

Determining total carotenoid content in different colours fruits

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Carotenoids accumulate a lot in fruits that are orange, yellow, red and green as antioxidants, help boost immunity, the objective of this research was to determine the total carotenoid content in 8 types of fruit as follows: Papaya (*Carica papaya* L.) Grape (*Vitis vinifera* L.) Jackfruit (*Artocarpus heterophyllus* Lam.) Pineapple (*Ananas comosus*) Banana (*Musasapientum* L.), Tomato (*Solanum lycopersicum* L.), Apple (*Malus domestica*), and watermelon (*Citrullus lanatus*) by acetone extraction method and the absorbance was measured

with a spectrophotometer. The total carotenoid content was 1681.07 ± 0.00 , 1230.83 ± 21.15 , 1365.59 ± 6.59 , 404.65 ± 2.85 , 1222.35 ± 7.75 , 1213.15 ± 3.71 , 857.89 ± 0.0 and 936.01 ± 9.25 mg/L respectively. The highest total carotenoid content was papaya (*Carica papaya* L.) total carotene content 1681.07 ± 0.00 mg/L and the lowest content was pineapple containing carotene. Total carotenoids 404.65 ± 2.85 mg/L. The results of this research should be beneficial to consumers in choosing to eat fruit with difference in the accumulation of carotenoids.

Key Words: Total carotenoid; Accumulation; Immunity

INTRODUCTION

Benefits of fruit to help slow down aging. Everyone doesn't want to get old. Human want to be beautiful and look good all the time and enhance the beauty for us. Usually, people will age faster or slower depending on the functioning of the cell system. and immune system to help deal with toxins that enter the body including helping to repair damaged cells [1]. It also helps to create new tissues when the cellular and immune systems are working well. We will slow down, but that's not to prevent only those toxins that enter the body and we are not easy to get old. Because we ourselves make us old, such as stress and overwork. Including the food, we eat is very important to make us old quickly. But eating fruits that contain beta-carotene, vitamin C, vitamin E and selenium can resist aging, so people who eat a lot of fruit. Therefore, have firm skin no wrinkles can't predict the age from the face at all. A truly beautiful face will appear no more wattle or sag, say goodbye to wrinkles and crow's feet. Fruit is not the only way to slow down aging. In fact, the skin is the only indicator that the health of a person who eats a lot of fruit has a good internal system. It has a positive effect on our skin and women's health. Fruits that are high in vitamin C and bioflavonoids in citrus fruits (At the core or core of the fruit petals) can also help reduce menstrual bleeding.

The benefits of fruit help maintain mental health. Fruits can give you good mental health because the fruit contains many vitamins and minerals that are found. Can make people feel depressed not energetic and upset this can be caused by low blood sugar. Fruits that are slightly sweet and sour can help you feel better. Or whenever we feel so exhausted this is due to the low amount of potassium and magnesium in the body [2].

Therefore, eating fruits that contain these minerals. So it can make our body come back fresh and clear again. Benefits of eating fruit for weight loss our bodies can be pretty slim by eating fruit. Eating a lot of fruit, it is the most effective way to lose weight. And is very popular with your girls because the body will still receive enough vitamins and minerals our bodies are still strong. Not exhausted first, but on the other hand, the weight can be reduced as desired. For people who are often hungry and become obese without realizing it. Losing weight by dieting is harming one's body. The correct and effective method is turning to eat fruit as the main separate, in addition to not destroying the digestive system; it also helps to work better, making it easier for us to lose weight, not unhealthy. In addition, the fiber from the fruit also helps flush toxins out of the body.

Carotenoids are in the isoprenoid group, classified as macromolecules. That qualify as (Provitamin A) found in most colorful fruits such as yellow, orange and red. It is an antioxidant, anticancer in some plants, such as in carrots or papaya and in citrus plants [3]. A detailed report on the accumulation of carotenoids in plants has been of great interest to researchers [4,5]. Carotenoid compounds derived from Nature also regulates human metabolic

processes, preventing aging [6]. Roy and cardiovascular disease strengthen the immune system reduce the risk of many types of cancer, for example prostate cancer Breast cancer, lung cancer, and gastrointestinal cancer, which helps prevent the deterioration of various organs in the body as a result of eating fruit affects The excretory system can work normally and help prevent constipation Some fruits and vegetables can also be used as medicines to treat and cure some diseases as well. Some fruits are also helpful in reducing weight. Able to gain weight or control weight Eating fruits and vegetables can help develop the brain. It enhances memory and is good food for the brain. Because nutrients are effective to the functioning of the nervous system often found in food Green leafy vegetables, fruits and various grains help maintain eyesight. Fruits and vegetables some are high in vitamins and contain important nutrients to maintain eyesight. Fruits and vegetables rich in vitamin A such as papaya, tomatoes, bananas and pineapple, etc. A variety of fruits are beneficial to human health as some food rich in many vitamins and minerals.

Carotenoids are found in many fruits and vegetables. Alpha carotene is found in carrots and pumpkins. Lycopene is found in red fruits such as guavas, watermelons, red grapefruits, and especially in cooked tomatoes. Lutein and zeaxanthin are abundant in dark green vegetables, pumpkin and red peppers and kryptoxanthin is abundant in mangoes, oranges and peaches. Carotenoids may protect against certain types of cancer by inhibiting abnormal cell growth. Lycopene can block the growth of prostate cancer. Harvard University researchers found that a man who eats mainly tomato-based diets Carotenoid supplementation combined with vitamin E will synergistically protect liver cells from free radicals. And reduce the incidence of liver cancer in patients infected with hepatitis.

MATERIALS AND METHODS

Consistently eating fruit strengthens the body system. Fruits promote growth prevents the development of various diseases, reducing the risk of disease progression [7]. Including in the fruit contains fiber. Food includes chlorophyll and carotenoids, which are components that accumulate in fruit. Photosynthetic carotenoids work Together with chlorophyll, a green pigment; carotenoids play an important role in preventing human disease and maintaining good health. It's part of a balanced diet. Although the mechanisms the main function of carotenoids as a result of its ability to resist free radicals free carotenoids are part of a complex metabolism [8]. Abroad, carotenoids are found in pears. And orange fruit helps to prevent macular degeneration and senile cataracts chlorophyll accumulates in green plants [9]. But also contains carotenoids although most carotenoids are Yellow, orange fruits can also be found in green fruits [10,11]. Carotenoids are found naturally in vegetables, fruits or flowers [12]. Fat soluble, is a pigment found in chloroplasts and chromoplasts of fruits, flowers and leaves

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of plants. Algae and photosynthetic microorganisms [13]. And extracted carotenoids Naturally, beta-carotene is used as a dietary supplement for eating and astaxanthin used as supplementation in animal feed to increase the properties of the meat in terms of color Including the flavor that helps to enhance the growth of animals. Natural extracts carotene and astaxanthin can be extracted from nature especially various kinds of vegetables and fruits with yellow, red, green, including extracts from animals such as fish eggs or from shrimp shells [14]. Today, there are more than hundreds of carotenoids. Structurally verifiable and common in nature, carotenoids in plants absorb light energy to pass on to chlorophyll. Continuing reports of academic seminars (Proceedings) National Research Presentation Graduate Network Northern Rajabhat University No.172022 photosynthesis [15]. Carotene has the chemical formula C₄₀H₅₆. Vitamin A This reaction takes place within the liver. Pure carotene has a red crystalline color, insoluble in water but soluble in solvents. Organic solvent Carotene is easily oxidized by the oxygen in the air. Carotenoids in the food industry, it is used as a food coloring that is extracted from nature [16]. It is a group of substances that are beneficial to the health of the body, helping to fight Free radicals protect against ultraviolet radiation. Protect plants from oxidative reactions. Due to light and prevent can destroy cells from free radicals from the foregoing, the There are many important carotenoids that help prevents the degeneration of many organs. Prevent disease as an anticancer especially to prevent eye diseases such as cataracts glass conjunctivitis Reduce the degeneration of eye cells and help maintain eyesight, making it possible to see in the dark. Reduce the degeneration of eye cells and treatment of conjunctiva and cornea cells. Look younger helping to treat oral maintenance digestive system respiratory system including the urinary system.

The aim of this research was to determine the total carotenoid content in 8 types of fruit as follows: Papaya (*Carica papaya L.*) Grape (*Vitis vinifera L.*) Jackfruit (*Artocarpus heterophyllus Lam.*) Pineapple (*Ananas comosus*) Banana (*Musasapientum L.*), Tomato (*Solanum lycopersicum. L.*), Apple (*Malus domestica*), and watermelon (*Citrullus lanatus*).

Selected fruits samples

Selected difference colors of fruits such as papayas (*Carica papaya L.*), grape (*Vitis vinifera L.*) jackfruit (*Artocarpus heterophyllus Lam.*), pineapple (*Ananas comosus*), and banana (*Musasapientum L.*), tomato (*Solanum lycopersicum. L.*), apple (*Malus domestica*), and watermelon (*Citrullus.lanatus*). All the fruits are taken from the fruit market, Kalasin Province Thailand which is a fruit that comes from many places in Thailand and neighboring countries but were sold in Kalasin fruit market.

Chemical analysis

5 g of the fruit was crushed by the extractor to 25 ml of acetone solution, shaken and sample was filtered. The extracted substance was then measured for absorbance at wavelengths of 470 nm, 645 nm and 663 nm by machine. Spectrophotometer by calculating the quantities of chlorophyll A and B first. Of the carotenoids in plants the association with green pigments requires first analyzing chlorophyll A and B from the formula.

$$\text{Chlorophyll a} = [12.7(A_{663}) - 2.69(A_{645})] \times V / (1000 \times W)$$

$$\text{Chlorophyll b} = [22.9(A_{645}) - 4.68(A_{663})] \times V / (1000 \times W)$$

And then save the resulting value to c the total carotenoid content was calculated using the following formula (Pallabi Kundu, Anitha K and Ramani N, 2016)

$$\text{Total Carotenoid} = 1000(A_{470}) + 3.27[(\text{chlorophyll a}) - (\text{chlorophyll b})] \times V / (W \times 229)$$

A=absorbance value (Abs)

V=acetone volume (ml)

W=sample weight (g)

RESULTS

Total carotenoids were determined in 8 types of fruit as follows: papaya (*Carica papaya L.*), grape (*Vitis vinifera L.*), jackfruit. (*Artocarpus heterophyllus Lam.*), Pineapple (*Ananas comosus*), Banana (*Musa sapientum L.*), Tomato(*Solanum lycopersicum. L.*), apple (*Malus domestica*) and watermelon (*Citrullus lanatus*). As follows, the amount of carotenoids was 1681.07 ± 0.00, 1230.83 ± 21.15,

1365.59 ± 6.59, 404.65 ± 2.85, 1222.35 ± 7.75, 1213.15 ± 3.71, 857.89 ± 0.0 and 936.01 ± 9.25 mg/L, respectively (Table 1).

TABLE 1
The carotenoids in fruits samples

Fruits samples	Total carotenoids (mg/L)t
Papaya (<i>Carica papyya L</i>)	1681.07 ± 0.00 mg/L
Grape (<i>Vitis vinifera</i>)	1230.83 ± 21.15
Jackfruit (<i>Artocarpus heterophyllus Lam.</i>)	1365.59 ± 6.59
Pineapple (<i>Ananas comosus</i>)	404.65 ± 2.85
Banana (<i>Musasapientum L.</i>)	1222.35 ± 7.75
Tomato (<i>Solanum lycopersicum L.</i>)	1213.15 ± 3.71
Apple (<i>Malus domestica</i>),	857.89 ± 0.0
watermelon (<i>Citrullus lanatus</i>)	936.01 ± 9.25 mg/L

Note: Highest total carotenoid content was papaya (*Carica papyya L.*) total carotene content 1681.07 ± 0.00 mg/L, and the lowest content was pineapple containing carotene. Total carotenoids 404.65 ± 2.85 mg/L

DISCUSSION

The highest total carotenoid content was papaya (*Carica papyya L.*), followed by jackfruit (*Artocarpus. heterophyllus Lam.*), grapes (*Vitis vinifera L.*), bananas (*Musa sapientum L.*), tomatoes (*Solanum lycopersicum.L.*), watermelon (*Citrullus lanatus*), apple (*Malus domestica*) and pineapple (*Ananas comosus*), respectively. Total carotenoid content: 1681.07 ± 0.00, 1365.59 ± 6.59, 1230.83 ± 21.15, 1222.35 ± 7.75, 1213.15 ± 3.71, 936.01 ± 9.25, 857.89 ± 0.0, and 404.65 ± 2.85 mg/L The results of this research should be beneficial to consumers in choosing to eat a variety of fruits. Eat fruits and vegetables can make your skin better some fruits contain carotenoids. Carotene is high in fiber and contains minerals.

Trace elements and antioxidants in this study, papaya was found to be the fruit with the highest carotenoid content of the eight fruits. Foreign countries in Latin America found that In countries such as in Mexico, USA, Spain and Italy and many others, their fruits The pear family contains high amounts of carotenoids. In addition, Latin American countries use pears in their juices, nectar, syrups. Jams and other food products. In addition, research in Japan has also found carotene content there is also a collection of citrus fruits. Which is considered a natural source of carotene?

Most of us find carotene [17] occurs naturally and is widely distributed in plants qualification important work on antioxidant activity boosts the immune system and prevents chronic Alzheimer's disease. Often available in free or esterified form, and esterified carotenoids are formed by the acylation of fatty acids with xanthophylls in plant tissues [18]. Therefore, consumers can choose to eat fruit that has accumulated carotenoids in their locality. By consuming, focusing on fruits that have Orange, yellow, red are the main ones, however, consumers should be given the amount of carotene. In quantities appropriate to the needs of the body should eat a variety of plant foods for benefits and diversity. And the resulting phytochemical maximum benefit to the body feedback Local and seasonal fruits should be picked [19]. As an option and to encourage local people to eat and Cultivated and sold for the benefit of health and sanitation. Concerning the environment and the economy.

Eating fruits and vegetables can help develop the brain. Enhance memory and food for the brain as well. Because nutrients that affect the functioning of the nervous system they are often found in green leafy vegetables, fruits and grains. eye care some fruits and vegetables are high in vitamins. Nutrients called lutein (Lutein) and zeaxanthin (Zeaxanthin) are important nutrients in the maintenance of eyesight. The fruits and vegetables that are high in vitamin A are carrots, pumpkins, morning glory, kale, gourds, papayas, ripe mangos, etc. Eating more fruits and vegetables can make your skin look more beautiful. Because in addition to helping to have a beautiful and slender figure some fruits and vegetables are also rich in vitamin C and vitamin E, which is a skin food that helps to nourish the skin Stimulate the blood circulation of the skin make the skin rosy Skin looks healthy and smooth. It also helps in the synthesis of collagen in cells. Thus helping to make the skin tight and flexible, firm, not wrinkled prematurely as well [20].

Green fruit the substance that gives the green color is chlorophyll. There are also other compounds that have health-boosting properties, such as lutein, an antioxidant which help prevent cancer and reduce the incidence of macular

degeneration, etc. Fruits and vegetables in this group include cantonese, cabbage, acacia, kale, spinach, broccoli, green apple, melon, guava, jujube, custard, avocado, green grapes, green apples, etc.

White or brown fruits and vegetables there are many types of flavonoids. That helps free radicals anti-inflammatory reduce the proliferation of cancer cells helps reduce knee pain which can be found in the flesh and peel of mangosteen White dragon fruit, guava, apple and other fruits such as banana, rambutan, langsung, longkong, lychee, jujube, etc.

Yellow or orange fruits and vegetables contains beta-carotene, flavonoids, vitamin C that help fight free radicals. Anti-inflammatory and boost immune system help prevent and reduce the risk of cancer [21]. Stimulate the body's elimination of cancer cells helps maintain healthy heart, blood vessels and immune system within the body. Fruits and vegetables in this group include corn, carrots, pumpkin, bananas, jackfruit, yellow cantaloupe, ripe papaya, oranges, pineapples, apricots, etc.

Red or pink-purple fruits and vegetables contains substances in the group Lycopene and Betalain, which are antioxidants. Reduces the risk of cancer especially male prostate cancer helps maintain heart and blood vessels help the amount of bad fat (LDL) in the blood and nourish the urinary system. It is found in fruits and vegetables such as okra flowers. Pink flesh dragon fruit, watermelon, papaya, red apple, cherry, tomato, red papaya, beetroot, onion, strawberry, red apple, etc.

Magenta or purple or blue fruits and vegetables it is rich in anthocyanin compounds, (Anthocyanin) and Polyphenol, which is an antioxidant, help slowly down the deterioration of cells. Prevents the destruction of ultra-violet rays, help protect every cell from the danger of cancer cells. Improves flexibility of the walls of blood vessels helps reduce the occurrence of atherosclerosis and coronary artery disease. helps inhibit E. coli in the digestive tract that causes diarrhea help against virus and reduce inflammation This group of fruits and vegetables are purple cabbage, black glutinous rice, red rice, jasmine rice, rose apple, red rose apple, black bean, red bean, taro, purple potato, eggplant, red onion, butterfly pea flower, aloe vera, wavy ball, prunes, blueberries, blackberries, cranberries, red grapes, purple grapes, etc.

CONCLUSION

The benefits of carotenoids are summarized as follows: Beta-carotene boosts the immune system. These nutrients act as powerful antioxidants. Which helps to integrate itself into the cell membrane like vitamin E. Beta-carotene has been shown to reduce the risk of many cancers such as lung cancer, cervical cancer, skin cancer, uterine cancer, and oral cancer? And colon cancer. High doses of beta-carotene reduce the risk of heart disease. High levels of beta-carotene it can help reduce your risk of cataracts and macular degeneration Lutin and zeaxanthin are carotenoids that accumulate in the retina of the eye. The pigment protects the retina and the retina from the oxidative stress process, which means this, will reduce your risk of macular degeneration, beta-carotene and carotenoids many other types are converted to vitamin A. If the body needs it, then they are safe to consume, which can help the body get vitamin A enough when needed total carotenoids can effectively increase the resistance to oxidation reaction with bad cholesterol (LDL).

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