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DETERMINATION OF VITAMIN C CONTENT IN DEWANDARU FRUIT (*Eugenia uniflora L.*) BY CONTENT MATURITY

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ABSTRACT
Vitamin C is a vitamin that is very important to the human body as a source of antioxidants. Vitamin C is found in vegetables and fruits, and the amount of vitamin C in each ripeness content varies. Dewandaru fruits come in different fruit colors at each ripeness content. This study aimed to determine vitamin C contents in Dewandaru fruit according to maturity (unripe, unripe, ripe, and late). The iodometric approach was used in this investigation to measure the amount of vitamin C present. According to the study's findings, the vitamin C contents of Dewandaru fruit were found to be 0.036 mg/g when the fruit was raw, 0.105 mg/g when it was semi-ripe, 0.211 mg/g when it was ripe, and 0.155 mg/g when it was past ripe. This means that the graph shows that the vitamin C contents of Dewandaru fruit will rise until the fruit is ripe and fall once the maturity content has passed.
Keywords: Vitamin C, Dewandaru Fruit, Iodimetric, Titration.
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INTRODUCTION
Indonesia is a country with a tropical climate, which is located on the equator. These conditions allow various fruits to thrive and contain high amounts of vitamins, as well as flavonoids that act as antioxidants. Fruits are a source of nutrition for the human body, especially as a source of vitamins, minerals, and potassium.[1] Vitamins as a source of nutrition obtained from fruit are organic compounds that the body needs for metabolic processes and growth. The human body cannot make vitamins. Hence, availability in the body is needed from outside the body through the consumption of food.[2] The human body requires a variety of vitamins, including vitamins A, B, C, D, E, and K. The body needs vitamin C, a water-soluble vitamin, to produce collagen in bones, cartilage, muscles, and blood vessels as well as to aid in the absorption of iron. Vitamin C also plays a role in collagen biosynthesis, carnitine, and catecholamine metabolism, and cholesterol metabolism in bile. Vitamin C cannot be synthesized by the human body and can only be obtained through food intake, especially in fruits and green leafy vegetables.[3-4-5] Fixed C is also known as an antioxidant and is effective in dealing with free radicals to protect molecules needed by the body such as proteins, lipids, carbohydrates, and nucleic acids, and prevent damage to cells or tissues in the body. When compared with other vitamins, this vitamin is a type of vitamin that is widely known by ordinary people. Even though it is equally important, many consider that the properties of vitamin C are more needed than other vitamins, and are often associated with increased body resistance or antioxidants.[6] The amount of vitamin C consumed also varies by age. The intake of vitamin C for children is between 30-45 mg/day, for adults, it is 50-60 mg/day, while pregnant and lactating women need to supplement 10-25 mg/day.[7] According to 2, vitamin C is made from hexose, a readily oxidized and water-soluble sugar. Heat, light, alkali, enzymes, and copper and iron catalysts all affect the oxidation of vitamin C. What's more, in addition, this vitamin has a chromophore that is sensitive to light stimulation. It was also explained that one of the factors that can affect vitamin C contents in plants is fruit maturity. Dewandaru is a plant that can be found in Indonesia, although the tree or fruit comes from Brazil and belongs to the myrtle family. This plant is able to adapt to different soils and climates. This is the reason why this plant is often found in various regions of the world, including Indonesia.[8] According to[9], the characteristics of the dewadaru fruit are its round shape and protruding surroundings. The fruit of this plant is about 1.5-3 cm in diameter and the color can gradually change from green when young to yellow, orange when the fruit is half ripe, and purplish-

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dark red when ripe. This fruit can be eaten directly and made into juice or jam. The taste of this fruit itself is sour, fresh, and sweet. High levels of vitamin C, vitamin A, riboflavin (B12), and niacin (B3) can be found in dewandaru fruit. Fruit with high polyphenol content while unripe has a lower level as it ripens. On the other hand, as fruit ripens, the carotenoid content rises, as shown by an increase in the reddish-orange color.[10] Dewandaru fruit is one of the fruits that act as a free radical with the presence of flavonoids in the form of quercitin and phenolic compounds.[11-12] For this reason, it is necessary to conduct research that aims to determine the contents of vitamin C from various contents of maturity of Dewandaru fruit.

EXPERIMENTAL

To produce jam, Dewadaru fruit that is raw, half-ripe, ripe, or past-ripe is first cleaned. After that, it is chopped into small pieces and mashed with a mortar and pestle. After being crushed, the samples were weighed up to 5 grams, placed in a 50 mL volumetric flask, and distilled water was poured up to the mark. The filtrate and residue were then separated using filter paper. The collected filtrate is prepared for sampling. Up to 5 mL of raw Dewadaru fruit samples were placed in an Erlenmeyer, 1 mL of 1% starch indicator was added, and then 0.01 N iodine solution was titrated until the sample turned dark blue. Apply the same procedure to samples of Dewadaru fruit that are half-ripe, ripe, and over-ripe. Direct titration with 0.01 N iodine solution can be used to measure the vitamin C content of raw Dewadaru fruit; 1 mL of this solution equals 0.88 mg of vitamin C.[13]

RESULTS AND DISCUSSION

This study used samples of raw Dewadaru fruit originating from Palu City and samples of half-ripe, ripe, and over-ripe Dewadaru fruit originating from Manado City. Samples were analyzed using the iodometric titration method (direct titration). Titration was carried out 3 times (triple) on each sample using an iodine solution with a concentration of 0.01 N. The results of titrant volume (mL) of Dewadaru fruit based on maturity content can be seen in Table-1, 2, 3, and 4.

Tabel-1: Results of Raw-Fruit Sample Titrant Volume

Repetition	Titrant volume (mL)	Vitamin C content (mg/g)
1	0.1	0.018
2	0.4	0.074
3	0.1	0.018

Table-2: Results of Half-Rife Sample Titrant Volumes

Repetition	Titrant volume (mL)	Vitamin C content (mg/g)
1	0.6	0.111
2	0.5	0.093
3	0.6	0.111

Table-3: Results of Raw-Fruit Sample Titrant Volume

Repetition	Titrant volume (mL)	Vitamin C content (mg/g)
1	1.2	0.223
2	1.1	0.205
3	1.1	0.205

Table-4: Results of Over Rife Sample Titrant Volume

Repetition	Titrant volume (mL)	Vitamin C content (mg/g)
1	0.8	0.149
2	0.9	0.167
3	0.8	0.149

The iodometric approach (direct titration) was employed for the analysis of this vitamin C investigation. Iodine and vitamin C can interact to form dehydroascorbic acid, and iodine can also operate as an oxidizing agent by employing a starch indicator. Table-5 displays the findings of the analysis of the vitamin C content in Dewadaru fruit dependent on the level of maturity.

The idea behind iodine titration is that after iodine has created a double bond to carbon atoms numbers 2 and 3 in vitamin C, the double bond will eventually break down into a single bond. According to[14] the reaction changes that occur between vitamin C and iodine can be seen in Fig.-1.

Iodine drips later throughout the titration and will react with the starch indicator solution (starch) to generate blue iodine-amylum once all of the vitamin C has been added by iodine. Since all of the vitamin C has been combined with iodine to the point where the volume of iodine required for the titration is equal to the amount of vitamin C, the blue hue that results shows that the titration process has been finished. Since there are numerous elements that can contribute to vitamin oxidation, this titration needs to be done right away. C, as in the case of sample preparation.[14]

Table-5: Results of Analysis of Vitamin C Contents of Dewandaru Fruit (mg/g)

Number	Dewandaru Fruit Extract	Average Contents of Vitamin C (mg/g)
1.	Raw fruit	0.036
2.	Half-rife	0.105
3.	Rife-fruit	0.211
4.	Over rife	0.155

L-ascorbic acid and L-dehydroascorbic acid, both of which have the same properties as vitamin C, are two possible forms of the nutrient. L-dehydroascorbic acid is produced by the simple reversible oxidation of this vitamin. L-diketogulonic acid, which no longer reacts with vitamin C, can be created by further transforming L-dehydroascorbic acid. According to[15] the reaction to changes in vitamin C can be seen in Fig.-2.

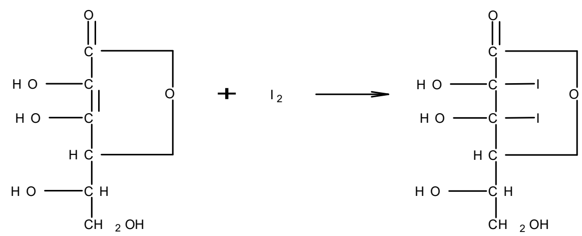

Fig.-1: The Reaction that Occurs between Vitamin C and Iodine Produces Dehydroascorbic Acid

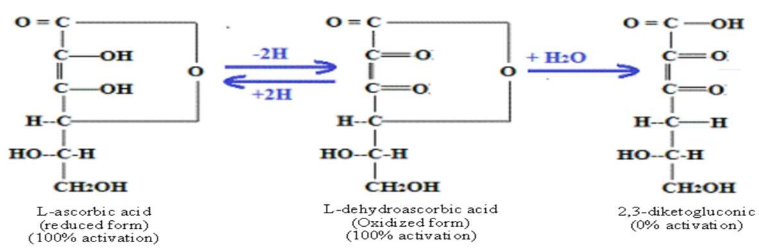

Fig.-2: Reaction to Changes in Vitamin C Contents

The human body may acquire plenty of vitamin C from fruits and vegetables. Fruits and even vegetables differ in their vitamin C concentration depending on the species, as well as on the environment, the amount of ripeness, and even the amount of vitamin C present in the fruit or vegetable.[16] Vitamin C contents are strongly influenced by the environment, where it grows, soil, temperature, fertilizer use, fruit maturity content, and so on. Vitamin C levels in fruit rise until they are ripe and fall once the maturity content has been reached.[17] More clearly the determination of vitamin C contents in Dewadaru fruit based on the content of maturity can be seen in Table-5. The total contents of vitamin C obtained in this study are supported by the opinion expressed by[14] which states that the contents of vitamin C that occur in Dewadaru fruit experience a decrease when the maximum point has been reached. It was further explained[18] that the biosynthesis of vitamin C is influenced by the presence of vitamin C oxidase activity during the aging process of the fruit. In addition to decreasing contents of vitamin C according to[18] it is also due to the breakdown of sugar from the reshuffling process that occurs when the fruit ages. So the amount of sugar used for catabolism is greater than the amount of starch hydrolysis sugar which causes the sugar content to decrease.

Another opinion was put forward by[19] that the vitamin C content will increase from raw to ripe conditions, but after being cooked, the vitamin C content will decrease. The decrease in vitamin C contents can be caused by organic acids, including vitamin C, which experience simpler compound breakdown as a result of respiration.

CONCLUSION

According to the study's findings, the vitamin C content of Dewandaru fruit was 0.036 mg/g in unripe fruit, 0.105 mg/g in half-ripe fruit, 0.211 mg/g in ripe fruit, and 0.155 mg/g in overripe fruit, respectively. As a result, the graph showed that the vitamin C content of Dewandaru fruit will increase until the fruit is ripe and decrease when the maturity content is passed. The vitamin C content of Dewandaru fruit is higher than that of Gadung Mango and Rambusa Fruit when compared to various fruits in the city of Palu, such as those two.

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CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest.

AUTHOR CONTRIBUTIONS

All the authors contributed significantly to this manuscript, participated in reviewing/editing and approved the final draft for publication. The research profile of the authors can be verified from their ORCID ids, given below:

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