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# NATA DE FRUTA: FORMULATION, ANALYSES AND ACCEPTABILITY

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**Abstract:** *Nata de Fruta*, a fermented dessert traditionally made from coconut water, but innovatively developed using tropical fruits like guava, jackfruit, melon, orange, and papaya. The main purpose of the study was to develop *Nata de Fruta* using tropical fruits, namely, guava, jackfruit, melon, orange, and papaya. The study aimed to evaluate the sensory qualities and general acceptability of *Nata de Fruta* across five treatments. It also sought to identify any significant differences in sensory qualities and acceptability among the treatments. Additionally, it sought to determine the microbial and proximate analysis of the best product and determine the shelf-life of *Nata de Fruta*. The researcher used a developmental method, and the nine-point hedonic scale was used to evaluate the treatments regarding sensory qualities and general acceptability. The findings of the study revealed that jackfruit consistently excelled in most sensory attributes, including aroma, taste, and texture, and was rated highest in general acceptability. The findings indicated no significant differences in appearance among the five treatments of *Nata de Fruta*, suggesting uniformity across the fruits used. However, there were significant differences in general acceptability among the treatments. Laboratory tests on 25 grams of *Nata de Fruta* showed no presence of Salmonella or E. coli, with an aerobic plate count of 560 CFU/g, yeast count of 35 CFU/g, and mold count of 10 CFU/g. The sample's composition included 57.57% carbohydrates, 27.06% moisture, 1.01% protein, and 0.13% fat.

Keywords: Nata de Fruta, Tropical Fruits, Sensory Qualities

#### I. INTRODUCTION

The production of *nata*, particularly *nata de coco*, from tropical fruits has garnered much interest because it provides nutritional benefits and helps diminish food wastage. *Nata de coco* is primarily produced from mature coconut water using the fermentation principle with the bacterium *Acetobacter xylinum*, and its thick dietary fiber content and unique texture are recognized (Gayathry, 2015). Studies have shown that the substrate coconut water may produce large amounts of *nata*, with production rates reportedly as high as 250 g/L under optimal conditions. Moreover, the fermentation could be adapted to utilize other fruits used in the tropics, such as pineapple and guava, thereby converting tropical waste into a range of economic food products. This contributes to the sustainability of food systems and ensures that underused resources in tropical regions are used effectively (Juwita et al., 2020).

*Nata* is a well-known dessert created through fermentation. It thrives when fruit, sugar, and water are combined and allowed to ferment. Tropical fruits like pineapple, melon, and orange are ideal for making *nata* due to their high water content, which facilitates bacterial growth and fermentation. Additionally, these fruits have natural acidity, with a lower pH level, which fosters an environment conducive to certain bacterial proliferation. For instance, a study on the production of *nata* from pineapple found that the maximum concentration for fermentation is within 1.1% to 1.5% acetic acid content (Thankappan & Anitha, 2018). In the production of *nata*, the natural acidity of the fruit serves a dual role: it helps control pathogen growth while enhancing the production of bacterial cellulose, which contributes to the jelly-like texture. The type and concentration of sugar used during fermentation are also crucial, as high sugar levels support bacterial activity and promote fermentation, although excessive sugar can impede bacterial growth, necessitating a balanced approach. Beyond the fruit's components, environmental factors such as temperature and pH significantly influence the fermentation process. Optimal conditions for *nata* production involve temperatures ranging from 25°C to 30°C and a slightly acidic pH, which favors the proliferation of beneficial bacteria (Nurainun, 2019).

Recent research found that guava is a good ingredient for *nata*, or *nata de guava*. Research has already been presented wherein guava and *nata* combined with extract of *Phaseolus vulgaris* sprout have a good quality such as thickness and water content plus taste that can be put in food products (Setiani et al., 2019). However, it is important to compare and contrast traditional coconut water *nata's* preparation methods, shelf life, and customer acceptance (Lathifaha & Nuryana, 2021). The already present market for guava-flavored products, for example, Cojo Cojo, gains a belief that perhaps there will be a demand for it from the target group in the marketplace of the product (Vinut, n.d.). The unique chemical makeup of guava might require changes in the fermentation process to improve the product's quality. Therefore, more research is needed to completely understand the possibilities and difficulties of using guava in *nata* production.



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In the study of Darmayanti et al. (2023), it was found out that jackfruit straw (Artocarpus heterophyllus) is a promising substrate for the production of *nata*. This innovation is driven by the nutritional profile of jackfruit straw, which contains essential nutrients that support the growth of Acetobacter xylinum, the bacteria responsible for cellulose production in *nata*. Their research explored the effects of varying ratios of jackfruit straw and purple cabbage (*Brassica* oleracea var. capitata) on the antioxidant activity of nata. Additionally, the fermentation process led to a reduction in total sugar content from 38.13% to 14.37%, indicating effective fermentation by Acetobacter xylinum. The results of their study suggest that utilizing jackfruit straw and purple cabbage can significantly improve the nutritional and functional properties of *nata*, making it a viable alternative to traditional coconut-based products while promoting sustainability by utilizing agricultural waste.

Considering the current interest of using tropical fruits in the making of *nata*, this study aims to determine the development of Nata de Fruta by using guava and jackfruit, melon, orange, and papaya. All the fruits have, besides having high water content and natural acidity that favors fermentation, unique flavors and nutritional profiles which could elevate the quality of the final product (Choi & Kim, 2020; Wang & Zhang, 2019). As an example, guava is known to contain high levels of vitamin C content of more than 200% of the daily requirement and dietary fiber. Other fruits that have been considered in this research include jackfruit, which contains a high number of nutrients; hence, it is packed with vitamin C and antioxidants making it wholesome. Melon and orange are hydrating and nutrient-rich fruits; oranges contain potassium and lots of vitamin C, whereas melons are prized for their refreshing taste and pulp contents (Choi & Kim, 2020; Wang & Zhang, 2019).

In this regard, by exploiting the properties mentioned above, processing Nata de Fruta from such fruits can result in a product that is not only appealing in taste but also beneficial for health, thereby enhancing sensory qualities and acceptability.

## **Objectives of the Study**

- 1. determine the sensory qualities of *Nata de Fruta* in terms of appearance, aroma, taste, and texture;
- 2. determine the general acceptability of *Nata de Fruta* among the five treatments in terms of appearance, aroma, taste, and texture:

Phases	Description			
Phase 1	Evaluation Design			
Phase II	Experimentation			
Phase III	Analysis			
Methodology: Phase I Evaluation Design				

# **II. METHODOLOGY**

## Methodology: Phase I Evaluation Design

This study employed an experimental-developmental method of research. According to the OECD's Frascati Manual (2015), it is a systematic approach that integrates knowledge gained from previous research and practical experience to create new products, processes, or services, or to enhance existing ones. This type of research is characterized by its focus on producing new products or processes or improving existing products or processes. Hence, in this study, the experimental method was used to investigate the acceptability of Nata de Fruta using tropical fruits. The developmental method was used in the formulation of Nata de Fruta for product development and commercialization.

#### **Research Design**

The design that was used in the study was the Complete Randomized Design (CRD) in which Nata de Fruta made from guava, jackfruit, melon, orange, and papaya was studied with successive experimentation conducted to determine the cause of change.

#### **Experimental Treatments**

The experimental treatment for this study focused on incorporating tropical fruits in making Nata de Fruta, specifically guava, jackfruit, melon, orange and papaya. This study aimed to develop Nata de Fruta using the tropical fruits.

Table 1 presents the ingredients used in making Nata de Fruta for each treatment. The key variable in this study was the kind of tropical fruit incorporated in making nata, which differed among the treatments. Treatment A contained 150 grams of guava, Treatment B 150 grams of jackfruit, Treatment C 150 grams of melon, Treatment D 150 grams of



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orange and Treatment E 150 grams of papaya. The formulations remained consistent in most ingredients, 1200 ml of purified water, 35 ml. of glacial acid, 250 ml of mother liqour and 75 g. of sugar were kept the same amount across all treatments.

Ingredients			Treatments		
Ingreutents –	Α	В	С	D	Ε
Guava	150 g	-	-	-	-
Jackfruit	-	150 g	-	-	-
Melon	-	-	150 g	-	-
Orange	-	-	-	150 g	-
Papaya	-	-	-	-	150 g
Purified Water	1200 mL	1200 mL	1200 mL	1200 mL	1200 mL
Glacial Acid	35 mL	35mL	35 mL	35 mL	35 mL
Mother Liqour	250 mL	250 mL	250 mL	250 mL	250 mL
Refined Sugar	75 g	75 g	75 g	75 g	75 g

Table 2, on the other hand, presents the proportion of ingredients used in preserving *Nata de Fruta*. Each treatment used 500 g. of harvested *Nata de Fruta*. Likewise, the other ingredients were all in same measurements.

	Table 2. Ingre	culents used in p	lesel ving Ivala de	Truta.	
Ingredients			Treatments		
	Α	В	С	D	Е
Nata de Fruta	500 g	500 g	500 g	500 g	500 g
Purified Water	100 ml	100 ml	100 ml	100 ml	100 ml
Refined Sugar	100 g	100 g	100 g	100 g	100 g
Fruit Juice/Puree	150 ml	150 ml	150 ml	150 ml	150 ml

# Table 2. Ingredients used in preserving Nata de Fruta.

#### III. RESULTS AND DISCUSSION

#### Sensory Qualities of *Nata de Fruta* Using Tropical Fruits (Guava, Jackfruit, Melon, Orange, Papaya)

The sensory qualities of *Nata de Fruta* using tropical fruits (guava, jackfruit, melon, orange, and papaya) were evaluated based on their appearance, aroma, taste, and texture,

In terms of appearance, Treatment A (guava) and D (orange) received the highest mean score of 8.30 categorized as "extremely appealing", while melon scored the lowest at 8.00 described as "very much appealing". This suggests that guava and orange were perceived as more visually attractive, potentially due to their vibrant colors and overall presentation. According to Manjusha et al. (2022), guava-based products generally scored well in appearance, aligning with the observation that guava and orange were perceived as more visually attractive compared to melon, jackfruit, and papaya.

In terms of aroma, Treatment B (jackfruit) excelled with a mean score of 8.80 classified as "extremely pleasant", while Treatment E (papaya) had the lowest score of 7.70 described as "very much pleasant". The higher aroma scores for Treatment B (jackfruit) indicate that its scent was more appealing, likely due to the optimal combination of its natural



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fragrance with other ingredients. Barros-Castillo et al. (2022)stated that jackfruit has a complex mixture of volatiles that enhances its sensory appeal, supporting the observation that its aroma is perceived as more pleasant compared to other tropical fruits.

In terms of taste, Treatment A (guava) and Treatment B (jackfruit) both received high scores of 8.70 indicating that they were described as "extremely delicious". Treatment C (melon), however, scored lower at 7.90 while Treatment D (orange) received a score of 8.40, and Treatment E (papaya) was rated at 7.80 categorized as "very much delicious".

The findings suggest that both guava and jackfruit possess a flavor profile that resonates well with consumers, likely due to their balanced sweetness and aroma, which are critical factors in sensory evaluation. These findings aligned with the research of Nwaich et al. (2015) which discussed the nutritional profile of guava, highlighting its high vitamin C content and other phytochemicals that contribute to its flavor and overall sensory appeal.

In terms of texture, jackfruit and papaya excelled with a mean score of 8.90 classified as "extremely chewable", while melon had the lowest score of 8.50 described as "extremely chewable". The results conformed with the study of Divya and Raghunath (2020) discussing the textural properties of fruit bars made from a blend of papaya and jackfruit, highlighting that both fruits contributed significantly to the overall texture quality which was rated as "excellent" by most respondents.

Overall, the results indicated that jackfruit consistently outperformed the other fruits across most sensory attributes, suggesting that its unique combination of qualities makes it particularly appealing to consumers. These results aligned with the research of Isaskar et al. (2021), which emphasized the importance of sensory attributes in consumer preferences for food products.

This implies that guava and orange *Nata de Fruta* are likely to attract consumers visually due to their "extremely appealing" appearance, while jackfruit's superior aroma and texture may enhance overall sensory satisfaction and acceptance. These sensory qualities suggest that incorporating guava, orange, and jackfruit could improve consumer preference and marketability of tropical fruit-based *Nata de Fruta* products.

Sensory quanties of <i>Nata ae Fruta</i> using tropical fruits (guava, jackfruit, meion, orange, and papaya
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					Trea	tments				
Quality Attributes	A (Guay	va)	B (Jackf	ruit)	( (Me	C lon)	D (Orar	nge)	I (Pap	E Daya)
	Mean	AD	Mean	AD	Mean	AD	Mean	AD	Mean	AD
Appearance	8.30	EA	8.20	EA	8.00	VMA	8.30	EA	8.10	VMA
Aroma	8.70	EP	8.80	EP	7.80	VMP	8.20	EP	7.70	VMP
Taste	8.70	ED	8.70	ED	7.90	ED	8.40	ED	7.80	VMD
Texture	8.70	EC	8.90	EC	8.50	EC	8.80	EC	8.90	EC

#### Legend: Adjectival Description (AD)

Score	Appearance	Aroma	Taste	Texture
8.12 - 9.00	Extremely Appealing	Extremely Pleasant	Extremely Delicious	Extremely Chewable
7.23 - 8.11	Very Much Appealing	Very Much Pleasant	Very Much Delicious	Very Much Chewable

### General Acceptability of *Nata de Fruta* Using Tropical Fruits (Guava, Jackfruit, Melon, Orange, Papaya)

Table below revealed the results in the general acceptability of the *Nata de Fruta* using tropical fruits (guava, jackfruit, melon, orange, papaya) in terms of appearance, aroma, taste, and texture as evaluated by 110 evaluators, including 10 semi-trained panelists, 50 consumers, and 50 students. Among all treatments, Treatment B (jackfruit) received the highest general acceptability with a mean score of 8.63 described as "liked extremely". It consistently got excellent scores in all four sensory qualities. In terms of appearance, the mean score was 8.57 interpreted as "liked extremely". In terms of taste, the mean score was 8.64 interpreted as "liked extremely". Lastly, for the texture, the mean score was 8.54 interpreted also as "liked extremely".

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Treatment A (guava) received the second highest score for general acceptability, with a mean score of 8.48 interpreted as "liked extremely". In terms of appearance, aroma, taste, and texture, the mean scores were 8.46, 8.39, 8.50, and 8.58 respectively, all interpreted as "liked extremely".

In terms of general acceptability, Treatment D (orange) and E (papaya) were also evaluated as "liked extremely" by the respondents with mean scores of 8.44 and 8.25, respectively. Treatment C (melon) got the lowest general acceptability with a mean score of 8.09 interpreted as "liked very much."

The study demonstrated that jackfruit achieved the highest general acceptability among the tropical fruits evaluated for *Nata de Fruta* with consistently excellent scores across all sensory attributes. The results agree with the study of Ibrahim et al. (2023) on the sensory acceptability of jackfruit seed spread where they found that jackfruit received high scores in sensory attributes such as aroma, texture, and taste. Therefore, this shows that the products of jackfruit are well accepted by consumers, as is the case in this study, aligning with the study's conclusion that jackfruit had the highest general acceptability among the tested fruits.

Conversely, melon exhibited lower acceptability, aligning with the findings of Chaiyasaeng and Chaiyasaeng (2022), who studied and evaluated various tropical fruits for their sensory properties in sorbet formulations. Their study revealed that melon had lower scores in terms of overall acceptability compared to other fruits like mango and jackfruit.

### General acceptability of Nata de Fruta using tropical fruits (guava, jackfruit, melon, orange, and papaya).

					TREAT	<b>FMENTS</b>				
Quality Attributes	A (Guava)		B (Jackfruit)		C (Melon)		D (Orange)		E (Papava)	
	Mean	AD	Mean	AD	Mean	AD	Mean	AD	Mean	AD
Appearance	8.46	LE	8.57	LE	8.49	LE	8.56	LE	8.30	LE
Aroma	8.39	LE	8.76	LE	7.47	LVM	8.27	LE	7.95	LVM
Taste	8.50	LE	8.64	LE	7.90	LVM	8.40	LE	8.22	LE
Texture	8.58	LE	8.54	LE	8.49	LE	8.52	LE	8.51	LE
General Acceptability	8.48	LE	8.63	LE	8.09	LVM	8.44	LE	8.25	LE

Legend: Qualitative Description (QD)

Score	General Acceptability
8.21 – 9.00	Liked Extremely
7.41 – 8.20	Liked Very Much

#### IV. CONCLUSION

Based on the summary of findings, the following conclusions were drawn: Incorporating jackfruit into *Nata de Fruta* allows for the utilization of its distinctive volatile compounds to significantly enhance the product's sensory qualities, thereby increasing its appeal to consumers who prioritize sensory experiences in their food choices.

The high general acceptability of jackfruit suggests that utilizing jackfruit can significantly enhance consumer acceptance and satisfaction in the *Nata de Fruta* market.

The choice of fruit significantly influences the overall sensory experience, emphasizing the importance of selecting ingredients that enhance all sensory qualities in product development.

Flavor profiles are very important in product development and the exploration of sensory characteristics of ingredients used is crucial to the overall sensory appeal of the product.

The absence of salmonella in *Nata de Fruta* sample signifies that hygienic processing was acceptable.

While *Nata de Fruta* has relatively high calories and lacks significant amounts of essential vitamins, it provides some energy due to its carbohydrate content.

# V. RECOMMENDATION

For further improvement and utilization of the study, the recommendations below were made.



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To ensure optimal sensory quality and consumer acceptance, producers may prioritize jackfruit as the primary ingredient in *Nata de Fruta* formulations. The distinctive aroma and flavor profile of jackfruit significantly enhances the overall sensory experience, making it particularly appealing to consumers who prioritize taste in their food choices.

Producers may also focus on the aroma and taste profiles by experimenting with various combinations of jackfruit, guava, and orange. This strategic approach can yield a more complex flavor profile that caters to diverse consumer preferences while maintaining high sensory quality.

Producers may ensure consistency in texture across all formulations, as the study indicated no significant differences in texture among treatments. This consistency may be effectively marketed as a reliable feature, ensuring that consumers have a uniform experience with each purchase.

Moreover, conducting comprehensive microbial analyses on the best-performing formulations may be conducted to guarantee product safety and extend shelf life. Such analyses will help identify potential risks and inform necessary preservation methods to maintain product integrity.

Marketing teams may capitalize on the high acceptability ratings of *Nata de Fruta* made with jackfruit to attract health-conscious consumers. By highlighting the nutritional benefits of tropical fruits, producers can differentiate their products in a competitive market landscape.

Finally, research and development teams may explore seasonal variations in fruit availability to create limited-edition flavors or products that utilize fruits at their peak freshness. This strategy has the potential to generate excitement around the product line and encourage repeat purchases from consumers seeking novel experience

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