

Biochemical Traits of Selected Mango varieties Collected from Ranipet District

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ABSTRACT: An evaluation of physical, morphological and biochemical traits of twelve varieties of mango were made at Ranipet District and Agricultural College and Research Institute, Vazhavachanur, Tiruvannamalai District. It was observed that cv. Imampasad had the maximum fruit weight (667.33 g), pulp weight (466.67 g), stone weight (130g) and peel weight (68.67 g), cv. Raasal had the maximum fruit length (23.43 cm) and fruit width (16.33cm). The maximum contribution of pulp percentage was recorded in cv. Alphonso (75.46 %) whereas, on other hand maximum peel percentage was obtained from cv. kalepad (11.67 %). The highest stone percentage was noted in cv. Mandanapalli (24.02 %). Fruits of Banganapalli recorded the highest values of total sugar (16.16 %) and Alphonso recorded the highest values of reducing sugars (5.6 %) contents. Alphonso also recorded the highest protein content (895mg/100g pulp). The maximum ascorbic acid content was found in cv. Banganapalli (48 mg/100g), while the titrable acids are highest in cv. Desi type (0.60 %). Sendura recorded the highest Beta-carotene content (1430µg/100g pulp) and Total phenol content (18mg/100g pulp). Highest calcium content (16mg/100gpulp) was recorded in Raspuri.

In general, we can find variations in biochemical parameters among the different fruits and their varieties. These variations have not been studied and mentioned clearly in the available literatures. Biochemical information's are scanty in the varieties like Desi type, Imampasad, Raspuri and kalepad. The research work is seems to be first time for the varieties like Benisha, Raasal and Mandanapalli, Thus, need arises to design the experimental research to screen the top three among the tested varieties.

Overall view reveals that Imampasad, Raasal and Alphonso were found better in physical properties where as Banganapalli, sendura and Alphonso recorded their superior biochemical qualities.

Keywords: Biochemical, *Mangifera indica* L., Mango, Ranipet region, Varieties.

INTRODUCTION

Mango is one of the major fruits in the tropical and subtropical zones, where it occupies a very important place. Mango is called as 'king of fruits' due to its appreciable taste and it is also available at nominal price. Mango is considered as "national fruit of India" because of its Traditional consumption. Tamil speaking Indians always considers Mango, Jack fruit and Banana as Top three among the fruits and Mango always in the number one position. Mango is also known as seasonal fruit due to its seasonal availability. India ranks Top three position as a largest producer of Mango in the world and Uttar Pradesh ranks first position in India. India grows more than 1000 mango cultivars for its delicious and nutritional importance.

The mango tree belongs to the family *Anacardiaceae* and is native to eastern part of the Indo-Burma region at the foot of the Himalayas. Mango is a perennial tree with the life span of 40 years or more. Unripen mango have many antiviral compounds. Mango makes summer as cheery by its magical taste because it creates

tempting feel with its lusciousness and pulpiness. Mango is meant for temptation from kids to senior citizens. Children are fond of mangoes due to their lip-smacking savour and craziness stimulating fragrance. Mango fruit pulp streamlines the digestive system and keeps you young. Value added products like delicious jam and jelly are also prepared using mango fruits. A person should consume at least one mango fruit per day during the season since it has huge amount of potassium, fibre, Vitamin C (immune booster), A (Vision), B (heart diseases prevention) and magnesium. Consumption of mango in raw form increases the numbers of red blood cells.

Selection of Mango for export is screened based on size, shape, weight, percentage of ripening, pulp percentage and its colour for consumer attraction. Main advantage of Mangoes is their attractive colour and Long shelf life. In general, Mango fruits have a storage life upto 12 days. Fruits and vegetables plays crucial role in human nutrition by providing antioxidants to scavenge the free radical generation. Mango is a

climacteric fruit (ripening is based on ethylene production and have respiration pattern). Biochemical parameters plays important role in quality aspects of the mango fruit between post harvest and at the time of consumption. The nutritional value of mango fruits varies from variety to variety and in different stages of fruit development.

Mangoes are best source of antioxidants in human diet. Vitamin A precursors from Mango is also essential for better vision and immune function apart from scavenging of reactive oxygen species. Special Mango varieties have mixed taste because of special molecules like phenolic compounds. Desirable amount of phenolic compounds are necessary during human physiological or pathological stress conditions.

Chief phenolic compounds concerned with mango pulp are mangiferin, quercetin and ferulic acid. Mango is an excellent source of polyphenols, including mangiferin, gallic acid, gallotannins, quercetin, isoquercetin, ellagic acid, and β -glucogallin, with gallic acid being the most prevalent in the mango mesocarp (Singh *et al.*, 2022). These compounds offer numerous preventative health benefits (antioxidative, anticarcinogenic, anti-atherosclerotic, antimutagenic, anti-inflammatory, analgesic, antidiabetic and immunomodulator) and can protect against cardiovascular diseases (Masibo & He 2008; Hu *et al.*, 2021). Concentrations of phenolic compound derivatives were found namely catechol-O-sulfate, 4-O-methylgallic acid, 4-O-methylgallic acid-3-O-sulfate, pyrogallol-O-sulfate, and methylpyrogallol-O-sulfate in human plasma were 9520, 2790, 6030, 5990, and 4020 microgram per litre, respectively, following consumption of 400 g of Ataulfo mango pulp (Barnes *et al.*, 2020).

Mango cultivars differ in their antioxidant capacity due to genotypic variation and ripening stage. Variation in Ascorbic acid content is due to cultivar and the secondary reasons are cultivation practices and climatic conditions.

Major Biochemical constituents of Mangoes are carbohydrates inclusive of structural carbohydrates like pectin (unripe) and cellulose, organic acids (malic and citric acid), pigments (unripe-chlorophyll; ripe-carotenoids), phenolic compounds (inclusive of flavonoids), vitamins and minerals. In general fruits are considered as poor sources for protein (lesser than 1%), wood apple is exempted. The principal amino acids of Mango fruit proteins are methionine, arginine, valine, leucine, phenylalanine and lysine. Mango fruits are good sources for unsaturated fatty acids also.

Dietary fiber represents 1.6 to 2.6% of the edible portion of Tommy Atkins, Haden, Kent and Keitt mangoes (USDA, 2018). The levels of Pantothenic acid ranges from 0.16–0.24 mg/100g mango pulp according to USDA, 2018.

Biochemical parameters may be considered as important factors during selection of the variety.

In sambar preparation, in general, people use tamarind. Instead of tamarind, unripened mango or ripened tomato or ripened acid lime may be used.

Ranipet is a district in the Tamil Nadu state of South India. Ranipet is an industrial hub closer to Chennai city of Southern India. Twelve different mango varieties which is frequently consumed and rarely cultivated were collected from the Ranipet district and their Biochemical attributes were analysed. This study was carried out to identify the best varieties suitable for consumers of Ranipet District.

MATERIALS AND METHODS

Different varieties of mango fruits were collected from native farmers, neighbor homes and local markets at Ranipet district during the year 2021. Samples were sorted at the same maturity level and the selected mangoes were free from any pathogens, pathogen infection and mechanical damage.

The Biochemical study was carried out at Biochemistry lab, Agricultural College and Research Institute, Vazhavachanur, Tiruvannamalai District. The physical property study was carried out at Ranipet District, Tamil Nadu during 2021 [Covid 19 situation]. The experiment was laid out in a completely randomized block design having twelve varieties Sendura, Bangalora, Alphonso, Desi type, Benisha, Imampasad, Totapuri, Banganapalli, Raasal, Mandanapalli, Raspuri, Kalepad which were replicated thrice with one tree per replication. The trees were eight to twelve years old. Complete matured fruits were collected and allowed to ripe with the help of wooden box and paddy-straw at room temperature.

Fruit weight, stone weight, pulp weight, peel weight recorded by using digital balance, the length and width of fruit were measured with vernier calipers. Peel, pulp and stone percentage were calculated based on fresh weight basis.

Total sugars and reducing sugars were estimated by Phenol Sulphuric acid method (Dubois *et al.*, 1956) and Dinitrosalicylic acid method (Miller, 1959) respectively. Titrable acidity of fruits in complete ripened fruits of various varieties was determined by the methods/procedure as reported by Ranganna (2011). β -carotene was determined using methods of Biochemical analysis (Anonymous, 1967).

pH meter was used for the determination of pH value of mango pulp of different varieties. Beta-carotene was estimated following the methods of AOAC, (1980). Total phenolic content was determined by folin ciocalteu method with gallic acid as a standard (10 to 50 μ g) by Folin-Ciocalteu method (Bray and Thorpe 1954).

Ca²⁺ content was estimated by Versenate method (Diehl *et al.*, 1950). Ascorbic acid content was estimated by DCPIP method (AOAC method; 1984). Protein content was determined spectrophotometrically by Lowry *et al.* (1951).



Statistical Analysis. The experiment was carried out in a completely randomized design. All results were expressed as the mean value. The data obtained were subjected to statistical scrutiny for the parameter under study. The level of significance was considered at $P < 0.05$.

RESULTS AND DISCUSSION

Biochemical Traits of Mango Fruits

The data presented in Table 1 indicated that the Biochemical properties of fruits of twelve cultivars have been evaluated in terms of Total sugars, Reducing sugars, pH value, Beta-carotene, Total phenol, Calcium content, Ascorbic acid content and Protein content.

Fruits of Banganapalli recorded the highest values of total sugar (16.16 %) and Alphonso recorded the highest values of reducing sugars (5.6 %) contents. Alphonso also recorded the highest protein content (895mg/100g pulp). The maximum ascorbic acid content was found in cv. Banganapalli (48 mg/100g), while the titrable acids are highest in cv. Desi type

(0.60 %). Sendura recorded the highest Beta-carotene content (1430 μ g/100g pulp) and Total phenol content (18mg/100g pulp). Highest calcium content (16mg/100g pulp) was recorded in Raspuri.

Fruits of Desi type recorded the lowest values of total sugars (5.93 %), reducing sugars (1.8%), pH value (2.8), lowest calcium content (6mg/100g pulp) and lowest protein content (420mg/100g pulp). The minimum ascorbic acid content was found in cv. Totapuri (14 mg/100g), while the titrable acids are lowest in cv. Kalepad (0.24%). Alphonso recorded the lowest Beta-carotene content (450 μ g/100g pulp) and Imaampasand recorded the lowest Total phenol content (5.7mg/100g pulp).

Significance of Biochemical constituents of Mango pulp. Dietary sugars are the sum of mono and disaccharides, abundant in fruits. The main role of dietary sugars is to provide vital energy to all human cells.

Table 1: Biochemical composition of mango varieties.

Variety Name	Total sugars [g/100g Pulp]	Reducing sugars [g/100g Pulp]	Titratable acidity %	pH value	Beta carotene [μ g/100g Pulp]	Total Phenols [mg/100g Pulp]	Protein [mg/100g Pulp]	Ascorbic acid [mg/100g Pulp]	Ca ²⁺ [mg/100g]	
Sendura	11.13	4.4	0.30	4.2	1430	18.00	676.66	32	14	
Bangalora	15.25	5.4	0.42	3.6	900	8.25	623.33	45	10	
Alphonso	14.90	5.6	0.36	3.8	450	12.30	895.00	28	12	
Desi type	05.93	1.8	0.60	2.8	520	6.20	420.00	15	06	
Benisha	15.83	5.0	0.34	4.0	1050	11.25	785.00	26	14	
Imaampasand	13.20	4.6	0.26	4.4	867	5.70	805.00	37	11	
Totapuri	12.80	3.8	0.38	3.7	720	8.80	538.33	14	13	
Banganapalli	16.16	5.2	0.32	4.1	1120	14.60	848.00	48	15	
Raasal	10.00	3.4	0.25	4.5	1284	7.20	820.00	24	07	
Mandanapalli	14.20	4.8	0.28	4.3	630	10.75	580.00	35	08	
Raspuri	09.30	3.0	0.45	3.4	1031	9.27	610.00	21	16	
kalepad	12.33	4.1	0.24	4.7	1310	13.20	670.00	30	09	
Statistical analysis	SEm	0.308	0.113	0.008	0.076	22.15	0.282	14.58	1.12	0.577
	SEd	0.436	0.160	0.012	0.108	31.33	0.398	20.61	1.58	0.816
	CD 1%	1.189	0.435	0.033	0.294	85.34	1.085	56.15	4.30	2.224
	CD 5%	0.886	0.325	0.024	0.219	63.61	0.809	41.85	3.21	1.658

Carbohydrate metabolic disorder patients should be careful while taking high doses of dietary sugars especially glucose at a time. Raw fruit consumption has lower risk when compare to consumption in the form of juices, sweetened beverages and other artificial forms. Persons having blood glucose level lesser than the level 99 mg/dL at random sampling may prefer frequent uptake of raw fruits such as mangoes especially the Banganapalli which recorded the highest values of total sugar (16.16 %).

Since Banganapalli is abundant in sugars, Jams can be prepared from the pulp of this variety with minimum addition of sugar.

Titration deals with measurement of the total acid concentration contained within a fruit. Titration acidity of fruit pulp is an important parameter in determining fruit maturity and sour taste in mango fruits. The maturity of fruit is one of the most important factors to determine how well fruit will store and how it will taste. Titration acidity is a better predictor of acid's impact on flavor. Titration Acidity is an important trait for consumer acceptability of any fruits. Ripened mango pulp from varieties like Banganapalli and Sendhura can be used for Mango Lassi preparation due to their taste and nutritive value.

The pH value of a fruit is a direct function of the free hydrogen ions present in that fruit. Acids present in foods release these hydrogen ions, which give acid fruits their distinct sour flavor. Thus, pH may be defined as a measure of free acidity (e-resource-1).

Calcium is essential for building and maintaining healthy bones and teeth (e-resource-2). It has impact on blood pressure also. Our heart, muscles and nerves also need calcium to function properly (e-resource-2). Calcium protects proliferation of cancer cells. Raspuri variety has recorded highest level of calcium [16mg/100g pulp].

Phenolic compounds are one of the most important classes of phytochemicals with antioxidant property have positive impact on Human Health Care Management. Fruits are the excellent sources of these compounds, especially Mangoes. Sendhura variety recorded substantial amount [18mg/100g pulp] of Total phenolic compounds.

Carotenoids are 6 to 8 times more abundant during ripening than in unripe fruit (Haque *et al.*, 2015). In Ranipet District, Carotenoids levels in ripening mango will be increased to ten folds when compared to unripened.

Beta-carotene is one of the coloring pigments and itself an antioxidant, protect cell damage due to ROS. Human body can convert Beta Carotene into vitamin A which plays crucial role in eye health as well as maintaining the effective functioning of brain, heart and lungs. Sendhura variety recorded substantial amount [1430 µg/100g pulp] of β-carotene.

In general pulses are meant for protein (more than 18%) and fruits are considered as poor sources for protein (lesser than 1%) with few exceptions. Variation in protein content among the genotypes should be taken into account. Alphonso comes in the steer position [895mg/100g pulp].

Ascorbic acid is commonly known as vitamin C naturally present in all fruits, other plant sources and also available as a dietary supplement. Humans are unable to synthesize Ascorbic acid. It has to be supplied through diet particularly fruits. Ascorbic acid is meant for its antioxidant and antiviral property. Other important biochemical functions associated with Ascorbic acid are tissue regeneration, biosynthesis of collagen and L-carnitine. It is believed that vitamin C has the antagonistic action towards certain carcinogens. 250mg of Ascorbic acid may have good impact on reducing the levels of hyperglycemic hormones and at least 300mg of Ascorbic acid is required to enhance the levels of antibody. Deficiency of Ascorbic acid may lead to connective tissue weakness and stroke. Cytoprotective functions of vitamin C includes prevention of DNA mutation, lipid peroxidation and destruction of protein integrity. Vitamin C may inhibit hyaluronidase as one of the anticancer effects. Plasma Ascorbic acid have been reported to be directly correlating with survival and inversely correlating with multiorgan failure. Ascorbic acid favors better neurotransmission and thus improves learning and recalling capacity. More Ascorbic acid containing fruits may be recommended as an attempt to reverse memory loss. Ascorbic acid may be useful for the Alzheimer's patient, the incidence raised due to false life style. Ascorbic acid may have positive impact on ocular health. The results obtained in the current study on mango fruits shows that Banganapalli variety contains substantial amount [48mg/100g pulp] of ascorbic acid and serve as reliable source of vitamin C.

Physical Properties of Mango Fruits

Fruit appearance and attraction are influenced by colour, size and shape. These are the most important consumer preferences while purchase of the mango fruits. Therefore, various physical characteristics were recorded in different mango varieties. The variations in physical characteristics are due to genetics.

The data presented in Table 2 indicated that the physical properties of fruits of twelve cultivars have been evaluated in terms of weight, length, width, pulp weight, pulp percentage, peel weight, peel percentage, stone weight, stone percentage. The maximum fruit weight (667.33 g), stone weight (130 g), pulp weight (466.67 g) and peel weight (68.67 g) was recorded in cv. Imampasad, cv. Raasal had the maximum fruit length (23.43 cm) and fruit width(16.33cm). The maximum contribution of pulp percentage was recorded in cv. Alphonso (75.46 %) whereas, on other hand maximum peel percentage was obtained from cv. kalepad (11.67 %). The highest stone percentage was noted in cv. Mandanapalli (24.02 %).

Alphonso recorded the lowest values of physical properties such as pulp weight (101%), stone weight (22.67%), peel weight (8.67%), fruit width (10.33cm) and peel percentage (6.49%). The Desi type recorded the minimum fruit weight (159.67%), cv. Kalepad had the minimum fruit length (14.13 cm) The minimum contribution of pulp percentage was recorded in cv. Totapuri (62.72%). The lowest stone percentage was noted in cv. Benisha (17.17 %).

Table 2: Physical parameters of mango varieties.

Variety Name	Fruit Weight [g]	Pulp Weight [g]	Pulp %	Stone Weight [g]	Stone %	Peel Weight [g]	Peel %	Fruit Length [cm]	Fruit Width [cm]	
Sendura	161.67	105.00	64.94	30.33	18.76	17.33	10.72	17.73	11.67	
Bangalora	211.67	157.00	74.17	42.67	20.16	22.67	10.71	14.47	15.67	
Alphonso	133.67	101.00	75.55	22.67	16.96	8.67	6.50	15.20	10.33	
Desi type	159.67	111.33	69.72	28.67	17.96	18.33	11.50	19.33	14.10	
Benisha	368.67	270.33	73.32	63.33	17.17	34.00	10.29	14.87	14.00	
Imaampasand	667.33	466.67	69.93	130.00	19.48	68.67	9.22	14.80	11.20	
Totapuri	318.00	209.00	65.72	73.00	22.95	35.33	11.11	14.67	13.80	
Banganapalli	411.33	280.67	68.23	85.67	20.81	43.33	10.53	15.57	15.33	
Raasal	484.00	321.67	66.46	109.67	22.66	50.67	10.46	23.43	16.33	
Mandanapalli	442.67	288.67	65.21	106.33	24.03	46.00	10.39	15.47	14.53	
Raspuri	329.00	230.67	70.11	64.33	19.55	31.67	9.62	14.67	11.83	
kalepad	191.33	122.00	63.76	45.33	23.69	22.33	11.67	14.13	11.10	
Statistical analysis	SEm	29.47	23.66	2.4	5.21	1.69	2.78	2.54	0.76	0.87
	SEd	41.67	33.46	3.4	7.36	2.40	3.93	3.60	1.07	1.24
	CD 1%	113.2	91.16	9.2	20.05	NS	10.71	9.80	2.92	3.36
	CD 5%	84.61	67.95	6.8	14.94	NS	7.98	7.31	2.18	2.51

Variety Name	Specific gravity (Kg/m ³)	Pulp consistency in cm (30 secs @ 20 deg celcius)	Fruit colour	Fruit attractiveness
Sendura	0.162	8	Yellow with mild reddish parts	Excellent
Bangalora	0.210	12	Bright yellow	Excellent
Alphonso	0.130	13	Sunshine yellow appearance, orange yellow	Good
Desi type	0.157	14	Greyish green	Moderate
Benisha	0.363	11	Golden yellow to orange yellow	Excellent
Imaampasand	0.667	9	Yellow-green	Good
Totapuri	0.313	12	Greenish yellow with reddish parts	Moderate
Banganapalli	0.407	10	Golden yellow	Excellent
Raasal	0.477	11	Greenish yellow	Good
Mandanapalli	0.440	13	Butter yellow	Good
Raspuri	0.327	7	Reddish yellow	Moderate
kalepad	0.187	6	Reddish yellow	Moderate
Statistical analysis	SEm	0.029	0.287	
	SEd	0.041	0.407	
	CD 1%	0.114	1.146	
	CD 5%	0.085	0.843	

CONCLUSIONS

Fruit consumption has to be encouraged. Fruits should have 20% contribution in overall food consumption. A person should consume at least 20 different fruits per year to get the beneficial of all bioactive compounds. Importance may be given for Mango cultivation and Mango fruit consumption. Mango is the symbol of prosperity and happiness. The results rated the top three mango varieties suitable for Ranipet district farmers, sellers and consumers. The results revealed about the top three mango varieties Alphonso, Sendura and Banganapalli which are commercially and rarely cultivated in Ranipet district based on the physical and Biochemical parameters.

FUTURE SCOPE

Every one depend on at least one type of drink either tea/coffee/soft drinks/commercial drink without giving importance for nutritive value and medicinal value.

‘Toddler’ is very important age groups of human age. Mango pulp is highly recommended for toddler as 100g pulp per day on alternate days for evening refreshment. The practice will become a habit, leads to increase the number of teetotaler. Fruit pulps are meant for addition and not for addiction. Mango cultivation should be promoted. The promising varieties Banganapalli, sendhura and alphonso shall be included in varietal development programme by the breeders in the years ahead. Awareness has to be created on the value addition technologies in mango to the farmers, Women Self Help Groups, Entrepreneurs for increasing their net income and also consumers health would be improved. Hence, this study has greater importance and significance on value addition in mango and promotion of health benefits of consumers.

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Conflict of Interest. None.

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