Research Article

Assessment of Some Biochemical Characters of Four Mango Verities (Mangifera *India L.*) at Different Stages of Fruit Maturity

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Abstract

Two sets of experiment were conducted at Mango orchard of Devgaon, Faizabad (U.P.) and SHUATS, Allahabad (U.P.), during two consecutive years of 2008-09 and 2009-10 with 4 varities of mango fruits namely "Dashehari, Langra, Chaunsa and Safeda" to asses some physicochemical and biochemical characteristics of mango fruits at 30, 60 and 90 days after fruit settings. Premature, mature and ripened fruits were evaluated for total sugar, protein, β-carotene and crude fibre content. Result revealed that highest amount of total sugar (20.62 and 20.84%), protein (0.90 and 0.91%) and β-carotene content (3031.00 and 3052.00µg/100g) at 90 days after fruit setting were recorded with Dashehari while maximum crude fibre content was noticed in Safeda (1.24 and 1.26%) at 30 days after fruit setting in 2008-09 and 2009-10 respectively. The minimum total sugar (17.26 and 17.33%), protein (0.81 and 0.83%), β carotene content (2373.00 & 2398.67 µg/100g) at 90 day, were recorded with Safeda while minimum crude fibre (0.61 & 0.62%) were recorded with Dashehari in both the year's of experiment.

Keywords: Mango; fruiting stages; Biochemical characteristics; Nutritional composition.

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Introduction

Mango (Mangifera *india L.*) belongs to the Anacardiaceae family, is one of the most important tropical fruits commercialized and consumed worldwide fresh or processed, having an attractive colour and distinct taste and aroma. India is the largest producer of mango accounting for nearly 50% of the total world production, 34.9% of the area under fruit crops in India, and 20.7% of the total fruit production of the country [1]. In Indian context, it is an important fruit crops ruling both domestic & export market. It is an excellent source of fibre and bioactive compounds such as carbohydrate, carotenoids, provitamins, vitamin C, protein, phenolics and other health promoting qualities [2]. Based on these qualities it is recognized as one of the best fruit in the world market and known as king of fruits. The biochemical composition of mango fruits differs among the cultivars and the stage of maturity. Mango fruits are highly perishable due to enzymatic and non enzymatic reaction that takes place during maturation, affecting nutritional, sensorial, physicochemical & biochemical properties. Besides riching in carbohydrates (sucrose, glucose, fructose and maltose), in mango fruits there are about twelve amino acids have been identified including the essential ones like alanine, aspartic acid, lysine, leucine, cystine, valine, arginin, phenylalanine and methionine. The highest concentrations of these amino acids are observed in fruits just after fruit set and the concentrations decreased with fruit development [3]. The aroma and flavor content were also varying widely among the mango cultivars and there is no one typical formulation of flavor component of mango fruits. In ripened mango fruits aroma and good flavor is released due to monoterpene hydrocarbons [4]. Both ripened and unripened fruits are used extensively by food processing industry to prepare variety of products, such as syrup, jam, squash, juice, cereal flakes, pickles, chutneys, candy, jam, jelly, squash, mango chips and nectar etc. [5]. Generally, mango is consumed at all stages of fruit development from the tiny imperfectly set fruits, that shed abundantly on to develop beyond the initial stage to the fully mature ones and development stages of the fruits including mature and ripened stage. Little information about some varietal physicochemical characteristics has so for been recorded [6, 7].

New knowledge about mango composition and its biochemical characteristics is relevant to rational development in India and the exploitation of this fruit neglected by consumers. In this study we report a comparative study of four varities of mango (Dashehari, Langra, Chaunsa, and Safeda) selected from orchard of Devgaon, Faizabad (U.P.) and SHUATS, Allahabad (U.P.) India, to study about some biochemical characteristics which focuses on evaluation of total sugar, protein, β-carotene and crude fibre content at 30, 60 and 90 days after fruit setting of mango fruits.

Materials and Methods

Sample Collection

The present experiment was carried out in the laboratory, Department of Biochemistry, N.D. University of Agriculture and Technology, Kumargunj, Faizabad during two consecutive year's 2008-09 and 2009-10. The mango fruit samples used for this experiment were procured randomly from two mango orchard of Devgaon, Faizabad (U.P.) one mango orchard of SHUATS, Allahabad (U.P.) India, to get a clear assessment about the total sugar, protein, β-carotene and crude fibre content. In this experiment four varities of mango were selected and each variety contained ten mangoes. The cultivars of mangoes under experiment were, Dashehari, Langra, Chaunsa and Safeda which were analyzed at three different maturity stages viz., 30, 60 and 90 days after fruit settings.

Sample preparation

The freshly collected samples were free from insects bites, were cleaned, washed with deionized water and remove the water quickly with a blotting paper. Those were then cut into small pieces, peeled, homogenized and the stone was separated. Accurate quantity was weighted as required for different analysis. Every experiment was replicated 10 times to have a result for each parameter.

Determination of nutritional properties

Total sugar and β-carotene content were determined by Lane and Eynon method [8], protein content was determined by Kjeldahl method and crude fibre content was determined by AOAC method [9].

Statistical analysis

The data were statistically analyzed using Randomized Block Design (RBD) to asses and compare the biochemical properties of the all the 4 mango cultivars.

Results and Discussion

Outcome of the total sugar, protein, β-carotene and crude fibre content of four different mango varities are described. The data pertaining to total sugar content of all the four mango varities (Dashehari, Langra, Chaunsa and Safeda) at different stages of fruit setting are depicted in (**Table 1**).

Table 1 Total sugar content in mango fruits at different stages after fruit setting

Varieties	Total sugar content (%)					
	2006-07			2007-08		
	30 days	60 days	90 days	30 days	60 days	90 days
Dashehari	6.62	13.38	20.62	6.65	13.50	20.84
Langra	5.71	12.28	20.43	5.99	12.30	20.42
Chaunsa	5.68	11.18	19.81	5.43	10.97	19.93
Safeda	4.62	9.76	17.26	4.28	9.22	17.33
C.D. at 5% level	1.05	1.33	1.19	1.09	0.93	1.58

Data revealed that maximum total sugar content was obtained with Dashehari (20.62 and 20.84%) while minimum content was recorded with Safeda (17.26 and 17.33%) at 90 days after fruit setting in both the experimental year's 2008-09 and 2009-10 respectively [10]. The sugar in mango fruit comprised sucrose, glucose, fructose and maltose. During ripening stage, mango fruit shows decrease in acidity and increase in sugars. Reducing sugars have

been found to increase. Glucose, fructose and sucrose have been reported to be in similar concentrations in ripe mangoes and sucrose to be the major constituents of sugar during ripening. The loss in acidity was due to decreasing titrable acidity resulting increasing content of sugar. The sugar undergoes inter conversion and are ultimately utilized in the synthesis of oligo and polysaccharides [11]. The low sugar content in 'Safeda' may probably due to diversion for the synthesis of ascorbic acid and crude fibre along with irregular distribution of nutrients. In this study the sugar content was obtained minimum at premature stage [12].

Data pertaining to protein content (**Table 2**) revealed that mango fruits are rich in protein which ranged from 0.81-0.90% and 0.83-0.91% at 90 days after fruit settings during 2008-09 and 2009-10 respectively. The maximum increase in protein content with increasing days of fruit settings were recorded with Dashehary (0.60 and 0.61%), (0.72 and 0.73%) and (0.90 and 0.91%) while minimum protein content were noticed in 'Safeda' (0.55 and 0.55%), (0.63 and 0.63%) and (0.81 and 0.83%) at 30, 60 and 90 days after fruit setting during both the years respectively. It is clear that 'Dashehari' showed marked increase in protein content throught the growth and development of the fruit. Soluble protein content was found to decrease up to 44 days after fruit set and increased thereafter until 96 days [13]. The low protein content of 'Safeda' probably due to heavy bearing, whereas more synthesis of sugar and ascorbic acid diverts the path ways of synthesis of protein [14].

The data pertaining to β-Carotene content of all the four mango varities (Dashehari, Langra, Chaunsa and Safeda) at different stages of fruit setting are depicted in (**Table 3**).

Table 2 Protein content in mango fruits at different stages after fruit setting

Varieties	Protein content (%)					
	2006-07			2007-08		
	30 days	60 days	90 days	30 days	60 days	90 days
Dashehari	0.60	0.72	0.90	0.61	0.73	0.91
Langra	0.58	0.67	0.86	0.58	0.68	0.89
Chaunsa	0.56	0.64	0.84	0.57	0.66	0.85
Safeda	0.55	0.63	0.81	0.55	0.63	0.83
C.D. at 5% level	0.03	0.03	0.04	0.03	0.04	0.04

Table 3 β-Carotene content in mango fruits at different stages after fruit setting

Varieties	β-Carotene content (µg/100g)					
	2006-07			2007-08		
	30 days	60 days	90 days	30 days	60 days	90 days
Dashehari	116.67	1230.33	3031.00	121.00	2282.67	3052.00
Langra	111.33	1116.33	2819.33	114.67	1130.67	2855.33
Chaunsa	106.67	1010.00	2671.67	109.00	1022.67	2690.67
Safeda	94.00	671.00	2373.00	99.33	698.67	2398.67
C.D. at 5% level	13.34	163.08	206.67	12.33	111.88	191.55

The maximum β-carotene content was recorded in 'Dashehari' (116.67 and 121.00 µg/100g), 1230.33 and 2282.67 µg/100g) and (3031.00 and 3052.00 µg/100g) while minimum content was recorded in 'Safeda' (94.0 and 99.33 µg/100g), (671.00 and 698.67 µg/100g) and 2373.00 and 2398.67 µg/100g) at 30, 60 and 90 days after fruit settings during both the years of experiment 2008-09 and 2009-10 respectively. From the nutritional point of view the ripe mango is rich source of vitamin A (β-carotene), almost as rich as butter. The carotenoids pigments, β-carotene (provitamin A) increase with maturity of fruits. The ripened fruits contain fairly good quality of vitamin A (3000 IU/100g pulp) [15]. All fruits having carotenoids in chromoplast, there is a rapid synthesis of β-carotene during ripening which is accompanied by a simultaneous loss of chlorophyll as chloroplast. It has been claimed that banana skins maintain a constant caratenoids level during ripening. In fruits such as tomato in which the chromoplast normally develop from chloroplasts and thus carotenoids are still formed, if chlorophyll formation is prevented by allowing the fruits to develop in complete darkness, the fruit is first white and then become red as it mature.

The data pertaining to crude fibre content of all the four mango varities (Dashehari, Langra, Chaunsa and Safeda) at different stages of fruit setting are depicted in (**Table 4**).

Table 4 Crude fibre content in mango fruits at different stages after fruit setting

Varieties	Crude fibre content (%)					
	2006-07			2007-08		
	30 days	60 days	90 days	30 days	60 days	90 days
Dashehari	1.13	1.02	0.61	1.13	1.03	0.62
Langra	1.15	1.05	0.71	1.17	1.06	0.70
Chaunsa	1.20	1.07	0.91	1.22	1.09	0.92
Safeda	1.24	1.10	0.95	1.26	1.11	0.96
C.D. at 5% level	0.01	0.04	0.02	0.10	0.03	0.02

Data showed that crude fibre content in mango fruit throught the both years study period and different days after fruit setting ranged from 0.61-1.26%. The maximum crude fibre content was observed in 'Safeda' (1.24 and 1.26%), (1.10 and 1.11%) and (0.95 and 0.96%) at 30, 60 and 90 days of fruit setting during 2008-09 & 2009-10 respectively. Minimum crude fibre content was observed in 'Dashehari' (1.13 and 1.13%), (1.02 and 1.03%) and (0.61 and 0.62%) at 30, 60 and 90 days of fruit settings during both the year of experiment respectively. Fibre content have been found to increase with increasing fruit maturity and there after decreased at ripening stage. It may be ascribed due to effect of biochemical changes in fruits [16]**.** Mango fruits contain considerably amount of dietary fibre (cellulose, hemicelluloses and protein). Cellulose self associated with intra molecular hydrogen binding to form minofibrils, is of atleast 36 glucon chain. Cellulose microfibrils exist as a complex with hemicelluloses. Modification in the structure of hemicelluloses during ripening has been observed in various fruits viz., strawberry, melon and pepper. Pectins are basically a group of polysaccharides that are rich in galacturonic acid. The galacturonic acid occurs in two major structural form, linear homo galacturonan and a branched rhamnogalacturonan. During ripening of fruits, there is a dramatic increase in water chelator soluble polyuronides [17].

On the basis of general comparative characters and biochemical investigation of four cultivar's of mango viz., "Dashehari, Langra, Chaunsa and Safeda", it may be concluded that cultivar's 'Dashari' was rated most superior than 'Langra', 'Chaunsa' and 'Safeda' during both the years of experiment, as it contain higher content of total sugar, protein, β-carotene and crude fibres.

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