

Chemical Analyze of Beta-Carotene in Indonesia Local Fruit

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Abstract

Indonesia has different types of plants and fruits. Fruits, vegetables, and tubers can contain beta-carotene and are antioxidants. Generally, local fruits have bright colors such as red, orange and yellow, such as mango, papaya, orange, persimmon, etc. The purpose of this study was to identify beta-carotene compounds found in fruit. The findings are designed to inform the public about the importance of beta-carotene in fruit. The samples measured in this study included pineapple, papaya, guava, Medan orange, star fruit, melon, mango, banana, and dragon. All samples are from traditional markets in Bekasi. The research method used was UV-Vis spectrophotometry. Beta-carotene measurements were performed at a wavelength of 450 nm. The highest content of beta-carotene was found in pineapple at 123.36 micrograms per milliliter, while the lowest was found in dragon fruit, at 2.253 micrograms per milliliter. Pineapple flesh contains sugar, vitamins, minerals, and retinol, and its pale yellow color indicates the presence of beta-carotene.

INTRODUCTION

Indonesia has various types of plants and fruits. Fruits, vegetables and tubers have the potential to contain beta carotene and antioxidants. In general, local fruits have bright colors such as red, orange, and yellow, for example, mango, papaya, orange, persimmon, and so on. The color of these fruits is identical to the color of beta carotene (Dahlan, 2019).

Beta carotene is a precursor of provitamin A which is very beneficial for the human body. Foods containing beta carotene are generally also bright red, yellow or orange depending on color degradation so that the amount of content is different. Beta carotene is one type of antioxidant that can counteract free radicals so as to prevent non-communicable diseases and neutralize toxic substances from air pollution. Antioxidants are also beneficial for women's

beauty which can prevent premature aging (Wijayanti, 2019).

Antioxidants based on the source can be divided into two, namely natural antioxidants and synthetic antioxidants. Natural antioxidants are antioxidant compounds that occur naturally in the body as a normal body defense mechanism or come from intake outside the body (Gumolung, 2017). One source of antioxidant compounds are fruits that contain very high beta carotene.

Measurement of beta-carotene antioxidant activity to see how far the reactivity of antioxidants in inhibiting free radicals that exist in nature. The method used in testing antioxidant activity is the DPPH method where this method is very effective for calculating the value of beta-carotene antioxidant activity. When the purple DPPH solution meets with an

electron donor, DPPH will be reduced, causing the purple color to fade and be replaced by a yellow color that comes from the picryl group. (Nguyen et al, 2022).

The content of β -carotene in different varieties of pineapples such as queen pineapple and cayenne pineapple were qualitatively and quantitatively determined. The results showed that qualitatively positive blue color results were obtained with antimony chloride and quantitative test with a spectrophotometer of 11,72 microgram/gram on samples of queen pineapple and the sample of cayenne pineapple was 9,92 microgram/gram (Putri, Ningrum, & Lindasari, 2018). According to Gumolong research results, 2017 shows that every pumpkin contains beta carotene. Pumpkin extract with Petroleum Ether (EPE) contained 39.1 g/g beta-carotene and ethanol extract (EET) was produced 7.94 g/g.

Based on the explanation above, it is necessary to do research on the content of beta carotene which is owned by various types of fruits in Indonesia. Local fruit in Indonesia is classified as tropical fruit and seasonal fruit, so it is hoped that this research can also increase public interest in consuming local fruit that is safer and contains many benefits with beta carotene.

METHOD

A. Sample preparation

The sample used it a pineapple, papaya, guava, Medan orange, star fruit, melon, mango, banana, and dragon. Fresh fruit mashed with a blender, then weighed as much as 50 grams. The sample was placed in a closed Erlenmeyer which was coated with aluminum foil on the outside and protected from light. The sample was added 50 ml of solution (hexane: acetone: ethanol = 2: 1: 1) v/v. The sample was shaken for 30 minutes with a magnetic stirrer. The sample was filtered using a separating funnel and part of the solvent hexane, acetone, and ethanol were taken. The sample is ready to be used for quantitative testing. (Comert et al, 2020)

B. Testing the levels of beta carotene by spectrophotometric method (SARI & SARI, 2017)

1) Preparation of beta-carotene standard solution

a) Concentration 1 mg/mL

The standard solution was prepared by weighing 100 mg of standard beta-carotene dissolved in 100 ml absolute ethanol/chloroform p.a to obtain a mother liquor concentration of 1 mg/mL.

b) Concentration 50 g/mL

The standard solution of beta-carotene 1 mg/mL was pipetted as much as 500 L then dissolved in absolute ethanol p.a until the volume became 10 ml.

2) Determination of operating time

The standard solution of beta-carotene 50 g/mL was read for absorption at a wavelength of 452 nm with a different operating time every 10 minutes for 90 minutes until a stable absorption time was obtained.

3) Determination of maximum absorption wavelength

The standard solution of beta-carotene 50 g/mL was read for absorption at a wavelength of 350 - 550 nm.

4) Standard curve determination

Determination of the standard curve made a series of beta-carotene standard solutions from 50 g/mL to 3.0 g/mL, 6.0 g/mL, 9.0 g/mL, 12 g/mL, 15.0 g/mL and then read on the operating system. maximum absorption time and wavelength obtained.

5) Measurement of sample absorption

5.0 mL of fruit residue was taken and put into a 10 mL volumetric flask. The solution was added with organic solvent (ethanol) to the limit mark then read the absorption.

6) Data analysis

Quantitative data of beta-carotene was carried out using spectrophotometric methods at the Mitra Keluarga STikes Laboratory. The samples used were 10 samples and were carried out in triples. (Soytong, 2021)

RESULT AND DISCUSSION

The maximum absorption on the UV-VIS Spectrophotometer can be seen on the curve which has the highest peak among other

wavelengths. The wavelengths used in this study started from the range of 350–550 nm. This range shows the visible color of beta carotene, which is yellow - orange. It can be seen in the Figure 1.

Based on Figure 1, describes the magnitude of the wavelength produced by the beta carotene contained in each of the samples, the maximum absorption wavelength obtained is 450 nm. The results of this wavelength are in accordance with previous studies (Ghosh, Chatterjee, Chalkroborty et al, 2019), which states that the absorption peak at the maximum wavelength is at 450 nm. The results of this wavelength are then used to determine the standard curve beta carotene with each predetermined concentration.

Determination of the standard curve aims to determine the graph of the linear regression equation and determine the levels in the sample (Safdarian, Hashaemi, Ghiasvad, 2021). Beta carotene standard solution was measured using

a UV-VIS (Genesys Thermoscientific) Spectrophotometer. The concentration used in the study was in the form of g/mL which was equivalent to ppb. The measurement results of the beta-carotene standard curve are presented in the table below:

Based on the data in table 1, a linear regression equation is obtained which states the relationship between concentration

Standard beta carotene solution with absorption measured at a wavelength of 450 nm, namely $y = 0.0241x - 0.0053$ with $r_2 = 0.9967$, where y is absorption and x is concentration in g/ml. This can be seen from the graph of the standard beta carotene curve in the form of a straight line.

Based on Figure 2, it can be seen that the results of the curve stated are included in the good category because the value of r_2 is close to 1. The regression equation obtained can be used in determining the content of a sample (Vinci et al, 2022).

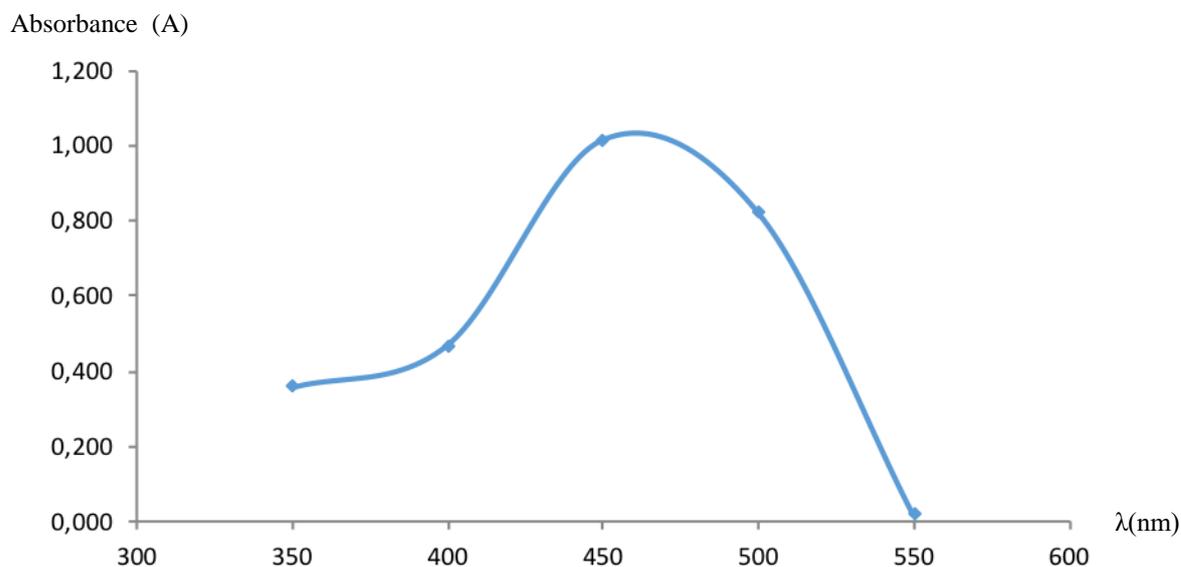


Figure 1. Maximum Absorption Wavelength Curve of beta-carotene

Table 1. Absorption of standard beta carotene solution at several concentrations

C ($\mu\text{g/mL}$)	Absorption (A)
0	0
6	0.138
9	0.203
12	0.277
15	0.372
18	0.426

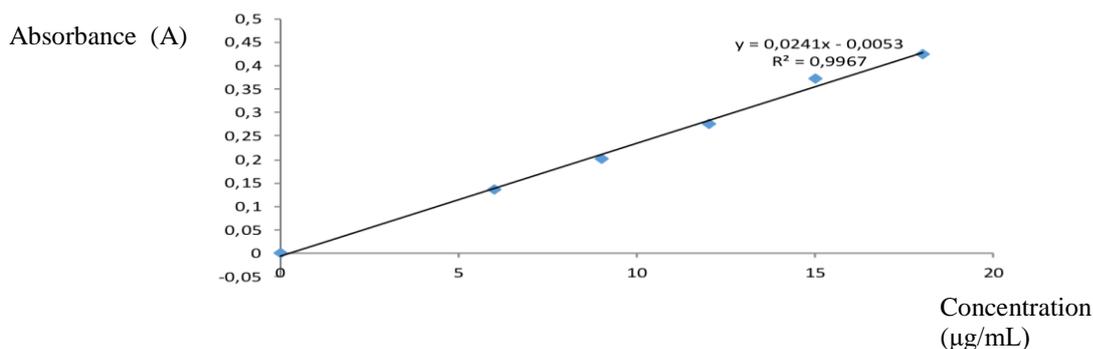


Figure 2. The Standart curve of the beta carotene concentration solution and absorption

Table 2. Measurement results of fruit samples in Indonesia

No	Sample Type	Dilution (Fp)	Absorbance (A)	Sample rate by dilution ($\mu\text{g/mL}$)	Actual sample rate ($\mu\text{g/mL}$)
1	Papaya	10	0.169	7.232	72.32
2	Pineapple	10	0.292	12.336	123.36
3	Banana	0	0.102	4.452	4.452
4	Jeruk medan	15	0.103	4.494	67.41
5	Mango	0	0.121	5.241	5.241
6	Melon	0	0.198	8.436	8.436
7	Guava	15	0.108	4.701	70.52
8	Dragon fruit	0	0.049	2.253	2.253
9	Star fruit	0	0.232	9.846	9.846

The samples measured in this study consisted of pineapple, papaya, guava, Jeruk Medan, star fruit, melon, mango, banana and dragon fruit. All samples were obtained from traditional markets in Bekasi. Sample taken by random sampling. The first step is to extract fruit samples by cutting them into small pieces and then mashing them using a blender. Next, the sample is weighed according to the working procedure. The purpose of extraction is to separate the content of beta-carotene contained in the sample based on the difference in polarity. Then, the solution will form two boundary planes. The colored layer that is in the upper phase is taken as a sample. The solution that is still in a concentrated state is diluted

according to the absorbance measurement conditions. Next, the solution was measured using a UV-VIS spectrophotometer.

From the results Table 2 of measurements of fruit samples that have been carried out, it was found that the concentration of beta carotene was the highest compared to other types of fruit, namely pineapple. The order of samples from the highest concentration to the lowest after pineapple is: papaya > guava > Jeruk Medan > star fruit > melon > mango > banana > dragon fruit.

CONCLUSION

Based on the research that has been done, beta-carotene measurements were performed at a wavelength of 450 nm. The highest content of beta-carotene was found in pineapple at 123.36 micrograms per milliliter, while the lowest was found in dragon fruit, at 2.253 micrograms per milliliter.

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