EVALUATION OF L- ASCORBIC ACID, β - CAROTENE AND Lycopene CONTENTS OF SOME FRUITS OF WESTERN GHATS

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ABSTRACT

The aim of the study is to evaluate L- Ascorbic acid, β carotene and lycopene contents of 16 different fruits of Western Ghats. The present study revealed that the presence of β carotene, Lycopene and Ascorbic acid in all the fruits of the study. β carotene content was found to be highest in Citrullus lanatus (2023±3.15µg/g) and lowest in Manilkara zapota (65.56±0.23 µg/g). Lycopene content was found to be highest in Citrullus lanatus (417.47±0.67 µg/g) and lowest in Anacardium occidentale (70.49±1.81 µg/g). Ascorbic acid content was found to be highest in Syzygium cumini and lowest in Carica papaya. Thus the study suggests that all the fruits were better source of β carotene, lycopene and Ascorbic acid, which might be helpful in protecting the body against various diseases.

KEYWORDS: Ascorbic acid, Beta carotene, Lycopene, Citrullus lanatus, Manilkara zapota, Anacardium occidentale.

INTRODUCTION

Carotenoids are yellow, orange, and red pigments synthesized by plants. Fruits and vegetables provide most of the carotenoids in the human diet. Alpha-carotene, beta-carotene, beta-cryptoxanthin, lutein, lycopene, and zeaxanthin are the most common dietary carotenoids. Alpha-carotene, beta-carotene and beta-cryptoxanthin are provitamin A carotenoids, meaning they can be converted by the body to retinol. Lutein, lycopene, and zeaxanthin cannot be converted to retinol, so they have no vitamin A activity. Lycopene is
the most predominant carotenoid in human blood, present naturally in greater amounts than beta-carotene and other dietary carotenoids. It accumulates in organs such as the skin, liver, lungs, and prostate.

Carotenoids are the main group of precursors of essential vitamins and antioxidants. Tomatoes are considered as a major source of carotenoids in the human diet. From a total of about 40 carotenoids present in the human diet in human blood is only 25 carotenoids which are present due to their selective intake of the digestive tract. Of these, the majority of carotenoids are present just in fresh and processed tomatoes. The most important carotenoids for humans include lycopene, lutein, zeaxanthin and β-cryptoxanthin. Lycopene is a lipophilic carotenoid pigment present in tomatoes and other red fruits and vegetables. Higher amounts of lycopene are found in fruits such as of watermelon, guava and pink grapefruit. Lycopene is considered to be the most effective natural antioxidant. It is reported that it is twice more effective than β-carotene and ten times more effective than α-tocopherol.

Epidemiological studies have shown that high intakes of fruits and vegetables are associated with a lower risk of chronic diseases, including cardiovascular disease. α-carotene, β-carotene, lycopene and tocopherols (vitamin E) are two important groups of a natural source of antioxidants. α-carotene, β-carotene, and β-cryptoxanthin have been suggested as precursor vitamin A, which is important to maintain healthy skin, bone, gastrointestinal, and respiratory systems.

Most plants and animals have the ability to synthesize vitamin C except mammals like humans and guinea pigs. Therefore humans depend on exogenous sources of the vitamin which include fruits and vegetables as well as food supplements and pharmaceutical preparations. Numerous analytical techniques have been reported in the literature for the determination of vitamin C by Spectrophotometric method. Ascorbic acid is a water soluble antioxidant known to be important to health. This has been recognized in the recent increase in the US daily reference intake of Ascorbic acid to 75 and 90 mg/d respectively, for women and men, with an additional 35 mg/d recommended for smokers.

The present study aimed to evaluate Ascorbic acid, β-carotene and lycopene contents of different fruits viz Annona reticulata, Vitis vinifera, Punica granatum, Malus domestica, Citrus sinensis, Ananas comosus, Carica papaya, Manilkara zapota, Citrullus lanatus, Musa
MATERIALS AND METHODS

Plant materials

Samples of fresh ripe fruits were purchased from the local market of Udupi district, (Karnataka state) which is located in the coastal region of Western Ghats. The fruits comprised of \textit{Annona reticulata}, \textit{Ananas comosus}, \textit{Carica papaya}, \textit{Citrullus lanatus}, \textit{Citrus sinensis}, \textit{Malus domestica}, \textit{Mailkara zapota}, \textit{Musa cavendishii}, \textit{Punica granatum}, and \textit{Vitis vinifera}. The wild fruits were collected from the local forest of Udupi and Kanakapura town of Ramanagar district, Karnataka. The fruits comprised of \textit{Phyllanthus emblica}, \textit{Limonia acidissima}, \textit{Syzygium cumini}, \textit{Artocarpus hirsutus}, \textit{Carissa congesta}, and \textit{Anacardium occidentale}. The fruit samples were authenticated by taxonomist, Dept. of Botany, Poornaprajna College, Udupi, Karnataka, India.

Extraction procedure

Each sample of fresh fruit was washed under running tap water followed by washing with distilled water to remove the surface debris. 100g of edible portions of the fruit were weighed and minced using a kitchen blender. After homogenization, it was extracted in methanol for 72 hours in dark at 37°C incubator shaker. After 3 days, the whole extracts are filtered and then centrifuged to obtain clear extract. The filtrate was concentrated in Rotary vacuum evaporator. The resultant extract was lyophilized to obtain dry powder. The yield of crude extracts were noted and later preserved in a deep freezer (-20°C) for further use.

\textbf{β-Carotene and Lycopene content}

\textit{β}-Carotene and lycopene contents of the sixteen fruit extracts were determined by the method of Nagata and Yamashita (1992) with slight modifications. 100 mg of each fruit extracts were dissolved in 10 ml of acetone-hexane mixture (4:6) and centrifuged at 6000rpm for 3 minutes. The absorbance of the supernatent was measured at 453, 505, and 663 nm. The assays were carried out in triplicates, the results were mean±SD and expressed as µg of carotenoid / g of extract.
L- Ascorbic Acid content (Vitamin C)
Vitamin C content of fruit extracts were estimated according to Roe (1954) with minor modifications.[18] 0.5g of the dried fruit extract was dissolved in 5ml of 5% TCA and centrifuged at 8000 rpm for 5 Minutes. The pellet was discarded. 100µl of the supernatant was made up to 2ml with 5% TCA and 0.5 ml of DNPH reagent was added. The reaction mixture was boiled for 15 minutes and cooled to room temperature, 85% sulphuric acid (2.5ml) was added, incubated at room temperature for 30 min and the O.D was measured at 540 nm. Ascorbic acid was used as standard. The results were mean±SD and expressed as µg of ascorbic acid / mg of extract.

RESULTS AND DISCUSSION
β-Carotene and Lycopene content
β-Carotene content for common fruit extracts were found to be highest in Citrullus lanatus followed by Vitis vinifera, Carica papaya, Punica granatum, Ananas comosus, Citrus sinensis, Annona reticulata, Malus domestica, Musa cavendishii, Manilkara zapota and values were 2023±3.15µg/g, 1592.3±0.74µg/g, 1114.7±1.68µg/g, 736.36±1.33µg/g, 570.29±1.16µg/g, 434.11±0.47µg/g, 359.053±0.55µg/g, 173.37±3.75µg/g, 106.36 ±1.68µg/g and 65.56 ±0.23µg/g of the extract respectively.

![Fig 1. β – Carotene and Lycopene in contents of common fruit extracts.](image)

Lycopene content for common fruit extracts were found to be highest in Citrullus lanatus followed by Vitis vinifera, Carica papaya, Punica granatum, Ananas comosus, Citrus sinensis, Annona reticulata, Musa cavendishii, Malus domestica, Manilkara zapota and
values were 417.47±0.67µg/g, 325.84±2.73µg/g, 205.84±1.73µg/g, 171.45±0.94µg/g, 151.69±0.78µg/g, 141.07±1.38µg/g, 128.31±0.25µg/g, 96.04±0.76µg/g, 91.6±1.78µg/g and 74.0±0.78µg/g of the extract respectively. The results are displayed in the Fig.1.

Among wild fruits β-Carotene content were found to be highest in Syzygium cumini followed by Phyllanthus emblica, Limonia acidissima, Artocarpus hirsutus, Carissa congesta, Anacardium occidentale and values were, 1934.9±0.98µg/g, 1113.7±1.21µg/g, 782.36±1.34µg/g, 573.55±1.94µg/g, 284.66±2.25µg/g and 167.20±1.58µg/g of the extract respectively. In the present study, higher β carotene contents were found in all the fruits when compared to those reported in the previous study.[19] This may be due to the number of topographical factors including species variation, climate, soil type (red soil), rain fall, vegetation and geographic features.

Among wild fruits lycopene content were found to be highest in Syzygium cumini followed by Limonia acidissima, Phyllanthus emblica, Artocarpus hirsutus, Carissa congesta, Anacardium occidentale and values were 388.67±3.16µg/g, 302.69±0.74µg/g, 266.84±0.87µg/g, 223.04±0.67µg/g, 101.85±1.05µg/g and 70.49±1.81µg/g of the extract respectively. The results are displayed in the Fig.2.

![Fig 2. β – Carotene & lycopene in contents of wild fruit extracts.](image-url)

These data, in this study, showed lower contents of lycopene in all the fruit extracts as increase in the β – carotene contents. This study also revealed that the fruits were richer source of β – carotene content and poor source of lycopene content. It is previously reported that differences in the values of β carotene and lycopene contents may be due to a number of
factors, including varieties, method for sampling and preparing, method for determination, natural variation of fruits, fertilizers, agro climatic conditions or soil, the amount of sunlight irradiation and geographical origin.\(^{[19]}\) Also post-harvest conditions, such as time of picking to market (transportation), shelf time prior to purchase, may also influence the amounts of β carotene.\(^{[20-23]}\)

**L – Ascorbic acid (Vitamin C)**

Vitamin C content for common fruit extracts were found to be highest in *Annona reticulata* followed by *Citrus sinensis*, *Vitis vinifera*, *Manilkara zapota*, *Punica granatum*, *Ananas comosus*, *Musa cavendishii*, *Malus domestica*, *Citrullus lanatus* and *Carica papaya* and values were 219±3.32µg/mg, 164.8±2.06µg/mg, 146.32±2.74µg/mg, 136.33±4.32µg/mg, 127.84±1.94µg/mg, 118.12±3.41µg/mg, 113.33±3.26µg/mg, 111.01±3.08µg/mg, 109.64±2.46µg/mg and 95.67±3.76µg/mg of the extract respectively. The values were graphically displayed in the Fig.3.

![Fig 3. Vitamin C contents of common fruit extracts.](image)

Among wild fruits Vitamin C content were found to be highest in *Syzygium cumini* followed by *Phyllanthus emblica*, *Limonia acidissima*, *Anacardium occidentale*, *Carissa congesta* and *Artocarpus hirsutus* and values were 274.31±3.76µg/mg, 220.65±2.07µg/mg, 168.91±2.26µg/mg, 161.93±4.51µg/mg, 150.77±2.38µg/mg and 106.97±2.76µg/mg of the extract respectively. The values were displayed in the Fig.4.
CONCLUSIONS

β-Carotene content for common fruit extracts were found to be highest in *Citrullus lanatus* followed by *Vitis vinifera, Carica papaya, Punica granatum, Ananas comosus, Citrus sinensis, Annona reticulata, Malus domestica, Musa cavendishii* and *Manilkara zapota* respectively. The same trend was seen in lycopene contents of ten fruits except *Malus domestica* and *Musa cavendishii*. Among wild fruits β-Carotene content were found to be highest in *Syzygium cumini* followed by *Phyllanthus emblica, Limonia acidissima, Artocarpus hirsutus, Carissa congesta* and *Anacardium occidentale* respectively. The same trend was seen in lycopene contents of six fruits except *Limonia acidissima* and *Phyllanthus emblica*.

Vitamin C content for common fruit extracts were found to be highest in *Annona reticulata* followed by *Citrus sinensis, Vitis vinifera, Manilkara zapota, Punica granatum, Ananas comosus, Musa cavendishii, Malus domestica, Citrullus lanatus* and *Carica papaya* respectively. Among wild fruits Vitamin C content were found to be highest in *Syzygium cumini* followed by *Phyllanthus emblica, Limonia acidissima, Anacardium occidentale, Carissa congesta* and *Artocarpus hirsutus* respectively.

As carotenoids and Vitamin C cannot be synthesized by humans they must be obtained from fruits, vegetables in the diet. The present Studies indicate that increased intake of fruits rich in beta-carotene lycopene and Vitamin C may reduce the risk of various diseases, including cancers, cardiovascular and age related diseases.
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