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# Nutritional and Physico-Chemical Evaluation of Four Different Packed Mango Juice Samples

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***Authors' contributions***

*This work was carried out in collaboration among all authors. Author PPN has guided students for design experiments, review, statistical analysis, interpretation of result and writing of manuscript. Authors NKAQ, SMAJ and BAAS have done literature survey and experimental analysis. All authors read and approved the final manuscript.*

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## ABSTRACT

**Aim:** To analyze mango fruit juice samples for their nutritional value. Mango fruit is perishable in nature and cannot be stored for long time. It can be made available during off season, by processing in to juices, jams, squashes, nectars, chutney, pickles, toffees and canned mango slices etc.
**Study Design:** Different physico chemical and elemental parameters were studied for four different made tetra packed mango juice samples available in local market.
**Place and Duration of Study:** Department of Applied Sciences, Chemistry section, University of Technology and Applied Sciences, Muscat, Oman. The study was performed during the January 2016 – July 2016.
**Methodology:** Different parameters were studied such as pH, conductivity, acidity, ash content, vitamin C, moisture and some mineral contents. Some chemical and instrumental methods were used for analysis.
**Results:** pH was found to be in the range of 3.17 – 3.97, conductivity 0.941 – 1.053 MS/cm, sugar found in the range of 13 – 15 $^{0}$brix, density was found 0.939 – 1.015 g/cm$^{3}$, water 65.25 – 67%,

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ash was found to be in the range of 0.059 – 0.099%, total acidity found 0.173 – 0.275 %. Vitamin C was found in the range of 24.8 – 67.3 mg/100 ml, potassium 6.6 – 94, sodium 6 – 69 mg/100 ml, calcium 0 – 105 mg/100 ml and iron was found to be in the range of 1.375 – 2.145 mg/100 ml.
**Conclusion:** Based upon result obtained found that content of all selected samples were contains labelled nutrients. Sample STMJ was having remarkable good amount of Vitamin C while sample ARMJ found good amount of potassium and iron content. In acidic perspective sample PMJ was higher acidic and ARMJ sample less acidic in nature.

*Keywords: Mango juice; Magnifera indica; physico-chemical analysis; nutritional facts; vitamin C.*

## 1. INTRODUCTION

Mango is called as a king of fruits in India. Mango is one of the most popular, delicious and loved fruit. It is a tropical fruit which belongs to the genus *Magnifera indica* and family *Anacardiaceae*. Mangoes are having numerous species of tropical trees belonging to the flowering plant genus *mangifera indica*, cultivated mostly for their edible fruit. The genus belongs to the cashew family Anacardiaceae. Mangoes are native to South Asia [1,2] from where the "common mango" or "Indian mango", *indica*, has been distributed worldwide to become one of the most widely cultivated fruits in the tropics. Most of the fruits cultivated in tropical regions are important source of antioxidants, vitamins, dietary fibers and various minerals and are healthy part of our diet [3].

According to the survey of year 2013, world production of mangoes (data including mangos teens and guavas) was nearly 43 million tonnes, with India accounting for 42% (18 million tonnes) [4]. China and Thailand were the next largest producers. Mangoes are produced in over 90 countries worldwide, Asian countries contributes approximately 77% of global mango production while American and African countries approximately 13% and 9% respectively [5]. Mango is mostly consumed as fresh fruit, but it can become perishable in a short time so mango cannot be stored for long time. Mango is a good source of nutrients, particularly vitamin A, vitamin C, minerals and dietary fibre [6]. Mango fruit taste and flavour can be processed to make juices, jams, squashes, nectars, chutney, pickles, toffees and canned mango slices etc. and make it available during off season as well.

The mango fruit has short life. Its varies varieties depending on different conditions. Shelf life of mango ranges from 4 to 8 days (at room temperature) and 2-3 weeks in cold storage (at 13ºC) [6]. Fruit juices may be an alternative vehicle for the incorporation of probiotics. Mango has high energy level and nutritional values. The energy value per 100 g serving of the mango is 250 kJ (60 kcal). Fresh mango contains a variety of nutrients , but vitamin A C and folate are in significant amounts [7]. Numerous phytochemicals are present in mango peel and pulp. Mango contains a high concentration of sugars, acids with good organoleptic properties, besides antioxidants and is a rich source of vitamin A (beta-carotene). Generally, both fresh fruits and their juices are included in our regular diet as they give health benefits to all age groups. Juices are advantageous because of their low allergenicity, perceived health benefits and appeal to a wide segment of the population [8].

### 1.1 Health Benefits

Fruit juices are often supplemented with oxygen scavenging ingredients such as ascorbic acid, thus promoting anaerobic conditions. In India mangoes are used for various health related issues such as a blood builder, because of their high iron contents. It is also suggested for treatment of anemia and beneficial to women during pregnancy and menstruation. People who suffer from muscle cramps, stress and heart problems can benefit from high potassium and magnesium contents that also help those with acidosis [9]. Dried mango skin and its big sized seeds are also very useful for various purpose and in Ayurvedic medicines [10]. Fruit juices contain high amounts of sugars which could encourage probiotic growth. Probiofication of fruit juices is beneficial, as these are rich sources of healthy nutrients such as antioxidants, vitamins, food fibres and minerals [11].

Fiber is important component and can be measured as “crude fiber,”. Fiber can lower risk of cardiovascular disease. It also been studies importance for normal gastrointestinal function and high intakes of dietary fiber are suggested to lower the risk of cardiovascular disease and

coronary heart disease [12]. Micronutrients are involved in various biochemical processes. Adequate intake of certain micronutrients can be worked to prevention various diseases. Iron (Fe) deficiency leads anemia and it affects one third of the world population [13,14]. According to Carr and Frei (1999) increased intake of vitamin C will reduce risk of chronic diseases such as cancer, cardiovascular diseases through antioxidant mechanism. It also used to prevent scurvy. Various data suggest that, 90-100 mg of vitamin C intake required for reduction of chronic diseases for nonsmoking human [15].

Calcium salt has important role in providing rigidity to the skeleton and calcium ions play a role in many metabolic processes. Iron serves as a carrier of oxygen to the tissues from the lungs by red blood cell hemoglobin as a transport medium for electrons within cells. Iron also plays important role in formation of enzyme systems in tissues. Zinc is an essential component for number of enzymes participating in the synthesis and degradation of carbohydrates, lipids, proteins, and nucleic acids as well as in the metabolism of other micronutrients. Magnesium functions as a cofactor of many enzymes involved in energy metabolism, protein synthesis, RNA and DNA synthesis, and maintenance of the electrical potential of nervous tissues and cell membranes [16].

## 2. MATERIALS AND METHODS

### 2.1 Physico-chemical Methods

Different physico-chemical and elemental analysis parameters were studied for four tetra packed mango juice samples available in local market. Four different packed mango juice samples were selected from local market with each sample of 250 ml pack manufactured in different countries. Symbolic names were given such as, ARMJ, STMJ, PMJ and RMJ. Samples were changed every 15 days and preserved in refrigerator. Parameters such as pH, conductivity, acidity, ash content, vitamin C, moisture and some elemental analysis were tested with routine analytical equipment.

pH, conductivity and density was measured by using ordinary pH meter, conductivity meter and picnometer available in the laboratory. pH of all samples were measured by using Mettler Delta 320 pH meter. pH meter was calibrated with two standard buffer solution of pH 4.0 and pH 7.0. Conductivity of the samples were measured by using conductivity meter TS Orion 4 – Star. Conductivity meter was calibrated by using standard conductance solution. All samples were tested three times and average of three readings were used for final calculation. Ash was measured by burning sample of juice on flame and then burned in furnace at around $525^0$C for about 5 hours in preheated and weighed crucible till the white ash was obtained [7].

Acidity of the sample was determined by titrating with standard 0.1 M NaOH solution with phenolphthalein as an indicator. Moisture content was determined by heating sample in an oven at $100^0$C [7]. Ascorbic acid (vitamin C) was determined by oxidation – reduction titration of sample with standard iodine solution and starch as an indicator. Standardization of iodine was done by using standard ascorbic acid. Total sugar (TSS) was determined by using refract meter.

### 2.2 Mineral Analysis

Different mineral were determined by using different instrumental methods. Sodium and potassium were determined by using Jenway flame photometer. Standard sodium and potassium ion solution was prepared by dissolving accurate amount of NaCl and KCl salt as a stock solution. Then standard series of solution was prepared from stock solution [13]. Emission intensity of standard series of Na and K ions and samples were measured by using flame photometer.

Iron and calcium were determined by using visible spectrophotometer and complexometric titration method respectively. Iron was measured at a colored intensity at 530 nm wavelength. Red colored complex was formed by using potassium thiocyanate in acidic condition. Standard 0.0015 mol/L iron solution was prepared by using ferric ammonium sulphate. Method of least square was used to prepare calibration curve equation. Calibration equation for sodium was, $y = 18262x - 0.385$ and regression was $R^2 = 0.972$. From that equation we determined amount of iron in the sample.

Calcium was determined by using EDTA complexometric titration and murexide as an indicator. This titration was carried out at highly alkaline condition to form a complex of calcium and EDTA.

## 3. RESULTS AND DISCUSSION

Physical and chemical parameters along with nutritional values were measured and compared among four different types of mango juice available in market. All parameters were measured in duplicate and triplicate analysis and average was used for further calculation. Results of different parameters are represented in Table 1.

### 3.1 Physical Parameters

pH was found to be in the range of 3.17 – 3.97. pH is related to acidity of the juice samples. The pH of mango juice depends on the type of mango and ripened stage of mango used for juice making. ARMJ sample found high pH value and less acidic while $^0$Brix and conductance was also found lowest. The conductivity of all the samples were measured in the range of 0.941 – 1.053 MS/cm. Conductivity of the samples relates with the different types of ions present in the sample. PMJ sample was found to high conductance. Density were measured in g /cm$^3$ and it was in the range of 0.94 – 1.02. Sugar present in the samples were measured in $^0$Brix and it was in the range of 13 – 15. Water content were measured in % and was found in the range of 66.29 – 67%. Graphical represent of result of parameters are show in Fig. 1.

**Table 1. Result of different parameters with standard deviation (SD value) of four different mango juice samples**

| Sample/ Parameter | ARMJ | STMJ | PMJ | RMJ |
|---|---|---|---|---|
| pH | 3.97±0.025 | 3.27±0.005 | 3.17±0.015 | 3.6±0.0 |
| Conductivity (MS/cm) | 0.941±0.005 | 1.035±0.007 | 1.053±0.007 | 0.963±0.006 |
| Density (g/cm3) | 1.015±0.012 | 0.999±0.009 | 0.939±0.017 | 1.003±0.002 |
| Sugar ($^0$Brix) | 15±0.57 | 15±0.23 | 13±0.18 | 13.5±0.47 |
| Ash (%) | 0.0019±0.002 | 0.099±0.009 | 0.059±0.008 | 0.079±0.003 |
| Acidity (%) | 0.173±0.004 | 0.275±0.006 | 0.243±0.02 | 0.236±0.009 |
| Water content (%) | 67±7.5 | 66.25±3.5 | 66.29±3.9 | 65±5.2 |
| Vitamin C (mg/100ml) | 33.6±0.36 | 67.3±4.53 | 24.8±1.38 | 56.7±2.1 |
| Sodium (mg/100ml) | 10±1.5 | 69±4.25 | 36.6±2.3 | 6±1.8 |
| Potassium (mg/100ml) | 94±4.5 | 52±3.9 | 6.6±1.4 | 85±3.2 |
| Calcium (mg/100ml) | 64±2.1 | 41.6±2.4 | 105.6±4.6 | 0±0 |
| Iron (mg/100ml) | 2.145±0.02 | 1.375±0.009 | 1.155±0.007 | 1.947±0.017 |

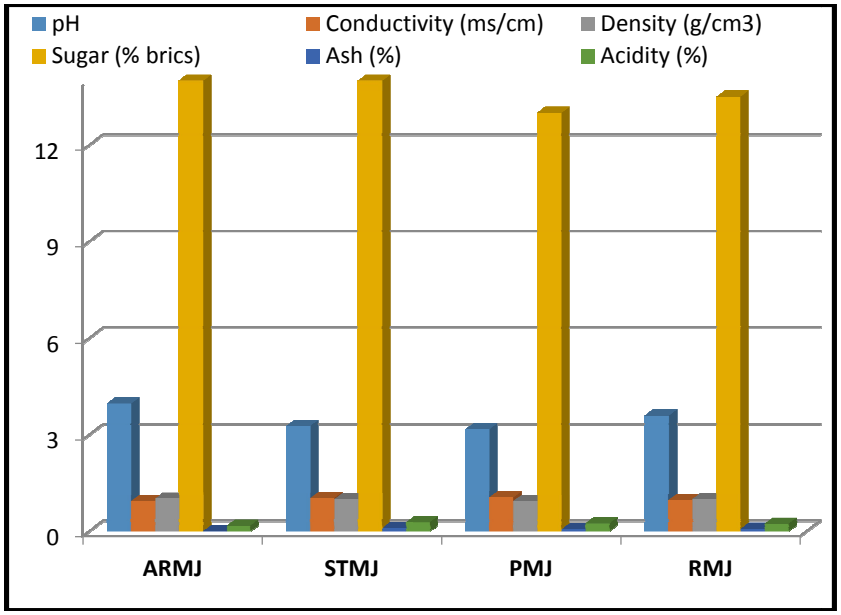


**Fig. 1. Comparison of some parameters**

### 3.2 Proximate Analysis

Ash and acidity were measured in the percentage. Ash was found to be in the range of 0.06 – 0.1 %. Ash value represents different minerals in oxide form present in the sample. The variations in ash contents of the samples may be attributed to the formulations of each manufacturer. The variations in brands might be due to the raw material, recipe or the ingredients used. Hussain et.al. (1993) suggest that length of storage and temperature also affect the quality parameters of these beverages [17]. Total acidity was found to be in the range of 0.173 – 0.275 %. ARMJ sample found less acidic in both pH and total acidity %. This acidity value is due to presence of various organic acids present in the sample. Akubor (1996) study of acidity of mango juices reported that acidity was increased with increasing period of storage. Mostly it is due to different organic acid in fruit itself and different preservatives added during manufacturing [18]. STMJ sample was high acidity and its contain highest amount of vitamin C.

### 3.3 Mineral Analysis

Different minerals were analyzed by using different methods of analysis. Amount of sodium, vitamin C, potassium, calcium and iron were determined in all four samples. Vitamin C was measured and it was found to be in the range of 0.024 – 0.32g/ L of sample. STMJ sample was having vitamin C and it leads to the higher total acidity value of the sample. While RMJ sample detecting lowest amount of vitamin C. Vitamin C is very important for various metabolic activity in the body. Ascorbic acid is an important constituent of fruits. Its deficiency produces a disease called scurvy. Sodium was measured in the range of 6 – 69 mg/100ml. Sodium is also useful in body. Sometimes high sodium is due to addition of sodium chloride during manufacturing process. Result of different minerals present in all juice samples are shown in Table 1 and Fig. 2.

Calibration graph was prepared and equation of straight line obtained. From the graph concentration of Sodium and potassium in the samples were calculated. Calibration equation for sodium was, $y = 0.962x + 9$, and $R^2 = 0.994$ (Fig. 3) and potassium $y = 0.9195x + 24.243$ and $R^2 = 0.99$ (Fig. 4). STMJ sample was found to high amount of sodium while RMJ sample was found at lowest one. Potassium content were in the range of 6.6 – 94 mg/100ml. ARMJ sample was found to contain high amount and PMJ sample was the lowest. Calcium was determined in the range of 0 – 105 mg/100ml. RMJ sample does not contain calcium and PMJ sample was found to have a high amount of calcium. Iron was measured and found to be in the range of 1.155 – 2.145 mg/100ml. ARMJ has the highest amount of iron while sample PMJ contain lowest amount. Except ARMJ all samples contain alcohol. All results are summarized in the Table 1.

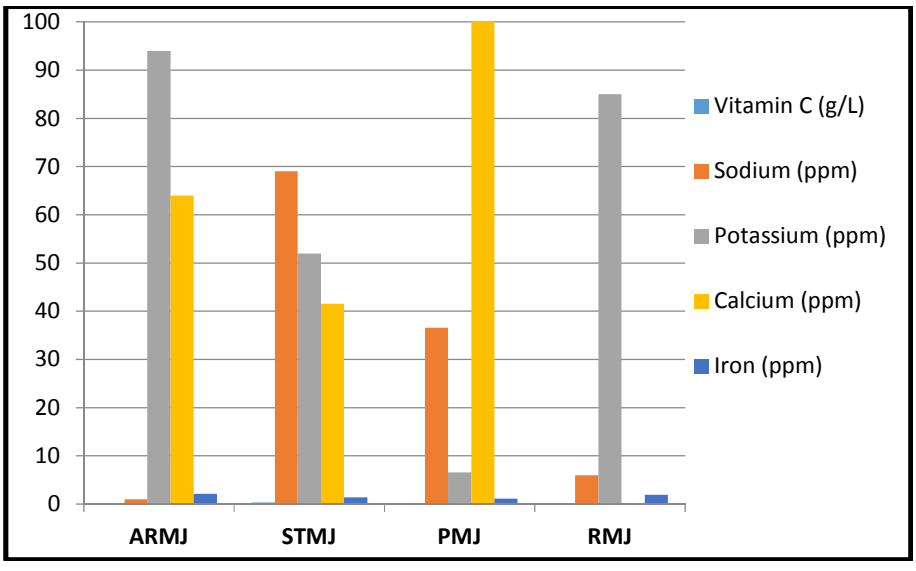


**Fig. 2. Different minerals in mango juice samples**

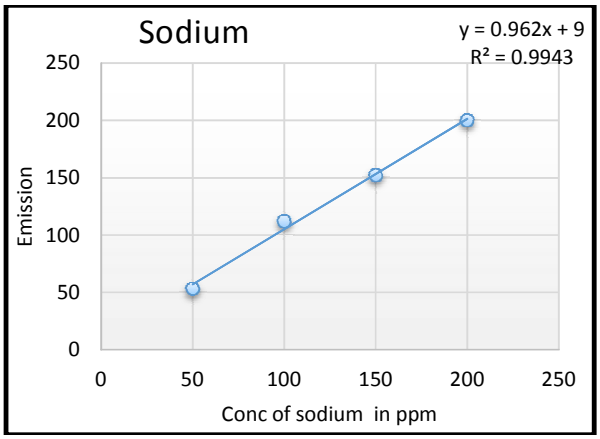


**Fig. 3. Analysis of Sodium**

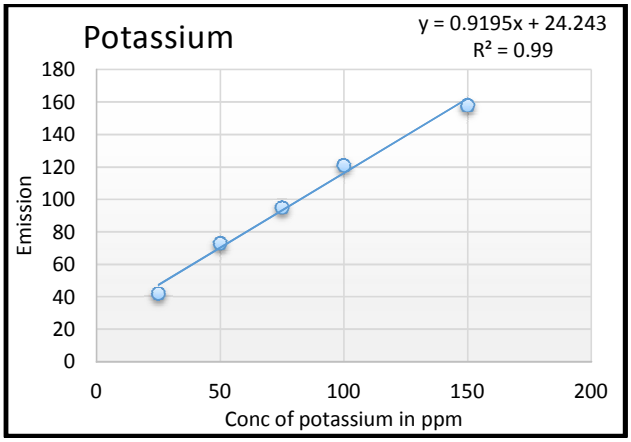


**Fig. 4. Analysis of Potassium**

## 4. CONCLUSION

Based upon result obtained found that content of all selected samples were contains labelled nutrients. Sample STMJ was having remarkable good amount of Vitamin C while sample ARMJ found good amount of potassium and iron content. In acidic perspective sample PMJ was higher acidic and ARMJ sample less acidic in nature.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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