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Comparison of L-Ascorbic Acid Content of Red Dragon Fruit (*Hylocereus lemairei* (*Hook.*) *Britton & Rose*) Based on the Level Maturity

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ABSTRACT

Introduction: *Red dragon fruit (Hylocereus lemaire (Hook.) Britton & Rose) It has abundant antioxidant content that is able to suppress oxidative stress from free radicals. One of them is vitamin C (L-ascorbic acid is an important molecule in plants and animals that functions as a cofactor of various enzymes. This compound is most abundant in fruits, but the level is affected by the level of ripeness of the fruit.* ***Aims***: *This study also aims to determine the difference in vitamin C levels of red dragon fruit at different levels of ripeness, namely raw, half-ripe, and ripe.* ***Result:*** *The analysis used includes qualitative and quantitative using a UV-Vis spectrophotometer. The qualitative analysis used three tests, treatment I used FeSO4 5% and NaOH 10%, treatment II with iodine 10%, and treatment III used KMnO4 as an oxidizer. All qualitative tests on red dragon fruit from all maturity levels showed positive results with vitamin C content. while quantitative analysis of vitamin C levels showed different levels ranging from raw, half-ripe, and ripe with each value of 0.7112 mg/5g; 0.5380 mg/5g; and 0.3410 mg/5g.* ***Conclusion:*** *These results showed that there was a decrease in vitamin C levels with the increasing level of fruit ripeness.*

KEYWORDS: *Red dragon fruit, vitamin c, l-ascorbic acid, fruit ripeness, spectrophotometer*

INTRODUCTION

Indonesia is a country that is famous for its natural wealth. Various types of vegetables and fruits can grow at dawn in Indonesian soil, including red dragon fruit. This fruit has many health benefits, including being able to prevent anemia in adolescents (Rohanah et al., 2023). Dragon fruit or its scientific name (*Hylocereus lemairei* (*Hook.*) *Britton & Rose*) is a fruit that is rich in antioxidants and bioactive compounds. Based on the amount of flavonoids it contains, red dragon fruit has more antioxidant activity than white dragon fruit (Puspawati et al., 2023). Another antioxidant content of red dragon fruit is vitamin C which has many benefits for health.

Vitamin C, scientifically referred to as L-ascorbic acid (Doseděl et al., 2021). Due to vitamin C's many health benefits, a variety of businesses, including raw materials, food, drink, and cosmetics, frequently use it (See et al., 2024). Due to its role as an enzyme cofactor in numerous processes, L-ascorbic acid is a significant antioxidant molecule in the metabolism of both plants and animals. Vitamin C can be synthesized by both humans and animals in the liver or kidneys, but most have lost this ability as a result of coding mutations. Dietary changes are one of the causative factors, so it is necessary to increase fruit consumption to increase vitamin C content in the body (Fenech et al., 2019).

The content of vitamin C in fruits is affected by various factors, including the environmental conditions, location of growth, the kind of fertilizer applied, and the fruit's stage of ripeness. The level of fruit ripeness greatly affects the amount of vitamin C content, the higher the level of ripeness, the higher the level and will decrease after exceeding the level of maturity (Oktoviana et al., 2012). Research conducted by (Hayati & Irhamni, 2023) shows an interaction between the level of maturity and the level of vitamin C, protein, and fat in the golden banana (*Musa acuminata Colla*). The same interaction was also shown in the study of tomato (*Lycopersicum esculentum* Mill) with the highest vitamin C level of 21.29 mg/100g after 45 to 63 days of planting. This level decreased significantly after 72 days of planting (Dwi et al., 2021).

Research on the vitamin C content of fruits has also been carried out on gadung and golek fruits with different levels of maturity. Vitamin C levels of gadung, half-ripe, mature, and over-ripe manga, respectively, were 83.66 mg/100 g; 101.82 mg/100 g; and 92.85 mg/100 g. Meanwhile, in manga, golek is 57.72 mg/100 g, respectively; 79.30 mg/100 g; and 61.14 mg/100 g (Rahman et al., 2015). The L-ascorbic acid content in red dragon fruit has been of interest due to its potential health benefits. L-ascorbic acid, also known as vitamin C, plays a crucial role in human health as an antioxidant and in immune function. The research objective of this study is to analyze the L-ascorbic acid content in red dragon fruit and its potential impact on human health. The hypothesis is that red dragon fruit will have a high concentration of L-ascorbic acid, making it a valuable addition to a healthy diet. In this case, red dragon fruit also has vitamin C content, therefore this study aims to determine the level of vitamin C at different levels of maturity using a UV-Vis spectrophotometer.

MATERIAL AND METHODS

Sample and Material

The fruit used as a sample in this study was the red dragon fruit (*Hyleocereus Lemaire* (*Hook.*) *Britton & Rose*) from Banyuwangi district with a level of raw, half-ripe and ripe ripeness. The sampling technique used is simple sampling. While the material used are ascorbic acid (Merck), NaOH 10% (b/v), methylene blue (Merck), $KMnO_4$, aquadest, $FeSO_4$ 5% (b/v), and Iodine 10% (b/v).

Sample Preparation

Red dragon fruit with different levels of maturity is peeled, cut into small pieces, and weighed 5 grams. Next, it is mashed and added aquadest, then filtered using flannel.

Qualitative Analysis

Testing was carried out on each treatment. Each test involved three treatments: raw, half-ripe, and ripe. For the first tube, 2 mL of sample was added, followed by 2 drops of 10% NaOH and 2 mL of 5% $FeSO_4$. Positive results were indicated by a yellow color. In the second tube, 1 mL of sample was added, and then 10% iodine was added dropwise until a positive result was obtained, evidenced by the disappearance or fading of the iodine color within approximately 3 minutes (Hayati & Irhamni, 2023). The third tube contained 2 mL of sample to which a few drops of $KMnO_4$ were added until a positive result was observed, characterized by the formation of brown deposits (Puspitasari et al., 2019).

Quantitative Analysis

Preparation of 100 ppm vitamin C stock solution

The stock solution was prepared using ascorbic acid. Fifty milligrams of ascorbic acid were weighed and transferred to a 500 mL volumetric flask. Deionized water was added to the flask up to the calibration mark (Mulyati & Pujiono, 2021).

Calibration curve preparation and sample measurement

Vitamin C standard solutions (1, 2, 3, 4, 5, and 6 ppm) were prepared by pipetting 1, 2, 3, 4, 5, and 6 mL of the 100 ppm vitamin C stock solution into separate 50 mL volumetric flasks, respectively. The solutions were diluted to the mark with deionized water and mixed thoroughly. The absorbance of each standard solution was measured at the maximum wavelength using a UV-Vis spectrophotometer. To determine the vitamin C content in dragon fruit filtrate, 5 grams of dragon fruit pulp were mashed and filtered. One milliliter of the filtrate was transferred to a 100 mL volumetric flask and diluted to the mark with deionized water. The absorbance of the diluted filtrate was measured at the maximum wavelength using a UV-Vis spectrophotometer. This measurement was replicated three times for each sample (Mulyati & Pujiono, 2021).

RESULTS AND DISCUSSION

Qualitative analysis of vitamin C

Qualitative tests of vitamin C were carried out with 3 treatments and each treatment used different reagents. The purpose of the qualitative analysis of vitamin C is to ensure the presence of vitamin C content in red dragon fruit and the results are shown in Table 1.

This qualitative analysis was carried out on red dragon fruit with different levels of maturity and the results showed that red dragon fruit positively contained vitamin C at all levels of maturity. Each treatment is based on a redox reaction, specifically an oxidation-reduction reaction. In treatment, I the oxidizer $FeSO_4$ oxidizes vitamin C, as indicated by the solution turning yellow and by the reaction equation displayed in Figure 1a. All of

Table 1. Vitamin C Qualitative Test Results

Maturity Level	Treatment	Observation	Ket.
	Treatment I	Yellow color	+
Raw	Treatment II	The color of iodine then disappears	+
	Treatment III	Chocolate precipitate	+
	Treatment I	Yellow color	+
Half-ripe	Treatment II	The color of iodine then disappears	+
	Treatment III	Chocolate precipitate	+
	Treatment I	Yellow color	+
Ripe	Treatment II	The color of iodine then disappears	+
	Treatment III	Chocolate precipitate	+

*Treatment I: NaOH 10% and $FeSO_4$ 5%; treatment II: iodine 10%; Treatment III: $KMnO_4$

treatments, it is based on an oxidation reduction reaction (redox), where in treatment I vitamin C is oxidized by the oxidizer $FeSO_4$ which is indicated by the change in the color of the solution to yellow with the reaction equation shown in Figure 1a. In treatment II, a redox reaction also occurred with I_2 as an oxidizing agent and vitamin C as a reducing agent in Figure 1b. During the reaction, there is a transfer of electrons from the reducing agent (vitamin C) to the oxidizer (I_2) producing dehydroascorbic acid and iodide (Hayati & Irhamni, 2023).

Meanwhile, in treatment III, the same reaction principle occurs as treatment I and II, namely redox reactions. In this case, $KMnO_4$ has properties as a strong oxidizer and is able to reduce ascorbic acid to dehydroascorbic acid. In this reaction, the element Mn in $KMnO_4$ has the highest charge, which is +7, so it will be very easy to undergo a reduction reaction to produce Mn^{2+} which is indicated by brown deposits (Puspitasari et al., 2019).

Quantitative Analysis of Vitamin C in Red Dragon Fruit

Quantitative analysis aims to determine the amount or level of substances or compounds in a sample. In this study, the quantitative analysis is aimed at determining the level of vitamin C in red dragon fruit at various levels of maturity, which later this data will be used as a reference for the comparison of the amount of vitamin C. The analysis was carried out using a UV-Vis spectrophotometer at 265 nm with ascorbic acid as standard. The analysis begins by making a stock solution and standard series solution to obtain the standard curve as shown in Figure 2. From the standard curve, the equation y = 0.054x + 0.1373 with a linearity of 0.9936 is obtained. This standard

$$C_6H_8O_6 + FeSO_4 + 2NaOH \rightarrow Na_2SO_4 + C_6H_6O_6 + Fe(OH)_2 + H_2O \qquad (a)$$

$$C_6H_8O_6 + I_2 \xrightarrow{2H^+} C_6H_6O_6 + 2I^- \qquad (b)$$

$$5C_5H_8O_6 + 2MnO_4^- + 6H^+ \rightarrow 5C_6H_8O_7 + 2Mn^{2+} + 3H_2O \qquad (c)$$

Figure 1. Vitamin C qualitative test reaction; (a) Treatment I; (b) Treatment II; (c) Treatment III

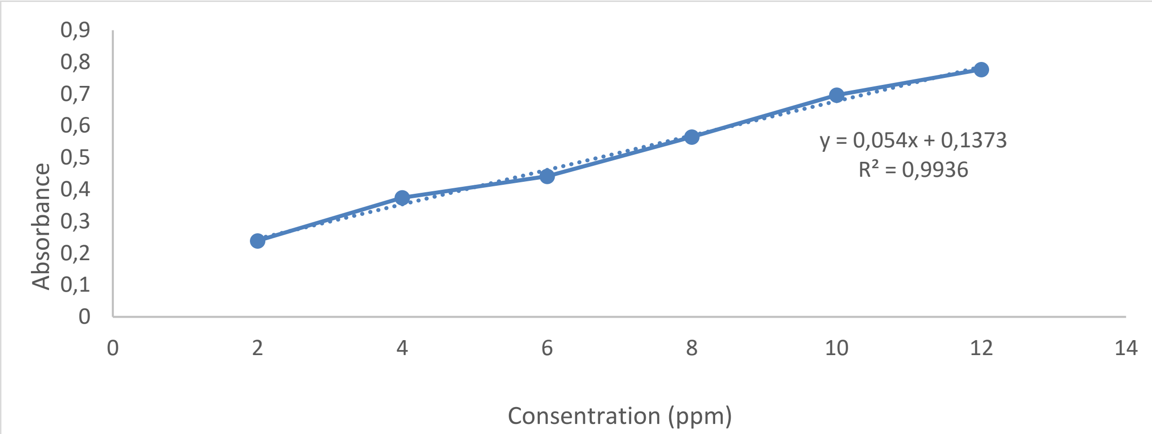

Figure 2. Standard Curve of Vitamin C Solution

curve is quite linear because the R-value is close to one, so it can be used to analyze samples. Meanwhile, the reaction equation will later be used to determine the concentration of vitamin C in the sample as shown in Table 2.

The equations obtained from the curves were used to determine the vitamin C concentrations of red dragon fruit samples at different levels of ripeness. The results of concentration calculation and level determination are shown in Table 2. The vitamin C level in raw fruits was 0.7112 mg/5g, in half-ripe fruits was 0.5380 mg/5g, and in ripe fruits was obtained 0.3410 mg/5g. These results showed a decrease in vitamin C levels from raw to mature maturity. This study shows that vitamin C levels in raw fruits are higher than in ripe fruits. The same results were also shown in (Mulyati & Pujiono, 2021) research, from the results of the research conducted there was a decrease in vitamin C levels with the increasing level of ripeness of the Podang mango fruit. The highest levels of vitamin C are found in raw Podang mangoes. (Risnayanti et al., 2015) research also reported a similar thing where vitamin C levels also decreased along with the high level of fruit maturity.

This difference is caused by the level of fruit ripeness causing the total dissolved solids, moisture content, color value, and texture of the fruit and the preference for aroma will increase, but not in line with the total acid, hardness value, and vitamin C will decrease (Risnayanti et al., 2015). Another factor that can affect the level of vitamin C in fruit is the length of exposure to heat from sunlight, the longer it is exposed to heat, the lower the level. The higher the level of ripeness, the longer it is exposed to heat so that the vitamin C level of the fruit decreases. In this case, prolonged exposure to heat or light can accelerate the oxidation reaction in Vitamin C to produce L-dehydroascorbic acid in an alkaline atmosphere. L-dehydroascorbic acid will undergo further oxidation to form 2,3 ditogulonic acid. 2,3-ditogulonic acid can be oxidized again into 1-threonic acid and oxalic acid. The oxidation reaction of vitamin C to form L-dehydroascorbic acid is reversible (can produce Vitamin C again), while other reactions are irreversible (Thurnham & Bender, 2000).

The results of the normality test data analysis show that the data is normally distributed because the p-value is p> 0.05, and the data is homogeneously distributed. The results of the ANOVA test obtained a value of 0.425, which means that there was no difference in the analysis of vitamin C levels in red dragon fruit based on the level of ripeness.

Table 2. Vitamin C levels of red dragon fruit at different levels of maturity

Maturity level	Average concentration (mg/5g)
Raw	0.711 ± 0,477
Half-ripe	0.538 ± 0,250
Ripe	0.341 ± 0,147

n = 3

CONCLUSION

Based on the results of this study, shows that there are differences in the vitamin C content of red dragon fruit based on the level of ripeness. Vitamin C levels decrease with increasing ripeness of red dragon fruit. Based on statistical tests, the p-value was obtained p> 0.05, which indicates that the data is normally distributed and homogeneous. Meanwhile, the results of the ANOVA test showed that there was no difference in the analysis of vitamin C based on maturity level.

REFERENCES

Doseděl, M., Jirkovský, E., Macáková, K., Krčmová, L. K., Javorská, L., Pourová, J., Mercolini, L., Remião, F., Nováková, L., & Mladěnka, P. (2021). Vitamin C Sources, Physiological Role, Kinetics, Deficiency, Use, Toxicity, and Determination. Nutrients, 13(2), 1–36. https://doi.org/10.3390/nu13020615

Dwi, L., Sari, A., Surya Ningrum, R., Ramadani, A. H., & Kurniawati, E. (2021). Kadar Vitamin C Buah Tomat (*Lycopersicum esculentum* Mill) Tiap Fase Kematangan Berdasar Hari Setelah Tanam. Jurnal Farmasi dan Ilmu Kefarmasian Indonesia, 8(1), 74–82.

Fenech, M., Amaya, I., Valpuesta, V., & Botella, M. A. (2019). Vitamin C Content in Fruits: Biosynthesis and Regulation. Frontiers in Plant Science. Frontiers Media S.A., 9(1), 1–21. https://doi.org/10.3389/fpls.2018.02006

Hayati, R., & Irhamni, D. (2023). Pengaruh Tingkat Kematangan dan Lama Penyimpanan Terhadap Kualitas Pisang Mas (*Musa acuminata Colla*). Jurnal Agrotropica, 20(2), 145–155.

Mulyati, T. A., & Pujiono, F. E. (2021). Analisa Kadar Vitamin C Mangga Podang (*Mangifera indica* L.) pada Berbagai Tingkat Kematangan dengan Metode Spektroskopi UV-Vis. Journal of Herbal, Clinical and Pharmaceutical Sciences. 2(2), 31–37.

Oktoviana, Y., Aminah, S., & Sakung, J. (2012). Pengaruh Lama Penyimpanan dan Konsentrasi Natrium Benzoat terhadap Kadar Vitamin C Cabai Merah (*Capsicum annuum* L). Jurnal Akademika Kimia, 1(4), 193–199.

Puspawati, G. A. K. D., Ina, P. T., & Ekawati, G. A. (2023). Potensi Antioksidan Buah Naga Merah (*Hylocereus polyrhizus*) Kering dengan Pre-Treatment. Jurnal Agroteknologi, 16(2), 148–162. https://doi.org/10.19184/jagt.v16i02.27927

Puspitasari, A. D., Susanti, E., & Khustiana, A. (2019). Aktivitas Antioksidan dan Penetapan Kadar Vitamin C Perasan Daging Buah Lemon (*Citrus limon* (L.) *Osbeck*) Menggunakan Metode ABTS. Jurnal Ilmiah Teknosains, *5*(2), 99–104.

Rahman, N., Ofika, M., & Said, I. (2015). Analisis Kadar Vitamin C Mangga

Gadung (*Mangifera* sp) dan Mangga Golek (*Mangifera indica* L) Berdasarkan Tingkat Kematangan Dengan Menggunakan Metode Iodimetri. Jurnal Akademika Kimia, *4*(1), 33–37.

Risnayanti, Sabang, S. M., & Ratman. (2015). Analisis Perbedaan Kadar Vitamin C Buah Naga Merah (*Hylocereus polyrhizus*) dan Buah Naga Putih (*Hylocereus undatus*) yang Tumbuh di Desa Kolono Kabupaten Morowali Provinsi Sulawesi Tengah. Jurnal Akademika Kimia, *4*(2), 91–96.

Rohanah, R., Puspita, R. R., Wijaya, R. D., Pratiwi, R. D., & Hareva, J. A. (2023). Buah Naga (*Hylocereus polyrhizus*) dan Buah Bit (*Beta vulgaris*) terhadap Peningkatan Kadar Hemoglobin. Holistik Jurnal Kesehatan, *17*(6), 465–472.

See, X. Z., Yeo, W. S., & Saptoro, A. (2024). A Comprehensive Review And Recent Advances of Vitamin C: Overview, Functions, Sources, Applications, Market Survey and Processes. Journal Chemical Engineering Research and Design, 206(2024), 108–129.

Thurnham, D. I., & Bender, D. A. (2000). Water Soluble Vitamins, Human Nutrition and Dietetics. United Kingdom: Harcourt.