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Study of Proportions of Porang Slurry and Coconut Milk and the Addition of Podang Mango Fruit on the Physicochemical And Organoleptic Characteristics of Plant Based Ice Cream

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A B S T R A C T

This research aims to determine the effect of the substitution of coconut milk and porang tuber porridge and the addition of porang mango on the physicochemical and organoleptic quality of vegetable ice cream. The research used a Completely Randomized Design (CRD) with two factors and two replications. Data analysis using ANOVA was continued with the Duncan multiple range test (DMRT) at a confidence level of 5%. The first factor is the substitution of porang tuber slurry for coconut milk (10:90 (A1), 20:80 (A2), 30:70 (A3)). The second factor is the concentration of podang mango (15% (B1), 20% (B2), 25% (B3)). Parameters observed include protein content, overrun, melting speed, color analysis, total dissolved solids, viscosity, fat content, dietary fiber, vitamin C, and organoleptic analysis including texture, aroma, color, and taste. The results of the treatment of porang tuber slurry substitution for coconut milk and the concentration of porang mango had a significant effect on protein content, total solids, overrun, melting time, and viscosity. The best treat- 35.967%, melting time 17 minutes 54 seconds, overrun 26.110%, and viscosity 1388 mPa.s. The organoleptic analysis produced the best treatment with a texture value of 3.867, color of 3.800, taste of 3.333, and aroma of 3.500.

1. INTRODUCTION

1.1. Research Background

Ice cream is a solid food in a frozen form that is liked by many people, from children, teenagers, adults to the elderly. Ice cream is a dairy product that is made by freezing and mixing the raw ingredients. The ingredients used are a combination of milk with additional ingredients such as sugar and honey or without flavorings colors, and stabilizers, the ice cream mixture is called ice cream mix (ICM), by mixing the right ingredients and processing correctly, ice cream can be produced with good quality [1]. Milk contains fat, protein, lactose, vitamins and minerals, but some people are hesitant to consume milk and products derived from milk because of health awareness, avoiding saturated fat, cholesterol and lactose for people with lactose intolerance [2].

One ingredient that can replace milk fat is vegetable fat which comes from coconut milk because it has a chemical composition that is almost like cow's milk. Coconut milk is an oil-in-water emulsion obtained by squeezing the pulp of fresh coconut meat [3]. Coconut milk has the advantage of not having a fishy smell like fresh milk, besides not having a fishy smell, coconut milk is cheaper than milk, and coconut milk does not contain cholesterol like milk and other animal fats contain. However, coconut milk has a disadvantage, namely that it easily separates into a water phase and an oil phase due to damage to the emulsion.

Porang tubers (Amorphophallus oncophillus) contain quite high levels of glucomannan compared to other Amorphophallus varieties with levels reaching 15-65%. Porang sweet potato contains a lot of glucomannan and is known as Konjac Glucomannan (KGM). KGM is widely used as traditional food in Asia such as noodles, tofu and jelly. Konjac flour is also a healthy food from Japan known as konyaku. Some of the benefits of konjac flour or KGM are reducing blood cholesterol, speeding up the feeling of fullness so it is suitable for diet food and for diabetes sufferers, as a substitute for agar and gelatin [4].

The quality of ice cream is not only seen from the taste and texture. Therefore, Podang mango fruit is used as a fortifier to make the appearance of the ice cream more attractive. Mango fruit contains carotenoids which function as natural dyes. The special features of the Podang mango are mainly the attractive orange-red skin color, sweet fruit taste, sharp fruit aroma, fine fiber, and contains quite a lot of water so that it is suitable for both fresh and processed fruit [5]. Apart from having an attractive color and a sharp fruit aroma, Podang mangoes also contain lots of vitamins A and C and are believed to contain a source of cancer-fighting carotenoids called betacryptoxanthin [6]. Based on these conditions, this research is needed to determine the combination of substitution treatment of porang tuber slurry for coconut milk and the addition of podang mango on the characteristics of the resulting vegetable ice cream.

1.2. Research Objective

This research aims to determine the effect of substituting porang tuber slurry for coconut milk and adding podang mango on the physicochemical and organoleptic characteristics of vegetable ice cream..

2. MATERIALS AND METHODS

2.1. Material and Tools

The main ingredients used in this research are porang tubers, podang mango, coconut milk, concentrated H2SO4, Na2SO4-HgO, distilled water, NaOH-Na2SO3, HCl, 96% ethanol, zinc granules, boric acid, petroleum ether, phenol, methylene blue indicator , DPPH, methanol.

Tools used include ice cream maker, mixer, pan, refrigator, freezer, blender, stove, digital scale, filter cloth, basin, measuring cup, food thermometer, ice cream container/cup, spoon, kjeldahl, viscometer separating funnel, water bath , oven, porcelain cup, desiccator, Erlenmeyer, analytical balance, petridish dish, mortar, beaker glass, measuring cup, small plate, stopwatch, dropper pipette, centrifuge, volumetric pipette, vortex, spectrophotometer and questionnaire sheet.

2.2. Design Experiment and Analysis

The research design used in this study was a Completely Randomized Design (CRD) with 2 treatments and 2 replications. The treatment used was the substitution of porang tuber slurry for coconut milk (10:90, 20:80, 30:70) and the addition of podang mango (15%, 20%, 25%). The observation variable data was tested statistically using analysis of variance at α = 5% using the DMRT follow-up test.

Table 1. Plant based ice cream formulation

Substitute porang tuber slurry and coconut milk	Podang mango concentration		
	B1	**B2**	**B3**
A1	A1B1	A1B2	A1B3
A2	A2B1	A2B2	A2B3
A3	A3B1	A3B2	A3B3

Where:

A1B1 = Substitution of porang tubers and coconut milk (10:90), Podang mango concentration 15%
A1B2 = Substitution of porang tubers and coconut milk (10:90), Podang mango concentration 20%
A1B3 = Substitution of porang tubers and coconut milk (10:90), Podang mango concentration 25%
A2B1 = Substitution of porang tubers and coconut milk (20:80), Podang mango concentration 15%
A2B2 = Substitution of porang tubers and coconut milk (20:80), Podang mango concentration 20%
A2B3 = Substitution of porang tubers and coconut milk (20:80), Podang mango concentration 25%
A3B1 = Substitution of porang tubers and coconut milk (30:70), Podang mango concentration 15%
A3B2 = Substitution of porang tubers and coconut milk (30:70), Podang mango concentration 20%
A3B3 = Substitution of porang tubers and coconut milk (30:70), Podang mango concentration 25%

2.3. Implementation of Research

2.3.1. Making coconut milk

Making coconut milk begins with grating the flesh of the coconut fruit. Next, extracted with a ratio of coconut fruit and water which is 1: 3. After that, squeezing is done by hand, then filtering is done with a cloth.

2.3.2. Making porang tuber slurry

Making process slurry porang tubers are done by peeling porang tubers measuring 3-4 inches then washing the porang tuber slices with running water and draining them. The middle piece of porang is pierced with a fork then soaked in water that has been added with rubbing salt, soaked for 3-4 days with the water changed every day. After the porang is washed, to ensure that the calcium oxalate content is removed, the porang is soaked again in salt water and soaked for 2-3 days. After the soaking process, the porang is washed with running water until clean. Clean porang is steamed for 3 hours. The cooked porang tubers are then cooled, then crushed using a blender and water is added with a ratio of 1:2 porang tubers: water.

2.3.3. Making Podang mango slurry

Making process slurry Podang mango is done by peeling the mango, then separating the seeds and flesh. Then the separated podang mango flesh is ground using a blender to produce slurry podang mango fruit.

2.3.4. Making plant based ice cream

The process of making ice cream is done using tools Ice Cream Maker, with a ratio of coconut milk and slurry porang (10:90, 20:80, 30:70). Next added slurry podang mango (15%, 20%, 25%) and pasteurized to remove the microbes contained in the mixture. Next, the mixture was cooled to room temperature. Then it's done aging on refrigator at 4ºC for 12 hours. The next stage is to stir using Ice Cream Maker for 1 hour. To increase consumer appeal, ice cream is poured into ice cream cups and stored freezer for 4 hours so that the resulting texture gets better.

2.4. Observation

2.4.1. Physical analysis

Physical analysis parameters for vegetable ice cream include melting time, overrun, viscosity and total solids analysis.

2.4.2. Chemical analysis

Chemical analysis parameters for vegetable ice cream include protein content and fat content.

2.4.3. Sensory analysis

Organoleptic testing was carried out on vegetable ice cream samples. In this organoleptic test, 30 panelists assessed the color, taste, aroma, and texture of vegetable ice cream. The analysis is continued with an effectiveness index test to determine the best treatment based on physicochemical and organoleptic properties. Then the best treatment will be to analyze the levels of food fiber, vitamin C, and color capacity.

3. RESULT AND DISCUSSION

3.1. Physic analysis

Physical analysis of vegetable ice cream with the substitution of porang tuber slurry for coconut milk and the addition of podang mango consists of melting time, overrun, viscosity and total solids.

3.1.1. Melting time

Melting time is one of the important things in determining the quality of ice cream-based products. The results of the analysis of the melting time of vegetable ice cream with the substitution of porang tuber slurry for coconut milk and the addition of podang mango ranged from 15.43 to 19.37 minutes. The results of the melting time analysis can be seen in Table 2.

Based on the results of the analysis, it was found that the results of the porang tuber slurry treatment: 30:70 coconut milk and 25% podang mango produced the highest melting time, namely 19.37 minutes, while the porang tuber slurry treatment: 10:90 coconut milk and 15% podang mango produced the lowest melting time, namely 15.43 minutes. The higher the variation of coconut milk and porang tuber with mango podang added, the melting time for coconut milk vegetable ice cream increases.

Table 2. Physical analysis of plant-based ice cream

Physic Analysis	Treatment								
	A1B1	**A1B2**	**A1B3**	**A2B1**	**A2B2**	**A2B3**	**A3B1**	**A3B2**	**A3B3**
Melting time (minute)	15.43 ± 0.1^{a}	16.10 ± 0.1^{b}	16.21 ± 0.0^{b}	17.31 ± 0.0^{c}	17.54 ± 0.0^{d}	18.34 ± 0.0^{e}	18.46 ± 0.1^{e}	18.53 ± 0.1^{e}	19.37 ± 0.1^{f}
Overrun (%)	31.07 ± 0.0^{i}	30.16 ± 0.0^{h}	29.43 ± 0.0^{g}	26.50 ± 0.0^{f}	26.11 ± 0.0^{e}	25.78 ± 0.0^{d}	23.09 ± 0.0^{c}	22.54 ± 0.0^{b}	22.07 ± 0.0^{a}
Viscosity (%)	1012 ± 2.6^{a}	1096 ± 1.5^{b}	1124 ± 2.0^{c}	1323 ± 1.7^{d}	1388 ± 1.5^{e}	1405 ± 1.0^{f}	1685 ± 1.2^{g}	1767 ± 2.3^{h}	1924 ± 1.2^{i}
Total solids (%)	29.82 ± 0.0^{g}	31.55 ± 0.1^{h}	32.56 ± 0.0^{i}	35.54 ± 0.0^{d}	35.97 ± 0.0^{e}	36.36 ± 0.0^{f}	38.07 ± 0.0^{a}	38.32 ± 0.0^{b}	39.06 ± 0.1^{c}

The average value accompanied by different letters shows a significant difference at $p \leq 0.05$.

Porang tuber and podang mango slurry can function to improve the texture and slow down the melting of vegetable ice cream due to increasing total solids and viscosity so that it can increase the melt resistance of vegetable ice cream products. The addition of porang tuber slurry and podang mango in vegetable ice cream can slow down the melting of vegetable ice cream, increase viscosity, and 52 reduce swelling. This is supported by the statement [7], that the starch content as a source of high carbohydrates found in wild cassava flour can also influence the melting speed because it plays a role in binding water so that the ice cream is more resistant to melting.

The melting time resulting from this research meets SNI 01-3713-1995 which states that the good melting range for ice cream is 15-25 minutes.

3.1.2. Overrun

Overrun is an important property of ice cream, namely its ability to expand from the original ice cream mixture. The results of the overrun analysis of vegetable ice cream with the substitution of porang tuber slurry for coconut milk and the addition of podang mango ranged from 22.07 to 31.07%. The results of the overrun analysis can be seen in Table 2.

Based on the analysis results, it was found that the porang tuber slurry treatment: 10:90 coconut milk and 15% podang mango produced the highest overrun, namely 31.07%, while the porang tuber slurry treatment: 30:70 coconut milk and 25% podang mango produced the lowest overrun, namely 22.07%. . The greater the addition of coconut milk and the decreasing number of added porang tubers, the resulting overrun value will increase.

The increasing number of porang tubers is added, followed by the increasing addition of podang mango, so the vegetable ice cream will become thicker and the viscosity will be higher, so the overrun will be lower. Porang tubers and podang mangoes can reduce the overrun value in vegetable ice cream because porang tubers and podang mangoes which act as non-fat solids as alternatives to skim milk can increase the viscosity which causes less air phase to be trapped in the vegetable ice cream mixture, so the value overrun decreases. Increasing viscosity will increase surface tension which makes it difficult for air to penetrate the surface resulting in lower overrun. This is following [8], increasing the viscosity of vegetable ice cream will reduce overrun as the concentration of stabilizer increases. High viscosity will reduce air entering the vegetable ice cream mixture or Ice Cream Mix (ICM) during foaming.

3.1.3. Viscosity

The results of the viscosity analysis of vegetable ice cream with the substitution treatment of porang tuber slurry for coconut milk and the addition of podang mango ranged from 1012 to 1924%. The results of the viscosity analysis can be seen in Table 2.

Based on the results of the analysis, it was found that the results of the porang tuber slurry treatment: 30:70 coconut milk

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and 25% podang mango produced the highest viscosity, namely 1924%, while the porang tuber slurry treatment: 10:90 coconut milk and 15% podang mango produced the lowest viscosity, namely 1012% . The lower the amount of coconut milk added and the more porang tubers added, the higher the viscosity value. The addition of podang mango can also affect the viscosity value of vegetable ice cream because it can increase the total solids so that the viscosity increases which results in the overrun value decreasing. Viscosity is a physical characteristic of vegetable ice cream that has a major influence on general sensory quality and on texture assessment.

The addition of porang tubers and podang mangoes can increase the viscosity value of coconut milk vegetable ice cream because porang tubers and podang mangoes will be counted as solids which will increase the viscosity of the vegetable ice cream mixture because during the mixing process, the presence of porang tubers and podang mangoes affects the mixture's viscosity and homogeneity. . Increasing viscosity will increase surface tension which makes it difficult for air to penetrate the surface resulting in lower overrun.

3.1.4. Total solids

The results of the analysis of the total solids of vegetable ice cream with the substitution treatment of porang tuber slurry for coconut milk and the addition of podang mango ranged from 29.82 to 39.06%. The results of the total solids analysis can be seen in Table 2.

Based on the results of the analysis, it was found that the results of the porang tuber slurry treatment: 30:70 coconut milk and 25% podang mango produced the highest viscosity, namely 39.06%, while the porang tuber slurry treatment: 10:90 coconut milk and 15% podang mango produced the lowest viscosity, namely 29.82% . The lower the amount of coconut milk and the more porang tubers added, the greater the total solids. The addition of podang mango also has a good contribution in increasing the total solids of vegetable ice cream products.

The addition of porang tubers and podang mango is a good combination that can increase total solids, because the higher the total solids, the higher the viscosity and the lower the overrun, this can produce a soft vegetable ice cream texture. Porang tubers and podang mangoes together contribute to increasing the total solids, so the higher the porang tubers and podang mangoes added, the higher the total solids produced, besides the addition of coconut milk can also contribute to the total amount of solids in vegetable ice cream. This is because coconut milk contains high fat in the vegetable ice cream emulsion so it can increase total solids. Fat is a component that can be calculated as total solids, because total solids are all the components that make up vegetable ice cream minus the water content. Meanwhile, porang tubers and podang mangoes produce slurry and porang tubers undergo a starch gelatinization process during the cooking process which can increase the thickness or viscosity of the dough so that it can increase total solids.

In this research, the alternative non-fat solids used in vegetable ice cream products are porang tubers and podang mango, so that the total solids obtained from coconut milk vegetable ice cream meet the SNI (Indonesian National Standard) standard for commercial ice cream, namely a minimum of 34%. . The total solids value of vegetable ice cream is in accordance with the European Patent Specification (EP 0 157 873 B1) which states that the total solids value of vegetable ice cream is 10% -13%.

3.2. Chemical analysis

Chemical analysis of vegetable ice cream consists of protein content and fat content.

3.2.1. Protein content

The results of the analysis of the protein content of vegetable ice cream with the substitution of porang tuber slurry for coconut milk and the addition of podang mango ranged from 3.68 to 4.12%. The results of the protein content analysis can be seen in Table 3.

Based on the results of the analysis, it was found that the results of the porang tuber slurry treatment: 30:70 coconut milk and 25% podang mango produced the highest protein content, namely 4.12%, while the porang tuber slurry treatment: 10:90 coconut milk and 15% podang mango produced the lowest protein content, namely 3.68%. The protein content of the raw material obtained from coconut milk is 1.90%, the protein content of porang tubers is 3.51%, and podang mango is 0.47% which can affect the protein content value of ice cream.

The greater the addition of coconut milk and the decrease in the number of added porang tubers, the more protein levels produced will decrease. Reducing the number of porang tubers added can affect the reduction in protein levels. This is caused by porang tubers which have quite a big influence on the protein content of vegetable ice cream products, this is because porang tubers have greater protein content than coconut milk and podang mango.

Table 3. Chemical analysis of plant-based ice cream

Chemical analysis	Treatment								
	A1B1	**A1B2**	**A1B3**	**A2B1**	**A2B2**	**A2B3**	**A3B1**	**A3B2**	**A3B3**
Protein content (%)	3.68 ± 0.0^{a}	3.77 ± 0.0^{b}	3.88 ± 0.0^{c}	4.02 ± 0.0^{d}	4.02 ± 0.0^{e}	4.03 ± 0.0^{f}	4.09 ± 0.0^{g}	4.10 ± 0.0^{h}	4.12 ± 0.0^{i}
Fat content (%)	6.18 ± 0.0^{a}	6.26 ± 0.0^{a}	6.30 ± 0.0^{a}	5.21 ± 0.0^{b}	5.23 ± 0.0^{b}	5.26 ± 0.0^{b}	3.99 ± 0.0^{c}	4.34 ± 0.6^{c}	4.34 ± 0.6^{c}

The average value accompanied by different letters shows a significant difference at $p \leq 0.05$.

3.2.2. Fat content

Based on the results of the analysis, it can be seen that there is no significant interaction ($p \geq 0.05$) between the substitution of porang tuber slurry for coconut milk and the addition of podang mango. However, the treatment with the substitution of porang tuber slurry for coconut milk had a significant effect on the fat content produced, whereas the treatment with the addition of podang mango did not. The results of the analysis of the fat content of vegetable ice cream can be seen in Table 3.

The greater the addition of coconut milk and the smaller the addition of porang tubers, the greater the fat content produced, this is because coconut milk has the highest fat content between porang tubers and podang mango, so the difference in the

amount of added coconut milk can affect the fat content significantly. The fat content of coconut milk is 19.67%, porang tubers 0.22%, mango podang 0.31%.

The addition of podang mango to making vegetable ice cream does not have a significant difference. This is caused by the podang mango which only has a fat content of 0.27g in a 100g sample of podang mango, so the more podang mango is added, the value of the fat content of vegetable ice cream products does not have a significant difference.

3.3. Sensory analysis

To determine the effect of tuber slurry substitution treatment for coconut milk and the addition of podang mango on the sensory properties of vegetable ice cream was done by distributing questionnaires to 30 panelists using the hedonic test method.

Table 4. Average hedonic test for sensory attributes of plant-based ice cream

Treatment	Color	Aroma	Taste	Texture
A1B1	3.0 ± 1.0	3.9 ± 0.6	3.3 ± 1.2	3.7 ± 0.9
A1B2	3.2 ± 1.1	3.6 ± 0.9	3.2 ± 1.0	3.3 ± 0.9
A1B3	3.4 ± 1.1	3.7 ± 0.9	3.1 ± 1.0	3.6 ± 1.0
A2B1	3.5 ± 1.0	3.6 ± 0.8	3.8 ± 0.9	3.6 ± 0.9
A2B2	3.5 ± 1.0	3.8 ± 0.8	3.3 ± 0.9	3.9 ± 0.7
A2B3	3.5 ± 1.0	3.5 ± 0.8	3.4 ± 1.0	3.5 ± 0.8
A3B1	4.0 ± 1.1	3.7 ± 1.0	3.4 ± 1.2	3.7 ± 0.7
A3B2	3.7 ± 1.2	3.5 ± 0.9	3.3 ± 0.9	3.7 ± 0.8
A3B3	3.6 ± 1.2	3.6 ± 1.0	3.3 ± 1.0	3.6 ± 1.0

From Table 4 it is known that the color of vegetable ice cream has an average value range of 3.0 to 4.0. The average score obtained from the color hedonic test on coconut milk vegetable ice cream shows that the results do not have a significant difference or are not significantly different. This is caused by the podang mango which has a yellow color and the porang tubers and coconut milk which have a white, milky color, so the color of the vegetable ice cream produced comes from the addition of the podang mango. The addition of podang mango with a concentration that is not too significant does not cause too striking a color difference. Meanwhile, coconut milk and porang tubers have a milky white color, so they do not affect the color produced by the podang mango. In this study, the color of vegetable ice cream produced a bright yellow color.

From Table 4 it is known that the aroma of vegetable ice cream has an average value range of 3.5 to 3.9. The average score obtained from the hedonic aroma test for coconut milk vegetable ice cream shows that the results do not have a significant difference or are not significantly different. The panelists' assessment of the aroma of coconut milk vegetable ice cream was based on the distinctive aroma obtained from podang mango. The aroma produced based on the panelists' assessment is also obtained from the typical coconut aroma obtained from coconut milk. Meanwhile, the addition of porang tubers does not have a real effect on the aroma of coconut milk vegetable ice cream because porang tubers are a type of tuber that does not produce aroma/odor. The aroma of each treatment tends to have the same value and is liked by the panelists because the combination of the fragrant aroma of Podang mango and the savory coconut aroma from coconut milk is delicious so it can attract interest when consuming it.

From Table 4 it is known that the taste of vegetable ice cream has an average value range of 3.1 to 3.8. The average score obtained from the hedonic taste test for coconut milk vegetable ice cream shows that the results are significant or significantly different. The taste of coconut milk vegetable ice cream is dominated by the taste of coconut and a slightly sweet taste from the podang mango, as well as the distinctive taste produced by the porang tuber. The addition of the concentration of podang mango affects the taste produced in each treatment because podang mango gives a distinctive taste and can give a creamy impression. Meanwhile, the addition of porang tubers to coconut milk vegetable ice cream does not have a significant effect on the taste, because porang tubers are a type of tuber that has a sweet taste and a fibrous texture. So the taste produced in coconut milk vegetable ice cream is dominated by the coconut flavor from the coconut milk and the sweet taste from the podang mango.

From Table 4 it is known that the texture of vegetable ice cream has an average value range of 3.3 to 3.7. The desired texture of vegetable ice cream is soft and has the appearance of creaminess (like a condition where it is rich in fat). The soft texture is also influenced by the ingredients mixed, processing, and storage. The texture of vegetable ice cream depends on the size, shape, and size of the solid particles that make up the vegetable ice cream. The ideal texture for vegetable ice cream is a very smooth texture and the solid particle size is so small that it is not detectable in the mouth [9]. The difference in the assessment of the texture of coconut milk vegetable ice cream is due to the large fat content in vegetable ice cream causing the texture to be better and more resistant to the melting process due to the presence of fat globules which can capture water and air during agitation, thereby increasing the overrun. the texture of vegetable ice cream is light and soft. Meanwhile, the addition of porang tubers which contain starch will help bind a certain amount of free water so that the vegetable ice cream becomes thicker and not runny, and can control the growth of ice crystals so that the texture of the vegetable ice cream is relatively softer and not rough.

Based on the results of the effectiveness index test on the physicochemical and organoleptic characteristics of vegetable ice cream, the best treatment results were obtained by substituting porang tuber slurry for 30:70% coconut milk and adding 15% podang mango. The best treatment results were then continued with testing of food fiber content, vitamin C and color capacity. Based on the results of the analysis of food fiber content, the best treatment of vegetable ice cream is 4.38%. The dietary fiber content of vegetable ice cream is influenced by the raw materials and ingredients used, namely porang tubers which are high in fiber [10]. The vitamin C content in the best-treated product in this study was 26.27%. The vitamin C levels in the product are produced from the addition of podang mango. The results of research [11] showed that the highest level of vitamin C in podang mango was 1.086 g/100 g of fruit. The color capacities of the best treatment ice cream were lightness 64.60, redness 47.70, and yellowness 79.21. Color testing is carried out using a color reader. This tool differentiates the color of coconut milk vegetable ice cream products based on three values, namely lightness or brightness, redness or level of redness, and yellowness value or level of yellowness. The higher the lightness value, the brighter it is, the higher the redness value, the redder it is, and the higher the yellowness value, the more

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yellow it is [12]. Based on the table above, it can be seen that the lightness value for the coconut milk vegetable ice cream product is 49.0. The yellowness value ranges from 0-100. A value of 0 means dark, while a value of 100 means bright. The higher the yellowness value, the yellower the color of the vegetable ice cream product produced. This shows that the level of yellowness of the coconut milk vegetable ice cream is obtained from the podang mango. The yellow color produced by coconut milk vegetable ice cream is caused by the anthocyanin content of the podang mango.

4. CONCLUSION

There was a real interaction between the substitution treatment of porang tuber slurry for coconut milk and the addition of podang mango on protein levels, total solids, overrun, melting time, and viscosity of vegetable ice cream. The best treatment in this study was vegetable ice cream with the substitution of porang tuber slurry for coconut milk (30:70%) and the addition of podang mango (15%) with a protein content of 4.09%, fat content of 3.99%, the dietary fiber content of 4.38%, vitamin C 26.27%, melting time 18.46 minutes, overrun 23.09%, viscosity 1685%, total solids 38.07%, lightness 64.60, redness 47.70, yellowness 79.21, and average hedonic value of color 4.0, aroma 3.67, taste 3.4, and texture 3.7.

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