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Comparison of Vitamin C, β-Carotene, and Water Content from Tamarillo (*Solanum betaceum Cav.*) Fruit and Tamarillo Jam

Hairul Bariah[1], Yuniarti Yusak[2], and Emma Zaidar[3]*

[1,2,3]Department of Chemistry, Faculty of Mathematics and Natural Sciences, Universitas Sumatera Utara, Jalan Bioteknologi No. 1 Kampus USU Medan 20155, Indonesia

Abstract. A research on the comparative analysis of levels of vitamin C, β-carotene, and water content, from a tamarillo fruit and its jam. Analysis of levels of vitamin C is done by the iodometric titration method, the analysis of levels of β-carotene performed by UV-VIS spectrophotometry, and water content analysis performed by the method of thermogravimetry. The research, found that levels of the vitamin C from tamarillo fruit were 12,3 mL/g and its jams is 6,16 mL/g, levels of β-carotene from the fruit is 180.91 ppm and its jam is 136.52 ppm, and water content of the fruit is 88.92% and its jams were 46.96%.

Keywords: Tamarillo, Vitamin C, β-Carotene, Water content

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1 Introduction

Tamarillo (*Solanum betaceum Cav.*) is a type of eggplant from the Solanaceae family. It grows in Indonesia only in a few areas, especially in Berastagi, Karo Regency, North Sumatera, and Takengon, Central Aceh, both quality and quantity. Tamarillo is a shrub or tree plant, which has a stem height of 2-3 m with a trunk diameter of 4 cm, a round stem shape, cordate leaf-shaped leaves, prominent veins, and a petiole length of 7-10. Flowers are small, have bunches, the color is pink to blue eggplant with a diameter of 1 cm, and oval-shaped fruit.

Tamarillo was originally known as *Cyphomandra betaceae* (Cav.) Send, but was later revised by Sendtner to *Solanum betaceum*, Cav. which is included in the family Solanaceae (Deny Suprihartini, *et. al*. 2007).

*Corresponding author at: Department of Chemistry, Faculty of Mathematics and Natural Sciences Universitas Sumatera Utara, Medan, Indonesia.

E-mail address: ema3@usu.ac.id

Journal Homepage: http://jcnar.usu.ac.id

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As 100 g of Tamarillo contains 82.7-87.8 g of water; protein 1.5 g; fat 0.06-1.28 g; carbohydrates 10.3 g; fiber 1.4-4.29 g; ash 0.66-0.94 mg; β-carotene 50 mg; vitamin A 150-500 SI; and vitamin C 23.3-44.9 mg (Suprihartini, 2007).

Jam is a jelly-shaped product (semi-solid) made from processed raw materials for certain fruits such as Tamarillo, pineapple, srikaya, and many other fruits with the addition of granulated sugar as a flavor parameter as well as a jam preservative. This product consists of fruit, fruit pulp, fruit juice, or fruit pieces which are processed into a gel-like structure containing fruits, sugar, acid, and pectin (Sayuti, 1997).

Vitamin C is very sensitive to external influences that cause damage such as temperature, sugar and salt concentration, oxygen, enzymes, and others. But vitamin C can also be used as an antioxidant in the body, anti-infection, anti-stress, preventing fever, influenza, and so on. (Andarwulan, N, 1992).

Carotenoids are hydroxylated derivatives of the 40-carbon hydrocarbon called carotene. Due to their highly conjugated structure, they can absorb visible light. The most naturally occurring yellow and red pigments are carotenes and carotenoids. These pigments are often involved in interactions between these systems and live with light. Therefore, in the animal body β-carotene is converted metabolically into vitamin A which is needed for the visual activity. (Philip W. Kuchel, 2006).

Researchers from the Institute of Health recommend that the body's need for β-carotene every day is only 5-6 mg. Like vitamins, although the amounts are only small, they are needed so that if not met their needs can cause liver function disorders. According to the results of these studies, β-carotene is very likely to have the benefit of inhibiting cancer. Especially cancers of the respiratory tract and digestive tract and some types of cervical cancer. In addition, β-carotene can also function as an antidote to free radicals because it acts as an antioxidant.

From the research of Wiwiek Indriyati in 2007 regarding the determination of the content of Proximate and β-Carotene in Tamarillo Fruit and Jam, it has been proven that to develop food ingredients, a series of processes are needed to obtain quality food products and have better economic value. Processing Tamarillo into a form of tamarillo jam is one of the efforts to increase the economic value of Tamarillo, of course without reducing its nutritional value of the Tamarillo.

Besides being able to be made into juice, Tamarillo can also be consumed by processing it into jam. The goal is to facilitate or help the community, especially those who suffer from stomach acid disease. Because the acidity level of the Tamarillo fruit is very high, some people cannot

consume this fruit. Therefore, another alternative was carried out how the acid content in the Tamarillo fruit was reduced, namely by processing it into jam.

2 Materials and Methods

2.1 Equipments

The equipment used in this study includes glassware, analytical balance, oven, desiccator, stative and clamp, cuvette, hot plate, porcelain cup, and UV-visible spectrophotometer.

2.2 Materials

Materials used in this study include tamarillo fruit, sugar, sodium benzoate, maize powder, tamarillo jam, starch, potassium iodide, and iodine.

2.3 Preparation of Tamarillo Fruit Extract

300 g of tamarillo, peeled, then put in a blender. Blend until smooth, filtered, and obtained tamarillo fruit extract.

2.4 Making Tamarillo Fruit Jam

500 g of tamarillo flesh put into a blender, and add 100 mL of water. Then blend until smooth, and filtered. Then put the filtrate into the pan and add 400 mL of water and then heated. Added 500 g of sugar while stirring. Then added 5 g of cornstarch and 0.5 g of sodium benzoate and stirred until evenly distributed and thickened. Removed and cooled, then put into a sterile bottle and tightly closed.

2.5 Determination of Moisture Content of Tamarillo Fruit

Tamarillo fruit filtrate weighed as much as 5.0008 g in a porcelain cup of known weight. It was dried in an oven at 110 ^{o}C for 6 hours. Then it was cooled in a desiccator for 20 minutes, then weighed until it reached a constant weight. Calculate the water content.

2.6 Determination of Vitamin C Levels of tamarillo fruit

10 mL of tamarillo fruit filtrate was measured, then put into a 100 mL volumetric flask and diluted with distilled water to the marked line. 10 mL was pipetted using a volumetric pipette and put into a 250 mL Erlenmeyer glass then added 3 drops of 1% starch indicator and titrated with 0.01 N I_2 solution until the color changed to blue. The titration was repeated 3 times.

2.7 Determination of β-Carotene Content from Tamarillo Fruit

Weighed 0.1 g of tamarillo flesh, then put into a 25 mL volumetric flask. Diluted with aquadest little by little until the marked line, after that it is homogenized. The solution was transferred to a cuvette. The absorbance of the solution was measured using a UV-Vis spectrophotometer at a

wavelength of 446 nm. The absorbance of the blank was also measured using a UV-Vis spectrophotometer at a wavelength of 446 nm. The results were recorded.

2.8 Determination of Moisture Content of Tamarillo Jam

Tamarillo jam was weighed as much as 5.0012 g in a porcelain cup with a known weight. It was dried in an oven at 110^{o}C for 6 hours. Then it was cooled in a desiccator for 20 minutes, then weighed until it reached a constant weight. Calculate the water content.

2.9 Determination of Vitamin C from Tamarillo Jam

Weigh 10 g of Tamarillo jam, then put it into a 100 mL volumetric flask and dilute with distilled water to the marked line. 10 mL was pipetted using a volumetric pipette and put into a 250 mL Erlenmeyer glass then added 3 drops of 1% starch indicator and titrated with 0.01N I_2 solution until the color changed to blue. The titration was repeated 3 times.

2.10 Determination of β-Carotene Content from Tamarillo Jam

Weighed 0.1 g of tamarillo jam, then put into a 25 mL volumetric flask. Diluted with aquadest little by little until the marked line, after that it is homogenized. The solution was transferred to a cuvette. The absorbance of the solution was measured using a UV-Vis spectrophotometer at a wavelength of 446 nm. The absorbance of the blank was also measured using a UV-Vis spectrophotometer at a wavelength of 446 nm. The results were recorded.

3 RESULT AND DISCUSSION

3.1 Analysis of Moisture Content

Based on the results of the study (Table 1), the water content obtained from the tamarillo fruit was 88.92%, while the water content obtained from the tamarillo jam was 46.96%. The decrease in water content was caused by evaporation that occurred during the jam cooking process. When the water temperature increases, the number of water molecules will decrease and the hydrogen bonds will break so that the water vapor pressure exceeds atmospheric pressure, as a result, the molecules are released from the surface and turn into gas. The water content in foodstuffs greatly affects the shelf life of these foodstuffs, because water can affect physical properties or chemical changes such as texture, color, and taste of food. The water content in food can also change according to the environment, and this is closely related to the durability of the food during the storage process.

Table 1. Table of water content analysis

No	Sample	Treatment			Average weight (g)	Moisture (%)
		I	II	III		
1.	5.0008 g tamarillo fruit filtrate	54.0980	54.0982	54.0990	54.0984	88.92%

2.	5.0012 g tamarillo fruit jam	56.1973	56.1970	56.1975	56.1972	46.96%

3.2 Analysis of Vitamin C

Based on the results of the study (table 2), the levels of vitamin C in the tamarillo fruit were 12.3 mg/g, while the vitamin C content in the tamarillo jam was 6.16 mg/g. This is because, during the process of making jam, the levels of vitamin C present in the Tamarillo also evaporate along with the water vapor when heating is in progress. Besides, processing in various ways will reduce levels of vitamin C such as heating. Other damage to vitamin C levels in fruits can be caused by the enzyme Ascorbic oxidase acid when the fruit is cut or sliced, the enzyme will be liberated and can damage vitamin C levels so that the loss of vitamin C levels will be faster.

Table 2. Table of vitamin C content analysis

No	Sample	Volume of Titrant (mL)			Average Volume (mL)	Vitamin C (mg/g)
		I	II	III		
1.	10 mL tamarillo fruit filtrate	1.4	1.5	1.5	1.4	12.3
2.	10 g tamarillo fruit jam	0.7	0.7	0.8	0.7	0616

3.3 Analysis of β-Carotene

Based on the results of the study (table 3 and table 4), the β-carotene content of the tamarillo fruit was 180.91 ppm while the β-carotene content of the tamarillo jam was 136.52 ppm. From these results, it can be seen that there is a decrease in β-carotene levels from tamarillo jam, this is due to the nature of β-carotene which is not resistant to heat so the β-carotene molecule will be damaged by the heating process at the time of making the jam. Changes in β-carotene levels are influenced by temperature and the length of the heating process. The higher the temperature and the longer the heating time, the more volatile compounds formed from the degradation of β-carotene will be numerous.

Table 3. Table of β-carotene content from tamarillo fruit

No	Sample (g)	Treatment	Absorbance at λ 446 nm	β-Karoten Levels (ppm)
1.	0.1 g tamarillo	I	0.2885	181.37
		II	0.2870	180.43
		III	0.2876	180.81
		IV	0.2880	181.06
Average			**0.2877**	**180.91**

Tabel 4. Table of β-carotene content from tamarillo jam

No	Sample (g)	Treatment	Absorbance at λ	β-Karoten Levels (ppm)

		446 nm	
1. 0,1 g tamarillo jam	I	0.2647	136.63
	II	0.2650	136.78
	III	0.2643	136.42
	IV	0.2640	136.26
Average		**0.2645**	**136.52**

4 Conclusion

From the results of research that has been done regarding the comparison of tamarillo fruit against tamarillo jam based on the analysis of vitamin C, β-carotene, and water content, it can be concluded as follows:

1. The results of the analysis of vitamin C levels from Tamarillo fruit were higher than in Tamarillo jam, which was 12.32 mg/100 g and 6.16 mg/100 g respectively.
2. The results of the analysis of β-carotene levels from Tamarillo fruit were higher than Tamarillo jam, which was 180.91 ppm and 136.52 ppm respectively.
3. The results of the analysis of the water content of the Tamarillo fruit were higher than that of the Tamarillo jam, which was 88.92% and 46.96% respectively.

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