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ORGANOLEPTIC TEST OF PAPAYA JAMS (Carica papaya L.) WITH DIFFERENT SUGAR CONCENTRATIONS

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ABSTRACT

Background: *Papaya fruit has many benefits, is relatively abundant in West Kalimantan and has not been optimized. One of the processed foods that can raise maximum papaya utilization and extend the short shelf life of papaya is papaya jam. This study measures the effect of different sugar concentrations for acceptance using an organoleptic test on papaya jam (Carica papaya L.).*

Methods: *The research on papaya jam used a Completely Randomized Design (CRD) with three treatments of sugar concentration (25, 45, and 65 g). Thirty untrained panelists were used as replicates. Papaya jam was evaluated using the organoleptic test to determine its acceptability of papaya jam. The assessment uses a line scalar sheet using six parameters: color, flavor, viscosity, papaya taste, sweetness level, and preference. The data of the organoleptic test were analyzed using the SAS CRD model. If there were effective treatments, then continued with the LSD test at an alpha of 0.05. This papaya jam was also analyzed for water and sugar content.*

Result: *The results showed that the panelists favored papaya jam with a sugar concentration of 65 g. Moreover, it was chosen because it has the highest average value on color, flavor, viscosity, papaya taste, level of sweetness, and preference. Moreover, the papaya jam with a concentration of 65 g sugar resulted from it in the lowest water content and highest sugar content, according to SII year 1978.*

Conclusion: *In the organoleptic test, papaya jam was accepted at the highest sugar concentration (65 g). Not only color, flavor viscosity, papaya taste, sweetness level and preference was significantly most elevated compared to other treatments, but papaya jam with a sugar concentration of 65 product maximum water content and minimum sugar content by SII (Indonesian Industrial Standard).*

BACKGROUND

Papaya (Carica papaya L.) is one of the leading tropical fruit commodities and can be found in many Indonesian regions (Usmayani et al., 2015). According to Almatsier (2010), papaya fruits contain calories, carbohydrates, protein, fat, fiber, antioxidants, antioxidants, vitamin A, B1, B2, B3, B5, B6, C, E, K, and folate acid. According to Badan Pusat Statistik (BPS) of West Kalimantan in 2019, papaya was ranked number six as the most abundant fruit as many as 18.045 tons in West Kalimantan. However, the abundance of papaya has not been optimized, and according to Taris et al. (2015), papaya has a short shelf life, so it is easy to decay, reduces its quality and price, and cannot be sold or consumed. As a result, papaya has no benefits that cannot be used and become a waste. In West Kalimantan, young papaya is usually used as a vegetable, or in some cases, young papaya is processed to become candied fruit. The mature ones are consumed directly or as fruit juice, but most of these products have a limited shelf life (Faramita et al., 2019). Thus, efforts are needed to raise the potential of papaya fruit by extending its shelf life with a straightforward procedure. Papaya fruit is always available, the price is relatively low, and processed products can increase the economic value. One of the processed foods that can improve the use of papaya with a longer shelf life and increase economic value is papaya jam.

Jam is one of the semi-wet food ingredients that can be smudged, processed from fruit and sugar with or without other food ingredients and permitted food ingredients (Standard Nasional Indonesia, 2008). In addition, according to Yuniarti (2000), the making of jam consists of three main ingredients, namely pectin, acid, and sugar, with the appropriate composition. Jams sold in the market are generally made from fruits or seeds such as strawberries, pineapple, sugar apple, chocolate, nuts, and blueberries. Furthermore, papaya has high nutrient content (Almatsier, 2010). Therefore, in this study, the making of papaya jam with various sugar concentrations was evaluated as an alternative way to process papaya fruit that extends shelf life and increases the selling price.

According to Teangpook & Paosantong (2013), the shelf life for papaya jam can reach six months. According to Ishak (2012), the shelf life of jam is determined by the presence of sugar as a preservative, high sugar content, 65-75% dissolved substances, high acidity, pH ranging from 3.1 to 3.5, high temperature when heating or cooking (105-106º C), except for evaporation and precipitation at low temperatures, and low oxygen pressure during storage, for example on hot filling in airtight containers. Therefore, the water and sugar content affect the sustain of the jam. Therefore, the making of papaya jam with various sugar concentrations was evaluated as an alternative to processed papaya fruit that extends shelf life and increases the selling price in West Kalimantan. This papaya jam needs to be tested to determine consumer acceptance, namely by an organoleptic test. According to Susiwi (2009), the organoleptic test is a method of assessment by using the senses or sensory to assess the quality of a product. The person who evaluates the organoleptic test is called a panelist. In this study, untrained panelists were used. The use of untrained panelists provides a broader picture of the acceptance of papaya jam.

MATERIAL AND METHODS

This study used an experiment with three treatments of sugar concentrations of 25, 45, and 65 g with a Completely Randomized Design (CRD) model. The essential ingredients for making papaya jam are one kg of papaya (Carica papaya L.) and one gram of CMC (Carboxyl Methyl Cellulose) with different sugar concentrations. Papaya peeled and removed from the seeds is grated and cooked over medium heat and sugar. CMC was added when the mixture had boiled. After that, the papaya jam was removed and cooled. Parameters measured were color, flavor, viscosity, papaya taste, level of sweetness, and preference. The experiment used an organoleptic test with 30 untrained panelists as replicates. The linear RAL model is as follows:

$Y_{ij} = \mu + \alpha_i + \varepsilon_{ij}$

Explanation:

Y_{ij} = result (color, papaya flavor, viscosity, papaya taste, sweetness level, and preference) on the i-th treatment and j-th sample.

μ = mean value

α_i = Factor effect of i-th treatment (sugar concentration)

ε_{ij} = error caused by i-th treatment on the j-th replication

The instrument used in the organoleptic test is a line scalar sheet for the six parameters. The data from the organoleptic test were analyzed by analysis of variance (ANOVA) with CRD model using SAS application. If the treatment is significant, it is continued with the LSD test at the alpha of 0.05. The average value of each parameter with different sugar concentrations is also interpreted using a modified score category based on Riduwan (2012). The score interpretation criteria can be seen in Table 1.

Table 1. Organoleptic Test Score Interpretation Criteria

Score	Parameters					
	Color	Flavor	Viscosity	Taste	Sweetness level	Preference
0 - ≤ 20	Pale Orange	No flavor	Watery	No taste	Tasteless	Not prefer
>20 - ≤40	A bit bright orange	A bit flavor	A bit viscous	A bit taste	A bit sweet	Less prefer
>40 - ≤60	Slightly bright orange	less flavor	A little viscous	A little taste	A little sweet	A bit prefer
>60 - ≤80	Bright orange	Flavor	Viscous	taste	Sweet	Prefer
>81- ≤100	Very bright orange	Very flavor	Very viscous	Very taste	Very sweet	Very prefer

The water content of papaya jam was dried using the Arsyad method (2018). First, the material was weighed and put in the oven at 105°C for four hours. The sample was then cooled in a desiccator for 10 minutes and weighed. Then the material was reheated in the oven for one hour, cooled in a desiccator, and weighed again. The weighing was carried out a minimum of three times or until the dry weight did not change or was not more than a difference of 0.02 g.

Water content was calculated using the following formula:

$$\%\ \text{Water content} = \frac{\textit{Initial weight} - \textbf{Final Weight}}{\textbf{Initial weight}}\ \mathbf{x\ 100}$$

In addition, the sugar content of papaya jam was measured with a calibrated refractometer. Sugar content was measured from papaya jam droplets on a refractometer with units of % Brix.

RESULT AND DISCUSSION

Papaya Jam Organoleptic Test

A test is needed to determine the acceptance of papaya jam made, namely an organoleptic test. Papaya jam was made with three different sugar concentrations (25, 45, and 65 g) and added with CMC. The organoleptic test used untrained panelists of 30 students. Parameters measured in the papaya jam test were color, flavor, viscosity, papaya taste, level of sweetness, and preference. The assessment of this organoleptic test used a line scalar sheet. The organoleptic test can be seen in Figure 1.

Figure 1. Implementation of Papaya Jam Organoleptic Test to Measure Six Parameters, namely Color, Flavor, Viscosity, Papaya Taste, Sweetness Level, and Preference

The data from the organoleptic test were analyzed using the (ANOVA) CRD model with SAS application to test the differences in treatments. If the treatment is significant, it is followed by an LSD test. The results of the organoleptic tests are written in Table 2.

Table 2. Average Results of Papaya Jam Organoleptic Score

No	Sugar Concentrations	Average of Each Parameter					
		Color	Flavor	Viscosity	Papaya Taste	Sweetness level	Preferences
1	25 g	$66,16^{b}$	$57,76^{b}$	$62,50^{b}$	$63,83^{b}$	$55,00^{b}$	$57,33^{a}$
2	45 g	$70,83^{b}$	$66,43^{a}$	$67,30^{ab}$	$66,66^{b}$	$69,56^{a}$	$65,93^{a}$
3	65 g	$80,56^{a}$	$70,23^{a}$	$72,93^{a}$	$75,83^{a}$	$77,06^{a}$	$66,66^{a}$
	Description	S	S	S	S	S	NS

Description: S: Significant; NS: Non-significance. Numbers followed by different letters in the same column showed a significant difference when tested with the LSD test at an alpha level of 0.05.

The treatments differed in color, flavor, viscosity, papaya taste, and sweetness level except for the preference parameters (Table 2). Parameters of color, flavor, viscosity, papaya taste and sweetness level had the highest significance in papaya jam with a sugar concentration of 65 g (Table 2). On the other hand, papaya jam with low sugar concentration (25 g) produced the lowest score on all parameters. However, different sugar concentrations did not significantly affect the preference parameter, but there was a trend of higher scores in papaya jam with high sugar concentration (65 g).

Color

According to Winarno (1997), color is the first sensory parameter. The organoleptic test of papaya jam showed that the panelists judged that the color was brighter at a sugar concentration of 65 g and was significantly different from the color at a sugar concentration of 25 g and 45 g, which looked bright. Based on the results of the LSD test, the color of the jam with a sugar concentration of 25 g was not different from

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that of a sugar concentration of 45 g. However, it was significantly different from the color of the jam, with a sugar concentration of 65 g.

Based on the observations conducted by researchers, the addition of sugar in the process can affect color changes. This is to Joseph et al. (2017) that at high sucrose concentrations, sugar can protect and coat the fruit so that the color produced at 50% and 60% sucrose concentrations is similar to the color of fresh peppers.

Flavor
The flavor is one parameter that determines consumer acceptance (Sagala, 2016). The highest average value was obtained from the test results on jam with a sugar concentration of 65 g with an average value of 70.23, followed by a jam at a sugar concentration of 45 g and 25 g, respectively 66.43 57.76.

Based on the results of the LSD test (Table 2) showed that the flavor of papaya jam with a sugar concentration of 25 g is less flavor (57.76) and lower than the flavor of papaya jam with a sugar concentration of 65 and 45, which is included in flavor category (60-80%). Giving sugar a high concentration does not cause caramelization to produce the flavor (Rochmah et al., 2019). According to Sangur (2020), adding sugar can increase the smell of a more robust fruit flavor because sugar can provide a better balance and create a more robust balance.

Viscosity
Papaya jam with a sugar concentration of 65 g gave higher viscosity (72.93), significantly different from papaya jam with a sugar concentration of 25 g. However, it was the same as the viscosity of papaya jam at a sugar concentration of 45 g (Table 2).

According to Engka (2016), sugar has properties that can bind water to bind sugar to the minerals contained in the product's ingredients and produce viscosity. This is to Siregar et al. (2015) that sugar has osmotic properties (absorbs water), and the water content of jam decreases with increasing sugar concentration. The higher the added sugar concentration, the lower the water content (Launuru, 2020) and the increased viscosity of papaya jam. In this study, increasing sugar concentration increased the viscosity of papaya jam. In making this jam, the addition of CMC also helps the viscosity of the jam (Kamal, 2010). According to Desroiser (1988), the addition of sugar will affect the water balance, the existing pectin will clot, and this structure can hold liquid.

Papaya Taste
Taste is a sensation formed from the combination of ingredients and composition of food or beverage products captured by the sense of taste (Sagala, 2016). Based on the CRD analysis results using the SAS application, the highest average rating given by the panelists was obtained with a sugar concentration of 65 g at the value of 75.83, followed by a concentration of 45 g (66.66) and jam with a sugar concentration of 25 g (63.83).

Based on the LSD test (Table 2), it was shown that the sugar concentration of 65 g was significantly higher than that of papaya jam, with the sugar concentration of 45 g and 25 g.

The taste produced in this papaya jam comes from the papaya itself. This is supported by Suneth & Tuapattinaya (2016), who stated that the addition of sugar strengthens the taste of the salak fruit in the product. The increase in papaya taste in papaya jam with a higher sugar concentration was possible due to the perception of the panelists who created a feeling of mature papaya because of the sweet taste, thus strengthening the papaya taste.

Sweetness level
In this study, another parameter assessed was the sweetness of papaya jam. The highest average score from the organoleptic test results showed that papaya jam with a 65 g had the highest score (77.06), not significantly different from sugar concentration of 45 g but significantly different from sugar concentration of 25 g.

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According to Mutia & Yunus (2016), the sugar content will increase if sugar concentration increases in a jam. The higher the added sugar concentration, the sweeter the taste (Launuru, 2019). The more sugar used, the higher the organoleptic score obtained from the panelists. This is because the addition of sugar can increase the sweetness of a product (Suneth & Tuapattinaya, 2016). According to Pelamonia (2009), the taste of jam is influenced by sugar concentration. The higher the sugar concentration used, the taste of the resulting jam is also sweeter. In addition, according to Subagjo (2007), the addition of sugar in food production increases the sweetness and can also be used as a preservative.

Preferences

The preference parameter test is a test of a product by asking for a response from the panelists regarding likes or dislikes. Based on the results of the organoleptic test, the highest score by the panelists was obtained from a jam with a sugar concentration of 65 g (66.66), followed by a sugar concentration of 45 g (65.93) and sugar concentration of 25 g (57.33).

The results of the organoleptic test on preference parameters did not show any significant difference. This insignificant difference may be due to the 30 panelists having the same preference for the three papaya jams with different sugar concentrations. However, although not significantly different, there was a tendency for increased preference for higher sugar consumption (Table 2). According to Astuti (2009), a person's acceptance of a food product depends on the level of preference, place of residence, and health conditions, both physically and spiritually. Meanwhile, it is related to how a food product can provide its attractiveness, so that the better a person's acceptance, the higher the level of preference for a product.

Water Content of Papaya Jam

The water content dramatically affects the quality of the jam. The high-water content facilitates the growth of bacteria, fungi, and other microorganisms, thus affecting jam quality (Arsyad, 2018). The water content of papaya jam is shown in Figure 2.

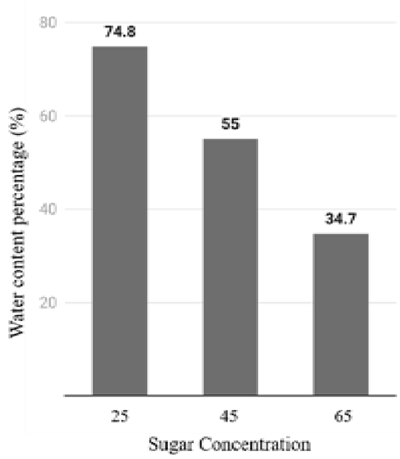

Figure 2. Average Water Content of Papaya Jam with Different Sugar Concentrations

Based on the results of the water content test, it was shown that the highest water content was in papaya jam with a concentration of 25 g (74.8%), followed by a sugar concentration of 45 g (55%) and sugar concentration of 65 g (34.7%) (Figure 2). With the addition of a sugar concentration of 25 g, papaya jam absorbs less water, so it has higher water content. On the other hand, the lowest water content was in papaya jam, with a sugar concentration of 65 g. Adding more sugar results in higher water absorption resulting in lower water content in a jam (Arsyad, 2018).

According to the Indonesian Industrial Standard (SII. No. 173 of 1978), the maximum water content of jam reaches 35%. Research showed that papaya jam with a sugar concentration of 65 g had reduced the water content below the maximum number based on SII. No. 173 of 1978. Water content in food can affect food resistance to microbial attack (Jabar et al., 2020). Papaya jam with a sugar concentration of 65 g causes sugar to have an osmotic ability to absorb water. This is to Winarno (2008) that the addition of sugar to the cell pressure decrease. As a result, the water content decreases.

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The Sugar Content Of Papaya Jam

The use of sugar as one of the main ingredients in making jam adds sweetness and creates a viscous texture in a jam. According to Buckle (1985), the high solubility of sugar and the ability to bind water (hygroscopic) are the properties that make sugar widely used in food preservation. Papaya jam sugar content can be seen in Figure 3.

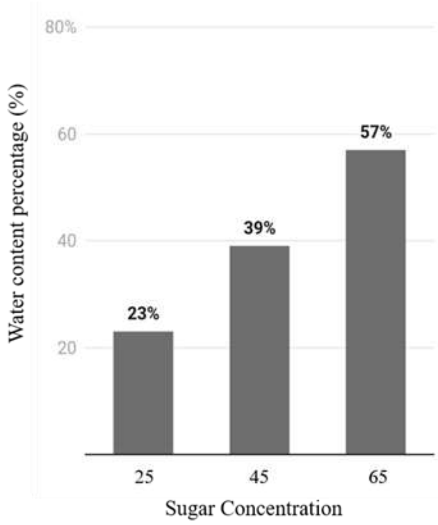

Figure 3. Average Sugar Content with Increased Sugar Concentration in Papaya Jam

Based on the test results, the sugar content in papaya jam at a sugar concentration of 25 g was 23% Brix, an increase in sugar concentration of 45 g was 39% Brix, and sugar concentration of 65 g was 57% Brix. The addition of sugar while making the jam will increase the sugar content in the jam. According to Mutia and Yunus (2016), adding sugar concentration to the jam increases with the concentration of sugar added to the jam. According to the established SII, the minimum sugar content in a jam is 55%. Thus, papaya jam with a sugar concentration of 65% has met the predetermined standard, while papaya jam with a sugar concentration of 25 g and 45 g has not met the standard.

CONCLUSION

In the results of the organoleptic test, high sugar concentrations affected the parameters of color, flavor, viscosity, papaya taste, and sweetness level. However, they did not affect the parameters of preference for papaya jam. The papaya jam that the panelists liked had a bright orange color, good flavor, viscous, tasted of papaya, sweet, and liked according to the score category. There is a higher tendency from the panelists' assessment to like papaya jam with a high sugar concentration. Papaya jam with a high sugar concentration (65 g) has low water content and contains a minimum sugar content according to SII No. 173 of 1978. This condition allows papaya jam with higher sugar concentration to last longer than papaya jam with lower sugar concentration. Thus, papaya jam with a sugar concentration of 65 g is appropriate to produce papaya jam by SII No. 173 of 1978.

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