Physicochemical and Sensory Properties of Watermelon Albedo *(Citrullus vulgaris)* and Soursop (*Annona muricata*) Jelly Drink

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ABSTRACT

Red watermelon albedo *(Citrullus vulgaris)* is a food waste that contains antioxidants, dietary fiber and pectin so it has the potential to be used as a jelly drink. The addition of soursop *(Annona muricata)* can increase the sour taste, distinctive sweetness, and high vitamin C content. The purpose of this study was to determine the effect of variations in watermelon albedo juice and soursop juice on water content, antioxidant activity, dietary fiber, vitamin C, pH, viscosity and sensory acceptance in jelly drinks. This research method is divided into 3 stages, namely making watermelon albedo juice, soursop juice and jelly drinks. Furthermore, this study was conducted to analyze the physicochemical properties and sensory acceptance of jelly drinks. This study used a completely randomized design (CRD) with variations of watermelon albedo juice and soursop F1 = 100%; F2 = 40:60%; F3 = 50:50%; and F4 = 60:40%. The results showed that the jelly drink with a variation of 60:40% had the best antioxidant activity value of 20.97ppm, 3.16% dietary fiber, pH 4.30, viscosity 430.8mPa.s. The more watermelon albedo and soursop juice, the more watermelon albedo and soursop juice. The more watermelon albedo added to the jelly drink, the higher the antioxidant activity, dietary fiber, pH, and viscosity, but the lower the water content, vitamin C and sensory acceptance. This study demonstrates the potential of utilizing watermelon albedo, an underused agricultural by-product, as a functional ingredient to develop antioxidant-rich jelly drinks while contributing to food waste reduction.

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1. INTRODUCTION

Watermelon is one of the fruits that are widely available in Indonesia. Watermelon production reached 481,744 tons in 2018, 523,333 tons in 2019 and 560,317 tons in 2020 [1]. The large utilization of watermelon produces waste in the form of watermelon rind which has not been optimally utilized [2]. Watermelon rind or watermelon albedo is a white layer on watermelon that is less desirable to the public because of its bland taste, pale color, rather hard texture and little water content, so that the utilization of watermelon albedo is currently not optimal. Watermelon albedo is rich in nutrients, minerals, enzymes, and fiber. Nutrients found in watermelon albedo include vitamin A, vitamin B2, vitamin B6, vitamin E, and vitamin C [3].

Watermelon albedo has more citrulline than the pulp. Citrulline is an antioxidant substance that is beneficial for health [4]. Antioxidants can capture free radicals produced in the body so it is very important to maintain a healthy body. To inhibit the activity of oxidant compounds, antioxidants act by donating one electron to the compound [5]. Watermelon albedo contains dietary fiber components namely cellulose, hemicellulose, lignin and pectin in 100g of material. Watermelon albedo is composed of 21.03% pectin compounds. Pectin is a pectic compound found in the fruit skin layer and is found between the cell walls of vegetables and fruits. With the help of acids and sugars, pectin can be used as a gelling agent, stabilizer and good thickener in food [6]. So that watermelon albedo is suitable to be used as raw material for jelly drinks. According to [2]. Watermelon albedo pectin has a low methoxyl content of about 6.24% resulting in a less sturdy gel texture. The need for carrageenan as an additional hydroxyl used in this study to increase the firmness of the gel in jelly drinks.

Jelly drinks are semi-solid beverage products made from water and fruit or vegetable juice that have a refreshing sweet taste and contain food fiber and vitamin C. However, jelly drinks on the market use auxiliary materials such as artificial sweeteners, food coloring and preservatives so that the nutritional content of jelly drinks is lower [7]. Jelly drinks can be a functional drink that serves as a thirst quencher and has great potential to be developed because currently there is a shift in food consumption patterns that tend towards instant or fast consumption patterns. The demand for healthy food and beverages is getting higher as public awareness of healthy living increases. Healthy consumption patterns must be adjusted to the tastes of people who currently tend to want practical products, one of which is jelly drinks [8]. One way to increase its nutritional value is by adding antioxidants.

Soursop (*Annona muricata*) is a fruit with a distinctive smell and sour taste, green skin, and soft, fibrous white flesh. It is rich in vitamins, minerals, and dietary fiber. Consuming 100 grams of soursop can meet 13% of daily fiber needs and provide 20 mg of vitamin C, which can help prevent aging, protect against free radical damage, and maintain immunity [9]. The shelf life of ripe soursop fruit is very short, making it prone to rapid spoilage. In jelly drink formulations, soursop is used to provide a natural sour taste and aroma without the need for added citric acid.

Although watermelon albedo contains valuable bioactive compounds and has potential as a functional food ingredient, its application in jelly drink formulations remains very limited. Previous studies have focused on fruit pulps or commercial pectin sources, while the integration of watermelon albedo with soursop fruit to enhance both functional and sensory properties of jelly drinks has not been extensively explored [10]. This study addresses this research gap by formulating jelly drinks with different ratios of watermelon albedo juice and soursop juice to determine the best combination for optimizing physicochemical quality and sensory acceptance.

The novelty of this research lies in the utilization of watermelon albedo, an underutilized agricultural by-product rich in antioxidants and dietary fiber, in combination with soursop to create a natural, antioxidant-rich jelly drink without artificial acidulants. The contribution of this research is twofold, it promotes sustainability through the valorization of agricultural waste into value-added food products and offers a formulation approach that enhances both functional and sensory quality in jelly beverages.

2. MATERIALS AND METHODS

2.1. Materials

The equipment used in the process of making this jelly drink are knives, digital scales, basins, filters, pans, spatulas, cutting boards, spoons, measuring cups (Iwaki) 100 ml, blenders (Philips), gas stoves (Rinnai), and plastic cups. Equipment used for analysis are measuring cup (Iwaki) 50 ml, spatula, waterbath, filter paper, erlenmeyer (Iwaki) 100 ml, burette (Iwaki), stative, beaker (Iwaki) 250 ml, green propipette, red propipette, funnel (Iwaki), volume pipette (Iwaki) 1 ml, 5 ml and 10 ml, dropper pipette, aluminum foil, 100 ml volumetric flask (Iwaki), vortex mixer (Thermo Scientific), watch glass, oven (Memmert), NDJ-8s viscometer, pH meter (Ohaus ST20), test tube rack, test tube (Iwaki) and UV-Vis spectrophotometer (B-One 100 DA-X).

The materials used in this research are watermelon albedo, soursop fruit purchased at Giwangan Market, gulaku brand sugar, carrageenan and water. Analysis materials used were distilled water, diphenyl-1picrylhydrazyl (DPPH), ascorbic acid, methanol p.a, I2 0.01 N, amylum 1%, α-amylase enzyme, NaOH 1 N, phosphate buffer pH 7 β-amylase enzyme, HCl I N, acetone, and pepsin enzyme 1%, and ethanol 95%.

2.2. Methods

2.2.1. Making Jelly Drink with Watermelon and Soursop Albedo Variation

Watermelon albedo is obtained from peeling the white skin of watermelon. Crushing is done with a blender and three times more water. The watermelon pulp is then cooked for 10 minutes at 70°C and then filtered and squeezed to produce watermelon juice. Soursop fruit was washed thoroughly and separated from the skin and seeds. The flesh of the soursop fruit was then mashed using a blender with the ratio of soursop fruit and water 1:2. The results of the pulverization are then filtered to obtain soursop juice [9]. Making watermelon and soursop albedo jelly drink uses 2 stages, namely the cooking stage and the cooling stage. The cooking stage is carried out by mixing the juice with carrageenan and sugar which is stirred to a temperature of 75 °C. The cooling stage is carried out by cooling the jelly drink to a temperature of 60 °C and put in a cup and then put in a refrigerator with a temperature of 6-9 °C for 24 hours [11]. The flow diagram for making watermelon albedo and soursop jelly drink is shown in Fig. 1.

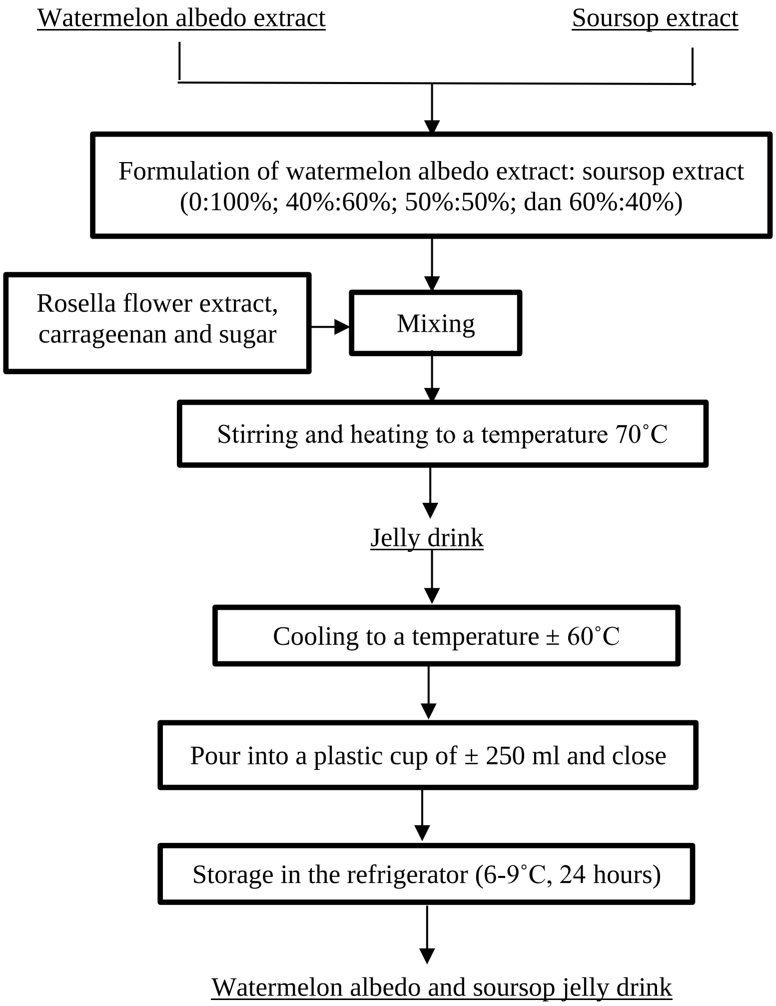

Fig. 1. Flowchart for Making Watermelon Albedo and Soursop Jelly Drinks

2.2.2. Water Content Analysis

The oven method was used to conduct the water content analysis. 5g sample was weighed in a sealed bottle of known weight (W). Then, the sample was dried for three hours at 105°C in the oven. After that, it was cooled for 30 minutes in a desiccator. Repeat this procedure until a constant weight is reached for the closed weighing bottle containing the dried sample (WI). The moisture content value can be obtained by entering the values of W and W1 [12].

2.2.3. Antioxidant Activity Analysis

Antioxidant activity analysis was carried out using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) method. The jelly drink was filtered first and then made sample solutions of 20, 40, 60, 80, and 100 ppm. The comparison solution used is vitamin C solution (20, 40, 60, 80, and 100 ppm). DPPH solution was made by dissolving 3.9432 mg of DPPH powder in 100 ml of methanol p.a with a concentration of 0.1 mM. Preparation of DPPH solution must be protected from sunlight because of its perishable nature, so it needs to be wrapped. Furthermore, 5 ml of 0.1 mM DPPH solution was taken each. The test tube was vortexed to make the solution homogeneous. The solution was incubated for 30 minutes. Then the absorbance measurement was done at a wavelength of 517nm. Antioxidant activity can be expressed in % inhibition and then a curve is made with a simple linear regression equation (1) and (2) [13].

$$\% \text{ inhibisi} = \frac{\text{blank absorbance} - \text{absorbance sample}}{\text{blank absorbance}} \times 100\% \quad (1)$$

$$IC_{50} = \frac{50-b}{a} \quad (2)$$

Descriptions:
b = slope
a = intercept

2.2.4. Analysis of Vitamin C

Measurement of vitamin C content was carried out by taking 20 ml of jelly drink samples and then weighing the weight. After the weight is recorded, the sample is filtered with filter paper. The filtrate obtained from the filtering results was taken as much as 5 ml and then put into an erlenmeyer. After that, the sample was added with 1 ml of 1% amylum. The sample was then titrated with 12 0.01 N solution until it changed color to violet blue. The volume of iodine solution used in the titration was then recorded. After that, make a blank solution with 10 ml of distilled water as a substitute for the sample [14].

2.2.5. Dietary Fiber Analysis

Samples were weighed as much as 0.5 g into an erlenmeyer and added 50 ml of phosphate buffer pH 7 and 0.1 ml of α-amylase enzyme then heated in a water bath at 100°C for 30 minutes while stirring occasionally. The sample was removed and cooled to room temperature, then added 20 mL of distilled water and 5 ml of 1 N HCI. Then 1 ml of 1% pepsin enzyme was added and heated in a water bath for 30 minutes. After that, the sample was removed and cooled, then 5 ml of 1 N NaOH and 1 mL of β-amylase enzyme were added. The β-amylase enzyme functions to cut α-1-4 bonds in carbohydrates and produce maltose. Then the sample was covered with aluminum foil and incubated in a waterbath for 1 hour. The precipitate was filtered using constant filter paper of known weight. The sample residue was washed twice with 10 ml of 95% ethanol and 10 ml of acetone (volume measured after heating). The residue was dried in an oven at 105°C for 24 hours, cooled in a desiccator, and weighed to constant weight (insoluble dietary fiber). The filtrate was adjusted to 100 ml and 400 ml of warm 95% ethanol was added. The filtrate was allowed to settle for 1 hour, then filtered with ash-free filter paper and washed twice with 10 ml ethanol and 10 ml acetone. Then dried for 24 hours in an oven at 105°C, put in a desiccator, and weighed the constant weight (dissolved dietary fiber) [15].

2.2.6. pH Sensitivity

The pH was measured using a pH meter. The pH meter is first calibrated with buffer settings of 4 and 7. After that, use distilled water to clean the electrode, and a tissue is used to dry it and then the pH of the sample is measured. The electrode is then cleaned using distilled water and dried with tissue [16].

2.2.7. Viscosity Analysis

Viscosity analysis was conducted using the NDJ-8S Digital Rotary Viscometer. This test was carried out by placing the sample in a glass beaker with a volume of 250 ml. The sample is then stirred by determining the RPM rotation using a spindle rod that has been determined according to the level of viscosity of the sample [17].

2.2.8. Sensory Acceptence

Sensory acceptance of jelly drinks in this study was tested on 30 untrained panelists. The testing parameters assessed included color, taste, smell, texture, suction, aftertaste and overall. The rating scale used was (0-1.0) dislike, (1.01-2.0) slightly dislike, (2.01-3.0) slightly like, (3.01-4.0) like, and (4.01-5.0) very like [18].

3. RESULT AND DISCUSSION

3.1. Water Content of Jelly Drink

Table 1. show that the decrease in water content occurred as the watermelon albedo juice increased in samples F2, F3 and F4. Watermelon albedo contains 21.03% pectin compounds [19]. Meanwhile, soursop fruit contains 0.91% pectin compounds [20]. The pectin contained in soursop fruit is lower than the pectin contained in watermelon albedo, the more soursop juice is used, the lower the water content. Meanwhile, the more watermelon albedo is used, the more water content increases due to the pectin content in watermelon albedo.

Which states that the higher the concentration of pectin added, the moisture content of the resulting jelly drink tends to be lower. This is because pectin can bind water so that free water decreases [21].

Table 1. Water Content, Vitamin C, Dietary Fiber, pH, Viscosity of Jelly Drink

Sample	Water Content (%)	Vitamin C (%)	Dietary fiber (%)	pH	Viscosity (mPa.s)
F1	87.55 ± 0.11[d]	14.90 ± 0.09[d]	2.19 ± 0.05[a]	4.14 ± 0.04[a]	263.3 ± 15.27[a]
F2	85.09 ± 0.06[c]	12.49 ± 0.09[c]	2.48 ± 0.02[b]	4.24 ± 0.02[bc]	308.3 ± 10.40[b]
F3	83.80 ± 0.07[b]	11.46 ± 0.06[b]	2.80 ± 0.07[c]	4.27 ± 0.01[cd]	351.8 ± 8.14[c]
F4	83.07 ± 0.02[a]	10.49 ± 0.07[a]	3.16 ± 0.01[d]	4.30 ± 0.01[d]	430.8 ± 12.27[d]

Based on SNI quality standards, jelly drinks have constant thick liquid characteristics with high water content. The moisture content of jelly drinks in several studies was obtained at 89.92% in watermelon meat jelly drinks, watermelon albedo and tomatoes [22]. The moisture content of grapefruit jelly drink produces a moisture content of 88.30% [23]. This shows that the results of the analysis of water content in this research jelly drink are still classified as normal.

3.2. Vitamin C of Jelly Drink

Analysis of Vitamin C levels in jelly drinks was carried out to determine the best vitamin C levels with various variations of watermelon and soursop albedo used. Decrease in vitamin C levels occurred as watermelon albedo juice increased in samples F2, F3 and F4. This is because watermelon albedo has lower vitamin C compared to soursop fruit. The more soursop juice used, the more vitamin C will be added. The results obtained are related to the high vitamin C content found in soursop fruit. The vitamin C content in watermelon albedo amounted to 5.39 mg/100g of material [24]. Meanwhile, soursop fruit contains 42.16 mg/100g of vitamin C [25]. Soursop fruit contains vitamin C of 41.70 mg/100g [26]. The results of vitamin C produced by jelly drinks have a value much lower than the vitamin C content of pure soursop fruit because the soursop fruit used has been added with water or made into juice. In addition, vitamin C can be damaged in the cooking process of jelly drinks. According to Widyaningtyas et al., (2017) the decrease in vitamin C levels can occur due to the cooking process that uses high temperatures and heat so that vitamin C is oxidized [27].

3.3. Dietary Fiber of Jelly Drink

Table 1. show that the increase in dietary fiber content occurred as the watermelon albedo juice increased in samples F2, F3 and F4. The addition of watermelon albedo which is more dominant will obtain higher soluble fiber content due to the presence of pectin compounds in watermelon albedo of 21.03% [19]. Pectin contained in watermelon albedo is a food soluble fiber so that the greater the concentration of pectin added, the soluble fiber content will increase [28]. The variation of watermelon albedo and dragon fruit in jam making, resulting in the highest food fiber content with more watermelon albedo treatment [29].

The highest result produced is F4 which is 3.16% equivalent to 3.16 grams. So it can be seen that consuming 100 grams of this jelly drink can meet the need for dietary fiber by 12.64%. According to Badan Pengawas Obat dan Makanan, a product is said to be a source of fiber if it contains 3 g/100g of food fiber [30]. From the results of the study, there was the highest value of food fiber in treatment F4, which was 3.16% or 3.16 grams. So it is known that watermelon and soursop albedo jelly drinks with rosella extract color in F1, F2 and F3 do not meet BPOM guidelines, while F4 can be considered a source of food fiber according to BPOM guidelines.

3.4. pH of Jelly Drink

Table 1. show that the increase in pH value occurs as the watermelon albedo juice increases in samples F2, F3 and F4. The more watermelon albedo juice used, the more alkaline the pH value. This is because soursop fruit has a pH value that is more acidic than watermelon albedo so that the more soursop fruit used, the pH of the jelly drink will be more acidic. The manufacture of fruit leather with soursop fruit raw materials producing a low pH level of soursop fruit pulp of 3.90 [31]. Meanwhile, the resulted in a pH level of watermelon albedo pulp of 5.01 [32].

Jelly drinks with a pH of 4 are included in the minimum point of acid, acidity in acidic drinks is allowed with a pH limit of 3.5. The ideal pH for gel development is pH 4-7. Gel formation will occur faster if the pH is high, but the viscosity will drop back quickly, if heating is continued at low pH the gel formation will take longer. At pH 4-7 the speed of gel formation is slower than at pH 10, but if heating is continued, the viscosity does not change [33].

3.5. Viscosity of Jelly Drink

This viscosity test was carried out with an NDJ-8S viscometer using rotor 2 and a speed of 12 rpm and was carried out 3 times for each sample. The principle of the NDJ-8S viscometer is to rotate the sample with the rotor at a predetermined speed and then the viscosity results will be shown on the monitor or screen [23]. Table 1. Show a increase in viscosity value occurs as the watermelon albedo juice increases in samples F2, F3 and F4. The more watermelon albedo juice used, the higher the viscosity value. Viscosity is influenced by the concentration of the solution which states that the higher the concentration of solute in the sample, the higher the viscosity [23]. The increase in viscosity value in jelly drinks is due to the increase in pectin as the watermelon albedo increases, causing the concentration of jelly drinks to also increase. The use of carrageenan and pectin plays a role in increasing the viscosity value of jelly drink because the gelling agent will make bonds with water in increasing amounts, the bond between the gelling agent and water makes the space between particles narrower because a lot of water is trapped into a hard solution [34].

High standard deviations can be caused by different temperatures between treatments. The greater the temperature, the smaller the viscosity. In other words, temperature is inversely proportional to viscosity. The samples used during the viscosity test temperature was not measured beforehand, making the temperature of the samples unknown to each other and being one of the causes of the high standard deviation in the test data. Viscosity measurement is also influenced by the breadth of the cross-sectional base used for the container at the time of testing so that the container used for the jelly drink sample must be the same so that there is no high data range between replicates so that the standard deviation becomes high [35].

3.6. Antioxidant Activity of Jelly Drink

Antioxidant activity analysis was performed using the DPPH method and using a UV-Vis spectrophotometer with a wavelength of 517 nm to calculate the IC50 (inhibitor concentration 50%) value. The comparison used as a positive control is vitamin C (ascorbic acid). The result of antioxidant activity of watermelon albedo and soursop jelly drink shown in Table 2.

Table 2. Antioxidant Activity of Jelly Drink

Sample	Antioxidant Activity (%)
F1	130.39 ± 0.15^{e}
F2	126.60 ± 0.13^{d}
F3	123.51 ± 0.26^{c}
F4	120.97 ± 0.15^{b}
Vitamin C	8.45 ± 0.22^{a}

The increase in antioxidant activity occurred as the watermelon albedo juice increased in samples F2, F3 and F4. The results of each treatment in this study are included in the medium category because the IC50 value obtained is in the range of 100-200ppm (medium). The IC50 value shows the amount of volume needed by a material to reduce 50% of DPPH radical activity. The lower the IC value, the stronger the antioxidant activity value. Antioxidant activity is included in the strong category if the IC value is below 50 ppm, 100-200 ppm is moderate and the weak category if above 200 ppm [36]. In watermelon albedo extract there is antioxidant activity of IC50 14.729 ppm [37]. Meanwhile, soursop only contains antioxidant IC50 of 282.61 ppm [38]. Antioxidant activity increased with higher watermelon albedo concentration, with F1 showing the highest activity. The value produced in this study is lower because the watermelon albedo used is not extracted but only made into juice. The percentage of inhibition between watermelon rind, fruit, and seeds, the best antioxidant activity is in watermelon rind [39].

3.7. Sensory Acceptent of Jelly Drink

Sensory acceptance of watermelon and soursop albedo jelly drink was conducted on 30 panelists. The scale assessment criteria used were (0-1.0) dislike, (1.01-2.0) slightly dislike, (2.01-3.0) slightly like, (3.01-4.0) like, and (4.01-5.0) very like. The panelists used were untrained panelists with healthy criteria for the senses of smell, sight and taste. The sensory acceptance assessed was color, smell, taste, texture, suction, aftertaste and overall liking level. The result of sensory acceptence of watermelon albedo and soursop jelly drink can see in Table 3.

Table 3. Sensory Acceptance of Jelly Drink

Sample	Color	Smell	Taste	Texsture	Aftertaste
F1	4.03 ± 0.61^{b}	4.06 ± 0.86^{c}	4.16 ± 0.87^{b}	3.46 ± 0.77^{a}	3.86 ± 0.86^{a}
F2	3.86 ± 0.97^{b}	3.76 ± 0.93^{bc}	3.80 ± 0.84^{ab}	3.70 ± 0.87^{ab}	3.80 ± 0.80^{a}
F3	3.80 ± 0.96^{b}	3.43 ± 0.93^{ab}	3.56 ± 0.93^{a}	3.96 ± 0.66^{bc}	3.53 ± 0.86^{a}
F4	3.33 ± 0.95^{a}	3.23 ± 0.85^{a}	3.40 ± 0.77^{a}	4.23 ± 0.62^{c}	3.46 ± 0.89^{a}

3.8. Sensory Acceptance of Color Parameters in Jelly Drinks

Color is the initial impression captured by panelists before perceiving other stimuli. Color is an important part in determining the quality or eligibility level of a food ingredient. In addition, color can be used as an indicator of chemical changes in food ingredients, such as browning and caramelization [40]. The color sensory acceptance value ranged from 3.33-4.03. The color of the jelly drink produced based on the assessment of panelists' preferences ranged from like to very like. The color liking value of treatment F2, F3 and F4 jelly drinks decreased as the concentration of watermelon albedo increased and increased as the soursop juice increased. F4 treatment jelly drink has a fainter color than the others. Making watermelon and soursop albedo jelly drinks using rosella extract to improve the pale color of watermelon and soursop albedo. Soursop and rosella make the jelly drink atmosphere acidic so there is no need to add citric acid. An acidic atmosphere with a lower pH will produce anthocyanin pigments in rosella redder [41].

3.9. Sensory Acceptance of Smell Parameters in Jelly Drinks

The sense of smell is used to evaluate this aspect. The food industry considers smell testing to be very important as it can provide an assessment of whether the creation is liked or not [40]. Sensory acceptance of smell ranged from 3.23-4.06. The smell of the jelly drink produced based on the panelists' favorability assessment ranged from like to very like. The favorability value of the smell of the treatment F2, F3 and F4 jelly drinks decreased as the concentration of watermelon albedo increased. F4 treatment jelly drink has a lower smell than the others because watermelon albedo has a thin and not distinctive smell like soursop. The lower the concentration of watermelon albedo, the higher the concentration of soursop fruit. A high concentration of soursop is preferred because soursop fruit has a distinctive and refreshing smell.

3.10. Sensory acceptance of taste parameters in jelly drinks

Panelist recognition of taste is influenced by several factors, namely temperature, concentration, chemistry and other flavor components. Taste limitations can determine consumers' conclusions to reject or like a product. Although the assessment of other parameters is good, if the taste is not liked, the product will be rejected by consumers [42]. Sensory acceptance of the jelly drink flavor parameters ranged from 3.40-4.16. The taste of the jelly drink produced based on the panelists' favorability assessment ranged from like to very like. The value of taste preference in the treatment of F2, F3 and F4 jelly drinks decreased as the concentration of watermelon albedo increased. The F4 jelly drink treatment has a lower taste value than the others because watermelon albedo has a thin flavor. The lower the concentration of watermelon albedo, the higher the concentration of soursop fruit. A high concentration of soursop is preferred because soursop fruit has a refreshing sweet and sour flavor.

3.11. Sensory Acceptance of Texture Parameters in Jelly Drinks

Jelly drinks have a different gel texture from other jelly products. The gel of the jelly drink is softer (smoother) and the texture is not hard, so when drunk it is easier to suck, but when drunk it still feels the texture of the gel [43]. The sensory acceptance value on the texture parameter of the jelly drink ranged from 3.46-4.23. The texture of the jelly drink produced based on the panelists' favorability ratings ranged from like to very like. The favorability value of the jelly drink texture increases as the concentration of watermelon albedo increases. F1 jelly drink treatment has a more liquid texture than the others. The higher the concentration of watermelon albedo, the more gel texture will be because watermelon albedo contains pectin. Pectin has the ability to form a gel with the help of acids and sugars which can be used as an adhesive or thickener in jelly making [19].

3.12. Sensory Acceptance of Aftertaste Parameters in Jelly Drinks

Aftertaste is the remaining sweet, bitter, savory and sour taste (taste and smell) from the back of the oral cavity and persists after the sample is lost from the mouth or swallowed. The sense of taste is used in this aftertaste test [44]. Sensory acceptance of the jelly drink aftertaste parameter ranged from 3.46-3.86. The aftertaste of the jelly drink produced based on the panelists' favorability assessment has a like scale. The results that are not significantly different in the aftertaste can occur because watermelon albedo has a thin and bland aftertaste so that the aftertaste produced in the jelly drink is also not different. This makes the concentration of watermelon albedo not affect the panelists' assessment of the aftertaste of jelly drinks. Although it shows results that are not significantly different, it can be seen that the highest liking value for aftertaste is found in treatment F1 with 0% watermelon albedo concentration with 100% soursop. This is because soursop has a stronger flavor and smell.

4. CONCLUSION

This study demonstrated that variations in the proportion of watermelon albedo juice and soursop significantly affect the moisture content, dietary fiber, vitamin C, antioxidant activity, pH, and viscosity of jelly drinks. The best formulation based on physicochemical properties was F4, with a higher proportion of watermelon albedo, which increased moisture content, dietary fiber, antioxidant activity, pH, and viscosity, but reduced vitamin C content. From a sensory perspective, F1, with a higher soursop proportion, was most preferred in terms of color, smell, taste, and aftertaste, although it scored lower in texture acceptance. These findings indicate that achieving the optimal balance between functional properties and consumer acceptability requires careful formulation adjustments. The results also highlight the potential of watermelon albedo as a functional ingredient to enhance nutritional quality while maintaining desirable sensory attributes. Further research could explore modifications in processing techniques or ingredient ratios to maximize both physicochemical quality and sensory appeal.

Author Contribution

All authors contributed equally to the main contributor to this paper. All authors have read and agreed to the published version of the manuscript.

Conflict of Interest

The authors declare no conflict of interest.

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