

Quality Attributes of Immature Fruit of Different Mango Varieties

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Abstract: The study was carried out to evaluate quality attributes of immature fruits of four commercially grown varieties of mango namely Sindhri, Chaunsa, Langra and Desi. The immature mango fruits were collected from basin of mango tree in the end of April followed by washing, surface drying and extraction of fruit pulp. The extracted fruit pulp was assessed for pH, TSS, moisture and ash percentage, acidity, vitamin C, fat, protein and sugars. Besides, minerals including sodium, calcium, potassium, magnesium, zinc, iron, copper, chromium, and manganese were also determined. On the basis of varietal comparison Sindhri had more moisture (88.60%), ash and fat (0.60%) each, total sugars (6.99%) and reducing sugars (2.78%) as compared to rest of the varieties. However TSS (9.35%), protein (0.71%), and non reducing sugars (4.86%) were recorded the highest in Langra variety. Only the Chaunsa variety had maximum pH of 3.01 and vitamin-C (27.16 mg 100g⁻¹). Regarding mineral elements, Desi was found potential in terms of sodium (453.93 mg kg⁻¹), calcium (403.79 mg kg⁻¹), Zinc (3.47 mg kg⁻¹) and iron (5.95 mg kg⁻¹). The zinc and iron was at par with the results obtained from Langra. However, potassium (904.58 mg kg⁻¹) and copper (2.58 mg kg⁻¹) were observed the highest in Langra, magnesium (78.09 mg kg⁻¹) in Chaunsa and manganese (2.43 mg kg⁻¹) in Sindhri.

Keywords: Nutritional composition, green fruit.

INTRODUCTION

Mango is one of the favored fruits cultivated throughout the world. It is also known as king of the Asiatic fruits as Asia is the largest producing region of the world. It provides high nutritional value in terms of vitamins, minerals, proteins, sugars, fat, and iron for human consumption providing about 64-86 calories energy [1-4]. Generally mango is consumed at all stages of fruit development from the tiny imperfectly set fruits, that shed profusely on to develop beyond the initial stage, to the fully mature ones. Mature fruit is chief food fruit of summer months consumed as dessert fruit. However, at the first windfall stages, the immature fruit is gathered for pickles and chutney coming as it does as the first material after the dry season. These immature green fruits are also chopped up for use in lieu of tamarind in various dishes where an acid flavour is desired. The nutritional value of mango fruits varies from variety to variety and developmental stages of the fruit including immature (tender green), mature and ripened stage. A lot of work has been reported on the nutritional value of different mature and ripened mango fruits of different varieties [5-13]. But no or little work has been done on immature green mangoes. Therefore the present study was designed to evaluate and compare nutritional status of immature tender green mangoes of four different commercially grown varieties.

MATERIAL AND METHODS

The immature mango fruits of four commercial grown varieties viz. Sindhri, Chaunsa, Langra and Desi were collected from basin of the fruit tree in the end of April, 2009. The average weight of fruit of each variety recorded 82 g of Desi, 180 g of Sindhri, 163 g Langra and 112 g of Chanusa. The harvested immature mango fruits were brought to the laboratory of Food Sciences and Technology followed by washing with double distilled water to remove dirt and dust. The cleaned fruits were surface dried, peeled and cut into small pieces. Homogenous mixture was prepared by blending the pulp in blender. The sample was thoroughly mixed and the extracted pulp was used for chemical analysis including pH, TSS, moisture, ash, acidity, vitamin C, fat, protein and sugar contents. All the chemical analysis was done as per AOAC methods [14]. All mineral elements including sodium, calcium, potassium, magnesium, zinc, iron, copper, chromium, and manganese were determined by the methods of Ecrement and Burell [15].

Each sample was replicated thrice in completely randomized design and the data was subjected to statistical analysis following Fisher's analysis of variance technique and treatment means were compared according to DMR test at 5% level of probability [16].

RESULTS

The results reported in Table 1 reflect that the pH of mango pulp of different varieties ranged from 2.77 to

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Table 1: pH, Total Soluble Solids, Moisture, Ash and Acidity of Immature Mango Fruits of Different Varieties

Variety	pH	TSS (%)	Moisture (%)	Ash (%)	Acidity (%)
Desi	2.88 b	8.53 b	86.55 b	0.29 d	0.59 a
Sindhri	2.82 c	9.09 ab	88.60 a	0.60 a	0.38 c
Langra	2.77 d	9.35 a	85.97 b	0.38 c	0.49 b
Chausa	3.01 a	7.33 c	85.72 b	0.45 b	0.38 c
Average	2.87	8.57	86.71	0.43	0.46
F-value	43.87	15.12	4.08	52.44	18.97
p-value	0.00	0.00	0.01	0.00	0.00
LSD (5%)	0.04	0.67	1.88	0.05	0.0671

3.01 with average value of 2.87. Chausa had the highest pH value of 3.01 followed by Desi (2.88) and Sindhri (2.82). The minimum pH was observed in Langra. However TSS (9.35%) was found maximum in Langra variety. These TSS results were at par with the results (9.09%) obtained from Sindhri variety. Sindhri was also on top in terms of moisture (88.60) and ash percentage (0.60). Significant difference were also observed for pulp acidity ranged from 0.38-0.59 percent being the highest in Desi and statistically similar and the lowest in Sindhri and Chausa varieties.

The data presented in Table 2, the highest vitamin C (27.16) was observed in Chausa followed by Langra (24.08). The other two varieties exhibited statistically similar results for vitamin C. The highest fat (0.60%), total sugars (6.99%) and reducing sugars (2.78%) were observed in variety Sindhri as compared to rest of the varieties. However, the total sugar of 6.99% was non significant with the results obtained from the variety Langra (6.57%). The variety Langra was also found high in protein content (0.71) followed by Chausa (0.63). The highest non reducing sugar (4.86%) was recorded from variety Langra with the

average value of 3.78% (Table 3). These results are at par with the results obtained from variety Sindhri (4.24%). On the basis of mineral content of immature mango fruits, sodium and calcium (453.93 and 403.79 mg kg⁻¹) was found maximum in variety Desi, potassium in Langra (904.58 mg kg⁻¹) and Magnesium in Chausa variety (78.09 mg kg⁻¹).

Table 4 depicted that Zinc and Iron was found maximum in variety Desi with the average of 2.74 and 5.55 mg kg⁻¹ respectively. The highest zinc content 3.47 mg kg⁻¹ from Desi was at par with the results obtained from variety Langra (3.17 mg kg⁻¹). Similarly the highest iron content 5.95 mg kg⁻¹ was also at par with the results obtained from Chausa (5.80) and Langra (5.63) varieties. The highest copper content (2.58 mg kg⁻¹) was observed in Langra and rest of the varieties exhibited non significant results with each other. The highest manganese (Mn) content of 2.43 mg kg⁻¹ was observed in Sindhri with average of 2.14 mg kg⁻¹. Chausa (2.38 mg kg⁻¹) had also non-significant results with Sindhri. The chromium content in immature mango fruits ranged from 0.52 to 0.88 mg kg⁻¹ with mean value of 0.68 mg kg⁻¹. The Chausa had the

Table 2: Vitamin-C, Fat, Protein and Sugar Content of Immature Mango Fruits of Different Varieties

Variety	Vitamin -C (mg 100g ⁻¹)	Fat (%)	Protein (%)	Total Sugar (%)	Reducing Sugar (%)	Non-reducing sugars (%)
Desi	13.89 c	0.29 c	0.29 c	4.56 b	1.58 b	2.97 b
Sindhri	13.61 c	0.60 a	0.44 b	6.99 a	2.78 a	4.24 a
Langra	24.08 b	0.45 b	0.71 a	6.57 a	1.83 b	4.86 a
Chausa	27.16 a	0.47 b	0.63 a	4.99 b	1.90 b	3.07 b
Average	19.68	0.45	0.52	5.78	2.02	3.78
F-value	44.87	19.19	24.02	13.90	17.09	9.67
P-value	0.00	0.00	0.00	0.00	0.00	0.00
LSD (5%)	3.03	0.08	0.11	0.92	0.36	0.86

Table 3: Sodium, Calcium, Potassium and Magnesium Content of Immature Mango Fruits of Different Varieties

Variety	Sodium (mg kg ⁻¹)	Calcium (mg kg ⁻¹)	Potassium (mg kg ⁻¹)	Magnesium (mg kg ⁻¹)
Desi	453.93 a	403.79 a	205.25 d	38.07 c
Sindhri	361.87 c	151.03 b	717.40 b	35.30 d
Langra	419.43 b	148.09 b	904.58 a	56.01 b
Chaunsa	196.81 d	89.59 c	424.18 c	78.09 a
Average	358.01	198.13	562.85	51.87
F-value	298.21	2313.11	677.97	606.47
P-value	0.00	0.00	0.00	0.00
LSD (5%)	19.26	8.49	34.71	2.34

Table 4: Zinc, Iron, Copper, Chromium and Manganese Content of Immature Mango Fruits of Different Varieties

Variety	Zinc (mg kg ⁻¹)	Iron (mg kg ⁻¹)	Copper (mg kg ⁻¹)	Chromium (mg kg ⁻¹)	Manganese (mg kg ⁻¹)
Desi	3.47 a	5.95 a	0.93 b	0.75 b	2.08 b
Sindhri	1.99 b	4.83 b	1.01 b	0.57 c	2.43 a
Langra	3.17 a	5.63 a	2.58 a	0.52 d	1.66 c
Chaunsa	2.32 b	5.80 a	1.23 b	0.88 a	2.38 ab
Average	2.74	5.55	1.44	0.68	2.14
F-value	14.02	9.55	30.76	129.45	11.13
P-value	0.00	0.00	0.00	0.00	0.00
LSD (5%)	0.54	0.46	0.40	0.04	0.30

highest chromium (0.88 mg kg⁻¹) followed by Desi (0.75 mg kg⁻¹).

DISCUSSION

In present study immature or tender green fruits of four different varieties namely Sindhri, Chaunsa, Langra and Desi were observed lower in pH and more in acidity. This may be due to immature developmental stage of the fruit. These results are in contradiction with the findings of Gozlekci *et al.* [17]. They harvested fruits of pomegranate at three development stages including immature, unripe and mature. They reported higher pH (4.56) from immature fruits as compared to unripe (2.95) and mature fruits (3.17). This contradiction may be possible due to different type of fruits i.e pomegranate and mango. When we talk on mango, generally pH increased and acidity decreased from immature to mature and mature to ripened stages of fruit development. This statement can be better justified with the results of Pleguezuelo *et al.* [18]. They observed higher pH from 4.2 to 5.7 and lower titratable

acidity from 0.05 to 0.22% from fruits of different cultivars harvested at maturity stage. While, on the basis of our results we observed lower pH and higher acidity from the fruits harvested at immature stage of development. Akhtar *et al.* [11] observed minimum pH lower than 4 and more acidity more than 0.60 in all four varieties including Dusheri, Chaunsa, Ratol and Langra fruits harvested even at maturity stage.

Total soluble solids (TSS) are directly correlated with the acidity of the fruit. Generally, acidity of the fruit decreases and total soluble solids increase during maturity and ripening stage of the fruit as reported by Padda *et al.* [13]. In present study the immature fruits were used and observed lower total soluble solids (TSS). However, Pleguezuelo *et al.* [18] reported more TSS from 15.7 to 20⁰ Brix from the fruits harvested at maturity stage. Akhtar *et al.* [19] also reported TSS more than 15⁰ Brix in Chaunsa and 14⁰ Brix in Langra fruits harvested at maturity stage. Gozlekci *et al.* [17] reported TSS of 6.16% from immature, 10.38% from unripe and 15.84% from mature fruits of pomegranate.

Moisture percentage of different varieties significantly differed and reported more than 80% in all varieties. Ueda *et al.* [20] also reported almost similar results. They harvested mango fruits after 10, 13, 16 and 19 weeks after flowering and observed moisture more than 80% in all stages of fruit development. However maximum moisture content of 88.6% was observed from the fruits harvested 10 weeks after flowering.

Regarding ash content, Sindhri variety was on the top following Chaunsa and Langra. Almost similar results were reported by Akhtar *et al.* [11] who reported ash content of more than 0.4% in Chaunsa and 0.45% in Langra varieties recorded from ripe fruits of mango.

Immature fruits of mango were observed lower in vitamin C and significantly different from variety to variety. Jilani *et al.* [12] reported vitamin C content from mature mango fruits in different varieties ranged from 131 to 178 mg 100 g⁻¹. On the basis of Jilani *et al.* [12] results there is huge variation in vitamin C content of different varieties from immature to mature fruits. Total and reducing sugar content of immature fruits of different varieties observed lower in present study because these sugars usually increase with the maturity stage of the fruit. Lakshminarayana [6] reported that reducing and total sugars increased slightly at later stages after fruit set, although they were nearly constant until 14 weeks in the mango cv. 'Alphonso' during development and maturation. Othman and Mbogo [10] reported that total and reducing sugars of the mangoes increased from the immature to mature and mature to ripened fruits. These sugars also increased within the seasons from early to late seasons and with days of storage-ripening making the most sugary fruits, the fully ripened fruits. Such high percent total sugars were also observed in mangoes from Egypt [21].

Regarding mineral content of different varieties, sodium and potassium were the predominant minerals examined from immature fruits of mango. Desi variety had more sodium and calcium content while more potassium was found in Langra. Akhtar *et al.* [11] reported maximum potassium from mature fruits of mango varieties including Dusheri, Langra, Chaunsa and Ratol. These results are also in accordance with the results of Othman and Mbogo [10]. They also observed more potassium in Dodo variety of mango fruits harvested at maturity stage. Calcium content of mango fruits also vary from variety to variety and development stage of the fruit. There is lot of variation observed in calcium content from immature to mature

fruits of mango. Akhtar *et al.* [11] reported calcium content of fruits different varieties harvested at maturity stage not more than 66.22 to 74.20 ppm. These figures are too much lower than the present results obtained from fruits harvested at immature stage. On the basis of varietal comparison, langra had more zinc, iron and copper content as compared to rest of the varieties. Akhtar *et al.* [11] reported zinc content of 2.55 ppm from fruits of Langra variety harvested at maturity stage. These results are much higher than the results obtained in the present study from immature fruits of the same variety. This variation may be due to difference in harvesting stage of the fruit. Contradictory results were observed by Akhtar *et al.* [11] for iron content. They observed iron content of 2.81 to 3.19 from mature fruits of different varieties of mango. However in present study immature fruits had more iron content in all the varieties. All these differences may be variation due to different harvesting stage of the fruit and variety.

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Received on 28-10-2012

Accepted on 19-11-2012

Published on 30-01-2013

<http://dx.doi.org/10.6000/1927-5129.2013.09.09>© 2013 Leghari *et al.*; Licensee Lifescience Global.

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