



## The Effect of Pumpkin (*Cucurbita moschata D.*) and Peel of Watermelon (*Citrullus lanatus*) Balance on the Characteristics of Jam Produced

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### Abstract

Jam is a semi-solid food ingredient made no less than 45 parts by weight of crushed fruit with 55 parts by weight of sugar. The mixture is thickened until it reaches a content of a dissolved solid substance of not less than 65% for all types of jam. The main components or conditions for making jam are pectin, sugar and acid. Pectin requirements for the manufacture of jams are a maximum of 0.75% and a minimum sugar of 55%. Ideal fruits in the manufacture of jam should contain enough pectins and acids to produce jams with appropriate characteristics. Research on the jam characteristics of various yellow pumpkin and watermelon peel balances has been tried with the aim of establishing the right balance. The method used in this study was an experimental method using a Randomized Block Design. The balance treatment of yellow pumpkin and watermelon peel consists of balances A (100: 0), B (90: 10), C (80: 20), D (70: 30), E (60: 40) and F (50: 50), each treatment is repeated four times. Inter-treatment testing using duncan multiple range test at a real level of 5%. The results showed that the balance of yellow squash and watermelon peels gave a noticeable difference in the effect on the moisture content, vitamin C, total soluble solids, the degree of liking for the color, taste, aroma and consistency of the jam. The balance of yellow pumpkin and watermelon peel (70:30) produces good jam characteristics, this determination is based on a color favorability level of 4.16, taste of 4.04 and consistency of 3.63 out of a maximum value of 5.00 and a total soluble solid of 70.03%.

**Keywords:** Pumpkin, peel of watermelon, characteristics, jam.

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### 1. Introduction

Indonesia is a tropical country that has a good climate and fertile soil, this is evidenced by the abundance of plant species that grow in Indonesia. Qualitatively that agricultural products after harvesting have suffered damage estimated at around 20-40%. The damage is generally caused by the improper timing of the harvest so that the harvest is too mature and the damage caused by mechanical, physical and biological treatments can actually be suppressed if post-harvest knowledge is mastered (Tiwari et al., 2020).

Fruits and vegetables in general cannot be stored long at room temperature because they have high water content. If this commodity is not handled properly, there will be high losses that cause losses. In the process of handling fruits and vegetables, basic knowledge is needed, namely physiology and postharvest handling technology. Fruits and vegetables are not only commodities for household needs for daily needs, but also commodities for hotels, restaurants, and catering companies. The problem faced is that these commodities are often of poor quality, vary, no sorting is carried out at the farmer level, there is no standardization, inventory is not continuous and packaging is not good. This needs to be considered so that economic losses can be reduced so that they become as small as possible. Post-harvest handling of fruits and vegetables is a solution to save from damage to fruits and vegetables, one way is to process fruits and vegetables into durable products such as made jam. Jam is one of the practical food products and is consumed as a spread or complementary food. Jam serves as a complement to bakery dishes, mixtures in baking, ice cream, and others. Jam is one of the food products made by cooking crushed fruit mixed with sugar with or without the addition of water (Mason, 2004). According to the definition of the Indonesian National Standard (2008), jam is a semi-solid food made from no less than 45 parts by weight of crushed fruit with 55 parts by weight of sugar. This mixture is thickened to a dissolved solid content of not less than 65% for all types of jam. The main components or requirements for making jam are pectin, sugar and acid. The pectin requirement for the manufacture of jam is a maximum of 0.75% and sugar is a minimum of 55%. The ideal fruits in the manufacture of jam should contain

enough pectin and acids to produce jam with the appropriate characteristics. Factors that must be considered in making jam, including the influence of heat and sugar on cooking, as well as the balance of sugar propositions, pectin, and acid. Sugar and pectin must be in the appropriate balance, if too little sugar is used then the resulting jam will become hard (May, 1990). The addition of watermelon skin waste can affect the characteristics of the jam produced, one of which can mask the distinctive aroma of yellow pumpkin, and can add potassium needed by the body. Jam products that we often encounter are pineapple jam, strawberry jam, peanut butter, in this study will be tried to make jam from yellow pumpkin and watermelon peel. Yellow pumpkin (*Curcubita moschata*) is a type of plant found in Indonesia, especially in the highlands (Eliza et al., 2021). One of the agricultural commodities preferred by the public because of its sweet taste, has an attractive aroma, attractive color and relatively cheap price. Yellow pumpkin contains carotene, carbohydrates, proteins, minerals such as calcium, phosphorus, iron, vitamin B, vitamin C and fiber. The production rate of yellow pumpkin in Indonesia is relatively high, and its production from year to year continues to increase, but the consumption rate of yellow pumpkin in Indonesia is still very low (Woolfw & Poats, 1987). To increase the added value of yellow pumpkin, it can be processed into a wide range of products, one of which is jam. Watermelon peel is also rich in vitamins, minerals, enzymes and chlorophyll. Vitamins found in watermelon peels include vitamin A, vitamin B2, vitamin B6, vitamin E, and vitamin C, beta-carotene and lycopene found in watermelon peels can be used as antioxidants. Watermelon rind contains the amino acid citrulline as much as 2-20 mg/gr of dry weight. Watermelon peel on the white part is called albedo, watermelon albedo is a potential source of pectin, composed of 21.03% pectin compounds. If a mixture of yellow pumpkin fruit and watermelon peel can be used as a jam product, then what is the right balance to produce this mixed fruit jam that has good characteristics. The manufacture of jam from a mixture of yellow pumpkin and watermelon peel is expected to cope with abundant production and wasted waste, in addition to being a diversification of processed fruits and increasing added value (Gowe, 2015).

## 2. Materials and Methods

The main raw materials used in this research experiment were bokor-type yellow squash, red watermelon peel, granulated sugar and citric acid. The chemicals used for the analysis are aquades, Iodium 0.01 N, and an amylum indicator of 1%. The tools used in this research experiment are analytical scales, refractometers, blenders, basins, pots, stirrers, knives, cutting boards, spoons, and stoves. The analysis equipment is drip pipette, filter paper, erlenmeyer, spatula, petri dish, beaker, erlenmeyer flask, measuring flask, spoon holder, cup, tray, stationery, and label paper. The method used in this study was an experimental method using a Randomized Block Design. The balance treatment of yellow pumpkin and watermelon peel consists of balances A (100: 0), B (90: 10), C (80: 20), D (70: 30), E (60: 40) and F (50: 50), each treatment is repeated four times. If there are differences between treatments, testing between treatments is carried out with the Duncan Multiple Range Test at a real level of 5% (Saville, 1990). The formula used is as follows:

$$S_x = \sqrt{KT \text{ galat/r}}$$

$$LSR = SSR \times S_x$$

The experimental design linear model is:  $Y_{ij} = \mu + t_i + r_j + \Sigma_{ij}$

Information:

- $Y_{ij}$  = measured response
- $M$  = general average
- $t_i$  = effect of balance treatment to-i
- $r_j$  = effect of replay to-j
- $\Sigma_{ij}$  = influence of random factors

## 3. Results and Discussion

### 3.1. Water Content

Based on the data from statistical analysis that the balance of yellow pumpkin and watermelon skin has a real different influence on the moisture content of the jam produced. Duncan's multiple distance test results on the average value of jam moisture content in various balances as shown in Table 1.

**Table 1:** Effect of Balance Yellow Pumpkin and Watermelon Peel on the Water Content of Jam.

Treatment	Average
A = 100: 0	19.66 a
B = 90: 10	20.73 b
C = 80: 20	21.73 c
D = 70: 30	23.55 d
E = 60: 40	26.59 e
F = 50: 50	31.13 f

Remarks: The average number followed by different letters shows a real difference of 5% according to Duncan's multiple distance test.

In table 1. It shows that the balance of yellow pumpkin and watermelon peel exerts a significantly different effect on the moisture content of the jam produced. The addition of decreased yellow pumpkin followed by the addition of watermelon peel waste that increases on various balances will affect the water content produced. The lowest level was obtained at balance A (100: 0) which was 19.66%, compared to other treatments B (90: 10), C (80: 20), D (70: 30), E (60: 40), and F (50: 50). The moisture content of jam increases with the greater the number of watermelon peels and the less the amount of yellow pumpkin used. This is because the water content contained in watermelon albedo is higher, which is 94 g in 100 g of ingredients, compared to the water content contained in yellow pumpkin, which is 91.20 g in 100 g of ingredients. Compared to the water content contained in yellow pumpkin, which is 91.20 g in 100 g of ingredients. The higher the water content in foodstuffs, the faster the food is damaged because more water is free for microorganisms to activate. The water content of jam produced has a value that is in accordance with the national jam standard that has been set in SNI 3746: 2008 which states that the maximum water content in jam is 35%.

### 3.2. Vitamin C

Based on the data from statistical analysis that the balance of yellow pumpkin and watermelon skin has a real different influence on the vitamin C jam produced. Duncan's multiple distance test results on the average value of jam moisture content at various balances as shown in Table 2.

**Table 2:** Effect of Balance Yellow Pumpkin and Watermelon Skin on Vitamin C Levels (mg/100grams)

Treatment	Average
A = 100: 0	26.36 f
B = 90: 10	24.36 e
C = 80: 20	22.38 d
D = 70: 30	20.21 c
E = 60: 40	18.59 b
F = 50: 50	17.11 a

Remarks: The average number followed by different letters shows a real difference of 5% according to Duncan's multiple distance test.

In Table 2, it shows that the balance of yellow pumpkin and watermelon peel exerts a significantly different effect on the vitamin C jam produced. On balance F (50: 50), gives the lowest level or content of vitamin C 17.11 mg, compared to the other balances (A, B, C, D and E). The lower the balance of yellow pumpkin pulp and the higher the balance of watermelon peel waste added, it will affect the levels of vitamin C in the jam produced, namely the vitamin C levels are also lower. This is because watermelon skin has less vitamin C content than yellow pumpkin. The low content of vitamin C in watermelon skin causes the addition of watermelon skin not too influential on the increase in vitamin C content of jam produced. Vitamin C is unstable due to high temperatures, the presence of acid, air or oxygen resulting in oxidation.

### 3.3. Total Dissolved Solids Content

Based on the data from statistical analysis that the balance of yellow pumpkin and watermelon peel has a significantly different effect on the total dissolved solids produced. Table 3 shows that the balance of yellow pumpkin and watermelon peel exerts a significantly different effect on the total dissolved solids of jam produced. The total

value of dissolved solids of jam produced in accordance with the quality requirements of jam is at least 65% (SNI, 2008).

**Table 3:** Effect of Balance Yellow Pumpkin and Watermelon Peel on Total Dissolved Solids (%)

Treatment	Average
A = 100: 0	65.58 a
B = 90: 10	66.73 b
C = 80: 20	68.33 c
D = 70: 30	70.03 d
E = 60: 40	71.40 e
F = 50: 50	72.40 f

Remarks: The average number followed by different letters shows a real difference of 5% according to Duncan's multiple distance test.

Table 3 shows that the balance of yellow pumpkin and watermelon peel exerts a significantly different effect on the total dissolved solids of jam produced. The total value of dissolved solids of jam produced in accordance with the quality requirements of jam is at least 65% (SNI, 2008). The less yellow pumpkin balance and the more watermelon peel balance causes the higher the total dissolved solids content because the watermelon peel pectin content is higher than the yellow pumpkin pectin content. Based on previous research "Pectin Retrieval From Watermelon Albedo with Acid Extraction Process" by Melisa and Doni, 2014, watermelon albedo pectin content obtained from the extraction process with HCl solvent 9.4590-11.2635% while with solvent CH<sub>3</sub>COOH 6.5960-7.4120% with albedo samples of 20 g and yellow pumpkin pectin content of 1.2g / 100g. Total dissolved solids tend to increase as the amount of pectin used increases. This is because pectin is a constituent component of total dissolved solids. The total dissolved solids are also affected by the pectin content of the raw material. Mahmud (2013) added that the higher the pectin content, the higher the total dissolved solids.

### 3.4. Colour

Based on the data from statistical analysis that the balance of yellow pumpkin and watermelon skin has a significantly different influence on the color of the jam produced. In Table 4, it shows that the balance of yellow pumpkin and watermelon peel has a significantly different effect on the color of the jam produced.

**Table 4:** Effect of Balance Yellow Pumpkin and Watermelon Peel on the Level of Preference for Jam Color

Treatment	Average
A = 100: 0	4.01 cd
B = 90: 10	3.74 bcd
C = 80: 20	3.52 abc
D = 70: 30	4.16 d
E = 60: 40	3.00 a
F = 50: 50	3.28 ab

Remarks: The average number followed by different letters shows a real difference of 5% according to Duncan's multiple distance test.

Table 4 shows that the balance of yellow pumpkin and watermelon peel has a significantly different effect on the level of preference for the color of the resulting jam. Color is a very important component to determine the quality or degree of acceptance of a foodstuff. The determination of the quality of a food ingredient generally depends on color, because color appears first (Winarno, 2004). The most preferred jam color of the panelists was jam on balance D (70: 30) = 4.16 because the resulting color was bright yellow and the lowest value on balance E (60: 40) = 3.00 with a dark color (slightly brownish yellow). The resulting color of jam is dominated by bright yellow shades obtained from yellow pumpkin. Each different balance has a different level of color.

### 3.5. Aroma

Based on the data from statistical analysis that the balance of yellow pumpkin and watermelon skin has a real different influence on the aroma of jam produced. In Table 5, it shows that the balance of yellow pumpkin and watermelon peel exerts a significantly different influence on the aroma of the jam produced.

**Table 5:** Effect of Balance Yellow Pumpkin and Watermelon Peel on the Favorability of Jam Aroma

Treatment	Average
A = 100: 0	2.94 a
B = 90: 10	3.00 a
C = 80: 20	3.18 ab
D = 70: 30	3.35 abc
E = 60: 40	3.55 bc
F = 50: 50	3.68 c

Remarks: The average number followed by different letters shows a real difference of 5% according to Duncan's multiple distance test.

In Table 5, it shows that the balance of yellow pumpkin and watermelon peel has a significantly different effect on the level of liking for the aroma of the jam produced. Scent is an odor that is difficult to measure so it usually raises different opinions in assessing the quality of the aroma. Differences of opinion are caused by everyone having differences in smell, although they can distinguish scents but everyone has different preferences. Organoleptic testing of the preferred aroma of jam produced showed that jam with a balance of F (50 : 50) was most preferred by panelists, because the balance of yellow pumpkin and watermelon peel was the same so that the aroma of yellow pumpkin was slightly disguised by the aroma of watermelon. The fewer the balance of yellow pumpkin and the more balance of watermelon peel, the higher the level of preference of panelists for the aroma of jam produced, because it further disguises the langu aroma of yellow pumpkin which some panelists do not like. Addition of watermelon peel gives the aroma of jam preferred.

### 3.6. Taste

Based on data from statistical analysis that the balance of yellow pumpkin and watermelon skin has a significantly different influence on the level of liking the resulting jam taste. The results of Duncan's multiple distance test on the average value of jam taste preference in various balances as shown in Table 6.

**Table 6:** Effect of Balance Yellow Pumpkin and Watermelon Peel on the Taste Preference Level of Jam

Treatment	Average
A = 100: 0	3.95 b
B = 90: 10	3.53 ab
C = 80: 20	3.68 b
D = 70: 30	4.04 b
E = 60: 40	3.15 a

Remarks: The average number followed by different letters shows a real difference of 5% according to Duncan's multiple distance test.

Table 6 shows that the balance of pumpkin and watermelon peel exerts a significantly different effect on the degree of preference for the resulting jam flavor. Taste is a sensory attribute that cannot be separated from the overall taste of food products. The enjoyment of the taste of a food product is impossible to obtain without taste in it. Everyone has the lowest concentration limit on a taste in order to still be felt (threshold). This limit is not the same for each person and (threshold) someone for different feelings is also not the same. Taste is influenced by several factors, including chemical compounds, temperature, concentration and interaction with other taste components. If the chemical properties contained in food ingredients are different, the resulting taste will also be different. The taste compounds in the product can stimulate the receiving senses when tasting, the presence of glucose, sucrose, starch and others can improve the taste of food ingredients (Winarno, 2004). Organoleptic testing of jam flavors showed that panelists liked the balance 70 : 30 (D = 4.04) the most because it had a balance of pumpkin and watermelon peel that matched the panelists' desired taste, compared to balances of 100 : 0 (A = 3.95), 90 : 10 (B = 3.53), 80 : 20 (C = 3.68), 60 : 40 (E = 3.15), 50 : 50 (F = 3.05). Panelists gave different values to the resulting jam due to the addition of different fruit pulps. Taste is a factor influencing the acceptability of food products. If the color and aroma components are good but consumers do not like the taste, consumers will not accept the food product.

### 3.7. Spread power jam

Based on data from statistical analysis that the balance of yellow pumpkin and watermelon skin has a significantly different influence on the level of liking of the resulting jam spread. The results of Duncan's multiple distance test on the average value of the liking level of jam smearing on various balances as shown in Table 7.

**Table 7:** Effect of Balance Yellow Pumpkin and Watermelon Peel on the Favorability of Jam Spread

Treatment	Average
A = 100: 0	3.75 b
B = 90: 10	3.67 b
C = 80: 20	3.65 b
D = 70: 30	3.63 ab
E = 60: 40	3.22 a
F = 50: 50	2.75 a

Remarks: The average number followed by different letters shows a real difference of 5% according to Duncan's multiple distance test.

Table 7 shows that the balance of pumpkin and watermelon rind exerts significantly different effects on the degree of preference for the resulting jam smear. The panelists' most preferred level of yaollesselai was on balance A = (100: 0) = 3.75 because the resulting consistency was thickest and when smeared on bread was better and lowest on balance E = (50: 50) = 2.75 with somewhat viscous consistency. A good jam standard is that if applied to bread will produce a good spread (not broken) (Putri et al, 2017). It is appropriate on the jam produced, can be smeared because the resulting is thick. It can be said that the proportions of the concentrate, acids and sugars in the jam made in proportions are balanced, the harder the gel is formed, the amount of free water contained in the ingredients will decrease. However, too high a pectin concentration will cause the gel to become harder, so it will be difficult to smear.

## 4. Conclusion

The results showed that the balance of pumpkin and watermelon peel gave a marked difference in the effect on water content, vitamin C, total soluble solids, level of preference for color, taste, aroma and consistency of jam. The balance of pumpkin and watermelon peel (70:30) produces good jam characteristics, this determination is based on a color preference level of 4.16, taste 4.04 and dispersion of 3.63 out of a maximum value of 5.00 and total solids of 70.03%. It is recommended that the use of agricultural waste, especially horticultural products, should be maximized by using appropriate, cheap and environmentally friendly technology.

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