Evaluation of quality of mango (Mangifera indica L.) squashes available in Lahore market

Ijaz Ahmad, Muhammad Usman*, Sabiha Rashid*, M.K. Saeed, Imran-ul- Haq
FBRC, PCSIR Laboratories Complex, Ferozepur Road Lahore, Pakistan
*Division of Science & Technology, University of Education, Lahore, Pakistan
Corresponding Author: ijazft@yahoo.com

Abstract
This study was conducted to evaluate the quality of five different mango squashes available in Lahore market. Physiochemical characteristics including moisture, ash, total carbohydrates, total solids, total soluble solids (TSS), pH, acidity, total sugars and ascorbic acid contents were evaluated. The results showed that there were significant differences among squashes of all brands for physio-chemical parameters. Sample (S3) showed the highest TSS, total sugar, total carbohydrate and total solids. The value of TSS of S4 and S5 were not according to Pakistan Standard Specification for fruit squashes. The squashes which possessed higher value of total sugar, total carbohydrates and total solids contained high pulp content and exhibited better quality. Sample (S2) exhibited the highest ascorbic acid contents. The organoleptic evaluation was done for color, taste and flavor. The results showed significant difference in color of different brands but taste and flavor of different brands exhibited non significant differences from each other. Two samples (S2 and S3) were better than other three but all the mango squashes were acceptable regarding organoleptic quality.

Key words: mango, squash, acidity, sugars and ascorbic acid.

Introduction
Mango (Mangifera indica L.) which belongs to the family Anacardiaceae, is one of the most cultivated fruit in the world (Ashoush and Gadallah 2011). Pakistan’s mango production in 2009-10 was 1847,000 tones (Anonymous, 2010). Mango has a prominent position in the fruit processing industry of Pakistan. The bulk of mango fruit is consumed as fresh fruit. It is perishable in nature and cannot be stored for long time. Therefore, it is also processed in many forms to make pulp, juices, chutneys, pickle, jams, nectars, squashes, mango toffees, canned mango slices and frozen mango slices etc. It is also used to prepare jellies, ice creams, milk shake, fruit cocktail and in topping products. Mango is the most relished fruit. It is cherished not only due to its pleasant taste, aroma but also for its nutritional contribution to our diet. It serves as a good source of energy and provides vitamins A, C and minerals like iron and phosphorus (Malik, 1994).

The fruit flesh of a ripe mango contains about 15% sugar, up to 1% protein. Mango has antioxidant, anticancer and anti-cardiovascular abilities. Because of the high iron content they are suggested for treatment of anemia and are beneficial to women during pregnancy and menstruation. Mangoes contain an enzyme with stomach soothing properties similar to pepsin. This comforting enzyme helps in digestion.

Juicy verities of mango are preferred for making squash. Squashes are sweetened juices containing some pulp. The term “cordial” is often used interchangeably with squash. Fruit squashes contain a minimum of 25% by volume of fruit juice and are intended to be drunk after dilution. Although sulphur dioxide is the usual preservative for squashes, benzoic acid is often used. The acidities are usually in the range of 1.5 to 2.5 per w/v citric acid. The squash is filled into washed and sterilized bottles, leaving about 1 inch head space. The bottles are closed with crown. The squash keeps in well for 1 to 1.5 years without much change in color or taste (Gupta, 1993). The present study was conducted to evaluate the quality of Mango Squashes available in Lahore market. It was investigated by evaluating the physio-chemical parameters and sensory evaluation of squashes.

Materials and Methods
Locally manufactured Mango Squashes were purchased from local market. All these brands had common packing materials (Pet bottles). Mango Squashes selected for study were: Shezan mango squash, Mitchell’s mango squash, PCSIR mango squash, Kinza mango squash and Tops mango squash.

Physio-chemical analysis
Moisture, ash contents, total solids, total soluble solids (TSS), pH, total titrable acidity, total carbohydrates, total sugars and ascorbic acid were determines as under:

Moisture: Moisture contents of samples were determined according to the method reported by AOAC (2005) by using oven drying method. Sample (5 g) was taken in a pre-weighed crucible and dried at 70°C for 16 to 18 hours.

Ash content: Ash content of the sample was determined according to Kirk and Sawyer (1999). Sample (5 g) was
dried in an oven at 70°C for 16 to 18 hours and placed in muffle furnace for 4 to 6 hours at 525°C.

**Total solid:** Total solid content of the mango squashes were determined as described by the Kirk and Sawyer (1999). Sample (5 g) was dried at 70ºC under vacuum.

**Total soluble solids:** Total soluble solids (°Brix) were estimated by using Refractometer (Reichert) as described by Kirk and Sawyer (1999).

**Acidity and pH:** Acidity of the mango squashes was determined as described by Kirk and Sawyer (1999). Sample (10 ml) was taken in 250 ml beaker and approximately 100 ml water was added. The solution was titrated with 0.1N NaOH to pH 8.2 by using pH meter (Inolab, WTO). The pH of all samples was also measured by using pH meter in accordance with Kirk and Sawyer (1999).

**Total Carbohydrates** Total carbohydrates were determined by titrimetric method as reported by Ranganna (1987). Sample (10 ml) was taken, 1 ml 6 N HCl was added and made up the volume 40–50 ml with distilled water. Boiled it (30 minutes) for inversion. Neutralized by adding 7 drops of 40% NaOH and made up volume 100 ml with distilled water.

Benedict’s solution (5 ml) was taken in a flask, added 40–50 ml distilled water and boiled. Sample solution (volume used = V) was taken in burette and titrated with benedict’s solution till color of benedict’s solution changes to water and white color ppt are formed.

Total carbohydrates = \( \frac{12 \times 100 \times 100}{V \times 10 \times 100} \)

**Total Sugars:** Total sugars were determined by titrimetric method as reported by Ranganna (1987). Same procedure was adopted as described for Total carbohydrate except boiling for 2-3 minutes for inversion.

**Ascorbic Acid:** Ascorbic acid was determined by titrimetric method as reported by Kirk and Sawyer (1999). Sample (5 ml) of mango squash (W) was taken in 100 ml volumetric flask. The volume was made up with 0.4% oxalic acid.

Standard ascorbic acid solution (1 ml) + 1.5 ml of 0.4% oxalic acid was titrated against freshly prepared dye (Indophenol dye 0.026% w/v, volume R), until brick red end point.

Sample solution (5 ml) was titrated against freshly prepared dye until brick red end point. The ascorbic acid contents were calculated by the following formula.

\[
\text{mg/ 100 ml ascorbic acid} = \frac{R_1 \times V \times 100}{R \times W \times V_1}
\]

Where: \( R_1 \) = volume of dye used.
\( V_1 \) = volume of aliquot taken for titration
\( V \) = volume of aliquot made by 0.4% oxalic acid.

**Organoleptic evaluation**

The Mango Squashes were evaluated organoleptically by a panel of four judges for color, taste and flavor as described by Larmond (1977).

**Results and discussion**

The study was conducted to evaluate the quality of Mango Squashes by studying their physio-chemical parameters and organoleptic characteristics.

**Physio chemical charactersitics**

The percentage of moisture present in different squashes is given in Table 1. The highest value of moisture is 74.27% and lowest 46.26% for S5 and S3, respectively. Statistical data regarding moisture contents showed that the differences among different squashes were highly significant with respect to moisture contents.

The data on ash contents of locally manufactured mango squashes is given Table 1. It is evident from data that the lowest value of ash 0.124% and the highest 0.268% was exhibited by S1 and S3, respectively. The statistical analysis of the data indicated that the differences with respect to ash contents are highly significant for different brands of mango squashes.

The highest value of total solids is for S3 and lowest is for S5 which are 53.74% and 25.73%, respectively. Fig. 1 shows the differences in total solids among different samples.
Table 1. Physio-chemical characteristics of locally manufactured different brands of mango squashes.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Sample 1</th>
<th>Sample 2</th>
<th>Sample 3</th>
<th>Sample 4</th>
<th>Sample 5</th>
<th>F value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture (%)</td>
<td>50.50</td>
<td>48.30</td>
<td>46.26</td>
<td>72.07</td>
<td>74.27</td>
<td>11902.204**</td>
</tr>
<tr>
<td>Ash contents (%)</td>
<td>0.124</td>
<td>0.231</td>
<td>0.268</td>
<td>0.208</td>
<td>0.217</td>
<td>158.625**</td>
</tr>
<tr>
<td>Total solids</td>
<td>49.44</td>
<td>51.70</td>
<td>53.74</td>
<td>27.93</td>
<td>25.73</td>
<td>20582.744**</td>
</tr>
<tr>
<td>Total soluble solids (TSS)</td>
<td>49.9</td>
<td>51.0</td>
<td>52.5</td>
<td>29.0</td>
<td>27.0</td>
<td>36431.075**</td>
</tr>
<tr>
<td>pH</td>
<td>2.81</td>
<td>2.74</td>
<td>3.06</td>
<td>2.72</td>
<td>2.95</td>
<td>316.950**</td>
</tr>
<tr>
<td>Acidity (%)</td>
<td>1.988</td>
<td>1.799</td>
<td>1.694</td>
<td>1.811</td>
<td>1.785</td>
<td>855.583**</td>
</tr>
<tr>
<td>Total carbohydrates (%)</td>
<td>60.00</td>
<td>60.06</td>
<td>63.00</td>
<td>28.80</td>
<td>23.61</td>
<td>675.827**</td>
</tr>
<tr>
<td>Total sugars (%)</td>
<td>48.67</td>
<td>50.00</td>
<td>55.41</td>
<td>28.35</td>
<td>23.08</td>
<td>841.167**</td>
</tr>
<tr>
<td>Ascorbic acid (mg/ 100 ml)</td>
<td>23.11</td>
<td>26.31</td>
<td>23.11</td>
<td>23.29</td>
<td>24.00</td>
<td>5.341*</td>
</tr>
</tbody>
</table>

** = Highly significant, * = Significant

Total soluble solids (TSS) give information about the soluble sugar present in the squash. TSS values of different squashes are presented in Fig. 2.

The squashes having high value of TSS indicated that they have more sugar contents than those having lower value. It is evident from the statistical data regarding TSS that the differences among different squash varieties were highly significant with respect to TSS (Table 1). The data showed that S3 Mango Squash has the highest value (52.5) and S5 Mango Squash has the lowest value (27.0). Hussain et al. (2005) observed that mango squash exhibited TSS values 44.66 to 53.74.

The values of pH of different brands of mango squashes are presented in Table 1. The pH value of sample S3 is highest (3.06) among other brands and S4 has the lowest value (2.72). Hussain et al. (2005) reported that mango squash prepared from different varieties of mangoes showed pH 2.15 to 2.56. High pH value may be due to low acidity. It is clear from the statistical data regarding pH that the differences among different squash varieties were highly significant with respect to pH.

The data about acidity of locally manufactured mango squashes is given in Table 1. The values of total acidity of all mango squashes are above one percent which is according to Pakistan Standard Specification for fruit squashes. The highest acidity was 1.988% and the lowest 1.694% in sample S1 and S3, respectively. The statistical analysis of data showed that the differences among different brands of mango squashes were highly significant with respect to total acidity. These results are in agreement with Hussain et al. (2005). They observed that mango squash showed acidity 0.933 to 1.149%.

The values of total carbohydrates were 60.00, 60.06, 63.00, 28.80, and 23.61% for S1, S2, S3, S4 and S5, respectively (Table 1). The highest value was 63.00% for S3 and lowest value of total carbohydrates was 23.61% for S5. The statistical analysis of the data showed that the differences among different brands of squashes were highly significant with respect to total carbohydrates. The differences in total carbohydrates are also evident from Fig. 3.
Organoleptic evaluation

The locally manufactured mango squashes of different brands were organoleptically evaluated for color, flavor and taste by a panel of four judges. The data about organoleptic evaluation of locally manufactured mango squashes is given in Table 2.

### Table 2. Organoleptic evaluation of mango squashes.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Color</th>
<th>Flavor</th>
<th>Taste</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample 1</td>
<td>8.12</td>
<td>6.50</td>
<td>6.75</td>
</tr>
<tr>
<td>Sample 2</td>
<td>7.67</td>
<td>6.25</td>
<td>6.50</td>
</tr>
<tr>
<td>Sample 3</td>
<td>7.75</td>
<td>7.12</td>
<td>7.62</td>
</tr>
<tr>
<td>Sample 4</td>
<td>7.00</td>
<td>7.25</td>
<td>7.00</td>
</tr>
<tr>
<td>Sample 5</td>
<td>6.87</td>
<td>6.25</td>
<td>6.00</td>
</tr>
<tr>
<td>F value</td>
<td>6.516**</td>
<td>1.170 NS</td>
<td>0.286 NS</td>
</tr>
</tbody>
</table>

Maximum mean score for S1 was 8.12 and minimum mean score for S5 was 6.87 (Table 2). Statistical analysis of data on color of squashes indicated highly significant differences among different varieties of mango squashes. Flavor is the blend of taste and smell perceptions noted when food is in the mouth. The overall flavor impression is the result of the tastes perceived by the taste buds in the mouth and the aromatic compounds detected in the nose (Rathore et al. 2007). The data on flavor of different mango squashes is given in Table 2. The highest value is 7.25 for S4 and lowest value is 6.25 for both S2 and S5. Statistical data regarding flavor indicated that the differences among different squash varieties were non significant with respect to flavor.

Maximum scores were awarded to S3 for taste followed by S4, S1, S2 and S5. The maximum score for taste was 7.62 (S3) and minimum score was 6.00 (S5). It is evident from the statistical data that the differences in taste of different squashes were non significant. Two samples (S2 and S3) were better than other three but all the mango squashes were acceptable regarding organoleptic quality. Ahmed et al. (1993) while preparing the squashes from pure and mixed fruit juices found that pure squashes were preferred over mixed fruit squashes. But all squashes were acceptable after 3-4 months of storage at 22-36°C. Babar (1999) observed that taste and flavor were not affected in mango drink after a storage period of 45 days.

**References**


