Physical and Chemistry Characteristics of Ice Cream with Additional Bitter Melon Puree

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ARTICLE INFO	ABSTRACT

Ice cream made from added with bitter melon puree it is hoped will get a unique taste. The processing of this ice cream utilizes the abundant yield of bitter melon from an area. This study aims to examine the chemical properties (vitamin C, and β-carotene) and physical properties (viscosity, overrun, and melting power). The type of research used is experimental research. The design in this study used a completely randomized design (CRD) with one treatment, namely the addition of bitter melon puree with three percentages (50%, 40%, 30%). The data obtained were then analyzed using the ANOVA method if there was a difference followed by DMRT. There are significant differences in vitamin C levels, β-carotene levels, viscosity, overrun value, and melting power. The highest levels of vitamin C were found in the addition of bitter melon puree by 50%, the highest β-carotene levels were found in the addition of bitter melon puree by 50%, viscosity was found in the addition of bitter melon puree by 50%, the highest overrun value was found in the addition of bitter melon puree by 50%, and the highest melting power was found in the addition of bitter melon puree by 50%. The conclusion obtained from this study is that the addition of more bitter melon puree will increase levels of vitamin C, β-carotene levels, viscosity, overrun, and melting power.

I. Introduction

The bitter melon (*Momordica charantia* L.) fruit is categorized as a fruit vegetable that grows and thrives in Indonesia. This *Momordica charantia* L. richs in phytochemistry compound and an bioactive agent in dietary regimens to prevent different maladies. Brief about the bitter melon, it is used as a vegetable in many countries but since time immemorial, it is also used for administration of numerous ailments comprising ulcer, diabetes mellitus, and inflammation, etc (Saeed, 2018). Bitter melon is a powerful nutrient-dense plant composed of a complex array of beneficial compounds. These include bioactive chemicals, vitamins, minerals and antioxidants which all contribute to its remarkable versatility in treating a wide range of illnesses. The fruits contain high amounts of vitamin C, vitamin A, vitamin E, vitamins B1, B2 and B3, as well as vitamin B9 (folate). The fruit is also rich in minerals including potassium, calcium, zinc, magnesium, phosphorus and iron, and is a good source of dietary fiber (bitter melon "monograph", 2008). Medicinal value of bitter melon has been attributed to its high antioxidant properties due in part to phenols, flavonoids, isoflavones, terpenes, anthroquinones, and glucosinolates, all of which confer a bitter taste (Snee, 2011).

Several investigational reports suggest that bitter melon can reduce body weight in high-fat diet-induced obesity in laboratory animals. Bitter melon (0.75% of diet) supplementation prevented the body weight gain and visceral fat mass significantly in rats fed a high-fat diet (Chen et al., 2005). Moreover, the bitter melon extract supplementation reduced the peritoneal fat deposition in rats fed a high-fat diet (Chen et al., 2005). In another study, bitter melon significantly decreased the weights of epididymal white adipose tissue (WAT), visceral fat, and the adipose leptin and resistin mRNA levels in C57BL / 6J mice fed with a high-fat (HF) diet (Shih et al., 2008). Bano et al. reported that a 2 mL/day dose of aqueous extract of bitter melon significantly reduced body weight gain in rats (Bano,

2011). A recent study also showed that the seed oil supplementation of the plant reduced body weight and fat mass in mice fed a high-fat diet (Chen et al., 2012).

The production of bitter melon fruit in Indonesia is very abundant, but its use is still not utilized, and the processing scale is relatively small. *Momordica charantia* L is a plant that has the potential to be developed because it contains a high nutritional value, including vitamin C, β-carotene (provitamin A), as well as minerals such as potassium, calcium, phosphorus, and iron (Astawan, 2009). Vitamin C belongs to the category of vitamins that are very susceptible to damage. Besides being very soluble in water, vitamin C is susceptible to being oxidized and this oxidation is accelerated by heat, light, alkalis, enzymes, oxidizing agents, as well as by copper and iron catalysts. Therefore, so that vitamin C is not wasted much, it is better to reduce excessive cutting and crushing (Winarno, 2004). A 100 grams of bitter melon contains 2.9 grams of soluble fiber, 55.6 mg of vitamin C, 0.2 grams of fat, 1.4 iron, and 34 kcal calories. There is an opportunity to process bitter melon into various products such as ice cream because bitter melon contains $1.41 + 0.05\%$ pectin which is useful as a stabilizer in making ice cream.

By definition "ice cream is a liquid mixture that turns into a paste after simultaneously shaking and cooling" (Corvitto, 2011), although the definition of ice cream varies from country to country due to differing regulations and traditions of composition (Clarke, 2012). In the ice cream mix that will become ice cream are so many elements of different nature as sugars, fats, dairy, stabilizer, water, among others. They all have to be correctly blended and emulsified together so there is nothing left behind that may reduce the quality of the final product. Making this possible considering the characteristics and properties of each ingredient and interactions between them is what is known as the balancing exercise. It can be made stable and spreadable at minus temperatures from -11 to $-18°C$ (standard ice cream serving temperatures) (Fiol, 2017). In the manufacturing of ice cream, the cooling method is used as factor to maintain the chemical properties of the bitter melon puree, and the application of coconut milk as the main ingredient in ice cream can reduce the bitter taste of the bitter melon. Based on that background, it will examine the effect of addition bitter melon puree on the physical and chemical characteristics of the ice cream. The purpose of this study was to analyze the effect of addition bitter melon puree by percentage of 50%, 40%, and 30% on differences in levels of vitamin C, β-carotene, viscosity, overrun, and melting power of ice cream.

II. Methods

The research conducted belongs to experimental research. This study used a completely randomized design (CRD). The research design can be seen in Table 1. The basic formulation of ice cream (Vadila, 2018) is used as the basis for the formulation used in the research test with the addition of bitter melon puree by 50%, 40%, 30%. The test formulation of ice cream bitter melon puree can be seen in Table 2.

The first stage is to make bitter melon puree by processing it (Fig.1). *Washing*, 500 grams of bitter melon which has been cut, washed with 20 grams of salt, for 2 minutes. *Blanching*, bitter melon that has been cleaned is boiled briefly using the Hot Water Blanching method at a temperature of 85°C for 3 minutes and added with 100gr *ampo* (clay) for 500 grams of bitter melon and 1 liter of water. *Cooling*, bitter melon that has been boiled then drained and cooled to a temperature of 30°C for 5 minutes. *Destruction*, booled bitter melon put in a blender then mash for 3 minutes until it becomes puree.

Table 1. Research Design

Repetition	Treatment		
	A1	A2	A3
P1	A1P1	A2P1	A3P1
P2	A1P2	A2P2	A3P2

Information: A1: ice cream with the addition of bitter melon puree by 30%
                   A2: ice cream with the addition of bitter melon puree by 40%
                   A3: ice cream with the addition of bitter melon puree by 50%
                   P1: Repetition 1
                   P2: Repetition 2

Table 2. Ice Cream Bitter Melon Puree Formulation

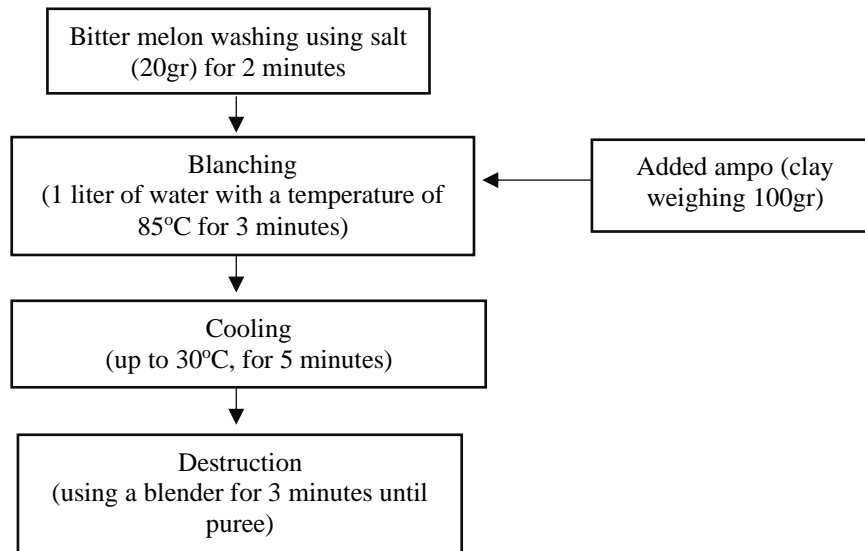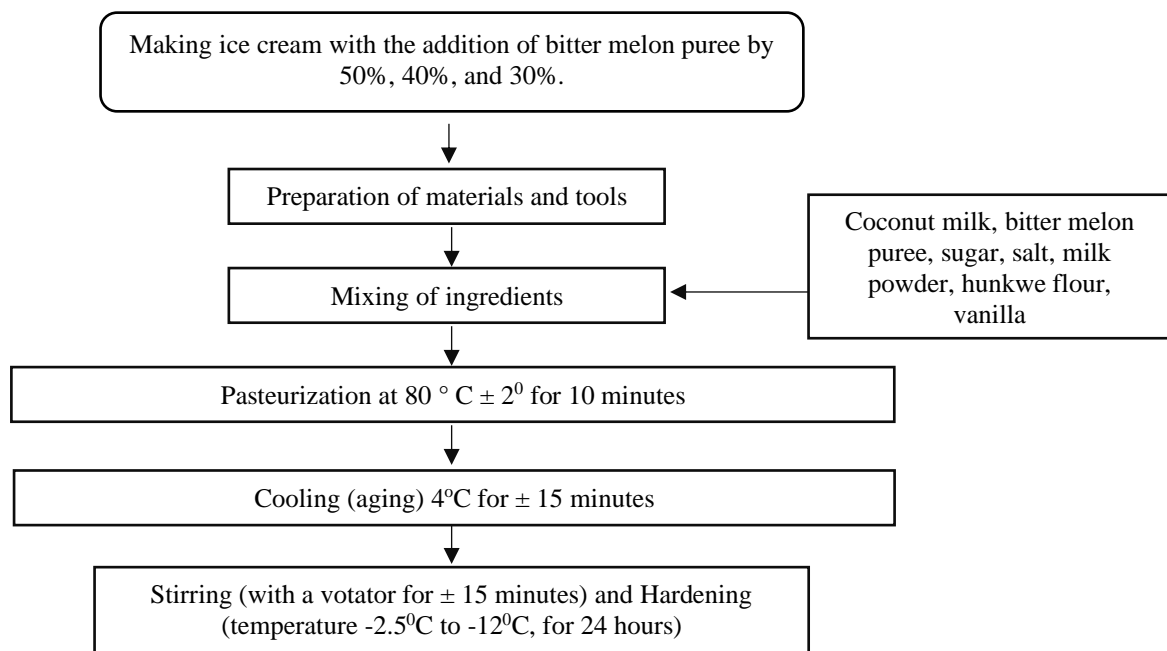| Material	Basic Formula	Trial 1 30%	Trial 2 40%	Trial 3 50%
Coconut milk	500 ml	500 ml	500 ml	500 ml
Bitter Melon Puree	-	150 ml	200 ml	250 ml
Sugar	375 gr	375 gr	375 gr	375 gr
salt	3 gr	3 gr	3 gr	3 gr
milk powder	27 gr	27 gr	27 gr	27 gr
hunkwe flour	30 gr	30 gr	30 gr	30 gr
vanilla	1 gr	1 gr	1 gr	1 gr

Fig. 1.Flowchart of Making Bitter Melon Puree.

Fig. 2. Flowchart of Making Ice Cream Bitter Melon Puree with Addition of Bitter Melon Puree by 50%, 40%, 30%.

At the stage after making the bitter melon puree, other ingredients are prepared to make the ice cream bitter melon puree with the addition of a different bitter melon puree. The ingredients are measured according to the formula set out in Table 2. The processing process starts after all the ingredients are weighed according to the predetermined recipe. Weighing is done to avoid unsuitable results because the ingredients are not weighed according to size (Fig.2). 1) Preparation of Materials

and Tools, material preparation in the form of weighing materials and preparing tools; All ingredients that have been weighed are put on the work table thereby reducing processing time. 2) Material Mixing, the weighed material is followed by mixing. Mixing is done so that the ingredients are mixed evenly by using a tool such as a blender; 3) Heating (Pasteurization), the mixed dough is then heated or pasteurized at about 80°C for 10 minutes to kill microbes and prevent contamination; 4) Aging (cooling), the next process is the aging process (cooling) using ice cubes at a temperature of 4oC for ± 15 minutes. This process aims to form a combination of a stabilizer and water in the dough so that the dough becomes more stable, thicker, and smoother. The dough aging process is stirred continuously; 5) Stirring, after the aging process, then stirring in the votator for ± 15 minutes, before freezing in the freezer at -15oC for 24 hours. The goal is to obtain small ice crystals and a soft texture; 6) Hardening, the ice cream dough that freezes in the container is then frozen in the refrigerator with a temperature of -2.5°C to -12°C, for about 24 hours. This process aims to make the ice cream firm and not easily melt. The ice cream dough that freezes in the container is then frozen in the refrigerator with a temperature of -2.5°C to -12°C, for about 24 hours. This process aims to make the ice cream firm and not easily melt.

Analysis of the chemical properties of vitamin C was carried out using the Iodometric method. β-carotene was analyzed using the Spectrophotometric method. Analysis of the physical properties of Overrun by measuring the ice cream container that has a certain size is weighed, for example, a container that has a volume of 100ml. ICM was added until the volume reached 100 ml, then weighed. ICM that has been processed using a votator is then put in a container, after which the ice cream surface is leveled so that the freezing volume remains 100 ml (Idris, 2003). Viscosity calculations were performed using the Brookfield Viscometer. Measurement of melting power or melting time is carried out on ice cream that has been hardened within 24 hours. The melting time is measured as follows: as much as 100 grams of ice cream is placed into a filter placed on top of the container, then allowed to melt at room temperature around 27°C.

In this study, the data obtained were chemical analysis data including vitamin C and β-carotene, and physical properties including viscosity, overrun, and melting power. The data obtained were analyzed using ANOVA (Analysis of Variance) if from the analysis Fcount> Ftable (there is a significant difference) then it is followed up with the DMRT (Duncan Multiple Range Test) tests to determine the level of influence on each treatment.

III. Results and Discussion

A. *Chemical Quality Test Results of Ice Cream Bitter Melon Puree (Vitamin C)*

The results of the analysis of the vitamin C content of ice cream bitter melon puree with different comparisons can be seen in Table 3. Based on Table 3, the average content of vitamin C in ice cream bitter melon puree is 11.215 to 25.942. The highest vitamin C content with an average of 25,942 was obtained from ice cream bitter melon puree with the addition of bitter melon puree by 50%. The data on vitamin C content that had been obtained were then analyzed using ANOVA. ANOVA results of vitamin C content of ice cream bitter melon puree can be seen in Table 4.

Table 3. Results of Vitamin C Analysis of Ice Cream Bitter Melon Puree

Type of Formula	Repetition	Vitamin C content (gram / 100 gram)	Average (gram / 100 gram)
A1 (30%)	1	10,994	11,215
	2	11,436	
A2 (40%)	1	18.023	18,468
	2	18.912	
A3 (50%)	1	25,065	25,942
	2	26,819	

A1: ice cream with the addition of bitter melon puree by 30%
A2: ice cream with the addition of bitter melon puree by 40%
A3: ice cream with the addition of bitter melon puree by 50%

Table 4. ANOVA Analysis Results of Vitamin C Content of Ice Cream Bitter Melon Puree

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	216,901	2	108,450	160,185	.001
Within Groups	2,031	3	,677		
Total	218,932	5			

The results of ANOVA data from the vitamin C content of ice cream bitter melon puree show a significance value of 0.001 <0.05 at the 5% significance level. This data shows that there is a significant difference in the vitamin C content of bitter melon puree with the addition of different bitter melon purees. Furthermore, followed by the DMRT (Duncan's Multiple Range Test) to determine the level of differences in the vitamin C content of ice cream bitter melon puree, the results of the DMRT test can be seen in Table 5.

Table 5. DMRT Results for Vitamin C in Ice Cream Bitter Melon Puree

	N	1	2	3
A1	2	11,2150		
A2	2		18,4675	
A3	2			25,9420
Sig.		1,000	1,000	1,000

Means for groups in homogeneous subsets are displayed
a. Uses Harmonic Mean Sample Size = 2,000

The DMRT test results in Table 5 show that the vitamin C content of bitter melon puree A1 is significantly different from A2, the content of vitamin C A1 is significantly different from A 3, and the content of vitamin C A2 is significantly different from A3.

The results showed that the addition of ice cream bitter melon puree was 30%, 40%, 50% significantly affected vitamin C. The average vitamin C level increased with the increasing concentration of bitter melon puree added to the ice cream. The results of the ANOVA test for the content of vitamin C in ice cream bitter melon puree showed that the highest average was found in ice cream with the addition of bitter melon puree by 50% with an amount of 25.942 (mg / 100 g), while the lowest average of vitamin C was found in ice cream with the addition of bitter melon puree amounted to 30% with the amount of 11,215 (mg / 100 g).

According to Winarno (2004), 100 grams of bitter melon contain vitamin C levels of 55.6 mg. Vitamin C is classified as a water-soluble vitamin, easily oxidized and the oxidation process is accelerated by heat, light, alkalis, enzymes, oxidizing agents, and by copper and iron catalysts (Almatsier, 2009).

B. β-carotene

The results of the β-carotene analysis of bitter melon puree with the addition of different bitter melon purees can be seen in Table 6. Based on Table 6, the average β-carotene ice cream bitter melon puree ranges from 92.345 to 150.736. The highest β-carotene with an average of 150,736 was obtained from the ice cream bitter melon puree with the addition of bitter melon puree by 50%. The β-carotene data that has been obtained was then analyzed using ANOVA. The ANOVA results of β-carotene ice cream bitter melon puree can be seen in Table 7.

Table 6. Results of the β-carotene content analysis of Ice Cream Bitter Melon Puree

Type of Formula	Repetition	B-carotene content (gram / 100 gram)	Average (gram / 100 gram)
A1 (30%)	1	90,537	92,345
	2	94,153	
A2 (40%)	1	121,164	123,354
	2	125,543	
A3 (50%)	1	149,295	150,736
	2	152,177	

Table 7. ANOVA analysis results for the β-carotene content of Ice Cream Bitter Melon Puree

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3413,892	2	1706,946	252,525	.000
Within Groups	20,279	3	6,760		
Total	3434,170	5			

The results of ANOVA analysis of the β-carotene content of ice cream bitter melon puree in table 7 show a significance value of 0.000 <0.05 at the 5% significance level. These results indicate that there is a significant difference in the β-carotene content of ice cream bitter melon puree with the addition of different bitter melon puree. Furthermore, followed by the DMRT (Duncan's Multiple Range Test) to determine the level of differences in β-carotene content ice cream bitter melon puree, the results of the DMRT test can be seen in Table 8.

Table 8. DMRT Results for β-carotene content of Ice Cream Bitter Melon Puree

	N	1	2	3
A1	2	92,3450		
A2	2		123,3535	
A3	2			150,7360
Sig.		1,000	1,000	1,000

Means for groups in homogeneous subsets are displayed
a. Uses Harmonic Mean Sample Size = 2,000

The DMRT test results in Table 8 show that the β-carotene content of ice cream bitter melon puree is significantly different from A2, the content of β-carotene A1 is significantly different from A3, and the β-carotene content of A2 is significantly different from A3.

The results obtained showed that the addition of ice cream bitter melon puree was 30%, 40%, 50% significantly affected β-carotene levels. The results of the β-carotene test on ice cream bitter melon puree show that the highest average was found in the addition of bitter melon puree by 50% with an amount of 150.736 (mg / 100 g) while the lowest average of the β-carotene test results was found in the addition of bitter melon puree by 30% with total 92,345 (mg / 100 g). The average β-carotene content increased with the increasing concentration of bitter melon puree that was added to the ice cream. There are double bonds in the chemical structure of β-carotene, causing this compound to be sensitive to oxidation reactions when exposed to air, light, peroxides, and heat during the processing (Astawan, 2009).

C. Physical Quality Test Results of Ice Cream Bitter Melon Puree (Viscosity)

The results of the viscosity analysis of ice cream bitter melon puree with the addition of different bitter melon purees can be seen in Table 9. Based on Table 9, the average viscosity of ice cream bitter melon puree ranges from 8425 to 11737.5. The highest viscosity with an average of 11737.5 was obtained from the ice cream bitter melon puree with the addition of the bitter melon puree by 50%. The viscosity data that has been obtained is then analyzed using ANOVA. The ANOVA results of the viscosity of ice cream bitter melon puree can be seen in Table 10.

Table 9. The results of the analysis of the viscosity content of Ice Cream Bitter Melon Puree

Type of Formula	Repetition	Viscosity Content (cps)	Average (cps)
A1 (30%)	1	8175	8425
	2	8675	
A2 (40%)	1	9825	10087,5
	2	10350	
A3 (50%)	1	11375	11737,5
	2	12100	

Table 10. ANOVA analysis results of the viscosity content of Ice Cream Bitter Melon Puree

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	10972708,33	2	5486354,167	31,313	.010
Within Groups	525625,000	3	175208,333		
Total	11498333,33	5			

The results of ANOVA analysis of the viscosity content of ice cream bitter melon puree show a significance value of 0.010 <0.05 at the 5% significance level. These results indicate that there is a significant difference in the viscosity content of ice cream bitter melon puree with the addition of different bitter melon puree. Furthermore, followed by the DMRT (Duncan's Multiple Range Test) to determine the level of difference in the viscosity content of ice cream bitter melon puree, the DMRT test results can be seen in Table 11.

Table 11. DMRT Results Viscosity Content of Ice Cream Bitter Melon Puree

	N	1	2	3
A1	2	8425,0000		
A2	2		10087,5000	
A3	2			11737,5000
Sig.		1,000	1,000	1,000

Means for groups in homogeneous subsets are displayed
a. Uses Harmonic Mean Sample Size = 2,000

The DMRT test results in Table 11 show that the viscosity content ice cream bitter melon puree is significantly different from A2, the viscosity content of A1 is significantly different from A3, and the viscosity content of A2 is significantly different from that of A3.

The results obtained showed that the addition of bitter melon puree to the ice cream by 30%, 40%, 50% had a significant effect on viscosity. The average viscosity increased as the concentration of bitter melon puree was added to the ice cream. The results of the ANOVA test for viscosity on ice cream bitter melon puree showed that the highest average was found in ice cream with the addition of bitter melon puree by 50% with a total of 11737.5 (cps), while the lowest average of viscosity results was found in ice cream with the addition of bitter melon puree by 30%. with the amount of 8425 (cps).

According to Mellado (1998), the viscosity in ice cream is influenced by the composition of the ingredients used, especially fats, sugars, emulsifiers and stabilizer materials. Viscosity can also be affected by the handling in the processing of the ice cream dough and the temperature of the dough (Lidiasari, et al., 2014). The higher the addition of bitter melon puree to the ice cream, the viscosity level will increase. This is because the pectin content in bitter melon increases the thickness of the ice cream bitter melon puree. According to Rohajatien, (2018) in 100gr of fresh bitter melon, a pectin 1.41+ 0.05% is obtained. So that the higher the bitter melon puree you add, the higher the viscosity of the ice cream.

D. Melting Power

The results of the analysis of the melting power of ice cream bitter melon puree with the addition of different bitter melon puree can be seen in Table 12. Based on Table 12, the average melting power of ice cream bitter melon puree ranged from 37.8245 to 42.792. The highest melting power with an average of 42.792 was obtained from the ice cream bitter melon puree with the addition of bitter melon puree by 50%. The yield data obtained were analyzed using ANOVA. The ANOVA results of the melting power of ice cream bitter melon puree can be seen in Table 13.

Table 12. Results of the Analysis of the Melting Power of Ice Cream Bitter Melon Puree

Type of Formula	Repetition	Melting power content (minute / 100 gram)	Average (minute / 100 gram)
A1 (30%)	1	38.383	37.825
	2	37.266	
A2 (40%)	1	40.366	40.391
	2	40.416	
A3 (50%)	1	42.451	42.792
	2	43.133	

Table 13. Results of ANOVA analysis of the melting power of Ice Cream Bitter Melon Puree

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	24,685	2	12,343	43,173	.006
Within Groups	,858	3	,286		
Total	25,543	5			

The results of ANOVA analysis of the melting power of ice cream bitter melon puree show a significance value of 0.006 <0.05 at the 5% significance level. These results indicate that there is a significant difference in the melting power of ice cream bitter melon puree with the addition of different bitter melon puree. Furthermore, followed by the DMRT (Duncan's Multiple Range Test) to determine the level of differences in the melting power content of ice cream bitter melon puree, the results of the DMRT test can be seen in Table 14.

Table 14. Results of DMRT Melting Power Content of Ice Cream Bitter Melon Puree

	N	1	2	3
A1	2	37,8245		
A2	2		40,3910	
A3	2			42,7920
Sig.		1,000	1,000	1,000

Means for groups in homogeneous subsets are displayed
a. Uses Harmonic Mean Sample Size = 2,000

The DMRT test results in Table 14 show that the melting power content of ice cream bitter melon puree is significantly different from A2, the melting power content of A1 is significantly different from A3, and the melting power content of A2 is significantly different from A3.

The results obtained showed that the addition of bitter melon puree to the ice cream was 30%, 40%, 50% significantly affected the melting power. The average melting power increased as the concentration of bitter melon puree was added to the ice cream. The results of the ANOVA test of the melting power of the ice cream bitter melon puree show that the highest average is found in the ice cream with the addition of bitter melon puree of 50% with a total of 42.792 (minutes / 100g), while the lowest average of the yields of melting power is in the ice cream with the addition of bitter melon puree of 30% with the amount of 37,825 (minute / 100g).

The melt-down rate of ice cream can be determined by placing a sample of ice cream on a wire-mesh screen at warm temperatures and measuring the rate of fluid accumulation beneath the screen (Muse et al., 2004). As the ice cream melts, heat transfers from the warm air surrounding the product into the ice cream to melt the ice crystals. Initially, the ice melts at the exterior of the ice cream and there is a local cooling effect (in the vicinity of the melting ice). The resulting decrease in yield velocity is thought to be related to the overrun value. According to Padaga and Sawitri (2005), there is air in the dough that will form air cavities that will immediately be blown away along with the melting of the ice cream. So that more air cavities make the ice cream quickly shrink and melt at room temperature. Conversely, the less air cavity will make the ice cream difficult to melt. Moreover, fat crystallization also contributed to the melting rate (Granger et al, 2005)

According to Marshall and Arbuckle (1996), the good melting quality of ice cream (10g) is 15-20 minutes at room temperature. ANOVA analysis data of ice cream added with bitter melon puree had a significant effect on melting power. The yield data for the yield of melting power was 37.825 minutes to 42.792 minutes. The results of the test for the highest melting power of the ice cream bitter melon puree were the addition of 50% of the bitter melon puree with the amount of 42.792 (minutes / 100g).

E. Overrun

The results of the overrun analysis of ice cream bitter melon puree with the addition of different bitter melon puree can be seen in Table 15. Based on Table 15, the average overrun of ice cream bitter melon puree ranges from 18.75 to 32.12. The highest overrun with a mean of 32.12 was obtained from the ice cream bitter melon puree with the addition of bitter melon puree by 50%. The overrun data that has been obtained are then analyzed using ANOVA. The ANOVA overrun results of ice cream bitter melon puree can be seen in Table 16.

The results of ANOVA analysis of the overrun content of ice cream bitter melon puree showed a significance value of 0.004 <0.05 at the 5% significance level. These results indicate that there is a significant difference in the overrun content of ice cream bitter melon puree with the addition of different bitter melon puree. Next, followed by the DMRT (Duncan's Multiple Range Test) to

determine the level of differences in the overrun content of ice cream bitter melon puree, the DMRT test results can be seen in Table 17.

Table 15. Analysis of the Overrun Content of Ice Cream Bitter Melon Puree

Type of Formula	Repetition	Overrun content (% / 100 gram)	Average (% / 100 gram)
A1 (30%)	1	18.24	18.75
	2	19.26	
A2 (40%)	1	28.38	27.57
	2	26.76	
A3 (50%)	1	33.31	32.12
	2	30.93	

Table 16. Results of ANOVA Analysis for Overrun Content of Ice Cream Bitter Melon Puree

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	184,835	2	92,417	59,473	.004
Within Groups	4,665	3	1,555		
Total	189.499	5			

Table 17. DMRT Results for Overrun Content of Ice Cream Bitter Melon Puree

	N	1	2	3
A1	2	18,7500		
A2	2		27,5700	
A3	2			32,1200
Sig.		1,000	1,000	1,000

Means for groups in homogeneous subsets are displayed
a. Uses Harmonic Mean Sample Size = 2,000

The DMRT test results in Table 17 show that the overrun content of A1 ice cream bitter melon puree is significantly different from A2, the overrun content of A1 is significantly different from that of A3, and the overrun content of A2 is significantly different from that of A3.

The results obtained showed that the addition of bitter melon puree to ice cream was 30%, 40%, 50% significantly affected overrun. The average overrun increased as the concentration of bitter melon puree was added to the ice cream. The ANOVA overrun test results on ice cream bitter melon puree show that the highest average is found in ice cream with the addition of bitter melon puree by 50% with a total of 32.12 (% / 100g), while the lowest average of overrun results is in ice cream with the addition of bitter melon puree equal to 30% with an amount of 18.75 (% / 100g).

The quality requirements for good ice cream are in accordance with (SNI) 01-3713-1995, namely having an overrun of 70% -80% on an industrial scale, then on a household scale it is around 30% - 50%. In this study, the overrun results of the ice cream bitter melon puree were 18.24% -33.31%. Based on these results, the overrun of ice cream bitter melon puree with the addition of bitter melon puree by 50% meets the standards of ice cream on a household scale. In the process of making ice cream, fat is used as a developer. According to Goff and Hartel (2013), fat in ice cream is used to aid development. Fat functions as a foaming agent in the process of making ice cream, because it can trap air and water during the agitation process (Violisa et al., 2012). Apart from that, the overrun value is also used by the viscosity. According to Marshall et al (2003), overrun in ice cream is very reliable by viscosity. According to Syed et al (2018), Increased overrun values caused collapsing of big-sized air cells and small air cells created. As well as during freezing the viscosity was also increased with increased overrun resulting in the efficient creation of smaller air bubbles. Hardening caused the air cells to increase in size in all samples. The soft texture of ice cream can also be obtained through fast freezing process which will produce small and fine ice crystals and a soft texture of ice cream (Goff and Hartel, 2013).

IV. Conclusion

There was a significant difference in the vitamin C content of bitter melon puree with the addition of 30%, 40%, and 50%. The highest average vitamin C content of 25.942 (mg / 100g) was found in the addition of bitter melon puree by 50%. There was a significant difference in the β-carotene content of bitter melon puree with the addition of 30%, 40%, and 50%. The highest average β-carotene content

of 150.736 (μg / 100g) was found in the addition of bitter melon puree by 50%. There was a significant difference in the viscosity of ice cream bitter melon puree with the addition of 30%, 40%, and 50%. The highest average viscosity of 11737.5 (cps) was found in the addition of bitter melon puree by 50%. There was a significant difference in the overrun value of ice cream bitter melon puree with the addition of 30%, 40%, and 50%. The highest average overrun value of 32.12% was found in the addition of bitter melon puree by 50%. There was a significant difference in the melting power of ice cream bitter melon puree with the addition of 30%, 40%, and 50%. The highest average melting power of 42.792 minutes / 100g was found in the addition of bitter melon puree by 50%.

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