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TOTAL CAROTENOID CONTENT IN SOME MANGO (*MANGIFERA INDICA)* VARIETIES OF BANGLADESH

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ABSTRACT: The present study investigated total carotenoid content of twelve mango varieties of Bangladesh. Change in the total carotenoid content at various stages of maturity was also determined. Carotenoids are bioactive substances in food with powerful antioxidant activity. It has role in enhancement of the immune response and reduction of the risk of degenerative diseases such as cancer, cardiovascular diseases, cataract and macular degeneration. Mango is the leading seasonal cash crop of the northwestern region of Bangladesh. The mango (Mangifera indica) (Bangla- aam) is the king of fruits in Bangladesh. It's a fleshy stone fruit. Mango is generally very sweat and tasty common fruits in Bangladesh. It's also one of the most popular fruits in the world. Total carotenoid content in twelve mango varieties was analyzed by solvent extraction method followed by spectrophotometric method. Mangoes contain different amount of total carotenoid in green, semi-ripe and ripe stages. Carotenoid content in green mango was 3.09 µg/100m while that of semi-ripe mango was 70.875 µg/100gm and ripe mango was 251.74 µg/100gm. Among the mango varieties AamRupali contains the highest amount of carotenoid which is about 444.66 µg/100gm. Kali Bhog and Lakshmon Bhog contain 352.41 µg/100gm and 345.09 µg/100gm carotenoid respectively. Surmi Fazli contains the lowest amount of carotenoid which is about 94.22 µg/100gm.

INTRODUCTION: Vitamin deficiency is a major dietary problem in developing countries like Bangladesh. Peoples in this part frequently suffer from lack of vitamins in their daily diets. Deficiency of Vitamin A is a major problem causing childhood blindness [1], retarded growth, inadequate RBC production, impaired reproduction & immunity, exacerbates infection, even increase the risk of death [2]. It has been estimated that 30.8 %(4.65M) and 0.62 % (0.09M) of preschool-aged children of Bangladesh have vitamin A deficiency and Xerophthalmia respectively [3].

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There are two sources of Vitamin A depending on whether the food source is an animal of plant. Vitamin A found in animal source is called preformed Vitamin A and those of plants are called provitamin A carotenoid. Carotenoids are bioactive substances in food with powerful antioxidant activity [4]. Carotenoids whether pro-vitamin A or not, have abundant beneficial effect on human health. It has role in enhancement of the immune response and reduction of the risk of degenerative diseases such as cancer, cardiovascular diseases, cataract and macular degeneration [5].

The action of carotenoids against diseases has been attributed to antioxidant properties, especially their ability to quench singlet oxygen and interact with free radicals [6] which take part in modulation of carcinogen metabolism, inhibition of cell proliferation, enhancement of cell differentiation, stimulation of cell to cell communication.

A tropical location, moisture rich loamy soil and production friendly climate all these make Bangladesh one of the notable growers of a vast range of mango. Mango trees grow up to 35–40 m (115–131 ft) tall, with a crown radius of 10 m (33 ft). The trees are long-lived, as some specimens still fruit after 300 years. In deep soil, the tap root descends to a depth of 6 m (20 ft), with profuse, wide-spreading feeder roots; the tree also sends down many anchor roots, which penetrate several feet of soil. The leaves are evergreen, alternate, simple, 15–35 cm (5.9–13.8 in) long, and 6–16 cm (2.4–6.3 in) broad; when the leaves are young they are orange-pink, rapidly changing to a dark, glossy red, then dark green as they mature. The flowers are produced in terminal panicles 10–40 cm (3.9–15.7 in) long; each flower is small and white with five petals 5–10 mm (0.20–0.39 in) long, with a mild, sweet odor suggestive of lily of the valley. Over 400 varieties of mangoes are known, many of which ripen in summer, while some give double crop. The fruit takes three to six months to ripen.

The ripe fruit varies in size and color. Cultivars are variously yellow, orange, red, or green, and carry a single flat, oblong pit that can be fibrous or hairy on the surface, and which does not separate easily from the pulp. Ripe, unpeeled mangoes give off a distinctive resinous, sweet smell. Inside the pit 1–2 mm (0.039–0.079 in) thick is a thin lining covering a single seed, 4–7 cm (1.6–2.8 in) long. The seed contains the plant embryo. Mangos have recalcitrant seeds; they do not survive freezing and drying.

The energy value per 100 g (3.5 oz) serving of the common mango is 250 kJ (60 kcal), and that of the apple mango is slightly higher (79 kcal per 100g). Fresh mango contains a variety of nutrients (right table), but only Vitamin C and folate are in significant amounts of the Daily Value as 44% and 11%, respectively [7-8]. Mango peel pigments under study include carotenoids, such as the provitamin A compound, beta-carotene, lutein and alpha-carotene [9-10], Bambangan (*Mangifera pajang* Kosterm.) pulp had higher α- and β-carotene contents (7.96 ± 1.53 and 20.04 ± 1.01 mg/100 g) than its peel (4.2 ± 0.14 and 13.09 ± 0.28 mg/100 g) [11].

The study investigated total carotenoid content of some mango varieties of Bangladesh which is 12 in number. Carotenoid contents of mangoes vary with the variation of species, their varieties and stage of maturation. Total carotenoid was analyzed by solvent extraction followed by spectrophotometric method.

MATERIALS AND METHODS:

Samples:

Twelve varieties of *Mangifera indica* including Gopal Bhog, Shidura, Him sagar, Misrikanto, Chini Guri, Aamrupali, Lakshmon Bhog, Kali Bhog, Surmi Fajli, Langra, Fajli and Arshini were selected for this study according to their market availability and consumption rate in Bangladesh. Sampling time was during summer (March to May). In order to determine edible portion of fruit, total weight of whole fruit and total weight of roughage were recorded and finally percentage of edible portion was estimated.

Reagents:

N-hexane (Analarar grade, BDH, UK). Acetone (Analarar grade, BDH, UK), Activated aluminiumoxide (Brockman activity H,BDH,UK) and Anhydrous sodium sulfate for the preparation of chromatographic column. Standard of Beta–carotene (Sigma chemical USA).

Preparation of chromatographic column:

Carotenoids were separated from mango extract using a pyrex chromatographic column (2.5x40cm) with sintered glass at bottom. The column was packed with the mixture (alumina, anhydrous sodium sulfate with n-hexane) and made the length 15 cm. n- hexane was passed through the column for few hours to make it stable.

Sample preparation:

Fresh and clean mangoes were chopped and mixed well. From the prepared mixer 2-3 gm was taken in a glass mortar and ground rapidly using a pestle along with 1 to 3 gm of sand, 5 ml acetone and 5ml n-hexane. The liquid was decanted into a 25 ml volumetric flask and the process was repeated 3 to 5 times to make the extract volume 25 ml using n-hexane on each occasion. The flask was stoppered and stored in the dark until analysis. Ten milliliter of the extract was placed on the top of the column

bed. The column was run with n-hexane. A deep yellow band containing carotenoid traveled down the column, leaving other pigments xanthophylls, oxidation products, chlorophylls absorbed in to the bed. The column was run until the band was collected. The eluent was made up of a final volume of 25 ml with n-hexane.

All extraction procedures were performed under subdued light to avoid degradation loss of the pigment.

Preparation of standard Beta carotene:

Beta carotene of 1 mg was dissolved in 2.0 ml of n-hexane to give an equivalent of 500 microgram/ml. From this solution 20 micro liters were diluted to 10 ml to have a solution equivalent to 1mg/ml. Absorbance of this solution was taken at 450 nm in spectrophotometer using extinction coefficient value of beta-carotene then solution was made 1mg/ml. The absorbance of this solution was recorded 0.27.

Recording absorbance of the extracted solution:

Carotenoids show characteristics absorbance spectra, for example beta carotene has an absorption maximum of 450 nm in n-hexane with a molecular extinction coefficient of 2592. Therefore to estimate the total carotenoid in the eluent, absorbance of it was read on a spectrophotometer at 450 nm using a 1cm cell.

The total carotenoid concentrated is calculated using the formula below:

Total carotenoid content (µg/g):

$$\frac{A \times \text{Volume (ml)} \times 10^4}{A^{1\%-cm} \times \text{sample weight (g)}}$$

A = Absorbance at 450 nm

Volume = Total volume of extract (25 or 50 ml)

$A^{1\%-cm}$ = Absorption coefficient of β-carotene in petroleum ether (2592)

RESULTS AND DISCUSSION:

By using the spectrophotometric method, total carotenoid contents were determined. The reading was taking against different standard in 450 nm wavelength using n-hexane. Among the mango varieties Aam Rupali contains the highest amount of carotenoid which is about 444.66 µg%, next Shidura Aam contains 406.97 µg%, Kali Bhog contain 352.41 µg%, Lakshmon Bhog contains 345.09 µg% of total carotenoid respectively. And Surmi Fajli contains the lowest amount of carotenoid which is about 94.22 µg%. Total carotenoid content of verities mangoes is mentioned in **Table 1**.

TABLE 1: TOTAL CAROTENOID CONTENT OF VERITIES MANGOES (VALUES EXPRESSED AS MICROGRAM%)

No.	Name of verities mangoes	Carotenoid (µg%)*
1	Gopal Bhog	250.31
2	Shidura Aam	406.97
3	Himsagor	174.38
4	Misrikanto	126.56
5	Chiniguri	282.94
6	Aam Rupali	444.66
7	Lakshmon Bhog	345.09
8	Kali Bhog	352.41
9	Surmi Fajli	94.22
10	Langra	244.41
11	Fajli	190.97
12	Arshini	108.00

*Microgram/100gm edible portion.

It is found from the studies that the content of total carotenoid increases with the maturation of mango. Total carotenoids in green, semi ripe and ripe Mangoes were found to be 3.09 µg%, 70.88 µg% and 251.74 µg% respectively. Out of these, Ripe Mangoes contains very high amount of total carotenoid. Total carotenoid content of mango at different stages of maturation (values expressed as micro gram % (µg %)) is mentioned at **Table 2.**

TABLE 2: TOTAL CAROTENOID CONTENT OF MANGOES AT DIFFERENT STAGES OF MATURATION (VALUES EXPRESSED AS MICRO GRAM %)

No.	Stage of maturation	Carotenoid(µg%)*
1	Green	3.09
2	Semi ripe	70.88
3	Ripe	251.74

*Microgram/100gm edible portion.

There is a worldwide call to develop a National Food composition Database. Unfortunately Bangladesh does not have rich food composition table of its own with the discovery of modern machines and their high level of accuracy. In an effort to update the food value tables and to fill in the data gap we have investigated most commonly. The composition of Mangoes especially carotenoid

content may vary largely due to topographical variations. This variation may be due to climatic condition, nature of soil and sometime rainfall. Maturity of mango is also responsible for this variation.

This study indicates that mango varieties are rich source of carotenoid. In addition to its role in addressing the widely prevalent vitamin A malnutrition, carotenoid also have potential antioxidant activity. Encouraging intake of these mangoes would alleviate Vitamin A deficiency in Bangladesh.

CONCLUTION: This study shows that most of the mango varieties are rich source of carotenoids. As vitamin A deficiency is one of the major public health concerns, regular intake of carotenoids rich fruits can play a great role in eliminating this problem. Our data could be used to update our Food Composition database.

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