



Chemical and Organoleptic Characteristics of Pineapple Jam Production with Varying Sugar and Pectin Concentrations as Mochi Filling

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Abstract: Pineapple is a key agricultural commodity in Subang Regency. One method of food diversification is transforming pineapple into pineapple jam. Mochi, a food product, can be filled with this pineapple jam. The chemical characteristics and consumer acceptance of pineapple mochi are influenced by the proper ingredients formulation. This study aims to determine the chemical and organoleptic characteristics of pineapple jam as mochi filling. The research design used in this study was a two-factorial Completely Randomized Design (CRD), with the factors being sugar concentration (30%, 40%, and 50%) and pectin concentration (without pectin, 0.015%, and 0.03%). The parameters tested included chemical analysis (water content, total acidity, total soluble solids, and Vitamin C content) and organoleptic evaluation (hedonic test for color, taste, texture, and aroma). The results showed that sugar and pectin treatment had a significant effect on water content G3 21.16^b%, total acidity G1 1.90^b%, and total soluble solids G3 77.26^b%, but did not significantly affect Vitamin C content in the jam 2.20-7.33 m/100 g. Pectin treatment had a significant effect on water content P2 23.27^a%, Vitamin C P3 7.09^b%, total acidity P3 2.17^c%, and total soluble solids P2 76.44^b%. There was no interaction between the sugar and pectin treatments on the pineapple mochi jam. The hedonic test indicated that panelists generally liked the pineapple jam filling for mochi in terms of taste, aroma, color, and texture.

Keywords: Jam; Mochi; Pectin; Pineapple; Sugar

Introduction

Pineapple is a widely favored fruit due to its sweet, acidic, and refreshing flavor profile. Pineapple, also known as (*Ananas comosus*) is a delightful tropical fruit that is high in nutrients, vitamins and minerals (Jarín et al., 2024). Subang is the largest pineapple-producing region in West Java Province, one of Indonesia's major centers of pineapple production (Prasetyo et al., 2023). The primary production areas within Subang include Jalcagak, Ciater, Cijambe, and Kasomalang. This abundant production establishes pineapple as a superior commodity with the potential for further processing and development.

The highly perishable nature and limited shelf life of pineapple can be addressed through product processing, effective packaging, and proper storage (Wardhani, 2019). While several processed pineapple products are available in Subang, their variety remains limited. Existing products include pineapple dodol, pineapple crackers, syrup, and jam. Increasing the variety of processed pineapple products is expected to enhance food diversification, attract consumer interest, and ultimately increase income from pineapple processing (Afoakwah et al., 2023).

Jam is food that is cooked using the meat/juice of fruits or vegetables which are then converted into jelly-like form. In general, jam is made using only one type of fruit with the characteristics of a good jam is to have a

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soft and even texture, favorable color and good fruit taste (Nissa et al., 2019). Jams have been produced from many tropical fruits including orange, watermelon and pineapple (Akinlolu-Ojo et al., 2022). It is a semi-solid food prepared from a fruit mixture with added ingredients such as sugar, pectin, and acid (Afoakwah et al., 2023). Pineapple jam is a common processed product widely used in various pineapple-based derivatives such as cakes, nastar (pineapple tarts), pastries, and other products. The characteristics of pineapple jam vary depending on the specific application to ensure the final product is of high quality and long-lasting (Mohd Naeem et al., 2017). The concentration of sugar and pectin influences the quality of gel formation in the jam. Pectin is a structural polysaccharide that forms gels in the presence of sugar and acid. Its degree of esterification and molecular weight strongly influence gel strength and stability (Lalujan et al., 2025). Utilizing appropriate concentrations of sugar and pectin determines both the characteristics of the pineapple jam and consumer preference (Nissa et al., 2019). Selecting a suitable jam for a product significantly impacts the final result and the product's shelf life. One such product utilizing pineapple jam is mochi. The appropriate characteristics of the pineapple jam will affect the final flavor of the pineapple mochi. The correct formula for pineapple jam will influence the chemical characteristics and the sensory acceptance of the jam by panelists.

Despite the widespread utilization of pineapple jam in various food products, studies focusing on the optimization of pineapple jam characteristics specifically for mochi filling remain limited. Most existing research emphasizes jam formulation in general bakery or spread applications, without considering the unique textural and sensory requirements of mochi products. Mochi requires a jam filling with balanced sweetness, acidity, gel strength, and moisture content to maintain product stability, prevent syneresis, and ensure consumer acceptance during storage. Therefore, this study introduces novelty by optimizing sugar and pectin concentrations in pineapple jam tailored explicitly for mochi applications, while simultaneously evaluating its chemical properties and sensory acceptance. The findings are expected to provide scientific insight into the development of value-added pineapple products and support diversification of pineapple processing in Subang.

Method

Materials and Equipment

The materials used in this study include pineapple, sugar, pectin, glutinous rice flour, cornstarch, liquid milk, cloves, and cinnamon (for making jam and mochi). Iodine 0,01N, amilum indicator 1 % and filter paper (for

vitamin C analysis). NaOH 0.1 N, PP indicator and filter paper (for TTA).

The equipment used includes a stove, pan, spatula, and basin (for making jam and mochi). Oven (for moisture content). Buret, erlenmeyer, volumetric flask 100 ml, beaker glass 100 ml, pipet 10 ml and mortar (for vitamin C). Refraktometer (for TSS). Buret, erlenmeyer, volumetric flask 100 ml, beaker glass 100 ml, glass funnel, pipet 10 ml and mortar (for TTA).

Research Methodology

The research design utilized a Completely Randomized Design (CRD) with two factors: sugar concentration (G1: 30%, G2: 40%, G3: 50%) and pectin concentration (P1: 0%, P2: 0.015%, and P3: 0.03%), with three replications. The tested parameters included chemical analysis—comprising water content, Total Titratable Acidity (TTA), Total Soluble Solids (TSS), Vitamin C (Silitonga et al., 2025) and organoleptic evaluation via a hedonic test. Panelist acceptance was measured through hedonic testing covering parameters of aroma, color, taste, texture and taste of the mochi jam filling. Total panelist acceptance was 30 semi trained panelist (Garnida et al., 2022).

The flow process for pineapple jam production is illustrated in Figure 1;

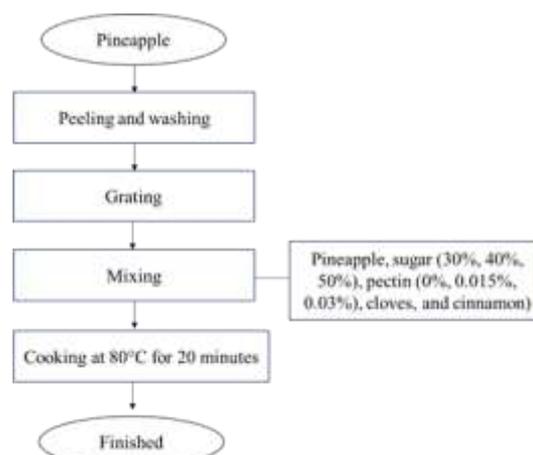


Figure 1. Pineapple jam production

Result and Discussion

The characteristics of the pineapple jam include chemical properties (yield, water content, vitamins, TSS, and TTA) and organoleptic properties (hedonic preferences for color, aroma, taste, and texture). The results for each characteristic are as follows.

Chemical Characteristics

Water Content

The water content results for the pineapple mochi jam are presented in Table 1.

Table 1. Water content of pineapple jam

Treatment	Pectin (%)				
	P1	P2	P3	Average	
Sugar (%)	G1	30.82	29.63	35.30	31.92a
	G2	24.03	19.76	28.73	24.17b
	G3	16.74	20.42	26.33	21.16b
	Average	23.86a	23.27a	30.12b	

Note: Different superscripts indicate significant differences.

Water content is a critical factor in jam stability (Arsyad, 2018). High water content can trigger microbial growth. The water content of the pineapple jam produced met the SNI 3746:2008 quality standard, which is a maximum of 35%. The average water content ranged from 21.16% to 31.92%. Sugar treatment significantly affected the water content. The highest water content was found in G1 (31.92%), while the lowest was in G3 (21.16%). Higher sugar concentrations resulted in lower water content in the jam. Sugar acts as a dehydrating agent in gel formation, attracting water molecules bound to pectin and affecting the pectin-water balance (Arsyad, 2018). Sugar fills the pores of the jam and replaces water evaporated during heating. Due to its osmotic properties, sugar absorbs water, thereby decreasing the water content as the sugar concentration increases (Siregar et al., 2015). Sugar is hygroscopic and capable of binding free water (Fahrizal & Fadhil, 2014). Pectin treatment also significantly affected the water content. Differences in the moisture content depend on the type and concentrations of pectin used in the formulation (Samakradhamrongthai et al., 2024). The highest water content was in P3 (30.12%) and the lowest in P1 (23.86%). Increasing pectin concentration led to higher water content in the pineapple mochi jam. Pectin forms a gel with sugar and is hygroscopic, allowing it to bind free water (Rianto et al., 2017). Pectin acts like a sponge that can be filled with water, thus influencing the water content (Fauziyah et al., 2022). Analysis showed that there are no interaction between sugar and pectin treatments regarding water content.

Vitamin C

Vitamin C is a vital nutrient in fruits and plays a crucial role in human nutrition (Jarín et al., 2024). The Vitamin C results for the pineapple jam are shown in Table 2. Analysis indicated that sugar treatment did not significantly affect Vitamin C levels. Vitamin C content for G1 was 4.4 mg/100 g, while G2 and G3 were 5.13 mg/100 g. Vitamin C levels are primarily influenced by the raw materials used and processing methods. Vitamin C is water-soluble; thus, slicing, washing, and boiling can lead to a reduction in its concentration (Putri & Setiawati, 2015). In this study, the amount of

pineapple used across all treatments was homogeneous. Pectin treatment significantly affected the Vitamin C content. Higher pectin concentrations resulted in higher Vitamin C levels. Pectin can bind water molecules and other compounds, including Vitamin C (Miranti, 2021). As a polysaccharide hydrocolloid, pectin forms a gel that can protect Vitamin C from oxidative damage (Maulidia et al., 2025). There was no interaction found between sugar and pectin regarding Vitamin C content.

Table 2. Vitamin C Content of Pineapple Jam

Treatment	Pectin (%)				
	P1	P2	P3	Average	
Sugar (%)	G1	2.20	3.67	7.33	4.40a
	G2	3.67	4.40	7.33	5.13a
	G3	4.40	4.40	6.60	5.13a
	Average	3.42a	4.16a	7.09b	

Note: Different superscripts indicate significant differences.

Total Soluble Solids (TSS)

The TSS results for the pineapple jam are shown in Table 3.

Table 3. TSS of Pineapple Jam

Treatment	Pectin (o Brix)				
	P1	P2	P3	Average	
Sugar (%)	G1	70.47	69.27	65.97	68.57a
	G2	75.50	81.83	68.83	75.39b
	G3	81.06	78.23	72.50	77.26b
	Average	75.68b	76.44b	69.10a	

Note: Different superscripts indicate significant differences.

The TSS of the produced jam met the SNI 3746:2008 criteria of at least 65 o Brix. Sugar treatment significantly influenced TSS. G1 was significantly different from G2 and G3, with the highest TSS found in G3 at 77.27 o Brix. Sucrose goes through, in an acidic environment, an inversion process that transforms it into monosaccharides (glucose and fructose), during the processing of jam (Salgado et al., 2022). Pectin and sucrose are the main components of TSS in jam. Increased sucrose addition results in higher TSS. Pectin treatment also significantly affected TSS. In general, high pectin causes high TSS. Interestingly, higher pectin resulted in lower TSS in this research. It is due to an increase in available water content as the concentration of the palm fruit pulp mixture increases in each treatment. It's in line with Putri et al. (2013) statement that the decrease in total dissolved solids in jam can be caused by hydrocolloids binding the available water used to form the gel, thus reducing the amount of dissolved sucrose (Natalia et al., 2022; Renitya Putri et al., 2013). Fruit ripeness also affects TSS, with more mature fruits having higher levels (Kusumiyati et al., 2018). The variations in TSS may also be due to differences in the ripeness of the pineapples used. No

interaction between sugar and pectin was observed for TSS.

Total Titratable Acidity (TTA)

The TTA results for the pineapple jam are shown in Table 4. TTA measures the concentration of dissociated and non-dissociated acids in a material (Kamaluddin, 2018). TTA measurement encompasses the measurement of total dissociated and undissociated acids (Angelia, 2017). The results showed that the sugar treatment had a significant effect on the produced TTA. The highest TTA was found in the G1 treatment at 1.90%, and the lowest was in the G3 treatment at 1.66%. The higher sugar concentration resulted in a lower TTA. This is attributed to the amount of sugar added to the jam, which causes differences in the resulting TTA.

Table 4. TTA of Pineapple Jam

Treatment	Pectin (%)			
	P1	P2	P3	Average
Sugar (%)				
G1	1.47	1.79	2.45	1.90b
G2	1.37	1.94	2.13	1.81ab
G3	1.28	1.75	1.94	1.66a
Average	1.37a	1.83b	2.17c	

Note: Different superscripts indicate significant differences.

Pectin treatment also significantly affected TTA. P3 had the highest TTA (2.17%) and P1 the lowest (1.37%). Increased pectin leads to higher TTA because pectin itself is acidic (Susianti et al., 2020). The result showed that there was no interaction between sugar and pectin was observed for TTA.

Organoleptic Evaluation

The evaluation included parameters of aroma, color, taste, texture and taste. Hedonic results are presented in Table 5.

Table 5. Hedonic Test Results for Pineapple Jam

Treatment Combination Sugar and Pectin	Aroma	Color	Texture	Taste
G1P0	3.68	3.71	3.59	3.47
G2P0	3.38	3.79	3.53	3.47
G3P0	3.50	3.50	3.50	3.44
G1P1	3.79	3.91	3.76	3.85
G2P1	3.59	3.59	3.53	3.35
G3P1	3.65	3.68	3.76	3.68
G1P2	3.74	3.88	3.50	3.38
G2P2	3.79	3.82	3.74	3.68
G3P2	3.74	3.82	4.00	3.82

Note: Hedonic Scale: Very dislike (1.0-1.8), Dislike (1.9-2.6), Neutral (2.7-3.4), Like (3.5-4.2), Very like (4.3-5.0).

Aroma

Panelists generally liked the aroma, with scores between 3.38 and 3.79. G1P2 and G2P3 were most

preferred. Low sugar concentrations allowed the pineapple aroma to be more dominant. The aroma is derived from volatile ester compounds in the pineapple (Susianti et al., 2020).

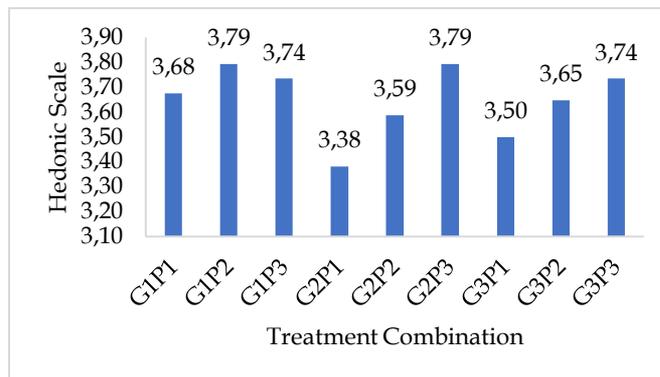


Figure 2. Aroma hedonic test (Note: Hedonic Scale: Very dislike (1.0-1.8), Dislike (1.9-2.6), Neutral (2.7-3.4), Like (3.5-4.2), Very like (4.3-5.0))

Color

Color is a vital criterion in assessing food as it attracts consumers (Jarín et al., 2024). Hedonic scores for color ranged from 3.50 to 3.91 (like). The highest preference was for G1P2 (3.91). Sugar addition causes caramelization, resulting in a brownish color. The reactions of sugars, amino acids and ascorbic acids results the products of non-enzymatic browning (Wardhani, 2019; Wan-Mohtar et al., 2021). Panelists preferred the golden yellow color of the pineapple over the brown from caramelization.

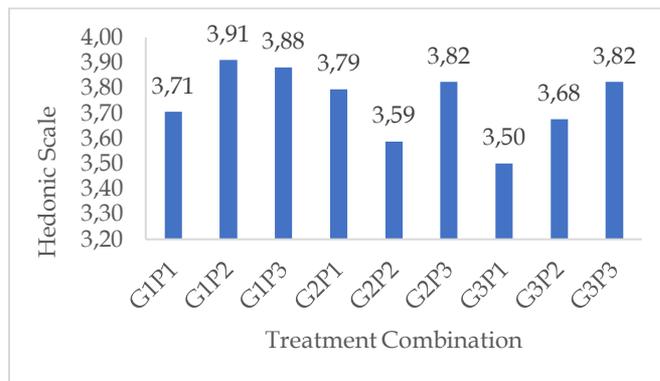


Figure 3. Color hedonic test (Note: Hedonic Scale: Very dislike (1.0-1.8), Dislike (1.9-2.6), Neutral (2.7-3.4), Like (3.5-4.2), Very like (4.3-5.0))

Texture

Texture significantly impacts consumer preference. Scores ranged from 3.50 to 4.00 (like). G3P3 was the most liked (4.00). Sugar influences gel formation through interaction with pectin (Nurani, 2020). More sugar leads to a firmer texture (Arsyad, 2018). Panelists preferred thick and chewy textures for the mochi filling.

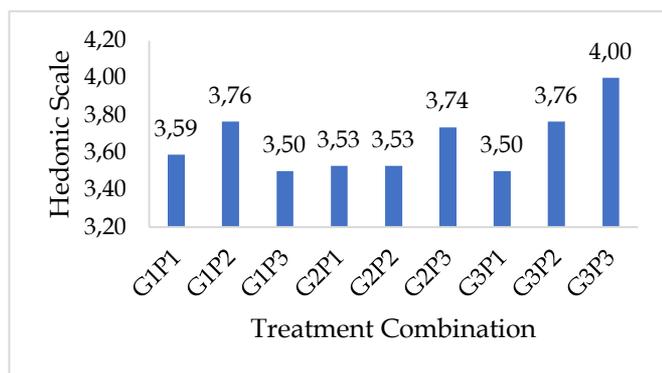


Figure 4. Texture hedonic test (Note: Hedonic Scale: Very dislike (1.0-1.8), Dislike (1.9-2.6), Neutral (2.7-3.4), Like (3.5-4.2), Very like (4.3-5.0))

Taste

Taste is a primary determinant of consumer acceptance (Arsyad, 2018). The result showed that scores ranged from 3.35 to 3.85 (like). G1P2 had the highest average at 3.85. Generally, higher sugar content was preferred as it reduces the pineapple's acidity. Pineapples contain citric acid, making up 78% of total acids (Anggraini & Fitria, 2021). Sugar provides sweetness, extends shelf life, and enhances texture and consistency (Kinanti et al., 2023; Ridhani & Aini, 2021).

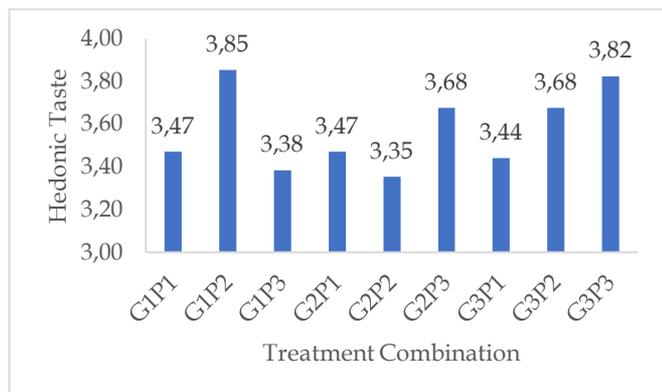


Figure 5. Taste hedonic taste (Note : Hedonic Scale: Very dislike (1.0-1.8), Dislike (1.9-2.6), Neutral (2.7-3.4), Like (3.5-4.2), Very like (4.3-5.0))

Conclusion

The results showed that sugar and pectin treatment had a significant effect on water content G3 21,16b%, total acidity G1 1,90b%, and total soluble solids G3 77,26b%, but did not significantly affect Vitamin C content in the jam 2,20-7,33%. Pectin treatment had a significant effect on water content P2 23,27a%, Vitamin C P3 7,09b%, total acidity P3 2,17c%, and total soluble solids P2 76,44b%. There was no interaction between the sugar and pectin treatments on the pineapple mochi jam. The hedonic test indicated that panelists generally liked

the pineapple jam filling for mochi in terms of taste, aroma, color, and texture.

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Author Contributions

Conceptualization; Wiwik ER, Nurul M and Fenny A; methodology, Wiwik ER; software, Nurul M.; validation, Wiwik ER, Nurul M and Fenny A.; formal analysis, Wiwik ER; investigation, Nurul M.; resources, Fenny A.; data curation, Nurul M.; writing—original draft preparation, Wiwik ER; writing—review and editing, Nurul M.; visualization, Fenny A; supervision, Fenny A.; project administration, Nurul M; funding acquisition, Fenny A. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

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