Ice cream products made from processed purple sweet potatoes: a product organoleptic study

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Abstract. The use of purple sweet potato in food processing is an effort to diversify food, one of which is ice cream processing. Ice cream is dominated by cornstarch (corn flour). The main ingredient for this ice cream is steamed sweet potato. The research method was an organoleptic test on aroma, taste, texture, and colour. The results showed that the acceptance of 26 panellists stated that the ice cream batata product was acceptable by evaluating the raw material by noting that the purple sweet potato colour remained consistent. The steaming process of purple sweet potato is carried out to maintain the high anthocyanin compounds in purple sweet potatoes.

1. Introduction

Indonesia is one of the countries that have a large number of food sources of carbohydrates. Apart from rice as a carbohydrate staple food consumed by most Indonesians, another source of carbohydrates is a type of tubers such as sweet potatoes or what is known as Ipomoea batatas L [1]. Sweet potato has several types, which can be distinguished based on the colour of the meat, namely, purple sweet potato, white sweet potato, yellow sweet potato and orange sweet potato. Purple sweet potato is a sweet potato originating from Japan. The sweet potatoes mostly found in Indonesia were only sweet potatoes with white, yellow and orange flesh. As stated by Firgianti in his writing that there are two varieties of purple sweet potato from Japan with very dark tuber flesh colour, namely Ayamurasaki and Yamagawa Murasaki [1].

Purple sweet potato has high levels of anthocyanins which function as antioxidants and free radical scavengers, thus preventing ageing, cancer and degenerative diseases. In addition, anthocyanins also can be antimutagenic and anti-carcinogenic. Furthermore, it prevents liver dysfunction, antihypertensives, and lower blood sugar levels [2]. Firgianti revealed that anthocyanins are pigments that cause a reddish colour, located in water-soluble cell fluids [1].

Research by Torres et al. (2021) purple sweet potato is a rich source of quinic acid and acylated anthocyanins [3–5]. Polyphenol oxidases degrade acylated anthocyanins. Bare et al. (2019) quinic acid is predicted to have potential as anti-inflammatory therapy [6]. This is shown because there is a bond formed between the ligand and the 11 amino acid residues. The research of Husna et al. (2013) that the concentration of anthocyanins causes several types of purple sweet potato to have different colour gradations [2].
There are 150.7 mg of anthocyanin, 1.1% fibre, and 18.2% starch regarding nutrition. In addition, 0.4% reducing sugars, 0.6% protein, 0.70 mg iron, and 20.1 mg vitamin C. Antioxidant compounds other than anthocyanins found in sweet potatoes are vitamin C, vitamin E, lutein, zeaxanthin, and beta-carotene which are carotenoid antioxidant pairs [3]. Purple sweet potato is very rich in nutrition. This is because purple sweet potato has anthocyanins as a colour-forming pigment in purple sweet potatoes [7]. The darker the purple sweet potato is, the higher the anthocyanin content in it, which means the better it is for the health of the body. Based on research by Sampaio et al. (2021) sweet potatoes with red and purple flesh are high sources of anthocyanins [8].

Tubers, including purple sweet potato (*Ipomoea batatas* L), can substitute for rice because they have carbohydrates that are not inferior to rice. In addition, consuming purple sweet potatoes can help maintain body stability because the nutritional content in purple sweet potatoes is more affluent than the nutritional content in white rice. However, the problem is the lack of public interest in enjoying processed purple sweet potatoes. As a result, there is more use of white rice as a carbohydrate source than purple sweet potatoes, even though people already know that purple sweet potatoes are rich in nutrients, including those contained in carbohydrates. Purple sweet potato can substitute or substitute for cornstarch (corn flour)—purple sweet potatoes in making bread [9]. The substitute for white rice is cauliflower as a healthy food [10]. Using sweet potatoes for ice cream [11]. Purple sweet potato is also mixed with lychee for making chips [12]. Purple sweet potato can be used as a variety of processed products, such as ice cream, chips, flour, syrup, juices, salads, and other processed products. Apart from cornstarch, it has also been studied using rice flour in making vanilla ice cream [13]. However, in this research, the authors will utilize purple sweet potato (*Ipomoea batatas* L), which is processed into the basic ingredients for making ice cream a healthy snack ingredient in today's cultural industry.

There are many kinds of ice cream on the market. The raw material for ice cream should be low fat, but consumers also prefer the aroma, taste and colour [14]. Research by Shen et al. (2017) consumers usually prefer high fat but not related to the taste genotype measured [15]. The results of the research of Iwuoha and Nwakanma (1998) showed that the density and viscosity of sweet potato (SP) were the highest and significantly different (P <0.05) from cassava (CS) and white yam (WY) [16]. Ice cream requires the consistency of raw materials such as sweet potatoes. Aime et al. (2001) regarding the texture of ice cream, trained sensory panellists rated low-fat and fat-free ice creams as having a lower viscosity, smoothness, and mouth-coating properties [17]. In this study, steamed and mashed purple sweet potato pulp was mixed with ice cream ingredients in general.

Some of the research relevant to purple sweet potato with ice cream is as follows.

1. This ice cream research aims to analyze the effect of differences in the composition of purple sweet potato by 15%, 20%, and 25% on the quality of the ice cream. The study used a completely randomized design with three replications with 30 panellists. Hypothesis test results indicate an influence on the third commission rate. The quality level of the colour test is better at 25%. The flavour is better when the addition of 15%, the texture is better at the addition of 15%, and the taste is better at the addition of 15%. The quality of the hedonic colour test is better, namely the addition of 25%. The better flavour is the addition of 15%. The texture is better, which is 15%, and better understanding is the addition of 15% [18].

2. The hedonic test results for the colour and texture most preferred by the panellists in the treatment with the addition of 15% yellow pumpkin and the treatment with the addition of 15% purple sweet potato, for the aroma of the panellists liked the treatment with the addition of 15% yellow pumpkin and treatment E with the addition of purple sweet potato 12.5%. In contrast, the taste favoured by the panellists was found in the treatment with the addition of 15% yellow pumpkin and treatment D with the addition of 10% purple sweet potato [19].

3. Substitution of soy milk in purple sweet potato ice-creamy cow’s milk reduces the level of preference for ice cream. The most preferred purple sweet potato ice cream-soy milk is ice cream with the proportion of cow’s milk: soy milk of 75:25 in terms of colour, aroma, taste, texture, and overall. With these proportions, ice cream has levels of protein, fat, total solids, and overrun that meet the requirements of the Indonesian National Standard. Its functional properties are also better than purple sweet potato ice-creamy cow’s milk because of its higher antioxidant activity [11].

4. This purple sweet potato ice cream study used a completely randomized design and was assessed by 35 panellists to determine the organoleptic properties of the purple sweet potato ice cream.
product. The measurement of organoleptic data used a hedonic scale consisting of colour, aroma, texture, and flavour variables. In addition, the DMRT test was carried out. This study indicated that the treatment had a very significant effect (P <0.01) on the colour, aroma, texture, and taste of ice cream. Organoleptic properties that use 450 grams of purple sweet potato as an additive in 1000 ml of milk can be used to make ice cream [20].

5. This ice cream research aims to determine the concentration of purple sweet potato that will produce the best ice cream, especially on its organoleptic characteristics. The results showed that the addition of 30% sweet potato paste produced the best quality etawa goat milk ice cream. Aroma score 3.5 (not specific goat’s milk). Taste score 3.47 (sweet), colour score 2.8 (slightly purple), texture score 3.5 (soft), and overall score. Reception is 3.203 (somewhat like). This ice cream contains water, protein, fat, ash, crude fibre, and total carbohydrates as much as 66.98%, protein 5.5%, 11.86%, 1.34%, 0.3% and 14.2% [21].

6. The overrun parameter (volume development) resulted in 6.66%, 11.11%, 11.32%; analyzing texture using the multi-needle penetration method (probe) with the TA.XT Stable Microsystem Texture Analyzer at 357 g, 153 g, 392 g (smoothness); 16.04, 14.47, 9.37 minutes of melting time. Then the higher the number of frozen shaking cycles in the manufacture of sweet potato ice cream resulted in a more fluffy, smoother texture, but the ice cream melted faster [22].

Based on the explanation above, the author tries to develop the idea of making ice cream with the essential ingredients of boiled purple sweet potato. The formulations of the research problems were: 1) determining the appropriate procedure for making ice cream from purple sweet potato; 2) determine the percentage of the panellists’ assessment of the aroma, texture, taste and colour of the product.

2. Research Method

2.1. Research Design

This research design is descriptive qualitative research [23], and organoleptic test [24] on Batata ice cream products with purple sweet potato as the base ingredient. The product's manufacturing goes through several procedures and trials until the best process and results are by the ice cream product. Furthermore, the organoleptic test was carried out by 26 panellists. Assessment of aroma, taste, texture and colour became a concern by panellists in organoleptic tests.

2.2. Procedure for Making Batata Ice Cream (Purple Sweet potatoes)

The ingredients to be used are purple sweet potato as a basic ingredient, sugar, powdered/sweetened milk, cornstarch, TBM/SP, and water. Other ingredients are ice cubes and salt as ingredients for the ice cream formation. This research involved panellists. Panellists are students who take Entrepreneurship courses.

The research procedure is regarding making Purple Sweet Potato Ice Cream (Batata Ice Cream), which is presented through the writing of entrepreneurial proposals, including explaining why choosing the product name Batata Ice Cream and the basic ingredients for its manufacture. Furthermore, Batata Ice Cream products are tested organoleptically, namely the preference test/acceptance test. Furthermore, the organoleptic test results are discussed in a Focus Group Discussion (FGD) [6]. This preference test/acceptance test involves a person's involvement in assessing a nature or quality of a material as a cause for someone to be attracted to a group product. Assessment or Organoleptic Test is the most primitive way of assessment. In this test, the emphasis is placed on the ability of the sensory organs to give impressions or responses that can be analyzed or differentiated based on the type of impression. These capabilities include the ability to detect (detection), recognize, differentiate, scaling and the ability to express likes or dislikes (hedonic) [9,24].

2.2.1. Ingredients Batata Ice Cream

- 250 gr purple sweet potato
- 250 grams of sugar
- 200 grams of sweetened condensed milk
- 3 tablespoons cornstarch
- 1 tablespoon TBM
- 1 litre of water

2.2.2. Processing
1. Choose a good purple sweet potato and steam the sweet potato until cooked, dry and peel it from the base skin, then puree using a blender until smooth. (It should be noted that there are several methods in the cooking process of purple sweet potato, namely steaming or boiling. This cooking method is very influential on the resistance of the anthocyanin content in purple sweet potato. So, to maintain the anthocyanin content, it is better to steam the purple sweet potato).
2. Enter the sugar, milk, water, and cornstarch into a container (pan), then cook until thickened, then let the dough cool down, then put it in the freezer for about 2-3 hours.
3. After the dough is removed from the freezer, the dough is in the mixer for 3 minutes, put the TBM and the mixer again for 3-4 minutes, then put the smooth sweet potato into the dough and stir until evenly distributed with the first mixture.
4. Then put in the freezer for 7-9 hours. For serving, depending on taste, you can taste it directly and can also be shaved.

2.3. Data Analysis
The organoleptic testing was performed by assessing food quality based on the value scale from 1 to 5 or from 1 to 4 [24,25]. Ice Cream product test, which is used is the hedonic test. The panelists were asked for their opinion regarding the products that have been given. The opinion of the panelists has to do with the impression of whether they like the product or not, then the level of like it or not. The hedonic scale relates to the degree of liking between very, very much like very, very much disliking. The scale given is given a number symbol, starting from number 1 to number 4.
1 = Very disliked
2 = enough
3 = like
4 = Really like

3. Result and Discussion
The test for the Ice Cream product used was the organoleptic test. The parameters used as the assessment benchmarks include aroma, texture, taste, colour and overall product. The results of the organoleptic test will be presented in tables 1 and 2.

| Table 1. Panelists’ Answers in the form of Score for Organoleptic Batata Ice Cream Test. |
|-----------------------------------------------|
| Assessment | Aroma | Texture | Taste | Colour | whole product |
| 1= Very disliked | 0 | 0 | 0 | 0 | 0 |
| 2= enough | 14 | 8 | 2 | 0 | 0 |
| 3= like | 9 | 13 | 14 | 0 | 21 |
| 4= really like | 3 | 5 | 10 | 26 | 5 |
| Total | 26 | 26 | 26 | 26 | 26 |

| Table 2. Percentage of Panelists for Organoleptic Test for Ice Cream. |
|-----------------------------------------------|
| Score | Aroma | Texture | Taste | Colour | Whole product |
|-------|-------|--------|-------|--------|---------------|
| 1     | 0     | 0      | 0     | 0      | 0             |
| 2     | 53.8% | 30.8%  | 7.7%  | 0      | 0             |
| 3     | 34.6% | 50%    | 53.8% | 0      | 80.8          |
| 4     | 11.5% | 19.2%  | 38.5% | 100%   | 19.2%         |
| Total | 100%  | 100%   | 100%  | 100%   | 100%          |

In terms of aroma assessment, there were 14 panellists (54.8%) who answered fairly, nine panellists (34.6%) who liked it, and three panellists (11.5%) who liked the aroma of the product. Panellists gave
good judgments because of the fragrant and distinctive aroma of the product. Based on the panellists’ assessment, the most dominant aroma was the aroma from the purple sweet potato itself.

In terms of texture, there were eight panellists (30.8%) who were sufficient, 13 panellists (50.0%) who liked it, and five panellists (19.2%) who liked the texture of the product. None of the panellists gave a bad rating because the texture of the product was not too soft and not too hard. In terms of taste, there were two panellists (7.7%) who were very good, 14 panellists (53.8%) who liked it, ten panellists (38.5%) who liked the taste of the product. Panellists give good ratings because of the taste, blend, and fit of the product. Ice cream flavour that is not bland because it provides a sweet taste. Panellists also consider the advantages of products that do not use artificial flavourings.

There were 21 panellists (80.8%) who liked it from the overall assessment of the product, five panellists (19.2%) who liked it very much. Judging from the product’s colour, all 26 Panelists (100%) who liked it, the panellists concluded based on the aroma, texture, taste, overall and colour of the product.

![Figure 1. Production of Batata Ice Cream.](image1)

![Figure 2. Ice Cream Batata Products in cup packaging.](image2)

The process of freezing ice cream products is put into large packages (Figure 1), then put into freezing. After the ice cream product has frozen, the ice cream is served in cup packaging, as shown in Figure 2. In the freezing process, it is necessary to avoid forming a layer of ice crystals on the surface of the ice cream in large packages. This is done to maintain the quality of the ice cream.

Through the Focus Group Discussion, the panellists gave comments on what needs to be further developed. Based on the discussion results, several things need to be evaluated, including the taste is less like Ice Cream (but after several trials, it has improved). Regarding the texture, it is closer to the texture of the Ice Cream (after several attempts, the texture has improved). Initially, the Batata Ice Cream colour has reached its full purple sweet potato colour.

Evaluation of Batata Ice cream products is to choose raw purple sweet potatoes on the market. The selection of raw materials takes into account the optimal purple colour. This natural material will be boiled, and the colour must remain purple because it does not use artificial dyes. Making ice cream should use a larger packaging than the cup to prevent ice crystals from forming. Therefore, from a large packaging, the ice cream is shaved into a cup.

4. Conclusions
Purple sweet potato contains high levels of quinic acid and anthocyanins, which are beneficial for health. To maintain the anthocyanin compounds in purple sweet potatoes. The steaming method was chosen compared to the boiling method. The organoleptic test results, both aroma, taste, texture, and colour, were acceptable to the panellists. The procedure for making ice cream made from purple sweet potato has been tested organoleptically.
Reference

[1] Firgianti G and Sunyoto M 2018 Karakterisasi Fisik Dan Kimia Ubi Jalar Ungu (Ipomoea Batatas L) Varietas Biang Untuk Mendukung Penyediaan Bahan Baku Tepung Ubi Jalar Ungu Prosiding Seminar Nasional Fakultas Pertanian UNS vol 2 p F-104

[2] El Husna N, Novita M and Rohaya S 2013 Kandungan antosianin dan aktivitas antioksidan ubi jalar ungu segar dan produk olahannya Agritech 33 296–302

[3] Torres A, Aguilar-Osorio G, Camacho M, Basurto F and Navarro-Ocana A 2021 Characterization of polyphenol oxidase from purple sweet potato (Ipomoea batatas L. Lam) and its affinity towards acylated anthocyanins and caffeoylquinic acid derivatives Food Chem. 356 129709

[4] Larief R and Dirpan A 2018 Purple Yam Flour (Dioscorea alata L.) Processing Effect on Anthocyanin and Antioxidant Capacity in Traditional Cake “bolu Cukke” Making IOP Conference Series: Earth and Environmental Science vol 207 (IOP Publishing) p 12043

[5] Mas’ud H, Rochimiwati S N and Dirpan A 2020 Acceptability and protein value of snack made of cord fish meat and sweet potato flour for tuberculosis (TB) patients in Public Health Center of Pacerakang Makassar Enfermería Clínica 30 335–9

[6] Bare Y, Kuki A D, Rophi A H, Krisnamurti G C, Lorenza M R W G and Sari D R T 2019 Prediksi Asam Kuinat sebagai Anti-inflamasi terhadap COX-2 secara Virtual Biota J. Ilm. Ilmu-Ilmu Hayati 4 124–9

[7] Laga A, Putri T P, Syarifuddin A, Hidayah N and Muhpidah 2019 Pengaruh Penambahan Ubi Ungu (Ipomoea Batatas L.) Sebagai Makanan Jajanan Berbasis Pangan Lokal Bagi Anak Sekolah J. Gizi 9 150–8

[8] Wijaya H, Rouw R H and Kadir A R 2020 Brassica box food products as a healthy local food innovation in The Covid-19 pandemic period IOP Conference Series: Earth and Environmental Science vol 575 (IOP Publishing) p 12011

[9] Affandi D R and Handajani S 2011 Es krim ubi jalar ungu (Ipomoea batatas) Tinjauan sifat sensoris, fisik, kimia, dan aktivitas antioksidannya J. Teknol. Has. Pertan. 4

[10] Anugrah R M and Suryani E 2020 Kandungan Gizi Donat dengan Penambahan Ubi Ungu (Ipomoea Batatas L.) Sebagai Makanan Jajanan Berbasis Pangan lokal Bagi Anak Sekolah J. Gizi 9 150–8

[11] Cody T L, Olabi A, Pettingell A G, Tong P S and Walker J H 2007 Evaluation of rice flour for use in vanilla ice cream J. Dairy Sci. 90 4575–85

[12] Shen Y, Kennedy O B and Methven L 2017 The effect of genotypical and phenotypical variation in taste sensitivity on liking of ice cream and dietary fat intake Food Qual. Prefer. 55 79–90

[13] Aime D B, Arntfield S D, Malcolmson L J and Ryland D 2001 Textural analysis of fat reduced vanilla ice cream products Food Res. Int. 34 237–46
[19] Nuralizah N, Adam A and Fadilah R 2021 Pengaruh Penambahan Labu Kuning (Cucurbita moschata) Dan Ubi Jalar Ungu (Ipomoea batatas L) Terhadap Kecepatan Leleh Es Krim Yang Dihasilkan J. Pendidik. Teknol. Pertan. 2 7–13

[20] Lanusu A D, Surtijono S E, Karisoh L C M and Sondakh E H B 2017 Sifat organoleptik es krim dengan penambahan ubi jalar ungu (Ipomea batatas L) Zootec 37 474–82

[21] Susilawati S, Nurainy F and Nugraha A W 2014 Pengaruh Penambahan Ubi Jalar Ungu Terhadap Sifat Organoleptik Es Krim Susu Kambing Peranakan Etawa [The Influence of Purple Sweet Potato Increment og Orgamoleptic Characteristic of Goat Milk Ice Cream of Etawa Generation] J. Teknol. Ind. Has. Pertan. 19 243–56

[22] Oktafiyani A and Susilo D U M 2019 Pembuatan Es Krim Ubi Jalar Ungu dengan Variasi Jumlah Siklus Pengocokan–Pembekuan Agrofood 1 20–6

[23] Wijaya H 2019 Analisis Data Kualitatif: Sebuah Tinjauan Teori & Praktik (Sekolah Tinggi Theologia Jaffray)

[24] Surya E, Ridhwan M, Rasool A, Noviyanti A, Sudewi S and Zulfajri M 2020 The utilization of peanut sprout extract as a green nitrogen source for the physicochemical and organoleptic properties of Nata de coco Biocatal. Agric. Biotechnol. 29 101781

[25] Takougnadi E, Boroze T-E T and Azouma O Y 2020 Effects of drying conditions on energy consumption and the nutritional and organoleptic quality of dried bananas J. Food Eng. 268 109747