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The Effect of Using Pegagan Leaves (Centella Asiatica L. Urban) Extract on the Physical Properties and Antioxidant Capacity of Mochi Ice Cream

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ABSTRACT

Pegagan leaf is a popular medicinal plant widely found in Indonesia. Pegagan can also be used in food and beverage products, such as mochi ice cream. This study aims to determine the physical properties (color and textures) and antioxidant capacity of mochi ice cream with different pegagan leaf extract concentrations of 20, 30, and 40 percent. This experimental study used a CRD (Completely Randomized Design), with treatment carried out twice for each concentration. The data obtained were analyzed using a one-way ANOVA (Analysis of Variance) test. If a real difference was observed, then the DMRT (Duncan's Multiple Range Test) was carried out. The results showed that the highest color brightness (L) mochi ice cream was obtained from a 20 percent concentration of pegagan leaf extract. The highest level of greenish color (a-) was obtained from 40 percent pegagan leaf extract, while the highest level of yellowish color (b+) was obtained from 20 percent pegagan leaf extract. The highest textures was obtained from a concentration of 20 percent pegagan leaf extract, and the highest antioxidant capacity was obtained from 40 percent pegagan leaf extract. Therefore, pegagan leaf extract concentration affects mochi ice cream's color, textures, and antioxidant content.

I. Introduction

Pegagan leaf is a prominent traditional medicinal plant commonly used in the form of fresh, extracted, and dried by the Indonesian community (Lasmadiwati, et al., 2003). Besides, it is well-known in various countries with different names, including gotu kola (India and Nepal) (Tawiri et al., 2011), bou-bok (Thailand) (Chaiwanichsiri et al., 2000), Indian pennywort or marshy pennywort (USA), pohecula (Hawaii), kapokapi (Cook Island), totodro (Fiji), and tohatupaou (Tahiti) (Joshi & Chaturvedi, 2013).

Pegagan leaves consist of various nutritional components, including polyphenols, flavonoids, β-carotene, tannins, vitamin C, and saponins, such as madecassode and asiaticosida (Mahapatra & Kumar, 2012; Rahman et al., 2013). Total phenol compounds in pegagan are one of the main contributors to antioxidant activity, capable of inhibiting oxidation reactions and warding off free radicals (Daniel et al., 2010). Meanwhile, the example of saponin compounds in pegagan is asiaticosida containing secondary metabolites (Matsuda et al., 2001). Asiaticosida functions as an antioxidant that can evade free radicals and revitalize blood vessels (Prabowo, 2002).

Generally, people use pegagan leaves only as a medicinal plant for treating several types of diseases. Therefore, an innovative product made from pegagan leaves is required to increase its economic value. According to Hashim (2011), pegagan (*Centella asiatica L. Urban*) is a herbal plant that can be processed into food and beverage products. One of the easily processed products is mochi ice cream. Mochi ice cream is a mochi cake filled with ice cream. It has a chewy and soft texture. According to Fitri (2018), mochi is made from white glutinous rice flour, added sugar, and red beans. Mochi has an uncomplicated preparation process requiring widely available ingredients. Its sweet taste positions mochi as a contemporary snack, popular among children, teenagers, and adults. The mochi ice cream variations generally only use flavor variants and skin colors with synthetic dyes. In this

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study, mochi ice cream was modified by adding pegagan leaf extract. The pegagan leaf extract is expected to increase mochi ice cream's nutritional value because it has high asiaticoside content beneficial for human health. Besides, pegagan leaves are also acceptable and consumable for the public. Therefore, this study investigated the effect of pegagan leaf extract (*Centella asiatica L. Urban*) on the physical properties (color and breaking strength) and chemical properties of mochi ice cream.

II. Method

We used experimental research with a completely randomized design (CRD) to determine the physical properties (color and breaking strength) and the antioxidant content of mochi ice cream with pegagan leaf extract. We used a variety of pegagan leaves extract of 20%, 30%, and 40%. The treatment was repeated twice for each concentration, then a physical test (color and breakout power) and antioxidant tests were carried out. The ingredients used in the preparation of mochi ice cream were 250 mL of pegagan leaf extract flour, 250 g of white glutinous rice flour, 50 g of granulated sugar, 100 g of roasted cornstarch, and 200 g of vanilla ice cream. Meanwhile, for the tools, we used digital scales, measuring cups, basins, blenders, filters, bowls, stainless bowls, steaming pans, stoves, wooden spatulas, pans, cutting boards, rolling pins, molds, ice cream scoops, plastic wrap, and freezers. For the physical properties, the mochi's color was obtained using a color reader, while the breaking strength was examined using a tensile strength. Analysis of antioxidant capacity was completed using a spectrophotometer with the DPPH method. The obtained data were analyzed using the ANOVA test, continued with the DMRT test if there was a real difference.

III. Results and Discussion

For the color of mochi ice cream with pegagan leaves extracts, our results showed three means, namely the value of L*a*b. Meanwhile, the breaking power of mochi ice cream from pegagan leaf extract was expressed in units of N/cm^2. For the antioxidant capacity, mochi ice cream from pegagan leaf extract presented a strong IC_{50} value. The detailed results of the data analysis are shown in Table 1.

Table 1. Analysis Results of Physical Properties (Color and Breaking Power) and Antioxidant Capacity of Mochi Ice Cream from Pegagan Leaf Extract

Pegagan Leaf Concentration	Color			Breaking Power (N/cm^2)	Antioxidant Capacity (IC_{50}, ppm)
	Brightness (L)	Greenish (a-)	Yellowish (b +)		
20%	50.54	0.77	35.18	10.88	71.58
30%	47.73	2.74	30.68	9.83	64.99
40%	43.77	4.68	28.78	8.7	52.68

A. Color

1) Color Brightness (L)

Table 1 shows that the highest and lowest color brightness (L) is obtained from the concentration of 20% (50.54) and 40% (43.77) pegagan leaf extract, respectively. The results were obtained using the ANOVA test at a significance level of 5% ($\alpha = 0.05$) and followed by the DMRT test, suggesting a significant difference.

The L value represents the brightness parameter with a value of 0-100 (black and white) (Safitri, 2014). The greater the L value in the concentration of pegagan extract represents a brighter color. The highest color brightness (L) was identified at a 20% concentration of pegagan leaf extract. The mochi ice cream's color brightness is induced by the chlorophyll content in pegagan leaves. As chlorophyll is a green pigment, it tends to be divided into dark colors (Putri et al., 2012), and high color pigment content affects the brightness level (Wahyuni & Widjanarko, 2015). Consequently, less usage of peagan leaf extract results in a higher color brightness level.

2) Levels of Greenish Color (a-)

According to Table 1, the highest and lowest greenish color level (a-) is obtained by mochi ice cream from 40% (4.68) and 20% (0.77) pegagan leaf extract, respectively. The results were obtained

through a calculation using the ANOVA test at a significance level of 5% (α = 0.05), followed by the DMRT test, which signified a significant difference.

The a- value represents the green color parameter, with the value ranging from 0-(-80) (Safitri, 2014). The more excellent a- value shows a darker green color of the pegagan leaves extract. The highest level of greenish color (a-) was found in the mochi ice cream with a 40% concentration of pegagan leaf extract, induced by the chlorophyll content in pegagan leaves. According to Setiari & Nurchayati (2009), pegagan leaves contain 24.2911 ^{cd} of chlorophyll, 17.7611 ^{bcd} of chlorophyll a, and 6,5467 ^{cde} of chlorophyll b. Thus, the use of higher pegagan leaf extract results in higher chlorophyll content.

3) Yellowish Color Level (b+)

Our analysis results signify that the highest and lowest yellowish color level (b+) were obtained from 20% (35.18) and 40% (28.78) concentrations of pegagan leaf extract. The obtained data were analyzed using the ANOVA test at a significance level of 5% (α = 0.05) with a significance value of 0.00, followed by the DMRT test suggesting a significant difference.

The b+ value shows the yellow color parameter, ranging from 0-70 (blue-yellow) (Safitri, 2014). The greater b+ value in the concentration of pegagan leaves produces a more yellowish and brighter color. From our results, the highest level of yellowish color (b+) was found in the mochi ice cream with 20% pegagan leaf extract due to the pegagan leaves' tannins and flavonoids content. Tannins compounds are capable of providing color pigments in food (Rohyani et al., 2015), from colorless to yellow or brown (Winarno, 2004: 181). Similarly, flavonoids tend to be colorless to yellow (Winarno, 2002). Thus, more extensive use of pegagan leaf extract results in higher tannin and flavonoid content.

B. Breaking Power (Food firmness)

According to data presented in Table 1, the highest and lowest breaking power or food firmness was found in mochi ice cream made from 20% (10.88 N/cm^2) and 40% (8.7 N/cm^2) of pegagan leaf extract, respectively. The results were obtained from a calculation using the ANOVA test at a significance level of 5% (α = 0.05) with a significance value of 0.00, followed by the DMRT test showing a significant difference.

Breaking power is the magnitude of force required to break a surface area of the material (Yuwono & Susanto, 1998:32 in Febriani, 2015). The investigation of breaking strength is required to identify the force value (N) needed to break the skin of mochi ice cream. The highest breaking power was found in mochi ice cream with 20% pegagan leaf extract, caused by the fiber content in pegagan, namely crude fiber, and food fiber. Pegagan leaves are reported to have 8.89% of crude fiber (Nur et al., 2017). Meanwhile, Kabaruddin in Siregar et al. (2017) described that crude fiber content in pegagan leaves is 14.69%. Pegagan contains a total dietary fiber content of 5.46%, a soluble dietary fiber content of 4.51%, and an insoluble dietary fiber content of 0.84% (Zulya, 2011). Thus, pegagan have a higher crude fiber content than food fiber, potentially lowering the firmness of the produced mochi ice cream. The higher concentrations of pegagan leaf extract decrease the processed food's power.

C. Antioxidant Capacity

The highest antioxidant capacity was observed in the mochi ice cream from 40% pegagan leaf extract, with an IC_{50} value of 52.68 ppm, as shown in Table 1. In contrast, the lowest antioxidant was found in mochi ice cream with 20% pegagan leaves extract, showing an IC value of 50. of 71.58 ppm. The findings were from calculation carried out the ANOVA test at a significance level of 5% (α = 0.05) with a significance value of 0.00, followed by the DMRT test, signifying a significant difference.

The increase in antioxidant capacity was influenced by the increasing concentration of pegagan leaf extract. Pegagan contains antioxidant compounds, including triterpenoid compounds named asiaticosida (Zainol et al., 2008) and total phenol compounds (Shahwar et al., 2010). BEsides, the chlorophyll content in pegagan leaves also contains antioxidant compounds (Winarno, 1995 in Sunyoto, 2017). Asiaticoside compounds are triterpenoid glycosides with a therapeutic effect (Bermawie, et al., 2005). The compounds are water-soluble because they contain glycons which tend to be polar and aglycones which tend to be non-polar (Lestari, et al., 2015). Besides, asiaticoside compounds can remain stable, even at high temperatures and humidity (Siregar & Wikarsa, 2010). As high antioxidant capacity resulted in a low IC_{50} value (Molyneux, 2004), the highest antioxidant capacity was found in the highest concentration of pegagan leaf extract (40%).

IV. Conclusion

Our findings signify that the highest color brightness of 50.54 (L) was found in mochi ice cream with a 20% concentration of pegagan leaf extract. Meanwhile, the highest level of greenish color (a-) of 4.68 was observed in the mochi ice cream with 40% pegagan leaf extract. The most significant level of yellowish color (b+) of 35.18 was found in the mochi ice cream with a 20% concentration of pegagan leaf extract. Additionally, the mochi ice cream with 20% pegangan leaf extract was confirmed to have the highest breaking power (10.88 N/cm^2). Lastly, the most significant antioxidant content (71.58 ppm) was identified in the mochi ice cream with 40% pegagan leaf extract.

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