IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 11, Issue 6, June 2024

DOI: 10.17148/IARJSET.2024.11601

FORMULATION, ANALYSIS AND ACCEPTABILITY OF ORGANIC RICE TART CRUST WITH BILIMBI JAM FILLING

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Abstract: Incorporating a variety of rice flours in tart-making introduces a delightful twist to traditional recipes, adding both diversity and nutritional benefits to the culinary experience. This study aimed to develop organic rice tart crust with Bilimbi jam filling, using three different types of rice: red, black, and brown. The sensory qualities of the tart, including appearance, aroma, taste, and texture, were evaluated in three trials by semi-trained panelists who were Food Technology teachers at Capiz State University. The study used a Completely Randomized Design (CRD), using three treatments in three trials. All three types of tarts were well-accepted, but the brown rice tart received the highest acceptability overall. Despite the differences in rice type, there were no significant differences in the sensory qualities among the three types of tart. However, there was a significant difference in consumer acceptability across the three types, with the brown rice tart being the most favored. In terms of shelf-life, the tarts made from brown rice lasted the longest at room temperature, remaining fresh for up to 20 days. When stored at chilling temperatures, the shelf-life of all types of tart extended significantly, with brown rice tart lasting up to 28 days. The study also confirmed the safety of the tart for human consumption based on microbial analysis, adhering to the BFAD standard for microorganism testing for baked goods. This study contributes to the development of diverse organic rice products, offering potential benefits for both consumers and producers.

Keywords: Development, Acceptability, Kamias Jam, Tart, Black Rice, Red Rice, and Brown Rice.

I. INTRODUCTION

Incorporating a variety of rice flours in tart-making introduces a delightful twist to traditional recipes, adding both diversity and nutritional benefits to the culinary experience. Different rice varieties, such as brown, red, or black rice flours, contribute unique flavors, textures, and colors to the crusts of tarts. This not only enhances the visual appeal but also offers some nutritional advantages, as each rice type contains a distinct set of vitamins, minerals, and antioxidants. The incorporation of diverse rice flours allows for creative exploration in the kitchen, catering to various dietary preferences and providing a wholesome alternative for those seeking gluten-free options. This innovative approach to tart crusts not only elevates the taste profile but also aligns with the growing trend of embracing healthier and more inclusive culinary choices.

The present research aimed to determine the acceptability of Organic rice tart with bilimbi jam filling product among consumers. It seeks to gather data on consumer preferences, sensory attributes, and overall liking for different bilimbi jam product treatments. This study intends to bridge the gap in previous research by providing insights into the consumer acceptability of present product innovation, thereby aiding in the development of commercially viable bilimbi-based products.

This study aimed to formulate and utilize of organic rice in making tart crust with Bilimbi Jam filling Specifically, it aimed to: (1) determine the sensory qualities of organic rice tart crust with bilimbi jam filling among three treatments in terms of appearance, aroma, taste, and texture; (2) determine the acceptability of organic rice tart crust with bilimbi jam filling in terms of sensory qualities among three treatments; (3) find out if there is a significant difference in the sensory qualities of organic rice tart crust with bilimbi jam filling among three treatments in terms of appearance, aroma, taste, and texture; (4) find out if there is a significant difference in the general acceptability of the product in terms of sensory qualities among the three treatments. (5) submit the best treatment of the product for proximate and microbial analysis; and (6) determine the shelf-life of the product in terms of room temperature.

II. METHODOLOGY

Table 1 shows the ingredients for creating Bilimbi Jam Filling with a selection of rice tart crusts, including black rice, red rice, brown rice, all-purpose flour, butter, sugar, and cold water.

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Table 1. Proportion of ingredients of the rice tart crust

Ingredients	TREATMENTS								
	Black Rice			Red Rice			Brown Rice		
	A	B	C	A	B	C	A	B	C
Rice Flour	20 g	30 g	40 g	20 g	30 g	40 g	20 g	30 g	40 g
All Purpose Flour	80 g	70 g	60 g	80 g	70 g	60 g	80 g	70 g	60 g
Butter	58 g	58 g	58 g	58 g	58 g	58 g	58 g	58 g	58 g
Sugar	20 g	20 g	20 g	20 g	20 g	20 g	20 g	20 g	20 g
Cold Water	20 ml	20 ml	20 ml	20 ml	20 ml	20 ml	20 ml	20 ml	20 ml
Egg	1 Small	1 Small	1 Small	1 Small	1 Small	1 Small	1 Small	1 Small	1 Small

In this study, the researcher explored an alternative approach by replacing the conventional all-purpose flour with various types of rice. This substitution aimed to provide a healthier option for the recipe.

Table 2 outlines the ingredients to be utilized in preparing Bilimbi Jam Filling, which include Bilimbi, and sugar.

In this research, the primary objective was to reimagine, enhance, and be able to create tastier and nutritious alternatives by incorporating the locally abundant ingredient bilimbi into the jam filling.

Table 2. Proportion of ingredients of the Bilimbi Jam filling

Ingredients (Bilimbi Jam Filling)	Quantity
Bilimbi (Kamias)	400 grams
Brown Sugar	200 grams

Experimental Procedures

The experiment was carried out in three (3) product formulations namely: Product one (1), bilimbi jam with black rice crust, Product two (2), bilimbi jam with red rice crust, and Product three (3), bilimbi jam with brown rice crust.

In this study, the product that was developed was the bilimbi Jam with three different rice crust. The proportions were based on the different rice crust and quantities of bilimbi jam that were used since the product to be developed is bilimbi jam filling with various rice tart crust.

Step 1: Preparation of Raw Materials

The raw materials were prepared through three (3) main processes: the preparation of bilimbi, the jam filling, and the preparation of rice tart crusts, which included Black Rice, Red Rice, and Brown Rice.

A. Preparation of bilimbi

The preparation started by gathering one (1) kilogram of bilimbi; it was washed thoroughly to ensure its cleanliness. Afterward, both ends of the bilimbi were cut off, and it was sliced into thin pieces. The sliced bilimbi was placed in a bowl and soaked for one (1) hour. Following the soaking period, the bilimbi was rinsed three times to remove any impurities and set aside for later use as shown in Figure 1.

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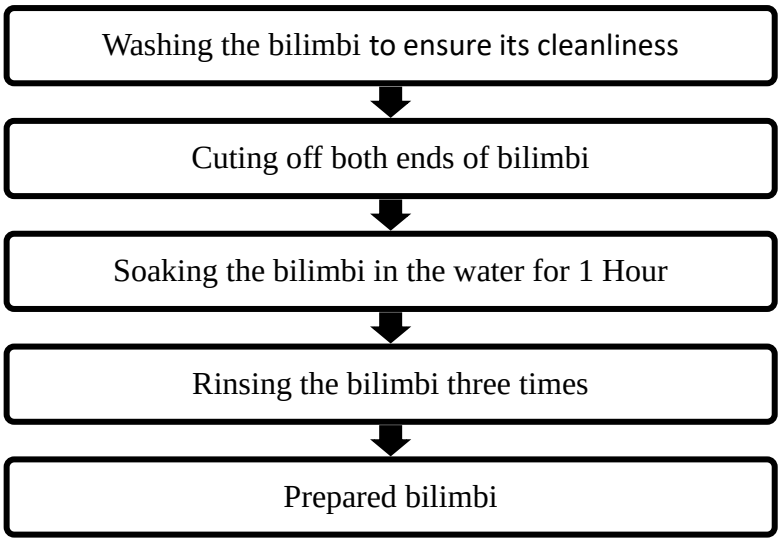

Step 2. Preparation of Bilimbi Jam Filling

Begin in gathering and preparing all the necessary tools, and ingredients. The tools and equipment needed were prepared. All ingredients were measured and weighed using digital weighing scale. In a pre-heat pan, place the prepared Bilimbi mixture, and let it simmer to reduce and achieve the desirable thickness. Stir once in a while for uniform consistency. Once the desired thickness is attained, turn off the stove and transfer it to a bowl, and set aside for later use as shown in Figure 2.

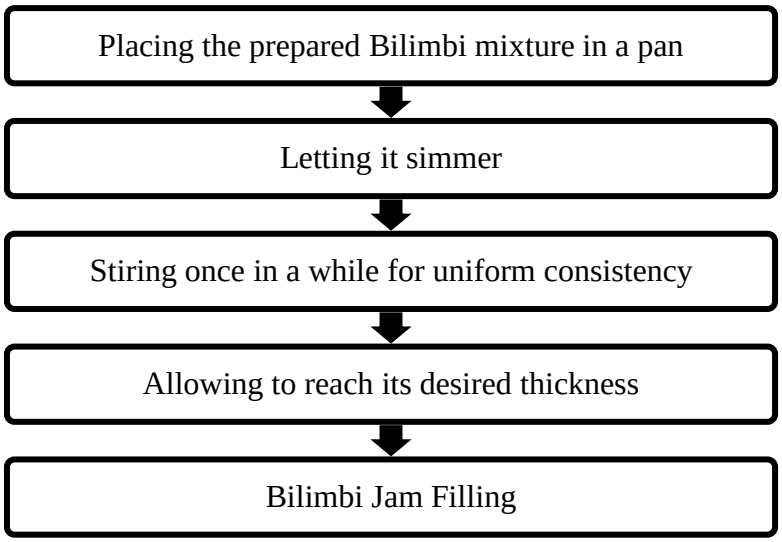

Figure 2. Procedure in Making Bilimbi Jam Filling

Step 3. Preparation of Rice Crust (black rice, red rice, brown rice)

Figure 3 shows the preparation of rice crust. The three kinds of rice were bought from a well-known rice dealer. The researcher began by giving the rice, all-purpose flour, and butter a series of short pulses or grinds, ensuring that they were thoroughly combined until the mixture reached a powdery or coarse texture.

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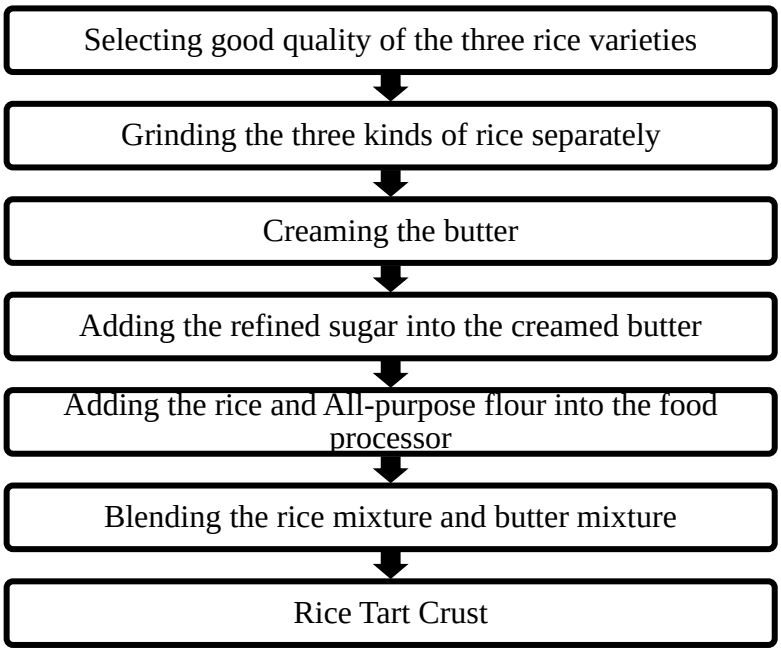

Step 4: Procedure in Making Rice Tart Crust with Bilimbi Jam Filling

Figure 4 shows the preparation in making rice tart crust**.** The tools and equipment needed were prepared. All ingredients were measured and weighed using a digital weighing scale.
Note: The same procedure was followed in making the other variety of rice tart crust.

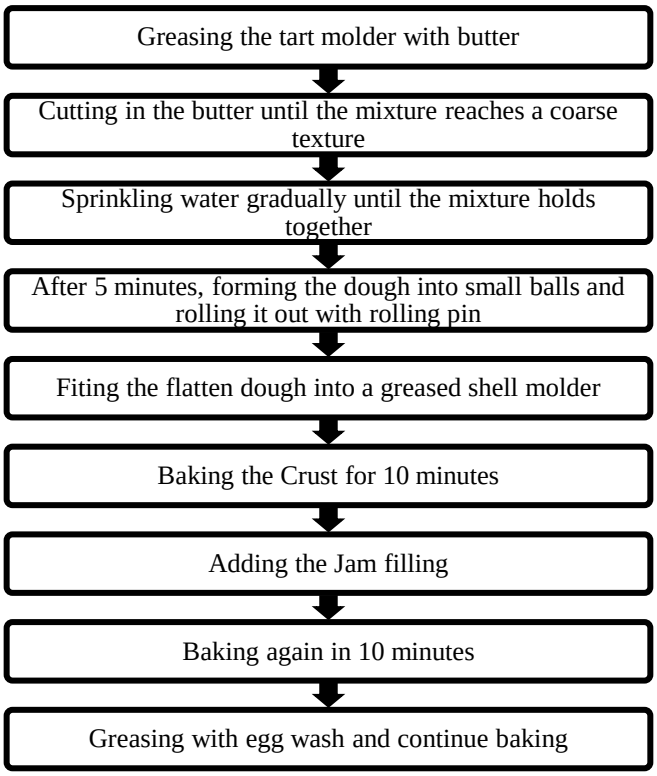

Figure 4. Procedure in Making Rice Tart Crust

Step 5: Procedure in Making Bilimbi Jam filling with Organic Rice Tart Crust

Figure 5 shows the procedure in making Bilimbi Jam filling with various rice tart crust. The prepared Bilimbi Jam filling was poured out into the molder, making sure it was nestled within the rice crust. It was then baked in a preheated oven at 400°F for about 15 to 20 minutes, allowing the flavors to meld and the crust to achieve its ideal texture.

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Once it was baked, it was allowed to cool down, and when it was at an ideal temperature, each tart was gently unmolded individually.

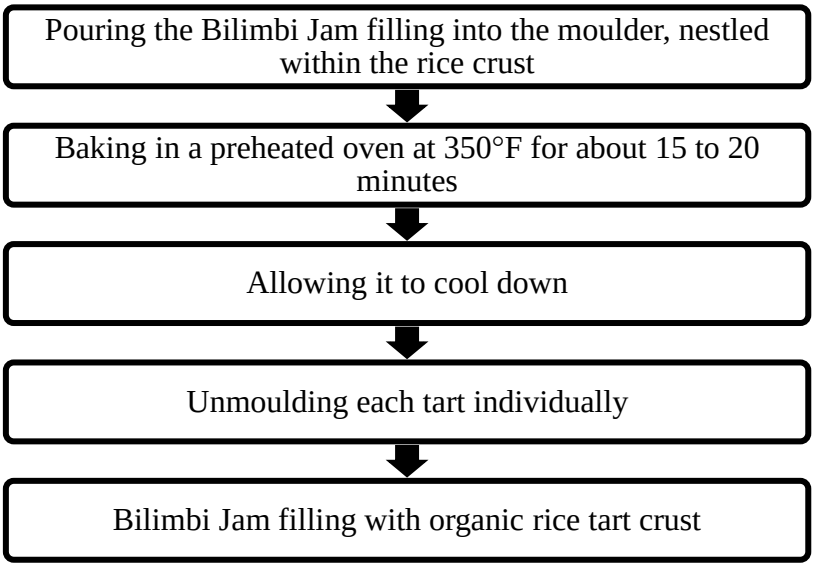

Figure 5. Procedures in Making Bilimbi Jam filling with Black Rice, Red Rice, and Brown Rice tart crust

III. RESULTS AND DISCUSSION

Sensory Qualities of Organic Rice Tart Crust With Bilimbi Jam Filling

The results reveal that regardless of the ingredients, all three types of rice (red, black, and brown) are perceived as "Extremely Appealing" in terms of appearance. This consistency suggests that the visual presentation of the rice crust is highly attractive across all treatments. The black rice and brown rice have a similar general mean score of 8.50 across its three treatments, while the black rice has 8.33. Furthermore, a closer examination of the data reveals a significant pattern becomes apparent. Both black rice and brown rice have a general mean score of 8.50, this indicates that both rice varieties are considered equally appealing, independent of the processing they have experienced, suggesting a sense of parity in their perceived appearance.

The overall mean scores of the sensory qualities for the different types of organic rice crust show consistent high ratings. Red rice had an overall mean score of 8.27, black rice had a slightly higher overall mean score of 8.32, and brown rice had an overall mean score of 8.31. These results indicate that all three (3) types of rice crusts, regardless of their color, were perceived positively in terms of sensory qualities such as appearance, aroma, taste, and texture. The minimal differences in mean scores suggest that participants found each type of rice crust to be similarly appealing and enjoyable. This consistency in ratings across different types of rice further emphasizes the overall high quality and desirability of the organic rice crusts, irrespective of their color or treatment.

The findings of this study are in conjunction of the findings of Gunes et al. (2022) which stated that, the sensory experience of jam as a filling played a pivotal role in consumer satisfaction. Texture, flavor, and aroma are key factors influencing the overall appeal of products featuring jam fillings. The balance between the fruit's natural sweetness, tartness, and the consistency of the jam contributed to the sensory harmony that defined a successful filling.

General Acceptability of Organic Rice in making Tart Crust with Bilimbi Jam Filling

The results of the general acceptability of organic rice in three different treatments, as evaluated by different customers using the best product formulation proportion. Treatment C achieved the highest scores in terms of appearance, aroma, taste, and texture, with the acceptability score of 8.06. Thus, Treatment C was described as "Liked Extremely" for its appearance, aroma, taste, texture, and general acceptability.

The Bilimbi Tart with Red Rice crust was "Liked Extremely" for appearance 8.17, "Liked Very Much" 7.85 for aroma, "Liked Very Much" for taste 7.98 and "Liked Very Much" for texture 8.00. The grand mean of 8.00 signifies that the consumers "Liked Very Much" the tart made of red rice. Moreover, black rice crust was "Liked Extremely" for appearance 8.26, "Liked Very Much" 8.05 for aroma, "Liked Extremely" for taste 8.36, and also "Liked Extremely" for

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texture 8.14. The grand mean of 8.20 signifies that the consumers "Liked Extremely" the tart made of black rice. On the other hand, brown rice was "Liked Extremely" for all the three sensory qualities which are appearance, taste and texture with the corresponding means of 8.72, 8.71, 8.62, except only to aroma that was perceived as "Like Very Much" with the mean score of 8.06. The brown rice has general acceptability score of 8.66 which has an adjectival description of "Liked Extremely" as evaluated by the consumers which indicates that brown rice crust was the most preferred among the three types of rice crusts. This level of general acceptability suggests that consumers found the Brown Rice crust to be extremely pleasing in terms of its sensory qualities, particularly its appearance, taste, and texture. The slightly lower rating for aroma did not significantly impact the overall acceptability of the brown rice crust, indicating that the other sensory qualities may have a greater influence on consumer preference. It's also worth noting that while the black rice and red rice crusts received slightly lower overall acceptability scores, they were still rated as "Liked Very Much" and "Liked Extremely", respectively. This indicates that these crusts were also well-received by the consumers, further emphasizing the high quality and appeal of all three types of organic rice crusts.

General acceptability of organic tart crust with bilimbi Jam filling made of organic rice crust (red, black, and brown rice).

QUALITY ATTRIBUTES	TA Red Rice		TB Black Rice		TC Brown Rice	
	Mean	AD	Mean	AD	Mean	AD
Appearance	8.17	LE	8.26	LE	8.72	LE
Aroma	7.85	LVM	8.05	LVM	8.06	LVM
Taste	7.98	LVM	8.36	LE	8.71	LE
Texture	8.00	LVM	8.14	LE	8.62	LE
Acceptability	8.00	LVM	8.20	LE	8.66	LE

Legend: LE - Like Extremely LVM - Like Very Much

Differences in the Sensory Qualities of Organic Rice Tart Crust with Bilimbi Jam Filling

The results of the study revealed that the texture of the three varieties of rice did not significantly differ. For Red Rice, the F statistic was 0.835 with a p-value of 0.445. Similarly, for Brown Rice, the F statistic was 0.988 with a p-value of 0.385. For black rice, the F statistic was 4.101 with a p-value of 0.028. Since all these p-values are greater than the set significance level of 0.01, the researcher fails to reject the null hypothesis, suggesting no significant difference in texture across the treatments for all rice varieties. This could be due to several factors. One of these is the processing methods used. The rice was ground into a flour and then baked into a crust. The grinding and baking processes might standardize the texture, resulting in a similar texture, regardless of the type of rice used. Another factor is the cooking techniques. The same cooking techniques and conditions, such as temperature, time, and method, were used for all rice varieties. This uniformity in cooking conditions may have resulted in a similar texture across all crusts. Lastly, almost the same ingredients and recipe were used for making the crust, with the only variation being the different rice varieties. The recipe calls for a constant amount of all-purpose flour, butter, sugar, and cold water. These ingredients could contribute to a similar texture in the final product, standardizing the texture across all rice varieties. Thus, while the treatments might have some effect on the texture of the rice, these effects were not significant enough to result in a noticeable difference in texture for red rice, black rice, and brown rice.

Difference in the General Acceptability of the Products in terms of Sensory Qualities among Three Treatments

Results showed that there was a significant difference in the appearance of varied organic rice crust among treatments. $F(299) = 17.523$, p value = .000. This implies that the appearance had dissimilarity in all treatment that suggests that the visual appeal of the rice crust, which could include factors such as color, and shape, varied significantly across the treatments. This variation in appearance could be due to the unique characteristics of each rice variety and how these characteristics are expressed under different treatment conditions.

Findings on the test of difference between treatments in terms of aroma showed a significant difference $f(299) = 32.113$, p value = .000). It means that there is a distinct aroma in between treatments which might be due to the ingredients used. This further implies, that the aroma of the rice crust, which can be influenced by the specific compounds present in each rice variety, differed significantly across the treatments. The distinct aroma between treatments could be due to the interaction of these compounds with the ingredients used in each treatment.

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The outcomes of the test for significant difference between treatment in terms of taste rejected the null hypothesis f (299) = 25.122, p value =. 000). The unevenness of the treatments in terms of taste may be due to the composition of the variants, and the unique flavor profiles of each rice variety and how these flavors are altered or enhanced by the different treatments.

Likewise, result of the test for significant difference between treatments of varied organic rice crust of tart with bilimbi jam filling in terms of texture rejected the null hypothesis f (299) = 31.529, p value = .000). The variation of the product in terms of texture may be due to the physical structure of each rice variety and how this structure is affected by the different treatments. Factors such as grain size, shape, and hardness can influence the texture of the rice crust and can vary based on the treatment applied.

Differences in the general acceptability of the product in terms of sensory qualities among the three treatments.

Quality Attributes	Groups	Sum of Squares	df	Mean Square	F ratio	P value	Remarks
Appearance	Between Groups	17.407	2	8.703	17.523	.000	s
	Within Groups	147.510	297	.497			
	Total	164.917	299				
Aroma	Between Groups	30.167	2	15.083	32.113	.000	s
	Within Groups	139.500	297	.470			
	Total	169.667	299				
Taste	Between Groups	26.660	2	13.330	25.122	.000	s
	Within Groups	157.590	297	.531			
	Total	184.250	299				
Texture	Between Groups	21.147	2	10.573	31.529	.000	s
	Within Groups	99.600	297	.335			
	Total	120.747	299				
General Acceptability	Between Groups	23.050	2	11.525	62.653	.000	s
	Within Groups	54.634	297	.184			
	Total	77.684	299				

F-value – 2.410 > .01, ns @ .01 alpha

IV. CONCLUSION

Based on the findings, the following conclusions were drawn, highlighting the implications of this study.

The result of this study implies that there is significant potential for culinary innovation using organic rice varieties, specifically black, red, and brown rice. Each variety possesses distinct features that can be creatively used for the creation of tarts. Black rice, known for its pleasing aroma and delicate texture, is an excellent option for creating tart crusts. Conversely, the strong flavor of red and brown rice is ideal for producing a tasty crust that enhances the flavor of tarts.

The positive acceptability of organic rice tart crust with bilimbi jam filling open doors for wider adoption of organic rice crusts in desserts. With all three varieties receiving favorable ratings, this would empower the industry to create a more diverse selection of rice tarts, to cater a wider range of consumer preferences. Thus, this can lead to increased market demand for these organic rice varieties, benefiting both bakers and producers.

The study findings suggest that the sensory qualities of rice tart crusts with bilimbi jam filling remain consistent, irrespective of the variations in ingredients and proportions. This indicates that different processing methods and ingredient choices do not significantly impact the overall sensory experience. Furthermore, minor changes in the texture of black rice do not affect the overall texture, providing bakers with the flexibility to experiment with techniques and organic rice crusts without affecting consumer satisfaction. Consequently, this could potentially streamline the production process and result in cost savings.

The results revealed a significant difference in the consumers acceptance of the rice tart crusts based on its sensory qualities. Appearance, aroma, taste, and texture all varied considerably across the three treatments. This

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emphasizes the importance of choosing the right processing method to achieve the desired sensory experience of the public. This further implies that bakers and manufacturers may tailor the processing method and ingredients depending of the need of their target audience, thus, this can create a wider range of rice tart options, catering to diverse tastes and market demands.

The results in the shelf life of organic rice tart with bilimbi jam filling when stored at room and chilling temperature varied depending on the rice type used, this difference implies that rice variety play a significant role in moisture retention, firmness, and susceptibility to spoilage. Thus, this further implies that, if bakers and retailers can establish appropriate storage and display guidelines for each crust type, they can minimize waste and ensure that consumers enjoy these rice tarts at their optimal freshness, and be able to enhance overall satisfaction and reducing potential product loss

Based on the result, organic rice tart with bilimbi jam filling was safe for human consumption as the result of the proximate and microbial analysis.

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