

# OPTIMIZATION OF THE USE OF SUWEG (*Amorphophalluscampanalatus* B) FLOUR AS STABILIZER ON ORGANOLEPTIC PROPERTIES, OVERRUN AND MELTING TIME OF GOAT MILK ICE CREAM

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**Abstract:** This study was aimed to find the optimal formulation for making goat milk ice cream using suweg tuber flour as stabilizer to substitute gelatin commonly used in making ice cream. In order to find the best formulation, ice cream were evaluated organoleptically for its color, texture, taste, aroma, and overall acceptance. While the melting time and overrun were determined objectively. The proportions of suweg tuber flour in the manufacture of goat milk ice cream were 0%, 2%, 4%, 6%, 8%, and 10%, as a comparison, 0.5% gelatin was used. The color and texture were evaluated using scoring test, while the taste, aroma and overall acceptance were evaluated using hedonic test (preference) performed by 30 trained panels for each test. The data were tested for their homogeneity using Bartlett test and the aditivity was tested using Tuckey test. Then the data were analyzed for variance to find the effect of the treatments, and further analyzed using Least Significant Difference (LSD) test. All tests were carried out at the level of 1% or 5%. The results showed the color, taste and aroma, and overall acceptance of ice cream were significantly affected by treatments. The most preferred The highest score for overall acceptance was found in goat milk ice cream treated with 2% suwed tuber flour which was 8.85 (most preferred). Whereas the highest value for melting time and overrun were found in goat milk ice cream treated with 10% suweg tuber flour, which were 24.5 minutes, 80.5%.

Keywords: ice cream, goat milk, stabilizer, suweg tuber flour

## 1. Introduction

Ice cream is one of the Snack that is likes by society, from the baby until the old one. Ice cream is a product of Frozen food which is Made by the combination of the Frozen process and the agitation of the ingredient the consist of milk, milk product, sweetest, stabilizer, thickener, gel amplifier, and flavor. The principle of ice cream manufacturing is to mold the cavity in the mixture of ingredient from the ice cream, so that there Will be produced the overrun which makes ice becomes lighter, not too solid and has soft texture. The good characteristic of ice cream is it has overrun value that is not less than 80% and 12%-14% fat level<sup>[1]</sup>. The Ice cream which has high quality is not quickly melt when it is served on room temperature. Mean while the texture that is wanted in ice cream is soft and creamy<sup>[2]</sup>. To produce ice cream which is soft and has stability of the crystals formation and also fast melting, the ingredient that muat be added on making ice cream is the stabilizer. The stabilizer that is usually used on making ice cream they are: gelatin, CMC, and vegetable product which have polisakarida<sup>[3]</sup>. The price of gelatin that is high enough, makes the result of product price of ice cream is also expensive. That is why it must be tried another

ingredient stabilizer which include polisakarida that has glucose and rich fiber, that is glucomanan from suweg tuber flour. The benefit of suweg tuber flour is food fiber content, protein and carbohydrates are quite high and also less fat content. Suweg tuber flour can be Made as the Ingredient stabilizer because it has glucomanan that can be fuction as thickening agent, ini stabilize emulsion. The special purpose of this research is to optimalize the formula of goat milk ice cream with uses suweg tuber flour, study about glucomanan content on stabilizing acitivity that is found in tuber, so that. Will give goat milk ice cream with chemical properties, organoleptik, and also the criteria of ice cream that is suitable with <sup>[4]</sup>. The result of <sup>[5]</sup> research shows the concentrate of 5% suweg tuber flour can produce the characterristic of the ice cream that has protein nutritional value, fat and carbohydrate which have fulfilled the requirement of <sup>[4]</sup>. The result of ice cream melting time test in 5 % concentrate of suweg tuber flour that has melting time internet 10 minutes/50 g. This condition indicates that the mechanizm of glucomanan ini suweg tuber flour can maintain the melting power of ice cream ini room temperature but it is not still optimal. The 5% and 1% concentrate of suweg tuber flour can give the different of overrun increasing, and it also happens ini stabilize emulsion and melting time. But in 5% concentrate of suweg tuber overrun ice cream is only 22% , and the store of the texture that is not optimal (still soft). Because of that in the second year of the research is used suweg tuber flour with the concentrate that is higher than addition of fat composition in basic Ingredient, it is hoped can increase overrun value and texture.

## **2. Research Method**

### **2.1. Material and Instruments**

Suweg tuber variety *hortensis* used in the research was obtained from farmers in Purwosari, Metro Timur. Etawa goat milk was obtained from Sekampung Village, Lampung Timur District. Other ingredients were creamer, full cream powder milk (Frisian flag), skim milk (Tropicana Slim), sugar, ovallet stabilizer, egg yolk. Analysis chemicals were hexane, concentrated H<sub>2</sub>SO<sub>4</sub>, 1.25% H<sub>2</sub>SO<sub>4</sub>, 0.02N HCl, 50% NaOH, H<sub>2</sub>BO<sub>2</sub>, Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>, and alcohol. This study used Tyler standard sieve 80 mesh, blender (Philips HR2115), thermometer, knife, basin, mixer (Philips HR1538), stove, pan, ice cream cup, scales, freezer (Frigigate F200), spoon, refrigerator, autoclave, petridisks, bottles, Soxhlet, desicator, furnance, cawan porselin, Buchner funnel, instruments and glassware used for analyses, and also intruments for organoleptic measurement.

### **2.2. Method**

Analyses were conducted in Complete Randomized Design in triplicate with single factor consisted of 6 experimental levels of suweg powder concentrations (2%, 4%, 6%, 8%, 10%) and 0.5% gelatin as comparison. Statistical variance similarity was analyzed using bartlet test, while significant difference was measured using analysis of variance (Anova), followed by post-hoc Tukey HSD (Honestly Significant Difference) at 5% significance level.

### **2.3. Sample Preparation**

#### **2.3.1. Suweg powder preparation**

Freshly harvested suweg (*Amorphophallus campanulatus* Bl) tuber was cleaned from dirt, peeled, washed in clean water, then soaked in solution contain 10% salt and 10% lime over the past 24 hours Tuber in thin slices then dried in 50°C oven for 18 hours, ground, and sieved to obtain 60 mesh powder.

### 2.3.2. Goat milk ice cream preparation

All ice cream ingredients were mixed, pasteurized at  $\pm 70^{\circ}\text{C}$  for 30 minutes, and continuously stirred until homogenous. The mixture was then cooled in temperature below  $5^{\circ}\text{C}$  for 4 hours, and stirred again using hand mixer at high speed before freezing. The stirring and cooling was repeated 3 times before freezing for 24 hours at  $-30^{\circ}\text{C}$ . Ice cream was stored into  $-18^{\circ}\text{C}$  freezer box before consumption.

## 2.4. Observation

### 2.4.1. Organoleptic Analyses

Texture and color of the ice cream was measured with scoring by 20 trained panelists for each replicate, taste, and aroma, while overall consumer acceptability was analyzed using hedonic test by 25 trained panelists for each replicate.

### 2.4.2. Volume Expansion (Overrun)

Overrun or % increase in volume of ice cream due to air bubble trapped into the mixture was measured using formula below<sup>[6]</sup>.

$$\% \text{ Overrun} = \frac{\text{Ice cream volume} - \text{ingredients mixture volume}}{\text{ingredients mixture volume}} \times 100\%$$

### 2.4.3. Melting time<sup>[6]</sup>

Melting time was measured by taking 100 ml packed ice cream previously stored at  $-20^{\circ}\text{C}$  for 24 hours into room temperature. Melting volume was counted every 10 minutes until all ice cream melted.

## 3. Results and Discussion

### 3.1. Organoleptic test

#### 3.1.1 Texture

It was indicated that suweg flour significantly affected goat milk ice cream texture, as also confirmed by HSD statistical analysis (Table 1).

Table 1. Texture of goat milk ice cream made by various suweg flour concentration at 5% significance level HSD

	S1	Suweg concentration					HSD <sub>0.05</sub>
	(0.5% gelatin)	S6 (10%)	S5 (8%)	S4 (6%)	S3 (4%)	S2 (2%)	
Texture mean	3.9 <sup>a</sup>	3.8 <sup>ab</sup>	3.6 <sup>bc</sup>	3.5 <sup>c</sup>	3.2 <sup>cd</sup>	3.1 <sup>c</sup>	0.406

Different superscript indicated significant difference.

Desired texture in ice cream is soft, creamy, and homogenous. Suweg flour concentration had significant effect on goat milk ice cream texture. The result of ice cream using 0.5% gelatin was significantly different to those of 8%, 6%, 4%, and 2% suweg flour, while those of 8% suweg flour was not significantly different to those of 6%, 4%, and 2%. It was indicated that ice cream with 10% suweg flour of 3.8 (soft) had almost similar texture to the highest score obtained by gelatin

of 3.9 (soft). Glucomannan in suweg flour was able to form emulsion in goat milk ice cream, thus water in the mixture was fully incorporated in emulsion, in which micro-sized ice crystals were formed during freezing, resulted smooth and soft ice cream texture. Glucomannan also has gel strengthening, texture improving, and thickening property<sup>[7]</sup>.

### 3.1.2 Flavor

Anova and HSD statistical analysis confirmed that suweg flour as stabilizer had significant effect on flavor of goat milk ice cream (Table 2).

Table 2. Taste and aroma of goat milk ice cream made by various suweg flour concentrations at 5% significance level HSD

	S1	Suweg concentration					HSD <sub>0.05</sub>
	(0.5% gelatin)	S6 (10%)	S5 (8%)	S4 (6%)	S3 (4%)	S2 (2%)	
Flavor mean	4.0 <sup>a</sup>	3.9 <sup>ab</sup>	3.3 <sup>b</sup>	3.0 <sup>c</sup>	2.9 <sup>bc</sup>	2.9 <sup>c</sup>	0.406

Different superscript indicated significant difference

Significant difference was found among taste and aroma of goat milk made using gelatin and various concentration of suweg flour. Similar to previous analysis, the result of 0.5% gelatin was not significantly different than those of 10% suweg flour, indicated by the highest preferable taste and aroma of 4.0 (like) was similar to 10% suweg flour of 3.9 (like). The main component in the ice cream was fresh goat milk, thus its unique strong odor remained. Another report mentioned that aroma and taste of ice cream is predominantly affected by milk and sugar<sup>[8]</sup>. As suweg flour has neutral aroma, it has no effect on product flavor when used as ingredient<sup>[9]</sup>. Suweg tuber has similar flavor to wild taro, locally known as talas, but with smother and softer texture. Previous research mentioned that suweg flour as wheat flour substitute in cookies had no effect on product color and taste<sup>[10]</sup>.

### 3.1.3 Color

Anova and HSD analysis indicated that 0.5% gelatin and suweg flour significantly affected goat milk ice cream color (Table 3).

Table 3. Color of goat milk ice cream made by various suweg flour concentrations at 5% significance level HSD

	S1	Suweg concentration					HSD <sub>0.05</sub>
	(0.5% gelatin)	S6 (10%)	S5 (8%)	S4 (6%)	S3 (4%)	S2 (2%)	
Color mean	3.7 <sup>a</sup>	3.4 <sup>b</sup>	2.9 <sup>bc</sup>	2.8 <sup>bc</sup>	2.5 <sup>c</sup>	2.4 <sup>c</sup>	0.406

Different superscript indicated significant difference

Goat milk ice cream color made using 0.5% gelatin was significantly different than those made using 2%, 4%, 6%, 8%, and 10% suweg flour in concentration dependent manner. This was due to suweg flour amount whose greyish and brownish color affected the final product, compared to white color of gelatin. Ice cream color index was 3.4 (greyish white) and 3.7 (white) for 2% suweg flour and gelatin, respectively. <sup>[9]</sup> noted that suweg has physical property fine powder with greyish white or yellowish white color. But the color of suweg flour are broken white compare to sukun flour, cassava flour, and wheat flour.

Different suweg flour concentration resulted different color. Addition of 10% suweg flour changed ice cream color. [11] mentioned that goat milk's vitamin A contains no carotenoid like the yellowish white cow milk, and the previous has whiter color than the later. Combination of suweg flour with greyish white and the pure white goat milk was considered as the main factor determining color changing of the ice cream.

### 3.1.4 Overall acceptability

Anova and HSD analysis showed that gelatin and suweg flour utilization significantly affected panelist's overall product acceptability (Table 4).

Table 4. Panelist overall product acceptability of goat milk ice cream

	S1	Suweg concentration				
	(0.5% gelatin)	S6 (10%)	S5 (8%)	S4 (6%)	S3 (4%)	S2 (2%)
Acceptability	4.1 <sup>a</sup>	3.7 <sup>b</sup>	3.2 <sup>c</sup>	3.0 <sup>cd</sup>	2.9 <sup>cd</sup>	2.9 <sup>cd</sup>

Different superscript indicated significant difference

Overall acceptability of goat milk ice cream using gelatin 0.5% was different to those made using suweg flour. Addition of 0.5% gelatin had significantly different result than those of 10%, 8%, 6%, 4%, and 2% suweg flour. Based on organoleptic test, goat milk ice cream with 0.5% gelatin had the highest acceptability, but not significantly different than ice cream made with 10% suweg flour. Therefore, researcher selected 10% suweg flour to be used in this study as preferred ice cream stabilizer.

### 3.2. Overrun

Ice cream volume expansion known as overrun was calculated based on the difference between volume of ice cream and initial mixture at the same mass, or mass of ice cream and mixture at the same volume<sup>[12]</sup>. The highest overrun of modified goat milk ice cream of 80.5% was obtained by 10% suweg flour. Based on [4] released by National Statistic Agency, standard overrun for ice cream is in 70-80% range, with 60-100% considered as good. Ice cream with good overrun of 80% has around 12-14% fat content<sup>[1]</sup>. Overrun is occurred due to trapped air in ice cream mixture during agitation<sup>[13]</sup> Suweg flour addition increased solid material in mixture which resulted higher viscosity. Higher suweg flour concentration led to higher bound water, decreased free water, thicker mixture, and slower melting<sup>[14]</sup>. Another study also reported that higher overrun led to longer melting time<sup>[15]</sup>.

### 3.3. Melting time

Goat milk ice cream made had various melting time at different suweg flour concentration. The lowest melting time or the longest period of 24.5 minutes was obtained by 10 % suweg flour, while the otherwise at 10.25 minutes was obtained by 0.5 % gelatin ice cream. Melting period is the time needed for ice cream to completely melting in room temperature. Ice cream is desired to melt longer in room temperature, but rapidly melt in body temperature. Too short or too long melting period in undesirable. Short period rushed consumers to consume the ice cream immediately, whereas too long period indicated excessive solid ingredients. [16] explained that desirable ice cream melting time is 15-20 minutes.

#### 4. Conclusions

1. Goat milk ice cream modified with 10% suweg flour as stabilizer to replace gelatin resulted texture, taste and aroma, color, and overall acceptability of 3.9 (soft), 3.9 (preferable taste and aroma), 3.7 (white), and 3.7 (likeable overall acceptability), respectively, which in accordance with Indonesian standard number 01-3713-1995.
2. The highest overrun of 80.54% and the longest melting time of 20.5 minutes were obtained by goat milk ice cream made using 10% suweg flour.

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