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# THE RATIO OF SUGAR AND CARBOXY METHYL CELLULOSE (CMC) TO THE QUALITY OF SLICED JAM OF DRAGON FRUIT

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## ABSTRACT

One type of fruit that useful for humans is a dragon fruit. Dragon fruit easily damaged if not stored properly and one alternative that can be done by processing it into various processed products such as dragon fruit syrup, dragon fruit jam and others. Dragon fruit is a kind of fruit that tastes sweet also slightly sour and the meat is quite chewy so it is suitable if made jam. Dragons fruit jams are often found in the form of jelly and sheet-shaped. This study aims to determine the effect of the ratio of sugar and CMC to the quality of sliced jam of dragon fruit. This research was conducted at the laboratory agricultural product technology Faculty of Agriculture Universitas Islam Sumatera Utara. The study used a complete randomized design factorial two replications with amount of sugar and the number of CMC (as treatments. The results showed that to produce good quality of sliced jam can be made with a ratio of 70% sugar and 2% CMC.

**KEYWORDS:** Dragon fruit, organoleptic, flavor, aroma.

## INTRODUCTION

Dragon fruit (*Hylocereus undatus*) is a fruit originating from Mexico and being developed on a large scale with the characteristic of having pink skin and red flesh. There are four types of dragon fruit, namely red flesh dragon fruit (*Hylocereus costaricensis*), white flesh dragon fruit (*Selenicerius megalanthus*), super red flesh dragon fruit, and yellow skin dragon fruit with white flesh.[1]

The most popular dragon fruit consumers today is the type of red dragon fruit because red dragon fruit is more nutritious for health and has an attractive color. This is supported by research conducted by Marhazlina in,[2] a researcher from the University of Malaysia's Department of Nutrition and Dietetics Faculty of Medicine and Health states that red dragon fruit has the potential to help lower blood sugar levels and prevent the risk of heart disease in diabetic patients. The benefits of dragon fruit according to Escribano et al. in,[2] that dragon fruit has the potential as an anti-free radical because it contains betasianin.

The availability of dragon fruit which is sometimes rare and sometimes makes the need for dragon fruit limited, consumers who process food from dragon fruit must wait for the availability of dragon fruit when it is rare. Conversely, when dragon fruit production increases and the limited storage capacity of dragon fruit, dragon fruit is wasted because of its large quantity. Currently, the existing products for red dragon fruit are only in the form of real fruit directly for fresh consumption and fruit juice or syrup. Therefore, processing red dragon fruit to be used as marmalade is important.

Marmalade is a food product made from fruit juice and has a semi-solid texture with the addition of sucrose, citric acid, pectin and pieces of fruit skin (albedo). Marmalade has the same texture as jam, the mixture of pulp, albedo, sugar and pectin is thickened to form a gel structure, with the same standard but with the addition of orange peel slices.[3]

Jam is usually used as a spread on bread and also as an additive for making cakes and other foods. The

processing of dragon fruit processed products is very limited, because dragon fruit is still consumed in fresh form. Therefore, various types of processed products are made, such as making dragon fruit jam, to create new and highquality processed dragon fruit products, and to extend the shelf life.

Jam includes processed food products derived from fruits. At this time, the demand for jam is increasing because breakfast using bread has become a public habit. The jam circulating in the market is generally in the form of packaged spread jam with a less practical way of presenting it so that it is necessary to develop other processed forms such as sheet jam. Sheet jam is more practical and easier to prepare and can be an alternative food product that can be consumed with bread for breakfast.

## MATERIALS AND METHODS

This research was conducted at the laboratory agricultural product technology Faculty of Agriculture Universitas Islam Sumatera Utara. Medan. The study used a two-replication factorial completely randomized design method with the addition of sugar and CMC as treatment. The first treatment is the addition of sugar (G) which consists of four levels, namely: 40% (G1), 50% (G2), 60% (G3), 70% (G4). The second treatment was the addition of CMC (C) which consisted of four levels, namely: 0.5% (C1), 1.0% (C2), 1.5% (C3), 2.0% (C4).

### Research Implementation

First, the sorting is carried out to select the raw materials according to the specified criteria. The fruit used is ripe fruit. The washing process is carried out to remove stuck dirt, the cleaned fruit flesh is cut medium, put in a belender and added with water to facilitate the crushing process to produce good fruit pulp. Fruit pulp was weighed as much as 300 g per treatment.

Before being heated the fruit pulp is added with granulated sugar according to the treatment (40%, 50%, 60%, 70%), and CMC according to the treatment (0.5%, 1%, 1.5%, 2%), and heated at a temperature of 100 $^0$C for 10 minutes, stirring and adding 1% citric acid. The jam dough that has been heated is poured into a mold and cooled for marmalade formation. The formation of this jam dough is so that the product is even and more practical in processing. Then it is removed from the mold and packed.

Packaging is carried out to prevent or reduce, protect foodstuffs or products contained therein, and protect the dangers of pollution as well as physical hazards (friction and collision). Packaging also functions to place a processing product or industrial product so that it has a form that makes it easier for storage, transportation and distribution. Packaging is also a promotional tool and information media.

### Observation and Analysis of Parameters

### Acidity (pH)

Determination of the degree of acidity (pH) refers to Muchtadi et al., (2010) which is determined using a pH meter. Before measuring, the pH meter must be calibrated using a buffer solution of pH 4.0 and 7.0. The material is mashed and then weighed as much as 20 g and 20 ml of distilled water is added, stirring until homogeneous. The electrode is dipped in the sample solution. The pH value can be read directly on the pH meter scale.

### Analysis of vitamin C content

A total of 20 g of material, put into 100 mL Erlenmeyer and add distilled water until the mark is tera and stirring until dissolved. Then filtered with filter paper. 50 mL of phytrate were taken and 1 mL of 1% starch indicator was added and then titrated with 0.01N iodine solution until a light blue color.[4]

$$mg/100g = \frac{mL\ yodium\ x\ 0.88\ x\ FP\ x\ 100\%}{Weight\ of\ sample(g)}$$

FP (Dilution Factor) = 2

### Rendemen

The rendemen is obtained by weighing the jam and divided by the weight of the whole material which is expressed as the initial weight and calculated using the equation:

$$Rendemen\ (\%) = \frac{Weight\ jam}{Material\ weight}\ x\ 100\%$$

### Flavor Organoleptic Test

The flavor organoleptic test was determined by presenting it to 10 panelists based on the hedonic scale and numerical scale.

**Table 1: Flavor organoleptoc value.**

| Hedonik Scale | Numeric Scale |
|---|---|
| Really like | 4 |
| Like | 3 |
| Do not like it much | 2 |
| Do not like | 1 |

Source:[5]

### Color Organoleptic Test

The color organoleptic test was determined by presenting it to 10 panelists based on the hedonic and numeric scales.

**Table 2: Color organoleptic value.**

| Hedonik Scale | Numeric Scale |
|---|---|
| Red | 4 |
| Blackish red | 3 |
| Reddish black | 2 |
| Black | 1 |

Source:[5]

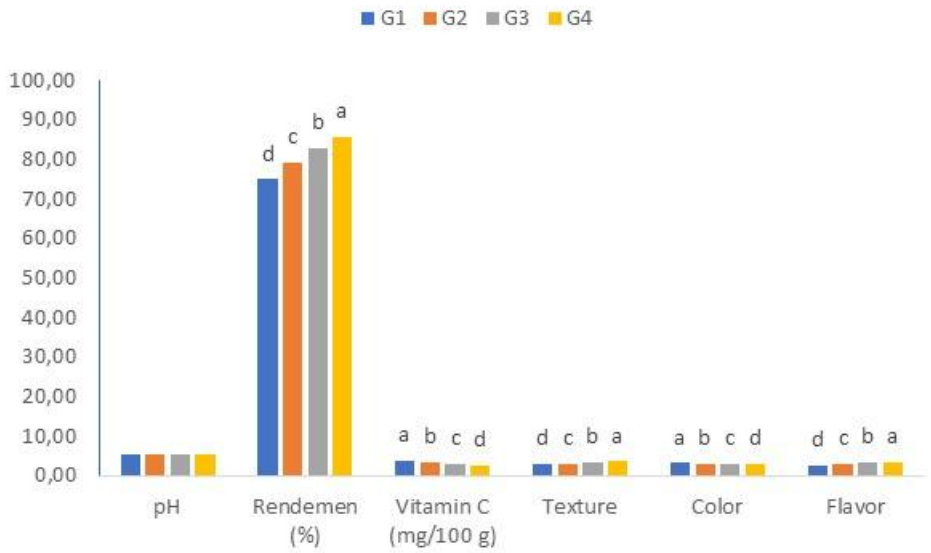
## RESULTS AND DISCUSSION

The results of the analysis of variance showed that the ratio of sugar and CMC given had a significant independent effect on the quality of dragon fruit jam, while the interaction between the two treatments had no significant effect on the quality of dragon fruit jam.

### Sugar Ratio

The results of the analysis of variance showed that the amount of sugar had no significant effect on the pH of dragon fruit sheet jam (P> 0.05), but had a significant effect on the rendemen, vitamin C content, texture, color and taste of dragon fruit jam (Figure 1).

Figure 1 shows that the amount of sugar given to dragon fruit jam has no significant effect on the pH of dragon fruit sheet jam. This shows that the amount of sugar given does not affect the level of acidity in dragon fruit jam. However, the amount of sugar given had a significant effect on the yield, vitamin C, texture, color and taste of dragon fruit jam.




**Note: G1: 40% sugar; G2: 50% sugar; G3: 60% sugar, G4: 70% sugar.**
**Figure 1: The content of pH, rendemen, vitamin C, texture, organoleptic color and flavor of dragon fruit jam sliced by giving sugar.**

Figure 1 shows that the highest rendemen of dragon fruit jam was given the amount of sugar 70% (G4), which was 85.86%, and the lowest yield was by giving the amount of sugar 40% (G1), which was 75.00%. All treatments are significantly different from one another. With the higher the amount of sugar given the rendemen of jam sliced will also increase. This is because the more sugar is added, the rendemen increases. Muryanti.[6] stated that sugar is hygroscopic so that the higher the sugar content is added, the more water is bound by sugar so that the rendemen in the material increases.

The amount of sugar also had a significant effect on the vitamin C content of dragon fruit jam (Figure 1). The highest vitamin C content was given 40% sugar (G1), namely 3.76 mg / 100 g, and the lowest vitamin C content was given 70% sugar (G4), namely 2.56 mg / 100 g. Figure 1 also shows that the vitamin C content of dragon fruit sheet jam decreases with the increasing amount of sugar. This is due to the increasing amount of added sugar, while the source of vitamin C which comes from ingredients remains constant, thereby reducing the vitamin C content calculated on the overall weight of sheet jam. Sugar is not a source of vitamin C so adding sugar to sheet jam affects the percentage of vitamin C content. The heating process can also result in a decrease in the vitamin C content of jam. According to Winarno,[7] vitamin C is the most easily damaged vitamin compared to other types of vitamins. Besides being very soluble in water, vitamin C is easily oxidized and the process is accelerated by heat, light, alkalis, enzymes, and other oxidizing agents.

The amount of sugar also has a significant effect on the texture of dragon fruit sheet jam, where the higher the amount of sugar given, the texture of the dragon fruit sheet jam will also be better (Figure 1). The best texture of dragon fruit sheet jam was found by giving 70% sugar (G4), and the texture of dragon fruit jam sheet was not good with 40% sugar (G1). The increase in the texture score value was due to the sugar binding to the water in the material to form a gel in making jam. This is in accordance with[7] which states that sugar will increase viscosity, this is because sugar binds to water so that the swelling of the starch grains becomes thicker. Marhazlina[8] suggest that the addition of sugar in making jam can function as a texture builder. The formation of texture in question is the formation of gel. Sugar will affect the balance of pectin and water because sugar functions as a dehydrating agent, which reduces

the water enveloping the pectin. The hydroxyl groups of sugar molecules can form intramolecular hydrogen bonds with water molecules to form stable hydrates and water is trapped in the gel, so that it can improve and improve the texture of the material.

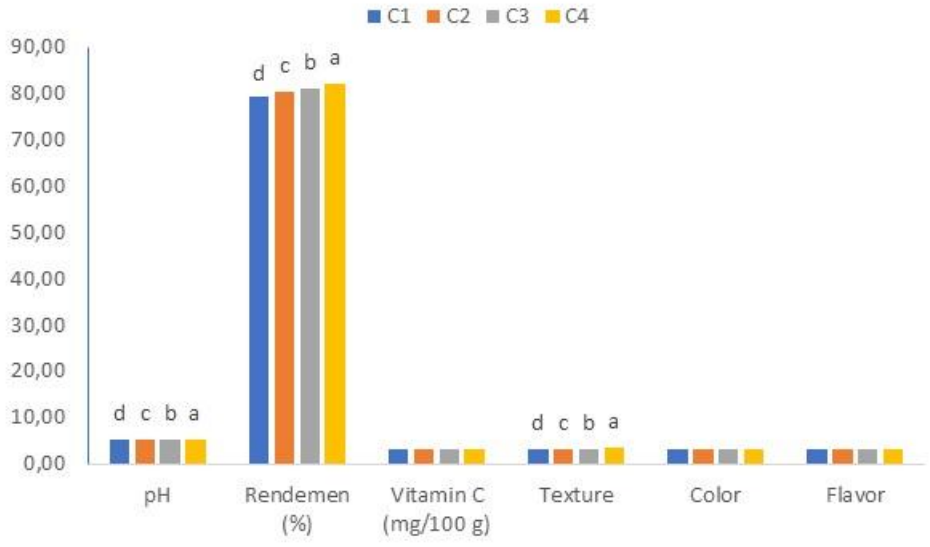
The amount of sugar has a significant effect on the color of the dragon fruit sheet jam, where the more the amount of sugar given, the lower the color value of the dragon fruit sheet jam (Figure 1). The highest color of dragon fruit sheet jam is in the provision of sugar 40% (G1), namely 3.21, and the lowest is in giving sugar 70% (G4), which is 2.89. This is due to the increasing amount of sugar added, the color of the sheet jam is getting brownish so that it is less liked by the panelists. Color is an important factor in determining food quality. The resulting color of the jam is clear yellow, brownish yellow, to brown. This is influenced by the process of cooking and adding sugar, where the higher the amount of sugar will produce a darker color. According to,[9] brown color is a process of browning reaction through caramelization. Caramelization occurs when sugar is heated above its melting point and turns brown. This is in accordance with the statement of,[7] which states that the Maillard reaction is a reaction of carbohydrates, especially reducing sugars with primary sugars, the result is a brown product.

Figure 1 also shows that the amount of sugar has a significant effect on the taste of dragon fruit jam, where the higher the amount of sugar given, the more preferred the taste of dragon fruit jam. The taste of dragon fruit jam is the most preferred in the treatment of the amount of sugar 70% (G4), namely with a value of 3.53, and the least preferred by giving 40% sugar (G1), which is with a value of 2.74. This is because the increasing amount of sugar given increases the sweetness of the dragon fruit jam so that it is increasingly favored by the panelists. The increase in the hedonic value of the taste is due to the sweet taste due to the addition of sugar which makes it more favorable. The increase in the hedonic value of the taste is in accordance with the statement of,[10] that the higher the percentage of sugar causes glucose and fructose produced from sucrose inverse will also increase, causing the level of sweetness to increase.

**CMC Ratio**

The results of the analysis of variance showed that the amount of CMC had a significant effect on pH, rendemen, and texture of dragon fruit sheet jam (P> 0.05), but had no significant effect on the vitamin C content, color and taste of dragon fruit jam (Figure 2).

The amount of CMC given to dragon fruit sheet jam has a significant effect on the pH of dragon fruit sheet jam, where the increasing the amount of CMC given, the pH of dragon fruit sheet jam also increases (Figure 1). The highest pH of dragon fruit sheet jam was at 2.0% CMC (P4), namely 5.35, and the lowest pH was at 0.5% CMC, which was 5.20. The increase in pH is due to CMC containing carboxyl groups and easily hydrolyzed so that it can increase pH. This increase in pH is in accordance with,[11] statement which states that the higher the percentage of CMC given to the material, the higher the hydrolyzed carboxyl group so that the pH value increases.




**Note: C1: 0.5% CMC; C2: 1.0% CMC; C3: 1.5% CMC, C4: 2.0% CMC.**

**Figure 2: The content of pH, rendemen, vitamin C, texture, organoleptic color and flavor of dragon fruit jam sliced by giving CMC**

Figure 2 also shows that the amount of CMC has a significant effect on the rendemen of dragon fruit jam sliced, where the more the amount of CMC is given, the rendemen of dragon fruit jam sliced also increases. The highest rendemen of dragon fruit jam sliced was found in the giving of 2.0% CMC (C4), which was 82.05%, and

the lowest rendemen of dragon fruit moist was 0.5% CMC (C1), which was 79.43%. The rendemen increase with the increasing amount of CMC given due to the increase in solute and water content in the material so that the weight percentage of the material increases. This is in accordance with,[12] which states that CMC stabilizers can bind water, sugar, mineral components and organic acids so that the addition of a higher percentage of stabilizers causes the rendemen to be higher.

The amount of CMC had a significant effect on the texture of dragon fruit jam sliced (Figure 2). The best texture of dragon fruit jam sliced was given 2.0% CMC (C4), and the poor texture of dragon fruit jam sliced was given 0.5% CMC (C1). The increase in the value of the texture score is because the viscosity of the jam increases so that the resulting texture is more solid and thick. CMC functions as a stabilizer that is able to bind water, the higher the amount of CMC, the more supple and preferred by the panelists. This is consistent with the statement of,[13] which states that CMC which is hydrophilic will absorb water that was previously outside the granule and is free to move, cannot move freely anymore so that the solution is more stable and there is an increase in viscosity. The higher the number of CMC, the higher the viscosity of the solution.

## CONCLUSION

To produce good quality of sliced jam can be made with a ratio of 70% sugar and 2% CMC.

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