intense that could result in a less balanced and enjoyable experience for consumers. Increasing the fruit content could also affect the overall texture and appeal of the cupcake. A well-crafted cupcake recipe achieves a balance between color, texture, aroma and flavor. Adding too much of one ingredient can disrupt the balance and lead to an undesirable result.

These findings imply that all three treatments are well-received in terms of general acceptability, with no significant preference for any particular formulation. The high acceptability scores across treatments suggest that variations in the amount of melastoma fruit used do not substantially impact overall consumer satisfaction. This indicates flexibility in the recipe, allowing manufacturers to adjust melastoma fruit content without significantly affecting consumer acceptability.

CONCLUSION

The researchers concluded that there was no significant difference in the Sensory Evaluation of Melastoma Fruit Cupcake in the three treatments in terms of color, texture, aroma, flavor, and general acceptability. Furthermore, the three treatments were generally acceptable thus can be evenly produced as an alternative product. Nonetheless, the acceptability of the five sensory attributes showed that Treatment 2 has the highest general acceptability and was the most preferable to the respondents.

RECOMMENDATIONS

1. The researchers could promote the product through conducting community outreach and introduce this product to the consumers to improve their way of preparing Melastoma Fruit Cupcake.
2. Future researchers could conduct process, product formulation optimization and shelf- life studies of the product.
3. Future researchers may conduct proximate analysis (protein, fat, and calcium) of the product.
4. The researchers recommend treatment 3 for production due to its cost efficiency.
5. The researchers recommend to chose for a packaging suitable for the nature and size of the product.

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