

Influence of sweet potato types on physical and sensory characteristics pure of sweet potato soup (*ipomoea batatas* L)

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Abstract. Pure Cream Soup is a cream soup by using pure tubers as thickening ingredients. The famous of it is potato cream soup. Potatoes are relatively more expensive than sweet potatoes. The chemical content of sweet potatoes is relatively the same as the potatoes. Thus it is very beneficial to develop sweet potato cream soup (SCS). Sweet potato cream soup was used many alternative processing techniques. The method used is development method with Quantitative Descriptive Analysis sensory test by the trained panelist. Trained panellists were generated through the screening stage, basic taste test, intensity test, and an interview. Of the 44 people who followed the screening were netted eight trained panellists, one male panellist and seven female panellists with a 21-24 year age range. Five types of sweet potato used purple sweet potato, Cilembu sweet potato, Japanese sweet potato, yellow sweet potato, and white sweet potato. The most preferred SCS color is Japanese Sweet Potato, and the most viscous texture is Cilembu sweet potato. The most preferred SCS overall is SCS Japanese sweet potato.

1. Introduction

The soup comes from the word "soupe" (French) which means a variety of groceries plus broth or liquid. Soup makers are broth, thickener and stuffing material. The Cream soup is soup with a thickening cream in addition to starch. Puree soup is soup with thickening ingredients in the form of carbohydrate source itself. Sweet potato cream soup is soup by using a thickener of cream and sweet potato puree.

Sweet potato production is very abundant, but its utilization is not maximal yet. Sweet potatoes have advantages compared to other tubers such as having a short planting period of 3-6 months, can grow in various types of soil and can be used as intercrops. Sweet potatoes are produced based on the color of the flesh there are three kinds of meat yellow, orange and purple. Purple sweet potatoes compared to other sweet potatoes are relatively resistant to pests and worms. Sweet purple sweet potatoes have anthocyanin content; yellow sweet potatoes contain higher carotene compared with cream-colored sweet potatoes. Anthocyanin is pink, red, purple to blue, water-soluble, antioxidant, anti-inflammatory, lowers blood sugar and prevents colon cancer. Sweet potatoes yellow and orange flesh is rich in beta-carotene which is a pro-vitamin A component that is beneficial for maintaining eye health. The average productivity of sweet potato (*Ipomoea batatas* L) in Indonesia is 12.33 ton/hectare, with total production 2,196,033 tons. The average richness of sweet potatoes in West Java is 19.4 ton/hectare, with the product composition movie of 429,378 ton [1]. Central sweet potato producer in West Java include Cilembu Sumedang, Bandung, Garut, Kuningan, and Ciamis. Excess sweet potatoes compared



with other bulbs can grow in various types of soil, has a relatively short harvest period of 3-6 months and can be used as intercrop.

In addition to carbohydrates as the main ingredient, sweet potatoes contain vitamins, minerals, phytochemicals (antioxidants: β -carotene, anthocyanin) and fiber (pectin, cellulose, hemicellulose). In addition to foodstuffs, sweet potatoes are potential use as flour, starch and functional food [2, 3, 4, 5, 6]. In 100 grams of sweet potato contains many nutrients that are needed by the body such as: (1) calories 123 calorie, (2) protein 1.8 grams, (3) fat 0.7 grams, (4) 27.9 grams of carbohydrates, (5) 1.1 grams of minerals, (6) potassium 49 mg, (7) vitamin A 7,700 SI and vitamin C 22 mg. Sweet potato contains antioxidant substances that can prevent the formation of free radical cells (cancer) and β -carotene, a material that was needed for eye health. Sweet potatoes of the yellow and orange flesh are potential pro-vitamin A sources because of the β -carotene content as sweet potato dye. Ejumula varieties grown in Uganda contain β -carotene up to 325 $\mu\text{g/g}$ dry basis [7]. Ninety percent of the sweet potato carotenoids of orange are trans β -carotene [7,8].

The purple fleshy sweet potato contains many anthocyanins. Anthocyanins are dyestuffs in flowers, leaves, tubers, fruits, and vegetables that give the color pink, red, blue, purple that is affected by the pH. Anthocyanin soluble in water, safe for consumption so widely used as a natural dye for beverage products, fermented drinks, juice, fruit juice, even instant noodles. Anthocyanin has antioxidant activity [9, 10, 11, 12].

According to [13] cooking technique can reduce the amount of phenolic content as much as 7% for the oven, and 40% for fried/boiled technique. Loss of most phenolic content in a boiled order > fry > saute - steam > microwave - burn with oven [14]. [15] Found that the amount of anthocyanin decreased by almost half when it was steamed and only slightly less when baked. The process of making sweet potato cream soup in this study for steamed sweet potatoes and pasteurized milk. In the development of sweet potato cream soup products, physical characteristics and sensory become the main thing into consideration so that the community can accept the product. Physical characteristics include color, consistency, and viscosity. Sensory characteristics include taste, aroma, mouth feel, flavor, and overall acceptance. Thus the purpose of this study was to see the effect of sweet potato type on physical characteristics and sensory sweet potato cream soup.

2. Materials and Method

2.1. Materials

Materials used purple sweet potato, Cilembu Sweet potato, Japan sweet potato, yellow sweet potatoes, Sweet potatoes, cooking cream, fresh milk, water, chicken bones, spices and spices obtained from traditional markets and supermarkets in the city of Bandung. The tool used is a set of soup processing tools.

2.2. Making Sweet potato cream soup

Wash sweet potatoes until clean and then cut into four parts. Bake sweet potatoes with oven with temperature up and down 160 ° C for 30 minutes. After the sweet potatoes mature and peel while warm. Combine sweet potatoes that have been peeled with chicken broth and puree by using a blender until smooth. Heat the pot and add sweet potatoes that have been smoothed, cook a mixture of broth and sweet potatoes to boil. After boiling the heat and then enter the fresh milk and cooking cream and season with salt and pepper. Lift the sweet potato cream soup and then give the decoration by using cooking cream.

2.3. Testing of Physical and Sensory Characteristics with Quantitative Descriptive Analysis (QDA) Method.

To analyze the physical and sensory characteristics, an organoleptic test of QDA method was performed by 8 trained panelists consisting of 1 male and 7 female. QDA begins with the formation of Focus Group Discussion (FGD). The Focus Discussion Group (FGD) is a discussion forum between selected panelists

and willing to attend the training, led by panel leaders who served as moderators in the discussion. FGD is intended for building vocabulary, a common perception of the sensory characteristics of sweet potato cream soup. A panelist training was then conducted with the aim of establishing and training the tastes of the panelists. Sweet potato cream soup is then assessed by a trained panelist using the supplied test sheets. The purpose of this QDA is to obtain constructive feedback from panelists. The input will be an improvement for further tests until the developed product is of good quality. The product is manufactured by conducting multiple tests to the approximate product standard.

2.4. Hedonic Test

The hedonic test is the consumer acceptance test of sweet potato cream soup developed. This hedonic test is performed after the product trial process has been completed. The purpose of this hedonic test is to know how much the panelists are not trained to the products that have been developed. The hedonic test used 30 untrained panelists, consisting of 7 men and 23 women. The hedonic test uses test sheets that provide choice answers ranging from very dislike to very like.

2.5. Data processing

The sample test sheet filled by the panelists is processed by tabulating the data obtained, then averaged, converted into a chart.

3. Results and Discussion

Results Focus Group Discussion

Physical characteristics referred to in this study are color, and texture. The processing technique that is compared is the technique of cooking sweet potatoes by baking at a temperature of 160 °C.

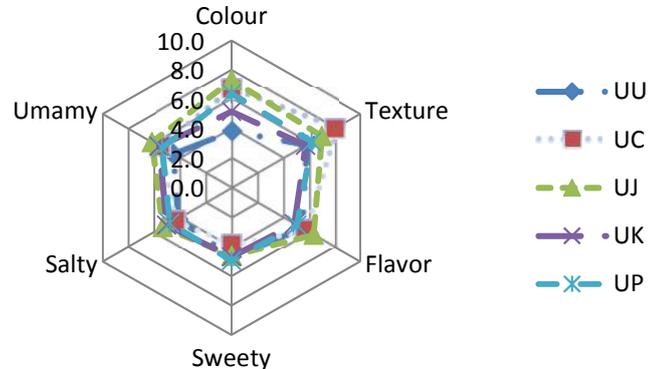


Figure 1. Physical characteristics and sensory sweet potato cream soup results from FGD: Purple Sweet Potato (UU), Cilembu Sweet Potato (UC), Japan Sweet Potato (UJ), Yellow Sweet Potato (UK), White Sweet Potato (UP)

The physical and sensory characteristics of SCS can be seen in Figure 1. Five types of sweet potato used purple sweet potato, Cilembu sweet potato, Japanese sweet potato, yellow sweet potato, and white sweet potato. The most preferred SCS color is Japanese Sweet Potato, and the most viscous texture is Cilembu sweet potato.

3.1. Hedonic Test Results

To test the public acceptance of SCS products, a hedonic test was conducted by 30 untrained panelists. The results of the hedonic test are shown in Figure 2.

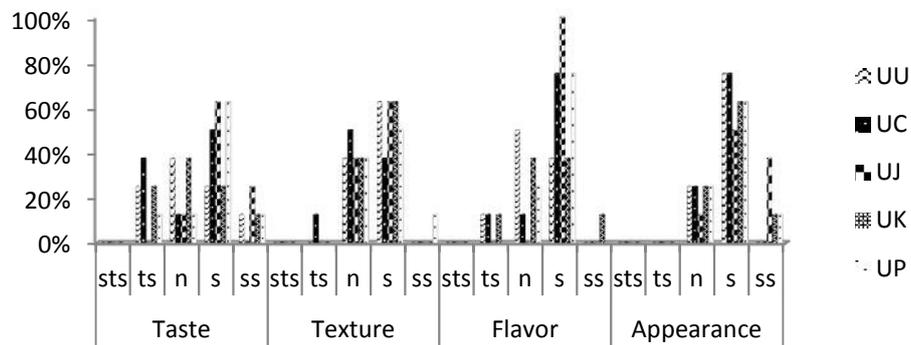


Figure 2. Physical and sensory characteristics of sweet potato cream soup: Purple Sweet Potato (UU), Cilembu sweet potato (UC), Japanese Sweet Potato (UJ), Yellow Sweet Potato (UK), Sweet Potato (UP). Very dislike (sts), dislikes (ts), neutral (n), likes (s), really likes (ss)

Figure 2 shows the average graph of untrained panelist preferences for SCS flavor is SCS UJ, and SCS UK is most preferred with an average of 62.5% for likes and 12.5% for very likes. For UU, UC and UP are relatively less favored. For the most preferred SCS textures the panelists are UU, UJ and UK. For UC SCS texture a small part does not like and UP a small part is very fond. The most preferred SCS flavor is UJ. The most popular appearance of SCS is UU, UC and UJ. Overall SCS's most preferred physical and sensory properties are SCS UJ. The differences in physical characteristics and SCS sensory are caused by different chemical constituents in the sweet potato, as shown in Table 1, Table 2 and Table 3.

Table 1. Comparison of some sweet potato chemical compositions

No	Chemical Composition	Amount		
		Cilembu*	Shiroyutaka**	Others***
1.	Water content (%)	55.33	59,8	68.5
2	Dry Matter (%)	44.67	40,2	31.5
3	Fiber (%)	4.16	2,2	-
4	Protein (%)	-	3,205	1.8
5	Starch (%)	35 – 36^	26-27	27.9
6	Sugar (%)	53.57	4,8	28.38
7	Beta carotene (mg)	-	7,38	
8	Vitamine C (mg)	-	16	22

Description: *** [16]; * [17]; **[18]; ^ [19]

Table 1 shows that the dry matter content of Japanese sweet potatoes is 40.2% which is relatively higher than the content of local sweet potato dry matter (31.5%). Cilembu Sweet potato has a dry matter content of 44.67% means slightly higher than the content of dry ingredients of Japanese sweet potatoes. The chemical composition of the sweet potato flesh is presented in Table 2. Table 2 presents the results of a proximate analysis of several researchers on several varieties of sweet potato. It appears that fresh water potato content ranges from 59.8% to 68.5%. The water content of five (5) varieties of CIP superior sweet potato (Center International Potato), ranges from 61.4% - 68%. Raw Cilembu sweet potato meat has moisture content of 55.33% (wb), pectin 1.38% (db), crude fiber content 4.16% (db), pH value 6.5, total sugar content 53.57% (db), and total sugar content of sweet potato Raw 28.38% (db) [17]. Cilembu sweet potato has the smallest water content. This shows that the content of Cilembu sweet potato

relatively larger compared with other sweet potato varieties. Sweet potatoes with high solids content suitable for use as a starch maker. Cilembu sweet potato produce flour with yield 15.94%, and starch 12.14%. Ayamurasaki sweet potato produce flour with yield of 21.99%, and starch 18.71% [20].

Table 2. Proximate analysis results of 5 CIP superior sweet potato varieties and other varieties

Variety	Water (%)	Lipid (%)	Protein (%)	Dash (%)	Fiber (%)	Carbohydrate (%)	Starch	Total Gula	carotene mg/100	Vitamine mg/100	C	Sources
CIP-1	68.00	2.93	0.93	0.67	11.85	15.62						[21]
CIP-2	62.00	2.03	0.65	1.22	12.80	21.30						
CIP-3	67.00	1.36	0.53	0.97	9.55	20.59						
CIP-4	62.30	2.25	0.69	0.74	7.08	26.94						
CIP-5	61.40	1.07	1.23	0.89	7.90	27.51						
Lokal	68.50	0.70	1.80	0.99	12.95	15.06						
Sukuh	61.48	0.19	1.29	0.72	-	36.32						[22]
Lokal	62.79	0.48	0.79	0.96	-	34.98						[23]

3.2. Not Available Data

The chemical composition of Cilembu and Ayamurasaki sweet potato flour and starch in sequence according to [20] can be seen in Table 3.

Sweet potato is very potential to be used as food for food security and prebiotic source so that need to be done research about characteristic and functional properties of sweet potato. For example, research on sweet potato starch or starch has been done by several researchers in the world, Japan [24]; China [25]; Nigeria [26]; Sri Lanka [27]; Philippine [28]; Taiwan [29]; Papua New Guinea, Australia [4]; Korea [15] and United Kingdom [5]. Their results indicate the nature of flour or starch, different components of sweet potato bioactivity depending on the variety, place and growing conditions.

The color and varieties of sweet potato determine the degree and profile of the phenolic content such as anthocyanin and carotenoids. The phenolic present in sweet potatoes are chlorogenic acids which are esters of cinnamic acid and quinic acid. Chlorogenic acid includes 3 isomers of mono-caffeoylquinic acid (CQA): 3-CQA (neochlorogenic acid); 4-CQA (cryptochlorogenic acid); And 5-CQA (chlorogenic acid); And three dicaffeoylquinic acids: 3,5-diCQA, 3,4-diCQA, and 4,5-diCQA (isochlorogenic acid) [30]. Anthocyanin are red, purple, and blue dyes in fruits, vegetables, cereals / seeds and flowers. Anthocyanin is soluble in water, a phenolic group of flavonoid groups. According to [31] the anthocyanin content in sweet potato extracted at 80 ° C using the highest acidified (3.3% b / v) acidified methanol is 186.1 cyanidin, 3-glucoside / 100 g wb. The main anthocyanins present in purple fleshy sweet potatoes are 3,5-diglucoside derivatives of cyanidin and peonidine are acylated each with p-hydroxybenzoic acid, ferulic acid, or caffeic acid [15]. The anthocyanin from purple sweet potato can be used as a natural dye because it is as stable as heat and light so it can be applied to juice making, fermented drinks, jam, confectionary, bread, snack and instant noodles [32, 33, 34]. Anthocyanin extract has the activity of counteracting free radicals, anti-mutagenic, lowering blood pressure and liver disease [32, 35, 36].

Table 3. Chemical composition of Cilembu sweet potato starch and Ayamurasaki sweet potato

Chemical Composition (%db)	Cilembu Flour	Purple Flour	Cilembu Starch	Purple Starch
Water	6.11	13.32	9.32	7.73
Ash	2.44	1.92	0.28	0.39
Fat	0.95	1.18	0.48	0.27
Protein	4.77	3.26	1.63	0.71
Carbohydrate	91.83	93.64	97.60	98.63
Starch	75.28	83.08	88.96	93.29
Amylose	11.60	13.16	24.55	26.02
Amylopectin	63.68	69.92	62.00	65.25

Carotenoids are organic dyes found in plants that play an important role as pro-vitamin A. Yellow or orange potatoes have higher levels of β -carotene than others [37, 38, 39]. Biofortified sweet potatoes with orange meat colors have been introduced in South Africa as a source of β -carotene (pro-vitamin A). Vitamin A deficiency is the leading cause of underfive and high-risk causes for pregnant and lactating women. The content of carotenoids found in biofortified sweet potatoes in South Africa ranged from 0.4 to 72.5 $\mu\text{g} / \text{g}$ of fresh weight [15]. Yellow yams contain provitamin A 1025 IU / 100 g, while the white ones contain provitamin A 10 IU / 100g. β -carotene in addition to functioning as pro-vitamin A also functions as an antioxidant.

Several studies have shown that the phytochemical content of sweet potatoes has antioxidant activity or has the ability to capture free radicals that give good effect to human health [40, 41, 3]. The red sweet potato cultivars grown in the Andean have higher antioxidant activity and phenolic content than blueberries, high antioxidant fruits [9]. The total phenolic content of 4 US sweet potato varieties ranges from 45 to 103 mg equivalent of gallic acid (GAE) / 100 g wet weight [10]. The content of phenolate, anthocyanin, sweet potato carotenoids correlates with antioxidant activity. The purple fried sweet potato developed in Japan contains anthocyanin 0.4 mg - 0.6 mg g / 100 grams wet weight [42].

According to [13] cooking technique can reduce the amount of phenolic content as much as 7% for oven, and 40% for fried / boiled technique. Loss of most phenolic content in sequence boil> fry> saute - steam> microwave - burn with oven. [14]. [15] found that the amount of anthocyanin decreased by almost half when it was steamed and only slightly reduced when burned. Loss of trans- β -carotene content by boiling more than burned. Trans- β -carotene content is more abundant than that of cis- β -carotene which is about 0.6-1.3% [43]. The storage of sweet potatoes in cold temperatures causes the phenolic content to increase [44]. The caffeoyl-sucrose derivative, 6-O-caffeoyl- (β -D-fructofuranosyl-(2-1)) - β -D-glucopyranoside (FCG), was found to increase during storage of 15 oC [30]. Carotenoid content decreases during storage due to auto oxidation because the rate of β -carotene decrease is related to the level of water and oxygen content. Sweet potatoes contain trypsin inhibitor 0.2 - 43.6 IU / 100 g. Tripsin inhibitors can close the active side of the trypsin enzyme so that it can not bind to the substrate.

4. Conclusion

This type of sweet potato affects the physical characteristics and sensory sweet potato cream soup (SCS). The most preferred characteristic of SCS color and texture is the Japanese Sweet Potato and the most viscous SCS texture is Cilembu sweet potato. The most preferred SCS overall is the Japanese yam sweet potato SCS. In general, panelists can accept and like SCS. Thus SCS is very prospective to continue to be developed.

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