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Level of Xanthophyll, Lutein and Zeaxanthin in Selected Thai Fruits Determined by HPLC

Nittaya Khonsarn [1] and Siriporn Lawan [2]

[1]Department of biotechnology, Faculty of Technology, Mahasarakham University, Thailand
[2] Department of Food technology, Faculty of Technology, Mahasarakham University, Thailand

Abstract. In this study 12 selected Thai summer fruits were determined xanthophyll, lutein and zeaxanthin content by high performance liquid chromatography (HPLC). The result shown that there were xanthophyll in 11 kinds of selected fruits except banana. The highest of average xanthophyll level was found in cantaloupe (1.31±0.07 mg/100g edible portion), meanwhile barbados cherry was the second (1.18±0.03 mg/100g edible portion). Among fruits analysed, lutein content was the highest in papaya (23.74±0.46 mg/100g edible portion), follow by cantaloupe (21.82±1.60 mg/100g edible portion). Whereas lutein was not detected in star gooseberry, java apple, dragon fruit, guava, salak plum, water melon, banana and satol. Cantaloupe was the highest source of zeaxanthin (1.72±0.07 mg/100g edible portion), zeaxanthin was not however detected in star gooseberry, java apple, dragon fruit, salak plum, banana and satol. These results are suggested that some kinds of summer fruits including papaya and cantaloupe, have potential as rich sources of xanthophyll, lutein and zeaxanthin for consumer health.

Keywords: Xanthophyll, Lutein, Zeaxanthin, Thai Fruit, HPLC.

1. Introduction

Xanthophyll, lutein and zeaxanthin are some kinds of carotenoid that not only play important role in organic pigments in fruits and vegetables but also important in the prevention of various diseases associated with oxidative stress. Moreover, there are many literature surveys on health benefits of xanthophyll, lutein and zeaxanthin that reported as powerful antioxidants. Several epidemiological studies demonstrated that the consumption of fruits and vegetables with rich of xanthophyll, lutein and zeaxanthin is associated with a lower problem of cancer, cardiovascular disease, age related macular degeneration (ARMD) and cataract formation.[1] In eye health, certain lutein and zeaxanthin apparently act directly to absorb damaging blue and near-ultraviolet light in order to protect the macular lutea. Although xanthophyll, lutein and zeaxanthin are more benefits for human health, in generally human cannot synthesis them by metabolism process. The best way to get high xanthophyll, lutein and zeaxanthin is from diets in natural foods such as fruits and vegetables. Because some reports revealed that higher xanthophyll, lutein and zeaxanthin intake as supplement has been associated with higher risk of carotenoid toxicity like a carotenedermia.[2],[3] A tell-tale sign of excessive consumption of beta-carotene is a yellowish discoloration of the skin, most often occurring in the palms of the hands and soles of the feet. Futhermore, the results of two research studies indicated that those who smoke heavily and drink alcohol regularly may increase their chance of developing lung cancer and/or heart disease. This is particular interest given that opportunities to be those diseases were down when they take beta-carotene supplements in amounts of 20-30 milligrams per day or more. This indicated that the safe way for human to obtain xanthophyll, lutein and zeaxanthin is in their regularly diets.[3],[4]

In Thailand, there are quite less varieties of fruits and vegetables in summer because of low humid and dry weather in this season. In general, tropical fruits is boomed among early rainy season, thus we can consume many varieties of fruits and vegetables on this period. However, high value of nutrition food such as xanthophyll, lutein and zeaxanthin is potential health benefit, high intake of these compounds is still not

considered as an essential nutrient. The seeking of rich sources of xanthophyll, lutein and zeaxanthin during out of season which less varieties of fruits and vegetable is very important. Therefore, the objective of the present study was to select Thai tropical fruits in summer and determine xanthophyll, lutein and zeaxanthin contents in selected fruits by HPLC. This information can be useful with a view to find interesting sources of xanthophyll, lutein and zeaxanthin contents in selected Thai tropical fruits for nutritionists to recommend people to consume fruits in appropriate amount for their health benefit.

2. Materials and Methods

2.1. Sample

Commonly consumed fruits, selected twelve kinds of fruits were purchased from local market of Mahasarakham province, Thailand. Xanthophyll, lutein and zeaxanthin contents were analysed by HPLC. Fresh fruits used in this study were cleaned and trimmed of only edible portion before they were used. The Thai common names, common name and scientific name of these fruits are given in Table 1.

2.2. Extraction and Determination of Xanthophyll Lutein and Zeaxanthin Content

Five grams of fresh fruit as edible portion were crushed and then extracted using solvents(chloroform: methanol(2:1v/v)), Approximately 5 grams (dry weight) of well-ground samples was extracted with 50.0 ml of each solvent and stored at room temperature and evaporated under reduced pressure at 25°C. The liquid phase was filtered and washed 3 times with saturated sodium chloride solution. The organic layer was taken and dehydrated with anhydrous sodium sulphate and evaporated under reduced pressure at 25°C. The residue was dissolved in 10 ml solution of dichloromethane (DCM) and MeOH(6:4). The contents of xanthophyll, lutein and zeaxanthin were quantified by high pressure liquid chromatography(HPLC), this method is referred to Nhungetal.[5],[6] The RP-HPLC system (Shimadzu) consisted of an auto sampler and column oven equipped with Inertsil ODS(4.6mm×250mm,5lm) with mobile phase of DCM: acetonitrile(6:4,v/v, containing 0.05:BHA as antioxidant) (eluentA) and MeOH(eluentB). The following gradient was used: initial condition was 70%(A) and 30%(B) for 5 min, followed by 80%(A) and 20%(B) for 5 min. The flow rate 1.5 ml/min., injection volume 20 µl and photodiode array detector at 472 nm for the analysis of lycopene and beta-carotene were carried out. Calibration curves were constructed with the external standards.

2.3. Statistical Analysis

This study used completely randomized design and all determinations were done at least in triplicate. Data analyses of xanthophyll, lutein and zeaxanthin content were performed by using SPSS version 13.

3. Result

The weather has been three seasons in Thailand namely rainy, windy and summer. In summer there are less varieties of fruits sold in the local market. The major of fruits such as mangoes, star gooseberry, and watermelon were found in this period. Thus, twelve fruits were selected in this study ,which based on frequency of consumption in local market as shown in Table 1.

Table 1: Thai common names, common names, scientific name and edible portion for analyze

Thai common name	Common name	Scientific name	Edible peroid
Thai cherry	Barbados-Cherry, Acerola	Malpighia glabra L.	Mature Fruit
Mayom	Star gooseberry	Phyllanthus acidus (L.) Skeels	Immature Fruit
Chompu	Java apple, rose apple	Eugenia javanica Lam.	Immature Fruit
Keaw Mung-Kon	Pitaya, Dragon Fruit	Hylocercus undatus	Mature Fruit
Farung	Guava	Psidium guajava L.	Immature Fruit
Malakor	papaya, papaw, or pawpaw	Carica papaya L.	Mature Fruit
Cantaloupe	Cantaloupe	Cucumis melo	Mature Fruit
Ma-Muang	Mango	Mangifera indica L.	Mature Fruit
Sala	salak plum	Zalacca edulis	Mature Fruit
Tang Mo	Watermelon	Citrullus lanatus	Mature Fruit
Klouy	Banana	Musa sapientum Linn.	Mature Fruit
Kra thon	Santol	Sandoricum koetjape Burm.f. Mer.	Mature Fruit

Table 1 contains Thai common name, common name and scientific name for the selected fruits analysed. Xanthophyll, lutein and zeaxanthin contents of these fruits were determined by HPLC. The edible portions of fruits that Thai people usually consume are also shown in Table 1. Most of these fruits are consumed in its mature life period except star gooseberry, java apple and guava which are usually consumed in immature period.

Table 2: Amount of Xanthophyll, Lutein and Zeaxanthin in selected Thai fruits determine by HPLC (mg/100g)

Common name	Xanthophyll(mg/100g) $\bar{x} \pm SD$	Lutein(mg/100g) $\bar{x} \pm SD$	Zeaxanthin(mg/100g) $\bar{x} \pm SD$
Barbados-Cherry, Acerola	1.18±0.03	9.20±0.23	1.14±0.03
Star gooseberry	0.32±0.01	ND	ND
Java apple, rose apple	0.36±0.02	ND	ND
Pitaya, Dragon Fruit	0.21±0.01	ND	ND
Guava	0.60±0.05	ND	0.03±0.01
Papaya, papaw, or pawpaw	1.07±0.02	23.74±0.46	1.45±0.19
Cantaloupe	1.31±0.07	21.82±1.60	1.72±0.07
Mango	0.33±0.01	3.17±0.10	0.15±0.01
salak plum	0.84±0.06	ND	0.09±0.01
Watermelon	0.52±0.01	ND	0.01±0.01
Banana	ND	ND	ND
Santol	0.23±0.01	ND	ND

ND = not Detect, Values are shown in mean ± SD of triplicate measurement.

Table 2 illustrated the contents of xanthophyll, lutein and zeaxanthin in selected Thai fruits. Among the fruits studied, xanthophyll, lutein and zeaxanthin in cantaloupe and papaya were at higher level than others. The result shown that xanthophyll was found in most fruits with the exception of banana. Among selected fruits, cantaloupe is the richest of average xanthophyll (1.31±0.07 mg/100g edible portion) and barbados cherry is the second highest source of xanthophyll (1.18±0.03 mg/100g edible portion). Papaya contained the highest level of lutein.(23.74±0.46 mg/100g edible portion) followed by cantaloupe (21.82±1.60 mg/100g edible portion). Whereas lutein was not detected in star gooseberry, java apple, dragon fruit, guava, salak plum, water melon, banana and satol. The highest level of zeaxanthin within these fruits was found in cantaloupe (1.72±0.07 mg/100g edible portion). The second highest fruit of zeaxanthin is papaya(1.45±0.19 mg/100g edible portion). However, this study indicated that level of zeaxanthin was not detected in star gooseberry, java apple, dragon fruit, salak plum, banana and satol.

4. Discussion

Although xanthophyll, lutein and zeaxanthin are not macronutrient in recommended dietary intakes (RDI), there are many researchs shown that lutein and zeaxanthin are continuously emerging role as an important nutrient for human health and necessary for human body function.[13],[14] Many studies tried to find out the estimate of average daily dietary lutein and zeaxanthin intake. O'Neill, et al.[9] was studied in European populations and found that people has consumed the daily dietary lutein about 2 mg. Chasan-Taberetal[10] conducted a prospective study of 77,466 female nurses who were 45–71 years old from 1980 through 1992 and found that those with the highest intake of lutein and zeaxanthin had 22% lower risk of cataract extraction when compared to those in the lowest quintile of intake. A recent study shown that 10 mg lutein and zeaxanthin per day is required to improve the vision in ARMD risk patients.[11],[14] Table 2 showed the interested fruits with high lutein content, thus just consuming 50 g edible portion of papaya or cantaloupe will provide the recommended level of lutein per day.

In case of zeaxanthin consuming just 500 g edible portion of cantaloupe could be the basis for recommendation the level of zeaxanthin per day or just 690 g edible portion of papaya in a daily diet. Indeed, fruits are a good source of minerals, vitamins and phytochemicals. [1],[6],[7] It should be noted, therefore, that cantaloupe and papaya are the best fruits among the fruits analysed for recommendation to consume as good sources of dietary lutein and zeaxanthin. This data generated on the composition of carotenoids in fruits which could be help in choosing the right fruits in a daily diet to prevent against age-related macular degeneration.

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