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The Effect of Sugar Percentage in Sempur Fruit Jam (Dillenia Phillipinensis) on Consumer Acceptance, Water Content and Vitamin C Content

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Abstract
This study was conducted to analyze the effect of different sugar percentages on the physical quality, consumer acceptance, moisture content, and vitamin C content of sempur fruit (Dillenia philippinensis) jam. The research was carried out at the Food Processing Laboratory, Culinary Education Study Program, Faculty of Engineering, Universitas Negeri Jakarta. The study was conducted from July 2024 to July 2026 using an experimental research method. The samples consisted of sempur fruit jam formulated with three different sugar concentrations, namely 10%, 12%, and 14%. Consumer acceptance was evaluated through a hedonic sensory test involving 30 moderately trained panelists. The sensory attributes assessed included color, aroma, taste, and texture. Organoleptic data were analyzed using the Friedman test, while the moisture content and vitamin C content were analyzed at the National Research and Innovation Agency (BRIN) Laboratory. The results of the organoleptic test showed that different sugar percentages (10%, 12%, and 14%) had no significant effect on consumer acceptance in terms of color, aroma, texture, sweetness, or sourness. However, descriptively, the 14% sugar treatment tended to receive the highest preference scores for all sensory attributes. The moisture content analysis showed a decreasing trend as the sugar concentration increased, with the lowest average moisture content observed in the 14% sugar treatment (1.55%). In contrast, the statistical analysis of vitamin C content indicated that the sugar formulation had a significant effect on the vitamin C content of sempur fruit jam. Based on these findings, the researcher recommends the utilization of sempur fruit as an innovative raw material for jam production to support local food diversification.

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1. INTRODUCTION

Indonesia is recognized as one of the world's megabiodiversity countries, possessing an exceptionally rich diversity of plant genetic resources, including a wide variety of indigenous fruits distributed across different regions (Ravindran et al., 2021). This biodiversity represents an important resource for supporting food security, food diversification, and the development of functional foods based on local resources. In addition to their diverse nutritional composition, many Indonesian indigenous fruits contain bioactive compounds that offer potential health benefits. However, many of these fruits are still classified as underutilized fruits, resulting in economic value and utilization levels that

remain considerably lower than those of commercial and introduced fruits. This condition highlights the need for innovation in processing indigenous fruits to increase their added value, extend their shelf life, and improve their competitiveness in the food market (Rawat & Das, 2020).

One of the indigenous fruits that has not been widely utilized is sempur fruit (Dillenia philippinensis). This plant grows in several regions of Indonesia and is commonly used as a shade tree, while its fruit is rarely utilized as a food source. Plants belonging to the genus Dillenia are known to contain various bioactive compounds, including phenolic compounds, flavonoids, and other secondary metabolites that contribute to antioxidant activity. Several Dillenia species have also been reported to possess a distinctive sour taste and significant vitamin C content, indicating their potential as raw materials for functional food products (Boruah et al., 2020). These characteristics make sempur fruit a promising ingredient for the development of various processed food products, particularly jam, thereby increasing its economic value while reducing post-harvest losses due to underutilization.

Jam is one of the most popular fruit-based processed products because of its desirable flavor, versatility as a food spread, and longer shelf life compared with fresh fruit. Jam production involves a gel formation process that depends on the interaction among pectin, sugar, acid, and water. Among these components, sugar plays a particularly important role in determining the sensory characteristics of the product and, consequently, consumer acceptance.

On the other hand, different levels of sugar addition may influence the chemical quality of jam, particularly its moisture content and vitamin C content. Insufficient sugar addition may produce a jam with a thin consistency and higher moisture content, making the product more susceptible to microbial spoilage (Mukminah et al., 2022). Conversely, excessive sugar addition may result in an overly firm texture due to changes in the gel structure. Furthermore, during the heating process, vitamin C is prone to degradation because it is highly sensitive to elevated temperatures and processing conditions. Therefore, an appropriate sugar formulation is required to achieve a balance between the physical quality, nutritional quality, and sensory quality of the final product.

Previous studies have reported that sugar concentration is one of the key factors affecting the quality characteristics of fruit jams. Variations in sugar percentage have been shown to influence the physicochemical and sensory properties of jam, including moisture content, texture, color, taste, and consumer preference. A study on carica jam demonstrated that differences in sugar concentration significantly affected the chemical characteristics and sensory acceptance of the product, as well as its microbiological quality (Mukminah et al., 2022). Likewise, research on avocado mango jam revealed that ingredient formulation and processing conditions influenced vitamin C content, physicochemical properties, and the sensory quality of the jam (Mujib et al., 2021).

Although numerous studies have been conducted on the genus Dillenia, most have focused primarily on its phytochemical properties, antioxidant activity, and pharmacological potential. Research investigating the utilization of Dillenia fruit as a raw material for processed food products remains limited, particularly regarding the development of gel-based products such as jam (Pasaribu et al., 2025). Meanwhile, studies on jam formulations from various fruits have consistently demonstrated that sugar concentration plays an essential role in determining physicochemical characteristics and consumer acceptance. However, no study has specifically evaluated the effect of different sugar percentages on the quality characteristics of jam made from sempur fruit (Dillenia

philippinensis), particularly in terms of consumer acceptance, moisture content, and vitamin C content.

Consumer acceptance reflects the extent to which a product is accepted by consumers, moisture content is closely associated with product stability and shelf life, whereas vitamin C content indicates the product's ability to retain its nutritional value after processing. The lack of information in these areas indicates that an optimum sugar formulation capable of producing sempur fruit jam with desirable sensory characteristics, acceptable moisture content according to quality standards, and high vitamin C retention has not yet been established.

Based on the above considerations, this study entitled "The Effect of Sugar Percentage in Sempur Fruit (Dillenia philippinensis) Jam on Consumer Acceptance, Moisture Content, and Vitamin C Content" was conducted. The findings are expected to provide scientific information regarding the optimum sugar formulation for sempur fruit jam production, enhance the added value of sempur fruit, and serve as a reference for the development of local food industries as well as future research.

2. RESEARCH METHODS

2.1 Research methods

The research method employed in this study was an experimental method to determine the optimum sugar percentage in sempur fruit (*Dillenia philippinensis*) jam. The population consisted of sempur fruit jam formulated with different sugar percentages. The samples comprised sempur fruit jam with three sugar concentration treatments, namely 10%, 12%, and 14%. The sampling technique used was random sampling, in which each sample was assigned a unique three-digit random code known only to the researcher to ensure unbiased evaluation during the sensory assessment.

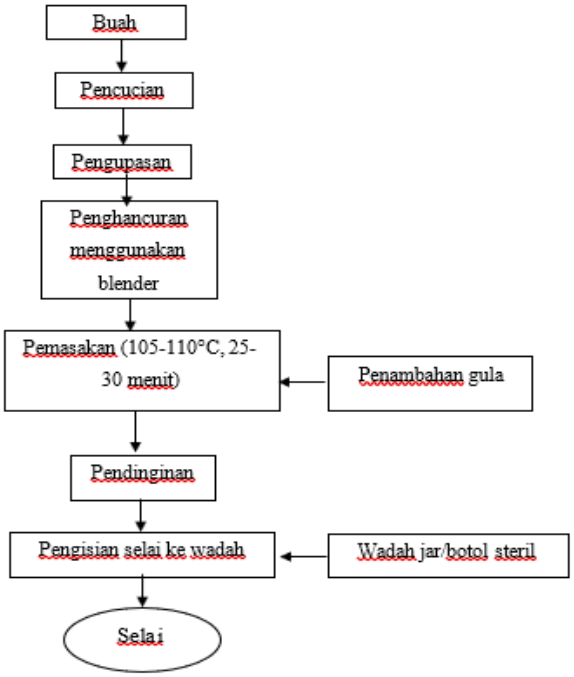
2.2 Data Collection and Analysis Techniques

Data collection in this study was conducted in several stages. The initial stage involved product validation by five expert panelists, who were lecturers from the Culinary Education Study Program, Universitas Negeri Jakarta. Subsequently, the samples were evaluated by 30 moderately trained panelists, consisting of students from the Culinary Education Study Program, Universitas Negeri Jakarta, to assess consumer acceptance. The evaluated sensory attributes included color, aroma, texture, sweetness, and sourness using a Likert scale. Furthermore, the samples were analyzed for moisture content using the gravimetric method, while vitamin C content was determined using the iodometric titration method.

Consumer acceptance data were analyzed using the Friedman test to determine the effect of each treatment. If a significant effect was detected, Duncan's multiple range test was performed as a post hoc analysis to identify differences among treatments. Meanwhile, the data on moisture content and vitamin C content were analyzed using one-way analysis of variance (ANOVA). When significant differences were observed, Duncan's multiple range test was subsequently conducted to determine the differences among treatments.

2.3 Making Jam

The process of making jam consists of several stages, starting with the preparation stage, which includes preparing the tools, preparing the ingredients, and weighing the ingredients, then the implementation stage, which includes making the perfect fruit pulp or juice, cooking, and the final stage, namely the finishing stage, which includes cooling



and packaging.

Figure 1 Jam Making Process

2.4 Making Jam by Adding Sugar

Table 1: Perfect Fruit Jam Formula with Different Sugar Additions

Bahan	Satuan					
	Gram	10%	Gram	12%	Gram	14 %
Sempur	250	100	250	100	250	100
Sugar	25	10	30	12	35	14
Water	125	50	125	50	125	50
Red Food Coloring	0,15		0,15		0,15	

Making sempur fruit jam begins with preparing equipment and ingredients such as sempur fruit, granulated sugar, water, and red food coloring. All ingredients are weighed, then the sempur fruit is peeled and cleaned. After that, the sempur fruit is cut into small pieces to make it easier to crush. Then, the cleaned and cut sempur fruit is soaked in salt water for approximately 1 hour to remove the mucus on the sempur fruit. After soaking for 1 hour, wash the sempur fruit thoroughly and then crush or juice it using a blender. After the sempur fruit is crushed using a blender, the fruit juice is then filtered using a coconut sieve. Then, enter the cooking process where the fruit juice,

water, sugar, and red coloring are cooked for approximately 30 minutes. After 30 minutes or after the jam texture is solid, cool the jam and then put it into a jar.

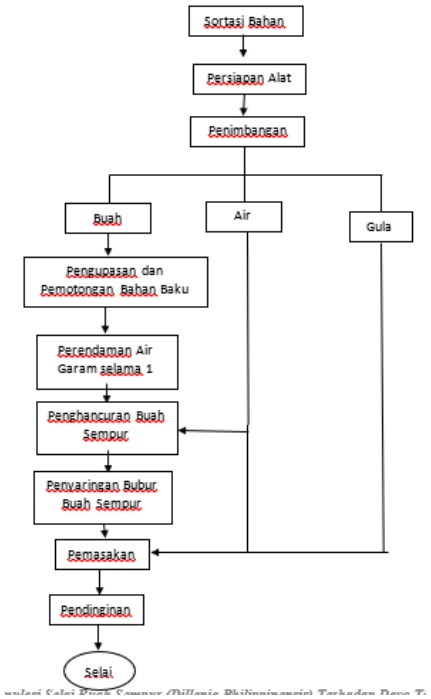


Figure 2 Process Chart for Making Sempur Fruit Jam

3. RESULTS AND DISCUSSION

3.1. Water Content

Kategori Pengujian	x^2_{hitung}	x^2_{tabel}	Kesimpulan
Kandungan Air	9,76	9,55	Fhitung < Ftabel Maka H_0 ditolak dan H_1 diterima

Figure 3 Results of the Hypothesis of Water Content of Sempur Jam

In the water content test of sempur jam with sugar percentage, the calculated F value (Fhit) was 9.76 with α = 0.05, degrees of freedom for treatment (dfp) 2, and degrees of freedom for error (dfe) 3, resulting in a table F (Ftable) of 9.55. The ANOVA test results show that Fhit > Ftable, which means H0 is rejected and H1 is accepted. So, the ANOVA results for water content in sempur jam with different sugar percentages indicate that there is an effect, so it was continued with the Duncan test.

TABEL DUNCAN	3,460	3,586
NILAI DMRT 5%	0,362	0,375

Komponen	Hasil		
	P1	P2	P3
Kandungan air	2,14a	1,60b	1,55b

Figure 4 Results of the Hypothesis Duncan of Water Content of Sempur Jam

The Duncan's follow-up test at the 5% level showed that the 10% sugar treatment resulted in a significantly different water content compared to the 12% and 14% treatments. Meanwhile, the 12% and 14% treatments were not significantly different from each other since they had the same letter notation (b). So, increasing the sugar percentage from 10% to 12% and 14% caused a decrease in the water content of sempur jam.

3.2. Vitamin C Content

Kategori Pengujian	x^2_{hitung}	x^2_{tabel}	Kesimpulan
Vitamin C	30,47	9,55	Fhitung < Ftabel Maka H_0 diterima dan H_1 ditolak

Figure 5 Results of the Hypothesis of Vitamin C Content of Sempur Jam

In the vitamin C test on Sempur jam with different sugar percentages, the F-Calculated value was 30.47 with α = 0.05, degrees of freedom for treatment (df treatment) 2, and degrees of freedom for error (df error) 3, resulting in an F-Table value of 9.55. The ANOVA test results showed that F-Calculated > F-Table, which means H0 is accepted and H1 is rejected. Therefore, the ANOVA results for vitamin C in Sempur jam with different sugar percentages indicate a significant effect, so it was continued with the Duncan test.

P	2	3
TABEL DUNCAN	3,460	3,586
NILAI DMRT 5%	0,538	0,557

Komponen	Hasil		
	P1	P2	P3
Vitamin C	16,40a	15,35b	14,70c

Figure 6 Results of the Hypothesis Duncan of Vitamin C Content of Sempur Jam

The Duncan's advanced test at the 5% level showed that all treatments were significantly different from each other. The 10% sugar treatment produced the highest value (16.40) and was significantly different from the 12% (15.35) and 14% (14.70) treatments. Likewise, the 12% treatment was significantly different from the 14% treatment.

3.3. Consumer Acceptance Test

Table 2: consumer acceptance test

Testing Criteria	Treatment		
	10%	12%	14%
Color	4,1[a]	4,3[a]	4,4[a]
Texture	3,83[a]	3,83[b]	3,93[c]
Jam Aroma	3,6[a]	3,90[a]	3,90[a]
Sweet Taste	3,83[a]	4,07[a]	4,24 [a]
Sour Taste	3,73[a]	4,07[a]	4[a]

Note: The same notation on the same line has no significantly different meaning.

Color

On average, the panelists' rating of the color aspect of sempur jam with 10% sugar treatment was 4.1, which means it falls into the 'liked' category. The average rating for the 12% treatment was 4.3, which also falls into the 'liked' category. The average rating for the 14% treatment was 4.4, which again falls into the 'liked' category. The average values for the color aspect of sempur jam in the table above show that the formula with 14% sugar is the most liked, with the highest score in the

'liked' category.

Texture

On average, the panelists' assessment of the texture aspect in sempur jam with 10% sugar was 3.83, which means it falls into the 'like' category. The average rating for the 12% treatment was also 3.83, which is still in the 'like' category. The average rating for the 14% treatment was 3.91, which also falls into the 'like' category. The average texture rating of sempur jam in the table above shows that the 14% sugar formula is the most liked, having the highest score in the 'like' category.

Perfect Jam Aroma

The average panelist rating for the aroma aspect of sempur jam with 10% sugar treatment was 3.6, which means it falls into the 'like' category. The average rating for the 12% treatment was 3.90, which also falls into the 'like' category. The average rating for the 14% treatment was 3.90, again falling into the 'like' category. The average aroma ratings of sempur jam with different sugar percentages in the table above show that the 12% and 14% formulas were the most liked, receiving the highest scores in the 'like' category.

Sweet Taste

On average, the panelists' assessment of the sweetness aspect of sempur jam with 10% sugar treatment was 3.83, which means it falls into the 'like' category. The average rating for the 12% treatment was 4.07, which also falls into the 'like' category. The average rating for the 14% treatment was 4.24, which again falls into the 'like' category. The average sweetness ratings of sempur jam for the different sugar treatments in the table above show that the 14% formula is the most liked, with the highest score in the 'like' category.

Sour Taste

On average, the panelists' assessment of the sour taste aspect of sempur jam with 10% sugar treatment was 3.73, which means it falls into the 'like' category. The average rating for the 12% treatment was 4.07, which also falls into the 'like' category. The average rating for the 14% treatment was 4, meaning it is in the 'like' category as well. The average values of the sour taste aspect of sempur jam in the table above show that the 14% sugar formula is the most liked, with the highest value in the 'like' category.

4. CONCLUSION

Based on the results of this study on sempur fruit (Dillenia philippinensis) jam formulated with sugar concentrations of 10%, 12%, and 14%, it was found that the 14% sugar formulation was the optimum formulation. This formulation produced results that were the closest to the control product in all evaluated sensory attributes, including color, aroma, taste, and texture.

In the sensory quality evaluation, data were collected from 30 moderately trained panelists to assess and analyze the sensory characteristics of sempur fruit jam with different sugar percentages. The results of the Friedman test indicated that the variation in sugar percentage had no significant effect on any of the sensory attributes evaluated. These attributes included color, sempur fruit aroma, texture, sweetness, and sourness.

The sensory evaluation showed that the 10% sugar formulation produced the best performance in terms of color. The 12% sugar formulation achieved the highest mean score for texture. Meanwhile, the 14% sugar formulation produced the best results for sweetness and sourness. For the aroma attribute, the highest scores were obtained from the 12% and 14% sugar formulations.

Based on the analysis of water content and vitamin C content using one-way analysis of variance (ANOVA), the results indicated that different sugar percentages had a significant effect on both water content and vitamin C content.

The analysis further showed that the 10% and 12% sugar formulations produced the highest mean values for water content and vitamin C content.

In conclusion, the 14% sugar formulation provided the best overall sensory quality and was the closest to the control product without producing statistically significant differences in consumer acceptance. Meanwhile, different sugar percentages significantly affected the water content and vitamin C content of sempur fruit jam.

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