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Application of Taro Beneng Inulin as a Fat Replacer in Low Fat Ice Cream and Addition of Red Dragon Fruit Peel Extract as a Natural Colorant

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ABSTRACT

The characteristics of ice cream with the addition of Taro Beneng Inulin (TBI) and Red Dragon Fruit Peel Extract (RDFPE) were evaluated in this study. Various concentrations of beneng taro inulin (3%, 4%, and 5%) and dragon fruit extract (25%, 30%, and 35%) were added as fat substitutes and natural dyes, respectively. The results showed that the addition of 4% beneng taro inulin had a significant effect on the overrun value, melting time, and fat content of ice cream. The addition of 30% red dragon fruit peel extract significantly affected the color of ice cream, fat content, antioxidant activity, and total plate number. There is an interaction between the treatment of the addition of beneng tuber inulin and dragon fruit peel extract on color analysis, namely the L* (brightness), a* (redness), b* (yellowness) notation. A3B3 ice cream was selected as the best ice cream formula based on existing criteria.

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Introduction

Today's consumers are interested in foods that have health effects on the body. Some focus has been on fat reduction and the role of sugar in promoting obesity, type-2 diabetes, and the resulting cardiovascular problems. Nevertheless, a reduction in dietary animal fat has been recommended by nutritionists (Kucukoner and Haque, 2003). One product that is much-loved by consumers is ice cream. Ice cream contains 10–16% fat from dairy or non-dairy sources and is an important component in ice cream, affecting dryness, shape retention after freezing, melt resistance, and smoothness after hardening, therefore eliminating or reducing fat content leads to the quality of the final product of ice cream has many drawbacks (Berger, 1990; Goff, 2002).

In recent years, the dairy industry has developed a variety of low-fat and fat-free ice cream products (Adapa et al., 2000). One of the accepted fat substitutes to ice cream was carbohydrates (Guven et al., 2005), that has the ability to form gel, increase viscosity, provide texture and mouthfeel, and increase water-holding capacity (Crizel et al., 2014). Inulin is a non-digestible polysaccharide that is found in some fruits and vegetables as a storage carbohydrate. Many researchers are currently developing inulin from local raw materials, one of which is inulin from Talas Beneng. Beneng taro (*Xanthosoma undipes* K. Koch) is a typical local food source in Banten which contains 6.29% protein, 84.88% carbohydrates, 1.12% fat, 75.62% starch, and 374.69 calories (Rostianti et al. 2018). Tiwari et al. (2014) conducted a study of low-fat ice cream with the addition of inulin which yielded 2% and 4% inulin substitution had overall acceptability was similar to controls.

In addition to adding inulin as a fat replacer, the nutritional value of ice cream can also be increased by adding red dragon fruit peel extract. Red dragon fruit peel is an agricultural waste in the fruit juice processing industry which is currently only used as fertilizer. However, various studies have shown that dragon fruit peel is a potential source of natural functional food (Wu et al., 2005).

According to Niah and Helda (2016), red dragon fruit peel is a good active ingredient source. One of the active ingredients found in dragon fruit peel is betalain. Betalains are compounds that contribute to the color of some fruits and promote health. Red dragon fruit skin meets the criteria as a substitute for natural fat and dies in ice cream manufacturers, thus eliminating doubts about the bad use of artificial coloring for health (Saneto, 2005).

The research aimed to identify the effect of the substitution of beneng tuber inulin and red dragon fruit peel on the physicochemical, microbiology, and organoleptic characteristics of low-fat ice cream.

Method

Tools and Materials

The materials used in this study were Beneng Tuber obtained from Saung Tani, Serang Regency, red dragon fruit peel obtained from the waste of fruit

juice traders in Cilegon City, skim milk, whipped cream, carboxy methyl cellulose (CMC), eggs, sugar, and all the other reagents were analytical grade.

Taro Beneng Inulin Production

The method for making inulin refers to Murwinda (2019) with modifications. Beneng taro was washed, cut, and soaked in a 10% salt solution for 2 hours. After that, it was weighed and crushed with a blender (1:2 w/v) and then heated on a hotplate (*Thermo-scientific)* to a temperature of 85-90^{o}C for 30 minutes. *) The result was filtered and 40% ethanol was added to the total volume of the filtrate obtained, then stored in the freezer for 18 hours. The frozen filtrate was left at room temperature for 2 hours (or until thawed) and then centrifuged (*Centurian Scientific/C2 Series*) at 1500 rpm for 15 minutes. The inulin precipitate was then re-added to water in a ratio of 1:2 (w/v), then heated in a water bath (*Memmert WNB14*) to a temperature of 70^{o}C, for 30 minutes. Process *) was repeated until inulin precipitate was obtained from centrifugation. The precipitate obtained was dried with a cabinet dryer at 50^{o}C for 24 hours.

Red Dragon Fruit Peel Extract Production

Preparation of red dragon fruit peel extract refers to Ekawati et al., (2015) with modifications. The peel of the red dragon fruit was washed and reduced in size using a chopper. Then blanched with hot water 1:3 (w/v) for 5 minutes and filtered.

Ice Cream Production

Making ice cream refers to Dewanti and Rahuni (2013) with modifications. All ingredients for making ice cream (including inulin A1:3%, A2:4%, and A3:5%) were weighed, mixed, and pasteurized at 80^{o}C for 15 minutes. After that, red dragon fruit peel extract (B1:25%, B2:30%, B3:35%) was added and mixed with a mixer for 15 minutes at high speed, then the ice cream mixture was stored in the freezer for 4 hours. Then the mixture was shaken again with a mixer for 15 minutes so that the ice crystals became soft and put into the ice cream maker for 35 minutes.

Overrun Analysis

The increase in the volume of ice cream is expressed as an overrun and is calculated based on the difference between the volume of ice cream and the volume of the initial mixture. Ice cream overrun was measured (Istiqomah et al. 2017) by weighing a 50 ml beaker glass, weighing 50 ml of ice cream dough (W1), and frothing with a mixer. After that, 50 ml (W2) was put into a beaker glass and weighed, then calculated using the formula:

$$Overrun = \frac{W1 - W2}{W2} x100\%$$

Melting Time Analysis

The melting time is calculated using a stopwatch by observing the ice cream until it changes shape or melts completely. Some of the ice cream was taken with a uniform weight of 10 g and stored in a plastic cup container and then frozen in the freezer for 24 hours. The frozen ice cream was placed in the same place at room temperature and left until all samples melted (Zahroh and Nisa et al., 2015).

Color Analysis

Color measurement using a chromameter is one of the methods used in assessing the quality of appearance (visual). Color measurement is carried out by attaching the tip of the tool to the surface of the sample being observed. Measurements were taken at three different points and then averaged. The value is calculated based on the coefficients L, a, and b (Siwi, 2018).

Antioxidant Analysis

A sample of 1 g of ice cream was put into a test tube that had been wrapped in aluminum foil, then added 2 ml of DPPH and 7 ml of methanol, after that the solution was vortexed, then incubated in a dark room for 30 minutes, measure the absorbance of the sample using spectrophotometer with a wavelength of 517 nm (final DPPH concentration is 0.2 Mm) (Zahroh and Nisa et al., 2015).

$$Inhibition(\%) = \frac{blankabsorbance - sampleabsorbance}{bankabsorance} x100$$

Fat Analysis

A total of 3 g of sample is weighed in a beaker glass, incorporated with 30 ml of 25% HCl and 25 ml of distilled water. The beaker glass was closed and heated for 15 minutes, then filtered through hot filter paper, then rinsed with 30 ml of hot water. The filter paper and residue were dried in an oven at 105^{o}C for 1 hour. Filter paper and dry residue were put in a thimble and extracted with petroleum ether for 2 hours in a Soxhlet. The extracted pumpkin and fat are then in the oven to obtain a constant pumpkin weight. Calculate the fat content with the following formula (AOAC, 1992).

Total Plate Count

A total of 1 ml of ice cream was pipetted and added with 9 ml of 0.9% physiological solution aseptically, then homogenized with a vortex, 1 ml of the suspension solution was taken and then diluted to a 10-5 dilution. After that, microbial inoculation was carried out at dilutions (10^{-3}, 10^{-4}, 10^{-5}) by pour plate method using NA media at 45^{o}C. After that, it was incubated at 37^{o}C for 24 hours (Barman et al., 2017)

Sensory Analysis

Sensory tests were carried out on all ice cream formulations using the hedonic organoleptic test. Test parameters include color, taste, aroma, texture, and overall. The test used was 50 untrained panelists according to SNI-01-2346-2006 (BSN, 2006). Testing was carried out by providing 9 kinds of samples, where each sample was given a code.
The best samples were continued with proximate analysis using a modified method from Khalish et al., 2020)

Results

Overrun

Overrun is the percentage of ice cream volume development before and after shaking (Oksilia et al., 2012). Overrun measurement is carried out by calculating the weight of the ice cream mixture before and after rising, and then the results are calculated using the overrun formula in Satriani et al., (2018). The results of the overrun analysis can be seen in Table 1.

The overrun value of ice cream decreased with increasing concentration of taro beneng inulin. The results showed that taro beneng inulin as a carbohydrate-based fat substitute was not able to trap air cavities during the shaking process. This is related to inulin's ability to form gel and bind air during the gelatinization process, this ability can cause the dough viscosity to be high or the dough to become thick. High viscosity makes the mobility of air molecules and the space between particles increasingly limited. Limited space between particles will create cavities, making it difficult for air to enter and being trapped in the dough so that the overrun value decreases (Tuhumuri et al., 2016). Apart from that, the fat content also affects the overrun value of ice cream. Air will enter the fat globules during the shaking process so that the volume expands (Raharja, 2018).

Table 1**.** Result of Ice Cream Analysis

Sample	Overrun (%)	Melting Power (Minutes)	L*	a*	b*	Fat Content (%)	Antioxidant Activity (%)	Total Plate Count (Log cfu/ml)
A1B1	45,60^{c}	31,21^{a}	46,35^{a}	32,33^{a}	-0,41	3,82^{i}	74,36^{a}	4,66
A1B2	45,38^{c}	31,37^{a}	44,13^{b}	33,35^{b}	-0,76	3,67^{h}	83,09^{b}	4,51
A1B3	45,39^{c}	31,32^{a}	42,30^{c}	34,55^{c}	-1,02	3,55^{g}	86,63^{b}	4,49
A2B1	43,43^{b}	32,56^{b}	46,44^{a}	32,43^{a}	-0,43	3,35^{f}	74,86^{a}	4,62
A2B2	43,01^{b}	32,54^{b}	44,81^{b}	33,55^{b}	-0,77	3,21^{e}	79,90^{ab}	4,56
A2B3	43,03^{b}	32,36^{b}	41,30^{c}	34,61^{c}	-1,06	3,13^{d}	83,73^{b}	4,52
A3B1	40,22^{a}	33,37^{c}	46,57^{a}	32,55^{a}	-0,43	2,85^{c}	73,46^{a}	4,61
A3B2	40,11^{a}	33,02^{c}	44,26^{b}	33,65^{b}	-0,77	2,73^{b}	83,29^{b}	4,59
A3B3	39,91^{a}	33,40^{c}	41,22^{c}	34,55^{c}	-1,04	2,62^{a}	84,89^{b}	4,52

Note: A=TBI (Taro Beneng Inulin); B=RDFP (Red Dragon Fruit Peel)
A1B1 = 3%,25%; A1B2 = 3%,30%; A1B3 = 3%,35%; A2B1 = 4%,25%; A2B2 = 4%,30%; A2B3 = 4%,35%; A3B1 = 5%,25%; A3B2 = 5%,30%; A3B3 = 5%,35%

The fat globules that line and trap the air cavities that enter the dough will bond to form fat tissue to hold the air cavities (Muse and Hartel (2004) in Mandari (2020)). In this research, inulin was substituted with another fat source, namely whipping cream. The more concentration of taro beneng inulin added, the less whipping cream was used, this caused the fat content in the ice cream to decrease and affected the overrun value of the ice cream.

Red dragon fruit peel extract has an influence on the value overrun in ice cream, the higher the percentage of red dragon fruit peel extract added, the lower the overrun value will be. The decrease in the overrun value is thought to be because the red dragon fruit skin contains a high enough pectin, which is around 10.79% (Prasetyo, 2013). Pectin is often used in the food industry because of its ability to form gels (Pratiwi, 2017).

The ability of pectin to form gel can increase the viscosity of the ice cream mixture and influence the overrun value. The higher the viscosity of the ice cream mixture, the more difficult it is for air cavities to form and be trapped so that the overrun value will decrease (Tuhumuri et al, 2016).

Melting Power

Melting time analysis is the time it takes for ice cream to partially melt or completely melt at room temperature and is measured using a stopwatch. The results of the analysis of the melting time of ice cream can be seen in Table 1. Based on the research results, it is known that the melting time of ice cream decreases as the amount of taro beneng inulin concentration added increases. This is due to inulin's ability to form gels and bind air. The gel structure formed binds air very tightly during the gelatinization process so that the ice cream becomes very thick and difficult to melt. Inulin's ability to bind air can form small ice crystals. Small ice crystals are able to prevent the melted liquid from falling down so that the melting time for the ice cream is longer (Hidayah et al, 2017).

Apart from that, the melting time of ice cream is directly proportional to the overrun value, the higher the overrun value, the faster the melting time of the ice cream. The trapped air cavities will come out as the ice cream melts, the more air cavities there are, the faster the ice cream will melt (Oksilia et al, 2012). This is thought to be due to the presence of fat globules in ice cream, the fat will melt at a temperature of 30-40^{o}C and lose its ability to bond with air cavities, causing the ice cream to melt easily (Mandari, 2020).

These results are in line with Satriani et al, (2018) and Zahro and Nisa (2015) who state that if the melting time of ice cream is related to the texture and viscosity of the mixture, the more air that is

bound due to the gel structure, the denser the ice cream will be and the melting time will be getting denser. the longer. Based on the research results of Istiqomah et al., (2017), the overrun value affects the melting time of ice cream, the higher the overrun value, the faster the melting time of ice cream.

Color

The color analysis aims to determine the effect of the treatment of adding taro beneng inulin and red dragon fruit peel extract on the color of ice cream. The color analysis carried out in this research was L*, a* and b* color testing. Statistically, the addition of taro beneng inulin and dragon fruit peel extract had a significant effect ($p < 0.05$) on the L* and a* values, and did not have a significant effect on the b* value.

The notation L* represents reflected light which produces achromatic colors white, gray, and black where the values are 0 (black) and 100 (white). The notation a denotes achromatic colors from red to green, values +a* values 0-80 for red and -a* values -80-0 for green. The notation b* represents the achromatic color blue-yellow, the value +b* from 0-70 for yellow and -b* from -70-0 for purplish.

The color test results are presented in Table 1. The L* notation color test states that reflected light produces white, gray and black achromatic colors where the values 0 (black) and 100 (white) indicate the brightness level of the ice cream. The results of the research showed that the highest average value of color analysis in L* notation was obtained by ice cream treated with the addition of 3% taro beneng inulin with 25% red dragon fruit peel extract with a value of 46.35 and the lowest average L* value was obtained by ice cream. treatment with the addition of 5% taro beneng inulin and 35% red dragon fruit peel extract with a value of 41.22. Based on Table 1, it is known that the more red dragon fruit peel extract is added, the L* value of ice cream decreases. This is thought to be due to the presence of anthocyanin pigments in the skin of red dragon fruit, which produces a deep reddish color. These results are in line with research by Wahyuni et al, (2018) on dry noodle products and Saati et al, (2017) on low-fat ice cream.

The color value notation a* tends to increase as more and more red dragon fruit peel extract is added. Red dragon fruit peel contains quite high anthocyanin pigments, anthocyanin pigments tend to be red in color, so the more fruit peel extract. the red dragon added, the color of the ice cream will be even more intense pink. The results of this study are supported by the results of Siwi's research (2018), the addition of 35 g of red dragon fruit skin extract resulted in the highest a value in jelly candy. Apart from that, in line with the research results of Pramana et al, (2016) and Wahyuni and Nugroho (2014) found that the intensity of the red color (a*) in noodles and cream increased as more concentrations of super red dragon fruit peel extract were added due to the presence of pigments. anthocyanins in super red dragon fruit skin.

Based on the results obtained, taro beneng inulin has an influence on the color a* value of ice cream. This is related to inulin's ability to form gel and bind water. In the process of making ice cream, inulin will bind water and form a gel and affect the overrun value in the dough. The overrun value affects the color of the ice cream produced, a high overrun value causes the color of the ice cream to fade, this happens because the expansion of the mixture will reduce the density of the color produced in the ice cream. However, if the ice cream overrun value is low, the ice cream color will be darker and the a* color value will be higher. This is supported by the research results of Istiqomah et al, (2017), the overrun value of ice cream affects the color brightness value, the higher the overrun value, the brighter the ice cream produces.

The -b* value shows the purplish blue achromatic color of the ice cream. Based on Table 1, it can be seen that the highest b* value was obtained in the treatment of adding 5% taro beneng inulin and 35% red dragon fruit peel extract to ice cream, amounting to -1.06. The lowest b* value was obtained from the addition of 3% taro beneng inulin and 25% red dragon fruit peel extract of -0.41. The more negative the b* value means the higher the level of purplish blue color in the ice cream. The b* value tends to increase as the concentration of red dragon fruit peel extract increases. This is thought to be because red dragon fruit skin contains anthocyanin pigments. Anthocyanin pigments have achromatic colors tending to red, purple, and blue. This is what causes the b* value for ice cream to get a negative value.

Fat Content

Fat in food plays a role in improving taste, aroma, crispness and forming texture (Satriani et al, 2018). The results of the fat content analysis are summarized in Table 1. The research results show that the fat content of ice cream does not meet the SNI 3713:2018 standard, namely a minimum of 5%. Increasing inulin taro beneng will decrease the fat content. The reduction in fat content in ice cream can occur because the fat source used (whipped cream) is substituted with taro beneng inulin. Replacing some of the fat sources in ice cream causes the fat content to decrease. Taro beneng inulin plays a role in improving the texture of ice cream because inulin has the ability to bind air and form a gel. Inulin can play a role in replacing fat physically but cannot replace fat chemically. The results of this research are in line with the research results of Satriani et al, (2018), starch has the ability to absorb air and form a strong gel so that it can improve the texture of low-fat ice cream. Based on the research results of Kriswanto, (2017) and Dewanti and Rahayuni (2013), increasing local flour and gembili inulin used as a fat substitute, the fat content in ice cream decreases, because some of the fat components in ice cream replaced with carbohydrates.

In addition, red dragon fruit peel extract also has an effect on reducing the fat content of ice cream. This is influenced by antioxidant compounds originating from the skin of red dragon fruit. The antioxidant compounds in red dragon fruit skin are polyphenols and flavonoids. Polyphenol and flavonoid compounds

can prevent the oxidation of fat into free fatty acids so that peroxide compounds will be reduced and inhibit the oxidation process in fat (Pramana et al. 2016). The results of this research are supported by the research results of Mukminah and Fathurohman (2019) which show that the addition of 10% red dragon fruit paste can significantly reduce the fat content of chicken sausages. Apart from that, based on the research results of Ekawati et al, (2015), the addition of 20% dragon fruit peel extract produces soybean juice and coconut milk which have the highest free fatty acids and the addition of 40% dragon fruit peel extract produces the lowest fatty acid levels.

Antioxidant

Antioxidant activity analysis used the DPPH method and absorption was measured using a spectrophotometer at a wavelength of 517 nm. The data table on the results of research on antioxidant activity can be seen in Table 1. The antioxidant activity of ice cream increases as the amount of red dragon fruit peel extract used increases. This happens because red dragon fruit skin contains natural antioxidants such as vitamin C, vitamin E, vitamin A, alkaloids, terpenoids, flavonoids, thiamine, niacin and polyphenols. According to Nizori et al, (2020), red dragon fruit skin contains greater antioxidants than the flesh of the fruit.

The antioxidant content in ice cream comes from red dragon fruit peel extract. The results of this research are in line with the research results of Waladi et al., (2015) which showed that there was an antioxidant activity of 15.26% in ice cream with the addition of 2% red dragon fruit skin. Based on the research results of Zahro and Nisa (2015), it shows that the increase in antioxidant activity is directly proportional to the increasing amount of grape juice added to ice cream. Grape juice contains natural antioxidants because it contains vitamin C, flavonoids and polyphenols.

Total Plate Count

The Total Plate Number (TPC) on a sample can be used as a reference for whether a product is suitable for consumption or not. The results of the TPC analysis are presented in Table 1. The number of number plates on ice cream tends to decrease as the amount of red dragon fruit peel extract added increases. The average TPC value of ice cream with the addition of 25% red dragon fruit peel extract was 4.63 log cfu/ml, the addition of 30% red dragon fruit peel extract was 4.55 log cfu/ml, and the addition of red dragon fruit peel extract was 30% is 35% of 4.51 log cfu/ml.

This is presumably due to the presence of antimicrobial compounds in red dragon fruit peels which are able to inhibit microbial growth in ice cream. According to Sari et al, (2021), Agustina et al, (2021), Zain (2019), Shinta and Hartono (2017), found that red dragon fruit skin has antibacterial abilities because it contains active compounds of flavonoids, alkaloids, and terpenoids. This active ingredient is effective in inhibiting the growth of gram-positive and gram-negative bacteria. The results of this study are supported by Ekawati et al, (2015), increasing the concentration of dragon fruit peel extract, will decrease the number of microbes in coconut milk and soy milk.

Sensory Characteristics

The sensory analysis carried out in this study was the hedonic organoleptic test. The hedonic test is a test to determine the level of panelists liking for a product. The hedonic test in this study was tested on 50 untrained panelists. The parameters tested were color, taste, aroma, texture, and overall, then the assessment criteria for each parameter was using a scale of 1-7 where 1 for strongly dislike, 2 for dislike, 3 for somewhat dislike, 4 for neutral, 5 for somewhat like, 6 for like, and 7 for like very much. The results of the hedonic organoleptic test are presented in Table 2.

Table 2. Result of Sensory Analysis

Sample	Parameters				
	Color	Taste	Flavor	Texture	Overall
A1B1	5.66	5,90	5.68	5.86	5.78
A1B2	5.92	5,86	5.50	5.86	5.64
A1B3	6.08	5,80	5.42	5.70	5.86
A2B1	5.62	5,80	5.38	5.62	5.88
A2B2	6.34	5,82	5.30	5,64	5,64
A2B3	6.02	5.78	5.34	5.66	5.52
A3B1	5.84	5.78	5.32	5.50	5.68
A3B2	5.96	5.80	5.42	5.34	5.64
A3B3	5.88	5.80	5.22	5.48	5.78

Note: A=TBI (Taro Beneng Inulin); B=RDFP (Red Dragon Fruit Peel)
A1B1 = 3%,25%; A1B2 = 3%,30%; A1B3 = 3%,35%; A2B1 = 4%,25%; A2B2 = 4%,30%; A2B3 = 4%,35%; A3B1 = 5%,25%; A3B2 = 5%,30%; A3B3 = 5%,35%

Color is the first impression judged by consumers. Color is the main parameter for determining the level of consumer interest visually (Umar et al, 2019). Data from the sensory analysis of the color of ice

cream shows that A2B2 ice cream has a superior value compared to other ice cream, namely with an assessment score of 6.34 (Like). Panelists preferred ice cream with the addition of 30% red dragon fruit peel extract compared to 25% and 35%. The level of preference for the color of ice cream is thought to be because red dragon fruit peel extract contains anthocyanin pigments which give ice cream an attractive red color. The results of this research are supported by the research results of Ekawati et al, (2015) that the more red dragon fruit peel extract added can increase the color preference value of soy milk and coconut milk, this happens because red dragon fruit peel contains anthocyanin pigments which give a red color. According to Handayani and Rahmawati (2012), red dragon fruit peel can be used as a natural coloring to replace synthetic coloring in food.

Taste parameter assessment ranged from 5.78-5.90 (rather like) and was included in the preferred category by the panelists. Based on the results of this research, it was found that inulin does not affect the taste of ice cream because taro beneng inulin has a neutral taste. The results of this study are supported by the results of Pratiwi et al (2018) research that commercial inulin has a neutral taste so it does not change the taste of ice cream. The results of this research are also in line with the research results of Ekawati et al, (2015) that the addition of red dragon fruit peel extract at various concentrations did not affect the taste of soy milk and coconut milk. Supported by the research results of Waladi et al, (2015), ice cream made with various concentrations of red dragon fruit peel extract was liked by the panelists and did not affect the taste of the ice cream produced.

The observed data for the aroma parameter is known to average from the results of the taste parameter assessment ranging from 5.68 to 5.22 (Rather like it). Based on the notes of 15 panelists, A1B1 ice cream has a stronger distinctive aroma of milk than A3B3 ice cream, because the percentage of added inulin taro beneng and red dragon fruit peel extract in A1B1 ice cream is less than in A3B3 ice cream, adding more whipped cream which causes A1B1 ice cream to have a more distinctive milk flavor than A3B3 ice cream. This is supported by the research results of Pratiwi et al, (2017), the use of dahlia tuber inulin affects the aroma of the ice cream produced, while the control ice cream has a milky aroma because it is not given treatment with the addition of dahlia tuber inulin and the basic ingredient used is milk so it has an aroma. milk in the ice cream.

The texture of ice cream is influenced by the ice crystals that form. The ice crystals that form are influenced by the ingredients used in making ice cream. According to Shoheh (2019), the softness of ice cream is influenced by the size of ice crystals, fat globules, trapped air bubbles and lactose crystals. Apart from being influenced by ice crystals, the texture is also influenced by the overrun value, the higher the overrun value, the softer the resulting ice cream texture. This happens because if the overrun value is low, more water molecules are bound to the ice cream mixture. These bound water molecules will freeze at low temperatures and make the ice cream have a hard texture. From the results of the study, A1B1 ice cream had the highest score of 5.86 and A3B3 ice cream scored the lowest score of 5.48. This happens because the overrun value of A1B1 ice cream is higher than the overrun value of A3B3. Because the overrun value is directly proportional to the texture of the ice cream produced, the higher the overrun value means that more air will enter and be trapped in the mixture, making the ice cream mixture fluffy and light so that the ice cream has a soft texture. The results of this study are in line with the results of research by Saputri et al, (2015), making ice cream made from 60% low-fat milk gets the lowest texture parameter assessment score because it has a hard texture.

The test results with the overall parameter in Table 2 can be seen and based on the results of the study it can be seen that the average panelists provide values for this parameter that range between 5.52 - 5.88 where the value is included in the preferred category. Based on the sensory test results, it is known that ice cream in this study is acceptable, the values obtained are between a scale of 5 and fall into the preferred category. This shows that the treatment of taro beneng inulin and red dragon fruit peel extract did not affect the overall assessment of ice cream, and overall the ice cream in this study was acceptable in the community.

The best product in this study was selected based on the results of the analysis, namely the lowest fat content of ice cream, the highest antioxidant activity analysis of ice cream, color analysis at the highest a* notation, and hedonic organoleptic analysis with an average assessment score obtained of at least 5 (somewhat like). Based on these criteria, A3B3 ice cream was obtained as the selected formula. A3B3 ice cream is a combination of adding 5% taro beneng inulin and 35% red dragon fruit peel extract. Then the proximate follow-up test was carried out on A3B3 ice cream.

The proximate analysis performed included moisture content, ash content, protein content, fat content, and carbohydrate content. The results of the proximate analysis of ice cream are presented in Table 3.

Table 3. Results of A3B3 Ice Cream Proximate Analysis

Parameters	Result (%)	SNI %	Criteria
moisture content	54,0	-	-
ash content	0,82	Max 3,0	Complied SNI 01-3713-1995
protein content	2,93	Min 2,7	Complied SNI 3713 : 2018
fat content	2,50	Min 5,0	Not Complied SNI 3713 : 2018
carbohydrate content	39,8	Min 8,0	Complied SNI 01-3713-1995

Based on the table above, the value that does not meet SNI standards is fat content. The fat content of A3B3 ice cream is 2.5% and has not reached the minimum requirement for ice cream in SNI 3713-2018 where the minimum requirement for ice cream fat content is 5%. Based on the results obtained, the fat content of A3B3 ice cream is classified as low-fat ice cream (Khairi, 2019). The low-fat content in A3B3 ice cream is caused by the use of inulin which is substituted for whipped cream which directly causes a decrease in the fat content of the ice cream.

Conclusion

The conclusion of this study was the addition of inulin to taro beneng 4% concentration has an influence on the overrun value, melting time, and fat content of ice cream. The addition of dragon fruit peel extract 30% red has an influence on the color of ice cream in the notation a*, fat content, antioxidant activity, and total plate number (TPC). A3B3 ice cream was chosen as the best formula based on the criteria of lowest fat content, highest antioxidant activity, highest a* notation, and having an average value of at least 5 (rather like) on all sensory parameters.

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