

RESEARCH ARTICLE :

Studies on physico-chemical properties of different varieties of mango

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SUMMARY : A study on physiochemical characters of different mango (*Mangifera indica* L.) varieties conditions was carried out at VNMKV, Parbhani. Six varieties were studied for quality aspects. Among six varieties the variety Totapuri recorded the maximum weight of fruit (360.00g), length (14.13cm), Breadth (7.95cm), thickness (7.52cm), and volume (357.33cc). The maximum per cent of pulp was observed in Totapuri (75.16 %) and it was at par with Alphonso (74.40 %). The minimum viscosity (5003cP) was recorded in variety Totapuri. While maximum was found in 7583cP in variety Dashahari. Alphonso and Kesar mango variety was observed rich nutritionally in terms of protein, fibre, beta carotenoids, ascorbic acid, total sugar and color among all the varieties. The higher redness (a*) value was found in of Alphonso mango pulp. Totapuri was yellowish red in color with higher lightness, yellowness and lower redness value. Alphonso exhibited higher redness, lower yellowness and lightness. Sensory evolution of six varieties of mango, mango pulp was studied. Alphonso and Kesar mango variety was found best between six varieties.

KEY WORDS :

Physio-chemical,
Quality, Mango
varieties

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BACKGROUND AND OBJECTIVES

Mango (*Mangifera indica* L.) fruit belongs to the family of *Anacardiaceae*. Mango commonly known as king of fruit. It is one of important tropical fruit grown in India and around the world. It is famous for its excellent flavor, attractive fragrance and nutritional value. The global production of mango in year 2014-2015 is about 54631.6 million metric ton. India ranks first in the production of mango in world. The area and production of mango in India in year 2014-

2015 is about 2163.5 million hector and 18527.0 million metric ton, respectively. In Maharashtra area under mango cultivation and production is about 157.77 million hector and 758.84 million metric ton, respectively (Anonymous, 2015a).

Mango is consumed as fresh fruit. It is a nutritionally important fruit. It is good source of vitamin A, B, C and minerals. Mangoes are good source of dietary fibre and energy. (Anonymous, 2015b). A number of products made from ripe mangoes are available in the market, including canned mango, mango

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puree, mango juice, dried mango powder, mango leather, mango slice and mango jam. The information on physico-chemical characters of different varieties of mango fruits is per requisites for the selection of desirable varieties which may acceptable to consumers and gain commercial importance. Hence the aim of this study was to evaluate physico-chemical characteristics of different varieties of mango grown in Marathwada region.

RESOURCES AND METHODS

Collection of samples :

The study was carried out at Department of Agricultural Process Engineering, College of Agricultural Engineering and Technology, VNMKV, Parbhani. Fruits of mango variety Alphonso, Kesar, Amrpali, Dashahari, Neelam and Totapuri were purchased from Parbhani Market. Care was taken while selecting the fruits that all the varieties have some stage of ripeness.

Physical characteristics :

Observations on physico-chemical properties were recorded. The physical characters were determined by using standard procedure as average fruit weight on electronic balance in g. volume by water displacement method in cc and specific gravity was calculated from weight and volume. The length, breadth and thickness were measured by vernier caliper in mm. Pulp percentage, peel percentage and stone percentage were measured. Rotational viscometer was to determine the viscosity of the fresh mango pulp. Colour (L^* , a^* , b^* values) of the mango pulp of different varieties were determined by using Hunter Lab Colorimeter.

Chemical properties :

The proximate analysis of each sample of mango fruit was conducted for the contents of moisture content, ash and crude fat According to AOAC. Crude protein was calculated as $N \times 6.25$ according to AOAC. Crude fibre was carried out using acid/alkali digestion method according to AOAC. Total carbohydrate content was calculated by subtracting the sum of the values for moisture, protein, fat, and ash content from 100. The pH of was determined by using pH meter. The content of total soluble solids (TSS) in the mango pulp was determined with the help of Hand Refractrometer (0-32^RBrix). Acidity was determined the methods of Jacob (1959) and Rangana (1990). Sugar content (%) was

analyzed using the phenol-sulfuric method Naz *et al.* (2014). Vitamin C was determined using 2, 6-dichlorophenol. Beta carotene was measured.

OBSERVATIONS AND ANALYSIS

The results obtained from the present study as well as discussions have been summarized under following heads :

Fruit weight :

Average weight of mango varied in the range of 360.0 to 119.6 g for six varieties of mango fruit. Highest average weight of mango fruit was found in Totapuri variety of mango (360.0g) while lowest average weight was found in Dashahari variety of mango (119.6g) followed by Kesar, Neelam Amrpali and Alphonso mango variety. Average weight of Kesar (239.2g) and Neelam (250.5g) mango variety was found at par with each other. Table 1 showed that there was significant difference among six mango varieties with respect to weight of mango fruit. However, mango varieties differ significantly at 5% level. Similar observations were reported by Anila and Radha (2003) and Vijayanand *et al.* (2015).

Fruit length :

Average length values for six varieties of mango fruit are presented in Table 1. From Table 1 it observed that the average length of mango was found in the range of 14.13 to 8.25 cm for six varieties of mango. Maximum length of mango fruit was found in Totapuri variety of mango while minimum fruit length was found in Dashahari variety of mango followed by Amrpali, Kesar, Neelam and Alphonso mango variety. It was observed that average fruit length of mango variety of Neelam and Kesar similar in range of 10.21 and 10.36 cm, respectively. Statistically, average length of different varieties of mango showed significant difference at 5% level of significance. Similar results were noted by Singh *et al.* (2011). Badhe *et al.* (2007) reported average length value of Alphonso mango variety (9.25 cm) which is similar to resulted value of Alphonso mango variety.

Fruit breadth :

Average breadth value of different variety of mango varied 7.95 to 5.03 cm within the six varieties of mango. Higher average breadth of mango fruit was found in

Totapuri variety while lower breadth was found in Dashahari variety followed by Neelam, Alphonso, Kesar and Amrpali mango variety. It was observed that average breadth value of Neelam and Totapuri similar in range of 7.45 and 7.95 cm, respectively. Similar results were observed by Anila and Radha (2003) and Badhe *et al.* (2007). From Table 1 it was observed that there was significant difference in the breadth value of different mango varieties.

Fruit thickness :

The average thickness value of different varieties of mango varied in the range of 7.11 to 4.52 cm for the six varieties of mango. Average maximum thickness of mango fruit was found in Totapuri variety while minimum thickness of mango fruit was found in Dashahari variety followed by Neelam, Alphonso, Amrpali and Kesar mango variety. It was found that average length value of Amrpali (7.11 cm) and Neelam (7.11 cm) mango variety

at par with each other. From data presented in Table 1, it was observed that there was significant difference in the thickness of different varieties of mango. These results are in close agreement with Badhe *et al.* (2007).

Volume :

From Table 1 it was observed that statistically, the average volume showed significant difference with respect to different varieties of mango. The average volume of different varieties of mango was found in the range of 357.33 to 111.80 cc. for six varieties of mango. Highest average volume of mango fruit was found in Totapuri variety (357.33cc) while lowest volume was found in Dashahari (111.80 cc) mango variety followed by Neelam, Kesar, Amrpali and Alphonso variety of mango. A similar observation for volume of mango fruit of different variety was in close agreement with the value reported by Anila and Radha (2003) and Badhe *et al.* (2007).

Table 1 : Physical properties of different varieties of mango and its mango pulp

| Mango varieties | Fruit weight (gm) | Fruit length (cm) | Fruit breadth (cm) | Fruit thickness (cm) | Volume (cc) | Peel% | Pulp % | Stone% | Sp. gravity | Viscosity (cP) |
|-----------------|-------------------|-------------------|--------------------|----------------------|-------------|--------|--------|---------|-------------|----------------|
| Alphonso | 182.5 | 09.39 | 7.18 | 6.96 | 190.75 | 14.33 | 74.40 | 13.91 | 1.02 | 7254 |
| Amrpali | 198.9 | 11.09 | 6.39 | 7.11 | 277.50 | 15.65 | 70.82 | 16.91 | 1.00 | 7337 |
| Dashahari | 119.6 | 08.25 | 5.03 | 4.52 | 111.80 | 18.73 | 65.71 | 18.90 | 1.00 | 7583 |
| Kesar | 239.2 | 10.36 | 6.94 | 6.32 | 238.00 | 17.10 | 68.99 | 17.75 | 1.00 | 7176 |
| Neelam | 250.5 | 10.21 | 7.45 | 7.11 | 246.75 | 13.60 | 72.60 | 13.47 | 1.01 | 6158 |
| Totapuri | 360.0 | 14.13 | 7.95 | 7.52 | 357.33 | 15.27 | 75.16 | 15.78 | 1.04 | 5003 |
| Mean | 225.12 | 10.57 | 6.82 | 6.59 | 237.02 | 15.78 | 71.28 | 16.12 | 1.01 | 6751.83 |
| S.E. ± | 4.275 | 0.445 | 0.078 | 0.141 | 6.519 | 0.655 | 1.21 | 0.316 | 0.035 | 261.40 |
| C.D. (P=0.05) | 13.319 | 1.3737 | 0.245 | 0.438 | 20.31 | 2.04 | 3.768 | 0.985 | NS | 814.39 |
| F value | 357.441* | 20.148* | 169.025* | 59.797* | 160.709* | 8.196* | 8.981* | 46.063* | 0.204* | 14.272* |

* indicate significance of value at P=0.05, respectively

NS=Non-significant

Table 2 : Proximate analysis of different varieties of mango pulp

| Mango varieties | Moisture content (%) | Fat (%) | Protein (%) | Fibre (%) | Ash content (%) | Carbohydrates (%) |
|-----------------|----------------------|---------|-------------|-----------|-----------------|-------------------|
| Alphonso | 79.80 | 0.60 | 0.60 | 0.71 | 0.45 | 17.89 |
| Amrpali | 79.68 | 0.57 | 0.53 | 0.65 | 0.42 | 17.85 |
| Dashahari | 79.25 | 0.58 | 0.51 | 0.64 | 0.46 | 18.56 |
| Kesar | 80.05 | 0.59 | 0.56 | 0.68 | 0.44 | 17.68 |
| Neelam | 79.07 | 0.60 | 0.57 | 0.61 | 0.40 | 18.75 |
| Totapuri | 84.75 | 0.55 | 0.50 | 0.56 | 0.35 | 13.29 |
| Mean | 80.43 | 0.58 | 0.54 | 0.64 | 0.42 | 17.33 |
| S.E.± | 0.554 | 0.054 | 0.015 | 0.018 | 0.053 | 0.23 |
| C.D. (P=0.05) | 1.722 | NS | 0.046 | 0.057 | NS | 0.730 |
| F value | 15.027* | 0.129* | 6.453* | 8.193* | 0.581* | 74.00* |

* indicate significance of value at P=0.05, respectively

NS= Non-significant

Peel percentage :

Data presented in Table 1, indicated that value of peel percentage had significant different between different varieties of mango. Peel percentage of different varieties of mango varied in the range of 18.73 to 13.60 % for six varieties of mango. The highest peel percentage of mango fruit was found in Dashahari variety while lowest peel percentage was found in Totapuri mango variety followed by Kesar, Neelam, Amrpali and Alphonso mango variety. It was observed that value of peel percentage of Dashahari and Kesar mango variety early in the range of 18.73 and 17.10%, respectively. Anil and Radha (2003), reported peel percentage value of Alphonso (14%) and Neelam (13%) mango variety which is similar to obtained value of Alphonso (14.33%) and Neelam (13.60%) mango variety. Similar results were observed by Badhe *et al.* (2007) and Vijayanand *et al.* (2015).

Pulp percentage :

Table 1 revealed that, value of pulp percentage of different varieties of mango showed significant difference between different varieties of mango. Pulp percentage of different variety of mango varied in the range of 75.16 to 65.71% for six varieties of mango. Maximum pulp percentage of mango fruit was found in Totapuri variety while minimum pulp percentage was found in Dashahari mango variety followed by Alphonso, Neelam, Amrpali and Kesar. From Table 1, it was observed that values of pulp percentage of Alphonso and Totapuri mango variety similar in range (74.40%) and (75.16%), respectively. Similar results were reported by Anil and Radha (2003), Badhe *et al.* (2007), Vijayanand *et al.* (2015) and Singh *et al.* (2011).

Stone percentage :

Data presented in Table 1 reported that stone percentage had significant difference between different varieties of mango. Stone percentage of different varieties of mango varied between 18.90 to 13.91% for six varieties of mango. Highest stone percentage of mango fruit was found in Dashahari variety while lowest stone percentage was found in Neelam mango variety followed by Kesar, Amrpali, Alphonso and Totapuri mango variety. From Table 1, it was found that values of stone percentage of Alphonso and Neelam mango variety are similar in range (13.91 %) and (13.47%), respectively. Similar results were observed by Anila and Radha (2003), Badhe *et al.* (2007), Vijayanand *et al.* (2015) and Singh *et al.* (2011).

Specific gravity :

Table 1, revealed that the specific gravity of different varieties of mango varied in the range of 1.00 to 1.04 for six varieties of mango. The value of specific gravity of Kesar, Amrpali, and Dashahari mango variety was found at par with each other. There was non significant difference noticed for specific gravity between different varieties of mango. Similar results were reported by Anil and Radha (2003), Badhe *et al.* (2007) and Vijayanand *et al.* (2015).

Viscosity of mango pulp :

Data presented in Table 1, reported that viscosity had significant difference between different varieties of mango. Highest viscosity of mango pulp was found in Dashahari (7583cP) Mango variety while lowest viscosity was found in Totapuri (5003cP) variety of mango pulp followed by Amrpali, Kesar, Alphonso and Neelam.

Table 3 : Chemical composition of different varieties of mango pulp

| Mango varieties | pH (%) | TSS (Brix ^o) | Titration acidity (%) | Ascorbic acid (mg/100g) | Total sugar (%) | Beta carotene (mg/100g) |
|-----------------|--------|--------------------------|-----------------------|-------------------------|-----------------|-------------------------|
| Alphonso | 4.68 | 20.70 | 0.41 | 23.53 | 18.21 | 7.39 |
| Amrpali | 5.49 | 22.60 | 0.44 | 21.88 | 17.05 | 7.20 |
| Dashahari | 4.90 | 21.17 | 0.51 | 20.59 | 16.97 | 7.18 |
| Kesar | 5.37 | 19.56 | 0.36 | 25.12 | 17.65 | 7.23 |
| Neelam | 4.40 | 17.78 | 0.49 | 19.25 | 13.95 | 6.10 |
| Totapuri | 3.80 | 14.40 | 0.35 | 18.79 | 11.59 | 5.96 |
| Mean | 4.77 | 19.37 | 0.43 | 21.53 | 15.90 | 6.84 |
| S.E. ± | 0.213 | 0.453 | 0.053 | 0.445 | 0.219 | 0.103 |
| C.D. (P=0.05) | 0.665 | 1.352 | 0.094 | 1.386 | 0.684 | 0.322 |
| F value | 8.69* | 45.35* | 3.41* | 30.92* | 138.09* | 37.83* |

* indicate significance of value at P=0.05, respectively

Similar results were observed by Rajkumar *et al.* (2006). The value of pulp viscosity of Totapuri mango variety almost same as obtained by Vijayanand *et al.* (2015) reported, that the value of viscosity of Totapuri mango pulp (5704cP).

Quality characteristics of different varieties mango pulp:

Proximate analysis of different varieties of mango pulp :

Moisture content :

From Table 2, it was observed that the moisture content of mango pulp varied significantly between varieties of mango. Higher moisture content value of mango pulp was found in Topapuri (84.75%) variety while lower moisture content was found in Neelam (79.07%) mango variety of mango pulp. There was significant difference within six varieties of mango. Moisture content ranged from 84.75% to 79.07% for six varieties of mango. The value of moisture content of Alphonso, Amrpali, Dashahari and Neelam was found similar with each other. Similar observation found by Robin *et al.* (2012). Rajkumar *et al.* (2006) reported value of Alphonso mango pulp (79.75%) which is similar to value obtained for Alphonso mango pulp (79.80%). Mohammad (2013) reported that lower moisture content is indication of good shelf life.

Fat :

The results pertaining to analysis of variance of fat contents are given in Table 4.2. There was non significant difference for fat content values of different varieties of mango at 5% level of significance. Table 4.2 it reveals that, fat content value of mango pulp ranged from 0.60%

to 0.55% for six varieties of mango. The fat content value of mango pulp of Alphonso (0.60%) and Neelam (0.60%) mango variety was found at par with each other. These results in lined with finding obtained by Muhammad *et al.* (2012), Mohammed (2013) and Naz *et al.* (2014).

Protein :

The data regarding protein content of different varieties of mango is given in Table 2. From Table 2, revealed that the values of protein content of mango pulp varied significantly within the six varieties of mango at 5% level of significance. The maximum value of protein content of mango pulp was found in Alphonso mango variety (0.60%) while minimum in Totapuri (0.50%) mango variety followed by Neelam, Kesar, Amrpali and Dashahari. The value of protein content of mango pulp of Amrpali (0.53%) and Dashahari (0.51%) mango variety was observed nearly with each other. These results are presented in Table 2. Similar results were found by Naz *et al.* (2014) and Muhammad *et al.* (2012).

Fibre content :

Values of fibre content of different varieties of mango pulp are presented in Table 2. From data presented in the Table 2, showed significant difference for values of fibre content of mango pulp at 5% level of significance within six varieties of mango. The maximum value of fibre content of mango pulp was found in Alphonso mango variety (0.60%) and minimum in Totapuri (0.56%) mango variety followed by Kesar, Amrpali, Dashahari and Neelam. The value of fibre content of mango pulp of Amrpali (0.65%) and Dashahari (0.64%) mango variety was observed nearly with each other. Similar results were reported by Muhammad *et al.* (2012).

Table 4 : Color characteristics of different varieties of mango pulp

| Mango varieties | L* | a* | b* | Hue angle | Chroma |
|-----------------|---------|----------|---------|-----------|--------|
| Alphonso | 52.68 | 27.11 | 73.77 | 69.82 | 77.97 |
| Amrpali | 53.56 | 25.79 | 72.31 | 70.37 | 76.77 |
| Dashahari | 55.26 | 23.02 | 77.55 | 73.46 | 80.89 |
| Kesar | 56.07 | 25.12 | 79.69 | 72.50 | 83.37 |
| Neelam | 63.20 | 10.79 | 65.28 | 70.73 | 78.16 |
| Totapuri | 59.56 | 5.20 | 60.64 | 89.82 | 80.89 |
| Mean | 56.72 | 14.99 | 71.54 | 74.45 | 79.68 |
| S.E. ± | 0.33 | 0.23 | 0.47 | 0.46 | 0.47 |
| C.D. (P=0.05) | 1.020 | 0.720 | 1.472 | 1.440 | 1.450 |
| F value | 142.02* | 1517.89* | 232.64* | 269.62* | 41.02* |

* indicate significance of value at P=0.05, respectively

According to Othman and Mbogo (2009) fibre helps to maintain the health of the gastrointestinal tract.

Ash content :

The data of ash content of different varieties of mango is given in Table 2. Statistically, ash content of different varieties of mango showed non significant difference at 5% level of significance. Table 2 it revealed that, the value of ash content of mango pulp was highest in Dashahari mango variety (0.45%) and lowest in Totapuri mango variety (0.35%). The value of ash content of mango pulp of Kesar (0.44%), Alphonso (0.45%) and Dashahari (0.46%) mango variety was observed nearly with each other. A similar observation for value of ash content was in close agreement with the value reported by Naz *et al.* (2014), Muhammad *et al.* (2012) and Othman and Mbogo (2009).

Carbohydrates :

The data of carbohydrate of different varieties of mango is given in Table 2. From Table 2 revealed that, significant difference was observed within the different varieties of mango pulp for carbohydrate value at 5% level of significance. The value of carbohydrate of mango pulp was found maximum in Neelam mango varieties and minimum in Totapuri mango variety. The value of carbohydrate of mango pulp of Alphonso (17.89%), Amrpali (17.85%) and Kesar (17.68%) mango variety was observed nearly with each other. The value of carbohydrate of mango pulp of Dashahari (18.56%) and Neelam (18.75%) mango variety was found nearly with each other. Similar results were found by Mohammed (2013).

Chemical properties of mango pulp of different varieties :

pH :

The pH values of six varieties of mango pulp of different varieties are presented in Table 3. Statistically, pH of different varieties of mango pulp showed significant difference at 5% level. From Table 3, it was observed that, the pH value of mango pulp was found highest in Kesar mango variety (5.37) and lowest in Totapuri Mango variety (3.8) varieties followed by Amrpali, Dashahari, Alphonso, and Neelam. The value of pH of mango pulp of Alphonso (4.68), Dashahari (4.90) and Neelam (4.40) mango variety was observed nearly with each other. Similar results were found by Reddy and Reddy (2009) and Akhtar *et al.* (2009). Rajkumaret *al.* (2007a) reported that pH value of mango pulp of Alphonso mango variety (4.60) which is similar to obtain value of pH of mango pulp of Alphonso mango variety (4.68).

Total soluble solids (TSS) :

The values of total soluble solids of mango pulp of different varieties of mango are shown in Table 3. The TSS of mango pulp of different varieties of mango was found statistically significant at 5% level of significance. Table 3 revealed that the highest TSS value for Amrpali mango variety (22.60 °Brix) while lowest TSS was obtained in Totapuri mango variety (14.40 °Brix). The value of TSS of mango pulp of Alphonso (20.70°Brix) and Dashahari (21.71 °Brix) mango variety was found nearly with each other. Higher TSS content is a good phenomenon of mango fruit (Hossain *et al.*, 2001). Shafique *et al.* (2006) reported that TSS content is considered as a measure of quality for most of the fruit. Taste and particular sweetness of the fruit depend on

Table 5 : Sensory evaluation of different varieties of mango pulp

| Mango varieties | Color and appearance | Flavor | Texture | Taste | Overall acceptability |
|-----------------|----------------------|--------|---------|--------|-----------------------|
| Alphonso | 8.6 | 8.6 | 8.3 | 8.3 | 8.5 |
| Amrpali | 8.2 | 8.3 | 7.9 | 8.1 | 8.1 |
| Dashahari | 8.1 | 8.1 | 8.0 | 8.0 | 8.0 |
| Kesar | 8.5 | 8.4 | 8.1 | 8.2 | 8.2 |
| Neelam | 7.3 | 7.5 | 7.2 | 7.7 | 7.8 |
| Totapuri | 7.8 | 7.4 | 7.3 | 7.3 | 7.5 |
| Mean | 8.08 | 6.80 | 7.80 | 7.93 | 8.01 |
| S.E. ± | 0.330 | 0.258 | 0.102 | 0.074 | 0.066 |
| C.D. (P=0.05) | NS | NS | 0.316 | 0.229 | 0.205 |
| F value | 2.06* | 2.84* | 18.94* | 24.96* | 31.2* |

* indicate significance of value at P=0.05, respectively

NS=Non-significant

the percentage of TSS content. According to Akhtar *et al.* (2009), the variability in TSS values of mango pulp of different varieties might be attributed to the alteration occurring in cell wall structure during ripening process. Moreover, various hydrolytic enzymes also affect complex carbohydrates changing them into smaller compound. The variation in TSS content among varieties might be due to their inherent characteristics as well as maturity/ripening stage Safdar *et al.* (2012).

Titration acidity :

Values of titration acidity of mango pulp of different varieties of mango are presented in Table 3. The maximum value of titration acidity of mango pulp was noted in Dashahari mango variety as (0.51%) while minimum in Totapuri mango variety (0.35%) followed by Neelam, Amrpali, Alphonso and Kesar. The value of acidity of mango pulp of Kesar (0.36%) and Totapuri (0.36%) mango variety was found at par with each other. According to Safdar *et al.* (2012), the variation in acidity among different varieties might be due to activity of citric acid glyoxalase during ripening process which lead to the degradation of citric acid their inherent characteristics as well as maturity/ripening stage. Similar result was reported by Nazet *et al.* (2014). From the Table 3 it was observed that the value of titration acidity of mango pulp was found statistically significant among six varieties of mango.

Ascorbic acid :

The values ascorbic acid of mango pulp of different varieties of mango is shown in Table 3. It was observed that the ascorbic acid of different varieties of mango pulp was found significant at 5% level of significance. From the data presented in Table 3, it can be seen that the ascorbic acid value of mango pulp was found highest for Kesar mango variety (25.53 mg/100g) and lowest in Totapuri mango variety (18.79 mg/100g) followed by Alphonso, Amrpali, Dashahari and Neelam. The value of ascorbic acid of mango pulp of Amrpali (21.88 mg/100g) and Dashahari (20.89 mg/100g) mango variety were found at par with each other. Similar results were noted by Anila and Radha (2003), Hossain *et al.* (2001) and Rajkumar *et al.* (2007a) for ascorbic acid content of different varieties of mango pulp.

Total sugar :

The results pertaining to analysis of variance of different varieties of mango pulp for sugar contents are

given in Table 3. The value of total sugar of different varieties of mango pulp was found statistically significant at 5% level of significance. From Table 3 it revealed that, the pulp of Alphonso mango variety possessed highest total sugar (18.21 %) while lowest in mango pulp of Totapuri (11.59 %) mango variety. The value of total sugar of mango pulp was at par with Kesar and Amrpali mango variety recording 17.65 % and 17.05%, respectively. Total sugar of mango pulp of Amarpali mango variety was 17.05%. These results are in line with finding obtained by Reddy and Reddy (2009) and Padhiar *et al.* (2011).

Beta carotene :

The data regarding beta carotene of mango pulp of different varieties of mango is given in Table 3. From Table 3 it was observed that the different varieties of mango showed significant difference in the values of beta carotene of mango pulp. The beta carotene of mango pulp was found maximum in Alphonso mango variety (7.39 mg/100g) and minimum in Totapuri (5.96 mg/100g) mango variety followed by Kesar, Amrpali, Dashahari and Neelam. The value beta carotene of mango pulp was at par with Kesar, Amrpali, and Dashahari mango variety noted 7.20 mg/100g, 7.23 mg/100g and 7.18 mg/100g, respectively. Similar results were reported by Rajkumar *et al.* (2007).

Color characteristics of mango Pulp of different varieties :

Color of mango pulp is a very important characteristic which influences the consumer acceptability. Table 4 shows the color of mango pulp extracted from different varieties of mango pulp (L*, a*, b*, hue and chroma value) of mango pulp. Table 4 revealed that there was significant difference in value of L*, a*, b*, hue and chroma of mango pulp.

Maximum lightness of mango pulp was observed in Neelam (63.20) mango variety while minimum lightness (L*) in mango pulp of Alphonso (52.68) mango variety followed by Totapuri, Kesar, Dashahari and Amrpali. The value of lightness Totapuri and Kesar mango pulp was found 59.56 and 56.07, respectively. Mango pulp of Alphonso (27.11) mango variety had highest redness (a*) value. Mango pulp of Totapuri (5.20) mango variety had lowest redness (a*) value.

The higher redness (a*) value of Alphonso mango pulp corroborates with high carotenoid content

Vijayanand *et al.* (2015). Totapuri was yellowish red in color with higher lightness, yellowness and lower redness value. It was observed from Table 4 that higher yellowish (b*) color was found in Kesar (79.69) mango variety pulp while lower yellowish (6.64) color was found in Totapuri mango variety. Similar results reported by Vijayanand *et al.* (2015). From Fig4 it was observed that Alphonso exhibited higher redness, lower yellowness and lightness. Redness was more predominant in Alphonso which appears to be the characteristic of the variety.

The value of hue and chroma are depended on the value of L*, a* and b*. The values of hue angle decrease due to increases value of a* and b*. The value of hue angle was observed lower in Alphonso mango pulp. The value of hue increases due to decrease value of a* and b*. From Table 4, it was found that significant difference found in the value of hue angle and chrom between different varieties of mango pulp. The chroma, however, increases with increases in yellowness of mango pulp. The value of chroma was found maximum in Kesar mango variety pulp.

Sensory evaluation of different varieties of mango pulp :

The sensory analysis of different varieties of mango pulp was done by using 9- point hedonic scale in term of color and appearance, flavor, taste, texture and overall acceptability. The average value of scores obtained for different varieties of mango pulp during evaluation for various sensory attributes are shown in Table 5

Color and appearance :

Table 5 showing the analysis of variance for score of color and appearance indicates that the difference in score among various judges was found to be non significant. The highest average sensory score of mango pulp was obtained for Alphonso (8.6) mango variety. Lowest average sensory score was obtained for mango pulp of Neelam (7.3) mango variety. The mean score of mango pulp of Kesar and Amrpali mango variety was found good as (8.5) and (8.2), respectively. Fig 5 represents the color and appearance of mango pulp of different varieties of mango through bar diagram. Similar results were observed by Akhtar *et al.* (2009) and Ubwa *et al.* (2014).

Flavor :

The mean score value for flavor of the different

varieties of mango pulp are presented in Table 5, observed that the maximum mean score was obtained for mango pulp of Alphonso (8.6) variety while lowest mean score was obtained for mango pulp of Neelam (7.4) variety. There was non significant difference found in terms of flavor of mango pulp of different varieties. The mean score of flavor of mango pulp of Kesar and Amrpali mango variety was found good as (8.4) and (8.3), respectively. Alphonso, Kesar and Amrpali variety mango pulp were having good flavor. Similar results were reported by Akhtar *et al.* (2009) and Ubwa *et al.* (2014).

Texture :

Table 5, noticed that there was significant differences in mango pulp of different varieties. From Table 5, it was observed that the higher mean score for texture was obtained for mango pulp of Alphonso (8.3) variety while lower mean score was obtained for mango pulp of Neelam (7.3) variety. The mean score of texture of mango pulp of Kesar and Amrpali mango variety was observed (8.1) and (7.9), respectively. Table 5 it was noticed that the better texture was found in varieties of Alphonso, Kesar and Amrpali mango pulp. Similar results were found by Akhtar *et al.* (2009) and Ubwa *et al.* (2014).

Taste :

Taste is the primary factor which determines the acceptability of many fruits and has highest impact as far as market success of product, is concerned. Table 5, observed that there was significance difference in mean score of taste of mango pulp of different varieties. Data presented for mean score of taste in Table 5; it revealed that the maximum mean score of taste for mango pulp of Alphonso mango variety while lowest score for Neelam mango variety pulp. The score for taste of the different varieties of mango pulp was varied in the range of 8.2 to 7.3. The mean score value of taste was observed in mango pulp of Kesar and Amrpali mango variety (8.2) and (8.1), respectively. The excellent taste was found in the case of mango pulp of Alphonso, Kesar and Amrpali mango variety. Similar results were observed by Akhtar *et al.* (2009) and Ubwa *et al.* (2014).

Overall acceptability :

Overall acceptability is the important parameter in organoleptic estimation. From Table 5, it was observed that the higher mean score for overall acceptability of

mango pulp was obtained for Alphonso (8.5) variety of mango. Lower score was obtained for Neelam (7.5) variety mango pulp. The mean score for overall acceptability of mango pulp of different varieties was varied from 8.3 to 7.2. Table 5, it was observed that there was significance difference in mean score of mango pulp of different varieties at 5% level of significance. The mean score value of mango pulp of Kesar and Amrpali mango variety (7.8) and (8.1), respectively. Table 5 it was noticed that the mango pulp of Alphonso, Kesar, Amrpali and Dashahari mango variety were acceptable as compared to mango pulp of Neelam and Totapuri mango variety.

Conclusion :

From results of sensory evolution of six varieties of mango, mango pulp of Alphonso and Kesar mango variety was found best between six varieties. Alphonso and Kesar mango variety was observed better nutritionally in terms of protein, fibre, beta carotenoids, ascorbic acid, total sugar and color among all the varieties. Based on above investigations, Alphonso and Kesar variety of mango was found better among six varieties.

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