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Study on Making Jelly Candy from the Melon Rind

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Abstract. The melon rind is a potential fruit waste to be processed into food products. Jelly candy is one form of processed food that can be made from melon rind. This study aimed to determine the effect of using melon rind on the physical, chemical, and organoleptic characteristics of jelly candy. This study used a completely randomized design with the treatments of 3 types of melon rind from different varieties: golden aroma melon, local melon, and sweet red melon. The results showed that the water content ranged from 16.06 to 21.89%. Analysis of color indicated that the L, a*, and b* values in the golden aroma melon rind treatment were significantly different from the local melon rind and red sweet melon rind treatments. The pH analysis showed that they were not significantly different. In contrast, descriptive tests show results that are not significantly different. The hedonic test showed that the panelists liked dry jelly candy from a golden aroma and local melon rind.

Keywords: Fruit rind, jelly candy, melon fruit, waste.

INTRODUCTION

Candy is a snack product that children much like because it has an appealing taste, color, and shape. Various types of candy are distributed to the public, including jelly candy. Jelly candy is made from fruit juice and a gelling agent with a clear, transparent appearance and specific texture and chewiness. The main ingredients in making jelly candy are pectin as a thickening agent, sugar as a sweetener, organic acids as preservatives, and sour taste agents (Hidayat & Ikariztiana, 2004). Meanwhile, according to (Silvianty *et al.*, 2021), other ingredients are added, such as sugar, jelly, carrageenan, gelatin, and water, in making jelly candy.

Pectin, as the main ingredient in making jelly candy, can be found in many fruits, both in the fruit flesh and fruit rind. Melon can be extracted for its pectin in various processed food products. This fruit that grows in the lowlands is prevalent because of its sweet taste and distinctive sweet fragrance. The level of consumption of melons is increasing, and as a result, the melon rind waste is also increasing. The melon rind is part of a melon with a more rigid texture and is tasteless than the flesh. The inner part of the rind (endodermis layer), which is adjacent to the fruit's flesh, is usually removed when eating melons because it has a hard texture and a bland taste.

Meanwhile, the high pectin content in melon rind can still be turned into processed products, such as jelly candy. Several commonly known melons are golden aroma melons, local melons, and red sweet melons. So far, few studies have utilized different types of melon rind to be applied to food products. This study aims to determine the effect of using three different types of melon rind on the physical, chemical, and organoleptic characteristics of the resulting jelly candy.

METHODS

The ingredients used in producing this jelly candy included melon rind of three different varieties, specifically golden aroma melon rind, local melon rind, and red sweet melon rind. While other ingredients being used included sugar, agar-agar, carrageenan, gelatin, and water.

The equipment used in making melon rind jelly candy was an aluminum cup, analytical scale, digital scale, pan, cabinet dryer, spoon, pot, stove, gas, candy mold, and knives. The equipment used in the analysis is a mortar and pestle, oven, desiccator, and pH meter.

The study employed a Completely Randomized Design (CRD) with the treatment of 3 different varieties of melon rind: local melon rind, golden aroma melon rind, and red sweet melon rind. Each treatment was carried out with six repetitions for each analysis.

The process of making melon rind jelly candy was done by cutting and peeling each type of melon, cleaning them with running water, cutting them into small pieces, and putting them into a blender. After the melon rind puree was ready, it was cooked with additional ingredients such as sugar, gelatin, agar-agar, and carrageenan according to a predetermined formulation. The cooking process was carried out by stirring until they boiled. Then put them into the mold. Jelly candies were dried using a cabinet dryer at 55ºC for 24 hours. After being dried, jelly candies were packaged to protect the product and prevent damage. The formulation used in the study can be seen in **TABLE 1**.

TABLE 1. Melon rind jelly candy formulation

Ingredients	Quantity (%)
Melon rind	54%
Sugar	42.5%
Carrageenan	1.25%
Jelly	1.25%
Gelatin	1%

Water Content

Water content (Helvich, 1990) was analyzed by heating the cup in the oven for 30 minutes and then putting it in a desiccator for 10 minutes. After that, the cup was weighed, and 3 grams of sample was added and put back in the oven for 24 hours. After 24 hours of baking, weigh it in a desiccator for 10 minutes. The baking process was continued until a constant weight was obtained. The calculation of water content was using the following formula:

$$\text{Water Content} = \frac{(Bc+Bs)-(Bc+Bs\ (constant))}{Bs} \text{ x } 100\%$$

Description:
Bc = *berat cawan* (cup weight)
Bs = *berat samp*le (sample weight)

Color

The sample was placed on HVS paper. The device was turned on and then fired toward the sample. There were Readout buttons L*, a*, b* where L* was for brightness parameters, a* and b* were for chromaticity coordinates.

pH

A pH meter analysis was performed by weighing 3 grams of sample dissolved in 50 mL of distilled water and then measuring it. The pH value could be read on the display of the pH meter.

Descriptive Test

A descriptive test was conducted on ten trained panelists. Before the test was carried out, panelists were previously trained to recognize sensory attributes and how to assess them. The sensory attributes tested included chewiness, stickiness, sweetness, melon aroma, and color. The intensity rating used a scale of 1 to 5.

Hedonic Test

Fifty untrained panelists carried out the hedonic test. The hedonic test was based on color, aroma, taste, texture, and overall impression. The hedonic rating scale was from 1, which is disliked very much, to 5, which is like very much.

Data Analysis

The data obtained were analyzed using the SPSS software for Windows with the Analysis of Variance (ANOVA) method. If there were differences among samples, it would be followed by a significance difference test using Duncan's Multiple Range Test (DMRT) analysis with a significance level of 5%.

RESULTS AND DISCUSSION

Water Content

Water is an essential ingredient component that can affect food's appearance, texture, and taste. The water content in food ingredients can determine the freshness and shelf life or durability of food ingredients. Low water content in food is one of the factors that can extend the shelf life of food. The water content in food can affect food quality so that the water can be reduced through drying and evaporation processes (Mappiratu & Kadir, 2018). The results of the water content test of jelly candy made from melon rind can be seen in **FIGURE 1**.

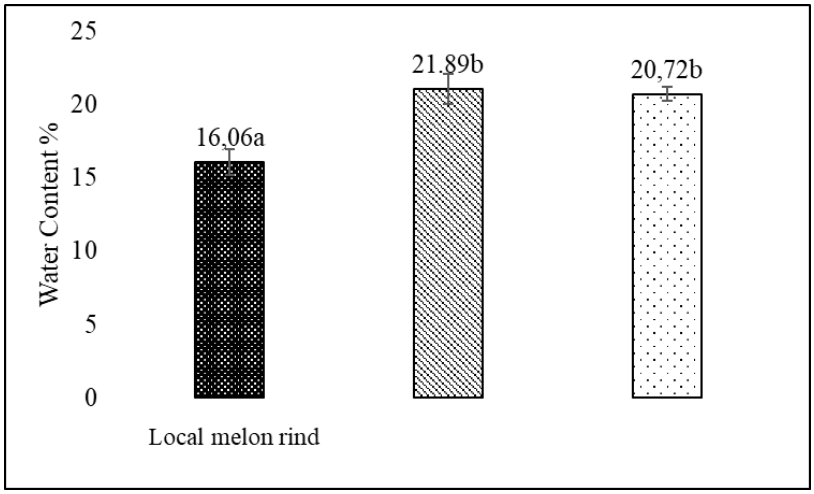

FIGURE 1. The water content of melon rind jelly candy. The same notation indicated results that were not significantly different from Duncan's test, with a significance level of 5%.

Based on Figure 1, the water content of melon rind jelly candy ranged from 16.06-21.89%. It demonstrated that the highest water content was obtained in the treatment of red sweet and local melon rind, with the results of the two treatments not significantly different. The lowest water content was found in the golden aroma melon rind; this treatment significantly differed from the red sweet and local melon rind. The higher water content was probably due to the different melons used because the fruit was grown in different soil types (Setiawati & Bafdal, 2020). Gelatin

has hydrophilic properties, so that it can affect the food structure. In addition, the water content could be affected by the addition of sugar because it has hygroscopic properties. This hygroscopic property was due to the reaction of sugar at high temperatures (Koswara, 2009). The water content decrease in the ingredients would cause the weight of the ingredients to decrease so that the amendment produced decreased (Nuh *et al*., 2020). The water content of jelly candy made from the local melon rind and red sweet melon rind did not meet the quality standard of jelly candy because the water content value was more than 20%. On the other hand, the water content of jelly candy made from golden aroma melon rind met the quality standard of jelly candy because the water content value was below 20%. The quality standard for jelly candy is a maximum of 20% water content (Badan Standarisasi Nasional, 2008).

Color

The color in food is an attribute in products that attract consumers so that consumers eventually can accept the product as a whole. The results of the color analysis of the melon rind jelly candy can be seen in **TABLE 2**.

TABLE 2. Color analysis on melon rind jelly candy

Types of melon	L*	a*	b*
Golden Aroma	46.3±2.23a	8.83±1.22a	35.43±4.37a
Local	45.63±2.7b	1.71±0.33b	25.23±2.45b
Red Sweet	40.06±2.18b	10.4±1.98b	33.66±4.50b

Description: L* value = brightness level, a* value = redness, b* = yellowness. The same notation indicated results that were not significantly different from Duncan's test, with a significance level of 5%.

Color is one of the crucial indicators in a food product, where color influences consumer interest in a product; attractive colors usually provide a better level of preference in the market. Color measurement can generate data from L*, a*, and b* values. The L* value indicates the brightness level based on white, the a* value indicates redness and the b* value indicates yellowness (Anggraini *et al*., 2016).

Based on Table 2, the jelly candy average value of L* using golden aroma melon rind significantly differed from the treatment of local and red sweet melon rind. In comparison, the local and red sweet melon rind treatments were not significantly different. Golden aroma melon rind had the highest L* compared to other types of melon rind, with an L* of 46.3. Different types of melon would affect the brightness level of the jelly candy made from the rind. The* value of golden aroma melon rind samples significantly differed from the treatments of local melon rind and red sweet melon rind. The highest a* value in red sweet melon rind was 10.4. A smaller a* value indicates a more yellow color; if the value increases, the color tends to be more orange. The b* value of the golden aroma melon rind treatment significantly differed from the treatments of local melon rind and red sweet melon rind. The golden aroma melon rind obtained the highest b* value of 35.43. The lower the b* value, the greener the color.

The color of the resulting jelly candy, which was a yellowish-green color, came from the original color of several types of melon and the cooking process using sugar. Apart from the original color of each type of melon, differences and color changes in jelly candy occurred due to adding sugar that affected the color through caramelization (Yunita, 2013).

pH

Based on the analysis of variance (ANOVA), the pH value of melon rind jelly candy can be seen in **FIGURE 2**.

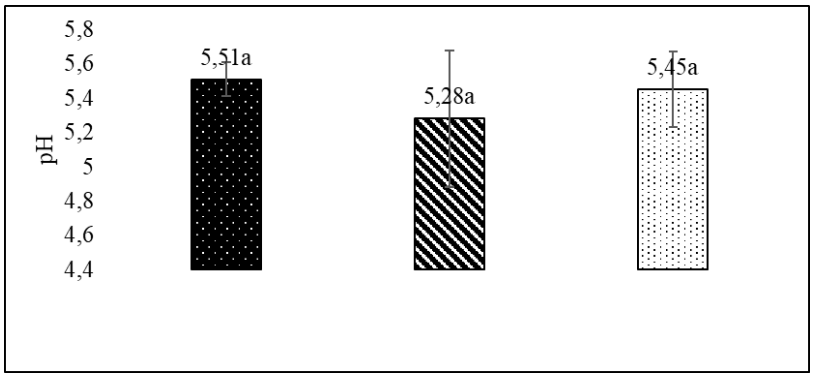

FIGURE 2. pH Analysis of melon rind jelly candy. The same notation indicated results that were not significantly different from Duncan's test, with a significance level of 5%.

Based on **FIGURE 2**, it can be seen that the pH of melon rind jelly candy ranges from 5.28 to 5.51. All treatments presented results that were not significantly different. It was due to the addition of gelatin in the production of jelly candy was the same. The optimal pH in forming gelatin gel ranged from 4-6. The increasing pH was presumably because more gelatin being added neutralized acidity in the food, so the ingredients' pH increased. When the acid concentration decreased, the pH value would increase, whereas when the acid concentration increased, the pH value would decrease (Wijayanti *et al*., 2018).

Descriptive Test

TABLE 3. Descriptive Test of Melon Rind Jelly Candy

Types of melon	Sensory Attributes					
	Chewiness	**Stickiness**	**Sweetness**	**Melon aroma**	**Orange Color**	**Green Color**
Golden Aroma	3.4±0.51ab	2.9±0.56b	4.4±0.69b	2±0.81a	3.7±0.67b	1.3±0.48a
Local	3.1±0.87a	2.1±0.87a	3.7±0.67a	1.8±0.78a	2±0.81a	2.2±0.78b
Red Sweet	4±0.66b	3±1.05b	3.7±0.67a	2.8±0.91b	4.9±0.31c	1.3±0.48a

Description: The same notation indicated results that were not significantly different from Duncan's test, with a significance level of 5%.

Based on the results of the descriptive sensory test specified that the three samples consisting of the golden aroma melon rind, the local melon rind, and the red sweet melon rind were significantly different. The highest score of chewiness was found in the treatment of red sweet melon rind, which was 4, where the value of 4 was considered chewy. The chewiness can be obtained by adding carrageenan, agar, and gelatin. Carrageenan was a stabilizer or balance regulator in the formation of gels and emulsions. Carrageenan is seaweed gum that is extracted using water or specific solutions.

Meanwhile, gelatin is a mixture of simple proteins obtained from a series of stages of degradation. Gelatin can function as a gelling agent in making jelly candy (Basuki *et al*., 2014). A high concentration of gelatin can bind more water to increase the gel's formation, making jelly candy chewy (Maryani *et al*., 2010).

Based on the table, it can also be seen that the results of the panelist's assessment on the stickiness parameters of red sweet melon rind received no significantly different score compared to the treatment of golden aroma melon rind, While the stickiness parameters of local melon rind received significantly different scores. This could be due to the high water content in the local melon rind, resulting in a lower stickiness score. The results of the stickiness score of the melon rind jelly candy ranged from 1-3 (not sticky to stickier). A higher concentration of gelatin added would increase the stickiness score of jelly candy (Handayani & Rohmayanti, 2019).

Melon rind jelly candy made from the golden aroma of melon had the highest sweetness intensity. The results were significantly different from the other two samples. The sweetness could be obtained from the addition of sugar in the making of melon rind jelly candy. This was in accordance with a study by Wijana *et al*. (2014) in which the factor that affected the sweetness of melon rind jelly candy was the addition of sugar in the processing. Apart from the sugar factor, the type of melon used also influenced the resulting sweetness, where golden aroma melons taste very sweet.

TABLE 3 shows that the panelists' descriptive assessment of the aroma of melon rind jelly candy ranged from 1.8 to 2.8 (not strong to slightly strong). The highest score of melon rind aroma in melon rind jelly candy was in the red sweet melon rind treatment, which was statistically significantly different from the other treatments. This was because the aroma of sweet red melon is more assertive, thus producing jelly candy with the most assertive melon aroma. Meanwhile, the aroma of melon rind, with a score of 1.8, was found in the treatment of local melon rind. Adding sugar and other ingredients did not affect the melon aroma of the jelly candy (Herawati Pamungkas, 2015).

Based on the orange color assessment, it can be seen that the results were significantly different. This occurred because of differences in treatment. The red sweet melon rind and the golden aroma of melon rind produced orange rind jelly candy and did not produce a green color. These two melon rinds were more orange, affecting the final product's color. Melon rind jelly candy made from local melon rind was not orange and produced a slightly green color because the melon rind being used had a slightly green color. Therefore, the color of the melon rind jelly candy depended on the raw material or the type of melon rind used.

Hedonic Test

TABLE 4. Hedonic test of melon rind jelly candy

Types of melon	Sensory Attributes				
	Texture	**Taste**	**Aroma**	**Color**	**Overall**
Golden Aroma	4.13±0.68b	3.96±0.18b	3.5±0.68a	4.3±0.74c	4.33±0.60b
Local	3.63±0.80a	3.76±0.85ab	3.33±0.80a	3.73±0.69b	4.03±0.66ab
Red Sweet	3.33±0.99a	3.46±0.77a	3.4±0.93a	3.33±0.84a	3.73±0.63a

Description: The same notation indicated results that were not significantly different from Duncan's test, with a significance level of 5%.

The hedonic test is conducted to determine the level of consumer acceptance of a product subjectively and to determine consumer preferences. As shown in **TABLE 4**, the preference level of panelists for melon rind jelly candy on the texture parameter with the treatments of local melon rind and red sweet melon rind were similar. However, the two treatments were significantly different from the golden aroma melon rind treatment. The preference level for the taste of melon rind jelly candy showed significantly different results, with the highest score being the golden aroma melon rind treatment. In addition, the preference level for aroma presented similar results for all treatments. The preference level on the color of melon rind jelly candy specified significantly different results, with the most preferred color being melon rind jelly candy made from golden aroma melon. Regarding the overall scores of the acceptance level, the panelists tended to prefer melon rind jelly candy made from golden aroma melon rind and local melon rind to those made from the red sweet melon rind.

CONCLUSION

Based on the water content test results on the melon rind jelly candy, there were no significant differences in the treatments of local and red sweet melon rind. The results of the water content test on the golden aroma melon rind were significantly different, with an average water content of 16.06%. Accordingly, the jelly candy with this treatment met the jelly candy quality standards. The color analysis indicated significantly different values between the golden aroma melon rind treatments and both local melon rind and red sweet melon rind. The pH value was not significantly different; the golden aroma melon rind treatment with a value of 5.51 obtained the highest value. The descriptive test generated values that were not significantly different; the highest value for the chewiness parameter was found in the red sweet melon rind treatment with a value of 4, and the highest stickiness was found in the golden aroma melon rind with a value of 2.9, the highest sweetness value was 4.4 obtained in the treatment of golden aroma melon rind, the highest orange color value was 4.9 obtained in the treatment of red sweet melon rind, the highest green color value was 2.2 obtained in the treatment of local melon rind. Meanwhile, the panelists liked jelly candy made from golden aroma rind and local melon rind in the hedonic test.

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