AJARCDE
ASIAN JOURNAL OF APPLIED RESEARCH FOR COMMUNITY DEVELOPMENT AND EMPOWERMENT

Journal home page: http://ajarcde-safe-network.org ISSN 2581-0405

The Effect of Proportion Pulp and Albedo Yellow Kepok Bananas on the Characteristics of Sliced Jam with Various Concentrations of Sucrose

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ARTICLE INFO

Article History:
Received: 02 February 23
Final Revision: 29 March 23
Accepted: 12 April 23
Online Publication: 14 April 23

KEYWORDS

sliced jam, sucrose, kepok banana, albedo

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A B S T R A C T

This research aimed to determine the effect of the proportion of pulp-albedo yellow kepok bananas and the concentration of sucrose on the characteristics of sliced jam. The study used a completely randomized design (CRD) with two factors and three replications. Data analysis used ANOVA followed by Duncan Multiple Range Test (DMRT) at 5% confidence level. The first factor was the proportion of pulp and albedo of yellow kepok bananas (1:2 (A1), 1:1 (A2), 2:1 (A3)). The second factor is the concentration of sucrose (30% (B1), 45% (B2), and 60% (B3)). Parameters observed included moisture content, ash content, pH, total sugar, water activity (aw), total dissolved solids, hardness, and organoleptic analysis, including taste, scent, color, and texture. The treatment results of the proportion pulp-albedo yellow kepok banana and the sucrose concentration significantly affected the water content, ash content, total sugar, total dissolved solids, hardness, and organoleptic tests. Sliced jam with the proportion of pulp-albedo yellow kepok banana (2:1) and sucrose concentration (60%) was the best treatment with 44.16% water content, 1.18% ash content, pH 4.03, total sugar 33, 21%, water activity 0.828, total dissolved solids 50, hardness 31.93N and the taste is quite typical of banana, quite smelly of banana, quite yellow in the color of banana, and has a firm texture.

1. INTRODUCTION

1.1. Research Background

Jam consumption is rising daily. This is due to the trend of modern consumption models that are beginning to come into Indonesia, where everything becomes practical (instant) and food is no exception. This caused a change in eating habits, from rice to bread consumption. The increase in the consumption of white bread is accompanied by the need for complementary preparations, specifically jam. Jam is a semi-moist food that comes from the process of ripening fruit and sugar followed by or without the addition of acid, pectin, flavoring and coloring [1]. The results of several studies that have been carried out indicate that there are still problems, especially in terms of the shelf life of jams and the practicality of its use which is not optimal. Spreadable jam is considered less practical so it is necessary to develop sheet-shaped jam products such as cheese slices with denser properties [2].

In general, making sliced jam is mixing crushed fruit with water with a certain amount of sugar and hydrocolloid then cooking and drying it to sliced shape. One of the expected forms of sliced jam products is sliced jam which has a sliced shape with a texture that is not too soft and not too stiff so additional ingredients are needed in the form of hydrocolloids as texture reinforcement [3]. The shape of sliced jam often has various problems such as low gel toughness so that the jam is prone to syneresis, and low nutritional value due to the cooking process that takes too long [4].

As a tropical country, Indonesia is one of the largest banana producers in the world. However, the abundant production has not been accompanied by its utilization. This is very unfortunate considering the potential for complete nutritional content possessed by bananas [5]. In addition, using bananas generally produces waste in the form of banana peels. Whereas in the kepok banana peel there is pectin which can help the formation of jam gel [6]. The toughness of the gel in sliced jam is also influenced by the concentration of sucrose used. Sucrose functions as a dehydrating agent, which can make the polygalacturonic acid chains that make up pectin close together and form a 3-

dimensional system that allows the entire system to gel. The more sucrose added, the sturdier the gel formed but if the addition is too much, crystallization will occur and the gel becomes sticky while a little sucrose makes the gel included soft [7]. Based on these conditions, this research is needed to determine the effect of the proportion of fruit-albedo of yellow kepok bananas and the concentration of sucrose on the physicochemical and organoleptic characteristics of sliced jam.

1.2. Literature Review

1.2.1. Sliced jam

Sliced jam is the result of a modification of jam that was originally semi-solid but turns into slices that are compact, solid, plastic, and non-sticky. Overall sliced jam has certain advantages compared to spread jam, apart from practicality in serving. Sliced jam has a fairly high shelf life, is easy to produce and the nutrients in the product did not change significantly. [8]. The steps for making sliced jam use almost the same method as making spreadable jam, but sliced jam requires several stages after the cooking process such as molding into thin slices with a 2-3 mm thickness and cutting the jam. At the same time, topical jam is immediately packaged in a jar or certain container [9].

In principle, fruit that can be used as raw material for jam is fruit that contains pectin. Pectin is a carbohydrate compound that can form a gel when it reacts with sugar and acid [10]. The balance of the concentration of sucrose, pectin and acid will affect the quality of the resulting sliced jam. The addition of sucrose in the manufacture of jam has the goal of obtaining an ideal texture, appearance and flavor. Sucrose is inverted into glucose and fructose during the sliced jam production process. This can occur due to the heat of cooking and the addition of acid, thereby increasing the solubility of sucrose [7].

1.2.2. Gel Formation

In making sliced jam, hydrocolloid is added. Hydrocolloid is a polymer with a high molecular weight consisting of a combination of molecules and coils of polymer molecules, which impact the viscosity and product gel [11]. The hydrocolloid used is carrageenan. Carrageenan was chosen to manufacture sliced jam because carrageenan is a gelling agent with a high gel strength [12].

The process of forming carrageenan gel begins with changing the polymer into a random coil form. This change was due to the heating process at a higher temperature than the carrageenan gel formation temperature. Then when the temperature is lowered, the carrageenan polymer will form a double helix structure and produce junction points of the polymer chains. If the temperature decrease continues, these polymers will be cross-linked strongly, with increasing helix forms, aggregates will form, which are responsible for forming a strong gel. However, if it is continued, there is a possibility that the gel formation process will shrink while releasing water or commonly called syneresis [13].

The gel system that gives shape to sliced jam is the interaction of various components in fruit juice, such as pectin, sugar, and natural organic acids as well as the addition of sucrose and carrageenan. Pectin and carrageenan are negatively charged, hydrocolloid groups. In a negatively charged hydrocolloid mixture, a gel will form under acidic conditions [14].

1.3. Research Objectives

This study aims to determine the effect of the proportion of pulp-albedo yellow kepok bananas and the concentration of sucrose on sliced jam's physicochemical and organoleptic characteristics.

2. MATERIALS AND METHODS

2.1. Materials and Tools

The main ingredients used in this study were fruit and peel of yellow kepok banana, carrageenan, sucrose, and citric acid. The materials used for chemical analysis were 1N NaOH, 1N CH3COOH, HCl, 0.1% anthrone, potato dextrose agar, 5% ethanol, acetone, pepsin, standard glucose solution, standard potassium solution, and equated.

The tools used include pH meter, spectrophotometer, texture analyzer, hand refractometer, furnace, oven, analytical balance, vortex, blender, hot plate, erlenmeyer, beaker glass, watch glass, rolling pin, and stirrer.

2.2. Design Experiment and Analysis

The research design used in this study was a completely randomized design (CRD) with 2 treatments and 3 replications. The treatment used was the proportion of pulp-albedo yellow kepok banana (1:2, 1:1, 2:1) and sucrose concentration (30%, 45%, 60%). Observational variable data is statistically tested using analysis of variance at $\alpha = 5\%$ using the DMRT advanced test.

Table 1. Formulation of sliced jam

Proportion of fruit-albedo of yellow kepok banana	**Sucrose concentration**		
	30% (B1)	45% (B2)	60% (B3)
1:2 (A1)	A1B1	A1B2	A1B3
1:1 (A2)	A2B1	A2B2	A2B3
2:1 (A3)	A3B1	A3B2	A3B3

2.3. Implementation of Research

2.3.1. Manufacture of fruit pulp

Yellow kepok bananas that have been sorted are cleaned by washing them first and then separating them from the peel. Banana pulp is cut into several parts. The prepared banana pulp and peel are blanched in steam at 80°C for 2.5 minutes. Then, the inner peel (albedo) is taken with a spoon for each banana peel. After that, it was weighed based on the weight of the proportion according to the treatment (1:2, 1:1, 2:1). The final stage of making fruit pulp is crushing by adding water 1:1 (w/w) using a blender.

2.3.2. Jam slice making

Fruit pulp was mixed with 2% carrageenan, 0.5% citric acid, and sucrose according to the treatment (30%, 45%, 60%) and then cooked/heated at ~98°C for 10 minutes. During the cooking process stirring is also carried out to avoid sucrose crystallization and browning. Next, the jam is poured into a tin with a size of 8x8x0.2 cm, then cooled to room temperature.

2.4. Observations

2.4.1. Physicochemical analysis

Analysis parameters include analysis of water content (%), ash content (%), pH, total sugar (%), water activity (aw), total dissolved solids (%), hardness (N) in sliced jam and analysis of water content (%), ash content (%), pH, pectin content (%), sugar content (%) in the fruit flesh and albedo of yellow kepok bananas.

2.4.2. Sensory Analysis

Organoleptic testing was carried out on samples of sliced jam. In this organoleptic test, 30 panelists gave an assessment of the color, taste, aroma, and texture of sliced jam. The analysis was continued with the effectiveness index test to determine the best treatment for physicochemical and organoleptic properties. Then the best treatment was analyzed for food fiber content (%), potassium content (kg/mg), total mold (colony/g), and the effect of storage temperature on the shelf life of sliced jam for 7 days.

3. RESULTS AND DISCUSSION

3.1. Physicochemical Analysis

3.1.1. Analysis of raw materials

Preliminary analysis of the pulp and albedo of yellow kepok bananas includes water content, ash content, pH, pectin content, and sugar content which can be seen in Table 2.

Table 2. Raw material analysis results

Parameter	Yellow kepok banana	
	Pulp	Albedo
Water content (%)	61.84±0.11	80.64±0.50
Ash content (%)	0.80±0.03	1.79±0.02
pH	4.71±0.01	6.15±0.01
Pectin content (%)	0.22±0.02	0.76±0.02
Sugar level (%)	11.67±0.58	6.33±0.58

Based on the data in Table 2, it can be seen that there is a difference in the water content of the pulp and the albedo of the yellow kepok banana, where the water content of the banana albedo is 80.64% higher than the pulp of 61.84%. This is because the banana albedo is part of the banana peel which contains a lot of water. Based on the analysis of ash content, it was found that the albedo of the banana was 1.79% higher than that of the pulp, which was 0.80%. The ash content of a material shows the mineral content contained in the material [15]. Thus, the banana albedo contains more minerals. In the pH analysis, the albedo of the banana (6.15) is higher than that of the pulp (4.71). This is because the pH is affected by the amount of organic acids contained in the material. In the analysis of the pectin content, the albedo of the banana is 0.76%, which is higher than the pulp, which is 0.22%. This is because pectin is a fiber component that is found in many parts of the banana peel. In contrast to the results of the other analysis, the sugar content of the pulp was 11.67% higher than the albedo of bananas, which was 6.33%. During the ripening process, starch will be converted into free sugars, especially glucose when the fruit is ripe.

3.1.2. Sliced jam analysis

Physicochemical analysis consisting of water content, ash content, pH, total sugar, aw, total dissolved solids, and hardness can be seen in Table 3.

The water content result of sliced jam is between 44.16%-56.40%. The water content of sliced jam is affected by the proportion of pulp used. Based on Table 2, it is known that the water content of the pulp is 61.84% lower than the albedo of bananas, which is 80.64%, where jam slice with a higher proportion of fruit has a lower water content as well. Sucrose also affects the water content of the sliced jam, which the higher the sucrose concentration, the lower the water content in the sliced jam. This is because sucrose is easy to bind water in foodstuffs. Sucrose has hygroscopic properties, meaning it has the ability to bind water [16]. Based on the standard [17], the moisture content of semi-moist food ranges from 10% -50%. Therefore the A1B1, A1B2, and A1B3 treatments did not meet the existing standards. This is because according to Ref. [6], the optimum condition for gel formation in jam is 65%-70% sucrose, so sliced jam with 30% sucrose concentration has a relatively high water content.

From Table 3 it is known that the ash content of sliced jam is between 0.97% - 1.33%. The ash content indicates the mineral content in sliced jam. The proportion of pulp-albedo bananas used affects the ash content of sliced jam, where the more albedo proportions of bananas used will increase the ash content of sliced jam. Based on Table 2 it is known that the ash content of banana albedo is 1.79% more than the pulp which is 0.80%. Sucrose also affects the ash content of sliced jam . This is because it is suspected that there are impurities that can affect the ash content of the sugar, so that with more sugar added it can increase the ash content of sliced jam. The ash content of food products is inversely related to its water content, where the lower the water content, the higher the ash content [18].

From Table 3 it is known that the pH value of sliced jam is between 4.03-4.31. The acidity level of sliced jam is influenced by the proportion of fruit: the albedo of yellow kepok bananas used. Based on Table 2 it is known that the pH of the fruit flesh is 4.71 while the albedo of bananas is 6.15, where more banana albedo will increase the acidity of the sliced jam. Sucrose has no effect on the pH of sliced jam. Adding sucrose has no effect on the pH level of a solution because sucrose does not have the chemical capacity to do this, adding sucrose may have an impact on a sweeter taste but not to change the pH significantly [19]. Acid is an important component in gel formation in sliced jam production, this is because a gel will form in acidic conditions. Based on the standard [20], The pH of the jam should be below 4.6. Thus, all sheet jam treatments have met these standards.

The total sugar yield of sliced jam is between 20.12%-33.21%. Total sugar is the sum of reducing and non-reducing sugars. The amount of total sheet sugar is influenced by the amount of sucrose and pulp used. The more the proportion of pulp yellow kepok bananas used can increase the total sugar. Based on Table 2 it is known that the sugar content of the pulp is 11.67% higher than the albedo of bananas 6.33%. Meanwhile, the higher the concentration of added sucrose will also increase the total sugar of the sliced jam. This is because sucrose is a non-reducing sugar and during cooking in the presence of acid, sucrose will hydrolyze to fructose and glucose which are reducing sugars [16].

 https://doi.org/10.29165/ajarcde.v7i2.262

Table 3. Physicochemical analysis results of sliced jam

Physicochemical Analysis	Treatment								
	A1B1	**A1B2**	**A1B3**	**A2B1**	**A2B2**	**A2B3**	**A3B1**	**A3B2**	**A3B3**
Water content (%)	56.40±	54.57±	53.46±	52.34±	50.91±	48.94±	45.80±	44.94±	44.16±
	0.320_{i}	0.406_{h}	0.405_{g}	0.450_{f}	0.246_{e}	0.234_{d}	0.201_{c}	0.078_{b}	0.435_{a}
Ash content (%)	1.09±	1.05±	0.97±	1.17±	1.13±	1.11±	1.33±	1.25±	1.18±
	0.035_{c}	0.010_{b}	0.032_{a}	0.010_{d}	0.021_{c}	0.015_{c}	0.010_{f}	0.017_{e}	0.006_{d}
pH	4.31±	4.23±	4.02±	4.32±	4.25±	4.05±	4.34±	4.25±	4.03±
	0.023_{c}	0.017_{b}	0.012_{a}	0.010_{c}	0.025_{b}	0.021_{a}	0.015_{c}	0.015_{b}	0.015_{a}
Total sugar (%)	20.12±	24.34±	22.74±	24.87±	25.96±	29.21±	31.08±	33.16±	33.21±
	0.375_{a}	0.473_{c}	0.370_{b}	0.355_{d}	0.176_{e}	0.135_{f}	0.302_{g}	0.078_{h}	0.167_{h}
Aw	0.855±	0.853±	0.851±	0.844±	0.843±	0.842±	0.833±	0.831±	0.828±
	0.002_{h}	0.002_{fg}	0.001_{f}	0.001_{e}	0.002_{de}	0.001_{d}	0.002_{c}	0.001_{b}	0.001_{a}
Total dissolved solids (%)	31±	33±	34±	40±	38±	40±	43±	45±	50±
	0.577_{a}	0.000_{b}	0.577_{b}	0.577_{d}	0.577_{c}	0.000_{d}	0.000_{e}	0.577_{f}	0.577_{g}
Hardness (N)	21.33±	21.55±	22.28±	26.54±	27.69±	29.31±	30.21±	30.58±	31.93±
	0.286_{a}	0.384_{a}	0.205_{b}	0.163_{c}	0.271_{d}	0.217_{e}	0.175_{f}	0.167_{f}	0.162_{g}

The average value accompanied by different letters shows a significant difference at $p \leq 0.05$

The results of sliced jam activity of water were between 0.828-0.855. The water activity (aw) value of sliced jam will be directly proportional to the decrease in the water content of the jam. This is due to sucrose's ability to bind water in the material. Sucrose is said to be a natural food preservative by reducing the activity of water in the food. According to Ref. [11], the addition of sugar can increase the osmotic pressure of the solution so that it can cause plasmylose from microbial cells, so that water comes out of the microbial cells. So, with reduced water for the growth of microorganisms, these microbial cells will dry out and eventually die. Based on the standard [20] jam has an aw below 0.85. Therefore, treatments A1B1, A1B2, and A1B3 did not meet these standards. This is the same as the result of water content, where in A1 treatment using a concentration of 30% sucrose, so that the optimum conditions for making jam have not been met.

From Table 3 it is known that the total dissolved solids of sliced jam are between 31%-50%. The increase in total sugar will be directly proportional to the total solids of jam. This is because the total dissolved solids of a material include reducing sugars, non-reducing sugars, organic acids, pectins, and proteins [21]. The more the proportion of pulp and the concentration of sucrose can increase the total solids of sliced jam. This is because the evaporation of water during cooking causes the water content to decrease and the solids concentration to increase. Based on the standard [20], the jam must have a total dissolved solids of not less than 65%. Thus, all treatments did not meet these standards. This is because the standard or reference is for jam products, whereas in this study it was sliced jam.

From Table 3 it is known that the hardness of sliced jam is between 21.33%-31.93%. Hardness is the force required to make sliced jam begin to deform, where the higher the value indicates that the sliced jam has a harder texture. The hardness of sliced jam is generally influenced by the jam gel formation process. The gel formation process requires the interaction of several components such as pectin, sugar, and acid [14]. Thus, both the proportion of fruit and the concentration of sucrose have an effect on the hardness of sliced jam, where the more proportion of pulp and the concentration of sucrose added can increase the hardness of the jam. This is due to the ability of sucrose to form a jam structure. Based on the statement [22], the decrease in water content will be accompanied by an increase in the hardness of the jam. This is because the less amount of water will make the gel mass that is formed more and more water so that the texture produced is harder.

3.2. Sensory Analysis

To determine the effect of the treatment on the sensory properties of sheet jam on taste, color, aroma, and texture, questionnaires were distributed to the panelists.

From Table 4 it is known that the treatment of the proportion pulp-albedo of yellow kepok bananas (1: 2) and a concentration of 30% sucrose produced the lowest taste score of 3.13 "quite typical of bananas", while the average value of the highest taste score was in the treatment of the proportion pulp-albedo of yellow kepok banana (2:1) and 60% sucrose concentration is 3.90 "typical banana". Jam must have a distinctive taste, aroma and color from the fruit used. Banana albedo has a taste that tends to be bitter, so panelists will like sheet jam with more fruit proportions. According to Ref. [25], the higher the addition of sucrose, the sweeter the jam will be and the more preferred it will be.

From Table 4 it is known that the treatment of the proportion pulp-albedo of yellow kepok bananas (1:2) and a 30% sucrose concentration produced the lowest aroma score of 2.67 "quite banana flavor", while the highest average aroma score was in the treatment of the proportion pulp-albedo of yellow kepok banana (2:1) and 45% sucrose concentration 3.43 "quite smells like bananas". The more the proportion of bananas, the stronger the aroma of bananas. In addition, sucrose will also increase the acceptance of the panelists' preference for the aroma of sheet jam. Sucrose will caramelize when exposed to high heat. The amount of sucrose added makes the caramelization that is formed bigger. The caramelization process will produce a caramelized sucrose aroma that slightly masks the distinctive aroma of yellow kepok bananas [11].

Table 4. Panelis average preference for the sensory atributes of sliced jam

Treatment	Taste	Colour	Scent	Texture
A1B1	3.13± 0.681$_{a}$	2.30± 0.651$_{a}$	2.67± 0.479$_{a}$	3.27± 0.691$_{abc}$
A1B2	3.23± 0.430$_{ab}$	2.53± 0.629$_{ab}$	2.87± 0.507$_{abc}$	3.40± 0.724$_{cd}$
A1B3	3.37± 0.615$_{abc}$	2.50± 0.682$_{ab}$	2.97± 0.490$_{bc}$	3.37± 0.718$_{bcd}$
A2B1	3.53± 0.507$_{cd}$	2.23± 0.728$_{a}$	2.73± 0.450$_{ab}$	3.30± 0.702$_{abc}$
A2B2	3.70± 0.596$_{de}$	3.17± 0.747$_{cd}$	3.00± 0.455$_{c}$	3.23± 0.679$_{abc}$
A2B3	3.80± 0.484$_{de}$	3.47± 0.681$_{d}$	3.43± 0.504$_{d}$	3.70± 0.651$_{de}$
A3B1	3.50± 0.572$_{bcd}$	2.37± 0.615$_{a}$	2.83± 0.461$_{abc}$	3.03± 0.718$_{a}$
A3B2	3.63± 0.556$_{cde}$	2.93± 0.640$_{c}$	3.33± 0.547$_{d}$	3.17± 0.747$_{ab}$
A3B3	3.90± 0.548$_{e}$	3.37± 0.718$_{d}$	3.27± 0.450$_{d}$	3.80± 0.761$_{e}$

The average value accompanied by different letters shows a significant difference at $p \leq 0.05$

From Table 4 it is known that the treatment of the proportion of yellow kepok banana fruit-albedo (1: 2) and a 30% sucrose concentration produced the lowest color score of 2.30 "not banana yellow", while the highest average color score was in the treatment of proportions pulp-albedo of yellow kepok banana (2:1) and 45% sucrose concentration 3.47 "enough banana yellow". The color of the sliced jam is influenced by the proportion of fruit added, where the more the proportion of fruit, the more distinctive the yellow kepok banana color will be. This is because the albedo of bananas has a less attractive color, which tends to be dark.

From table 4 it is known that the treatment of the proportion of fruit-albedo of yellow kepok banana (1:2) and the concentration of 60% sucrose is 3.03 "quite sturdy", while the highest average texture score is in the treatment of the proportion pulp-albedo of yellow kepok banana (2:1) and 60% sucrose concentration 3.80 "solid". Adding carrageenan (hydrocolloid) with a concentration of 2% and 0.5% citric acid produces a firm sliced jam texture. According to Ref. [27], sliced jam with the right sugar, acid and gelling agent composition will produce a good texture. Apart from carrageenan, pectin is found in fruit and the albedo of yellow kepok bananas which can help produce a firm texture in jam [27].

Based on the effectiveness index test results on the physicochemical and organoleptic characteristics of sliced jam, the best treatment results were obtained using the proportion pulp-albedo of yellow kepok banana (2:1) with a sucrose concentration of 60%. The best treatment results were then followed by testing food fiber content, potassium content, total mold, and continued with an analysis of the effect of storage temperature on shelf life based on moisture content and sliced jam organoleptic.

Table 5. The content of total food fiber, potassium and total mold of the best treatment sliced jam

Parameter	Analysis results
Total dietary fiber content (%)	8.09
Potassium levels (mg/kg)	267.85
Total mold (colony//g)	16

Based on Table 5, it is shown that the total food fiber content in sliced jam is 8.09%. Total dietary fiber consists of soluble and insoluble dietary fiber. In the pulp and albedo of yellow kepok bananas there is pectin, a water-soluble dietary fiber. In addition, carrageenan is also a water-soluble dietary fiber. Based on [28], the daily fiber requirement for adults is around 30g per day. By consuming 100g of sliced jam, it can fulfill 26.97% of daily fiber needs. The sliced jam potassium level is 267.85 mg/kg. Yellow kepok banana is a source of potassium. According to [29], adults need at least 3400 mg of potassium daily. Thus, consuming 100g of sliced jam can meet 7.88% of daily potassium needs. The total sliced jam mold was 16 colonies/g. These results make sliced jam meet the standard [30], where the amount of mold and yeast allowed to grow in fruit jam is a maximum of 50 colonies/g. The lower the product's water activity (aw), the lower the resistance to damage by microorganisms. This is because water activity (aw) is a growth medium for microorganisms.

Analysis of the shelf life of sliced jam using the effect of temperature, namely room temperature and refrigerator temperature with storage for 7 days. Based on Fig 1. The water content of sliced jam during storage has increased. This is due to the large amount of hydrolyzed sucrose resulting in the release of water which causes an increase in the water content of the sliced jam. Room temperature moisture content is higher than refrigerator temperature. During storage, the jam will balance its water content with the humidity of the air in its environment. The higher the storage temperature, the shorter the shelf life of the jam [26].

Storage temperature affects the organoleptic quality of sheet jam. The results showed a decrease in sheet jam's aroma, color and texture scores during storage. At room temperature storage, the aroma of sheet jam becomes "sour". This is thought to be due to the increasing activity of microorganisms [26]. The refrigerator's temperature can suppress the decrease in aroma, where on the 7th day the sheet jam has a “quite typical banana” flavor. The longer the storage, the color of the sheet jam will decrease. According to [31], food that is stored at temperatures above room temperature will tend to experience a dark color change caused by browning reactions, both enzymatic and non-enzymatic. This was proven when the color of sheet jam stored at room temperature for 7 days changed to "brown", while at refrigerator temperature "slightly browned". The texture of sheet jam also decreased during storage. This is because the water content of sheet jam also increases during this time interval, due to differences in air concentration in the environment, so the texture becomes soft and the gel strength decreases [26]. During 7 days of storage at room temperature, the texture of sheet jam becomes "slightly dense", while the refrigerator temperature becomes "quite dense".

https://doi.org/10.29165/ajarcde.v7i2.262

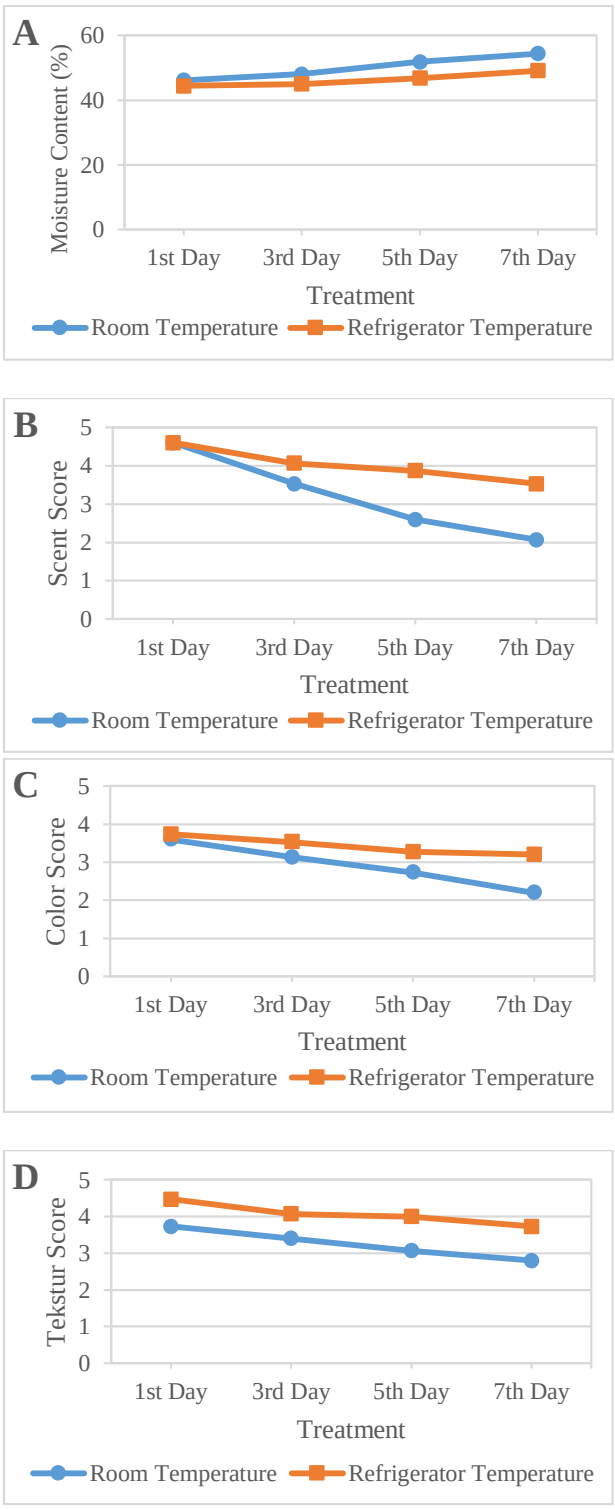

Fig.1. The effect of storage temperature on the shelf life of sliced jam based on: (A) Moisture content, (B) Scent, (C) Color, (D) Texture

4. CONCLUSION

There was a significant interaction between the proportion pulp-albedo of yellow kepok bananas and the concentration of sucrose on water content, ash content, total sugar, total dissolved solids, hardness, taste, scent, color, and texture of sliced jam. The best treatment in this research was sliced jam with the proportion pulp-albedo of yellow kepok bananas (2:1) and 60% sucrose concentration with 44.16% moisture content, 1.18% ash content, 4.03 pH, 33.21% total sugar, water activity (aw) 0.828, total dissolved solids 50, hardness 31.93N, taste score 3.90 (typical of banana), scent 3.27 (quite beary of banana), color 3.37 (fairly yellow of banana), texture 3.80 (firm), dietary fiber 8.09%, potassium content 267.85 mg/kg, total mold 16 colonies/g, and refrigeration temperature storage is better than room temperature in maintaining the quality of sheet jam for 7 days, reviewed from increasing water levels, and organoleptic include scent, color, and texture.

ACKNOWLEDGMENTS

Thank you to the lectures of Food Technology at the National Development University "Veteran" East Java for providing direction and support in writing this manuscript.

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 https://doi.org/10.29165/ajarcde.v7i2.262