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Physico-Chemical Evaluation of Four Different Apple Juice Samples and Comparison in Their Nutritional Values

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ABSTRACT

Fruits and vegetables play an important role in maintaining good health. Apple fruit juices are commonly consumed for their refreshing attribute, nutritive values. Fruit juice contain several important therapeutic properties that may reduce the risk of various diseases and health benefits. Present research work leads to analysis of various physico-chemical parameters, minerals of apple fruit juice samples. We have compare result obtained in work with different juice sample.

We found results various parameters such as pH in the range of 2.99 – 3.52, conductivity 0.657-2.303 MS/cm, density 1.030 – 1.061 g/ml, TSS was in the range of 11 - 12%, titrable acidity 0.1 g/100ml – 0.24 g/100ml, % water contents 81.48 - 87.38%, carbohydrate 13.4 – 16.55 g/100ml, vitamin C 0.82 – 0.93%. Sodium was found in the range of 23 – 37.9 mg/100 ml, potassium 2.33 – 5.02 mg/100 ml and iron was found 0.054 - 0.144 mg/ 100 ml of sample. Calcium and magnesium were calculated together and it was found 19.84 – 23.84 mg/100ml of sample.

Keywords : Apple Fruit juice, Physico-chemical analysis, Nutritional value, Mineral contents.

I. INTRODUCTION

Apple *Malusdomestica* is the most important fruit of the world. The apple is the pomaceous fruit of the apple tree, in the family Rosacea of *Malusdomestica* species. It is one of the widely cultivated tree fruits, and the most widely known of the many members of genus Malus that are used by humans [1].

Due to less or no consumption of fruit and vegetables has become dietary concern. Fruits and vegetables play an important role in maintaining good health. Wide research have found that fruits and vegetables are crucial dietary components associated with a reduced risk of developing a number of chronic diseases, particularly to be initiated by chronic inflammation [2,3]. Research has shown that biologically active components in plant-based foods contains phytochemicals, have important potential to modulate many processes in the development of diseases, including cancer, cardiovascular disease, diabetes, pulmonary disorders, Alzheimer's disease, and other degenerative disease states [4].

Apple fruit juices are commonly consumed for their refreshing attribute, nutritive values. Fruit juice contain several important therapeutic properties that may reduce the risk of various diseases and health benifits. They contain large amounts of antioxidants, vitamins C and E, and possess pleasant taste and aroma [5].

Apple juice is a nonalcoholic drink and it is more in demand due to increasing consumer awareness of its health benefits. Apple juice is the second most popular fruit juice consumed in the United States only behind orange juice. According to survey of USFAS apple juice is consumed over 535,000 metric tons of concentrated [6].

Health benefit of fruit juice

The health benefits of fruits and fruit juices have been reviewed by scientist Hyson. The high amount of potassium and low sodium present in most of juices helps to maintain a healthy blood pressure, as well as nearly absence of saturated fat in fruit juices is beneficial for the cardiovascular system [7]. Juices with calcium provide some supplemental bone and cardiovascular benefits [8].

Vitamins have a special role since they are essential for life and are not produced by the body. Vitamin C, naturally present or sometimes added to most juices, is necessary for the body to form collagen, cartilage, muscle, and blood vessels, and aids in the absorption of iron. The enzymatic and non-enzymatic functions of vitamin C were reviewed by Levine. Its role as an antioxidant has been extensively examined, in addition many vitamin C effects appear to be due to its role as a coenzyme in many biochemical reactions [9].

Fruits are poor sources of protein and oil. The fruits with reasonable amount of carbohydrates maycontain varying amount of dextrose, fructose, sucrose and starch. The other constituents of fruits includes cellulose,mineral salts, coloringmatters, and volatile oil.The principle acids present in fruits are citric, tartaric, andmalic acid. It also contains vitaminA, vitaminC, calcium, potassium, sodium, Iron, and fibers. Fruit sugars such as those found in apple products serve as an immediate source of energy [10]. The health benefits of minerals, vitamins, and micronutrients have been well characterized but many of the potentially beneficial properties of juices have been shown to come from phytochemicals, mainly polyphenols, carotenoids and limonoids.

II. MATERIAL AND METHODS

Four different types of commercially available apple juice samples were selected from local market. These samples were kept in the refrigerator during the span of search work. We have decided to test different physico chemical and nutritional parameters. We have tested of pH, conductivity, density, TSS (total soluble solids), water content, total acidity, vitamic C, sodium, potassium, iron, calcium and magnesium and carbohydrate in all selected samples.

pH and conductivity measured by using ordinary pH meter and conductivity meter available in college laboratory. Meteller mad pH meter and conductivity meter was used for the analysis. Density of the apple juice samples were measured by using 25ml picnometer, which is properly cleaned, dried and weighted before filling the juice sample. Total soluble solid (TSS) was measured with the help of refractometer [11]. Total titratable acidity was determined by titrating juice sample with previously standardized sodium hydroxide with standard potassium hydrogen phthalate solution and phenolphthalein as an indicator [11].

Votamin C is determined by using DCPIP (2,6 – dichlorophenolindophenol) method. 0.1% ascorbic acid was filled in burette and then titrated with 5 ml

of DCPIP solution in conical flask. Then repeat the titration replacing juice sample with 0.1 % ascorbic acid, quantity of DCPIP required for both solutions used for the calculation of % of ascorbic acid in the sample by using the following formula [12].

$$Vitamin\ C\ \% = \frac{Volume\ of\ Std\ ascorbic\ acid\ for\ DCPIP}{Volume\ of\ Apple\ juice\ for\ DCPIP}\ x\ 0.1$$

Water contents in the sample was measured according to [11] AOAC (2000). The sample was measured and kept in to previously heated and weighed crucible in an oven for about 105^{0}C. The water content is measured in %. Carbohydrate was measured by colorimetric method of analysis. Standard glucose sample solution was prepared 20-100 mg concentration and 4 ml of anthrone reagent was added to develop color. Then 0.5 ml of juice sample was treated same way and color developed was measured at 620 nm wavelength.

Different minerals components were measured from the ash prepared from all samples. Sodium, Potassium, Iron, Magnesium and Calcium were measured from all samples. Ash sample was prepared in 100 ml volumetric flask. Sodium and potassium was measured by flame photometric method with standard solution of sodium and potassium. Iron was measured by spectrophotometric method of analysis. Potassium thiocyanate (2M) was used for color development in presence of HCl condition. Standard solution of iron was prepared by using $NH_4.Fe(SO_4).12H_2O$ salt. 5 ml of sample also develop color and then OD of both standard and sample was measured.

Calcium and Magnesium was measured by using EDTA as a complexing reagent. The standardization of EDAT was performed with zinc solution. Both Ca & Mg was measured in all together by titrating juice sample with standard EDTA solution by using eriochrome blackT as an indicator.

III. Result and Discussion

The result obtained in our study correlate each other and comparison was made among each other. The results of all physico-chemical parameters are presented in Table 1. pH of all four samples were found in the range of 2.99 – 3.52. The pH represents acidic nature of the sample. UJ sample was found to be lowest pH value (more acidic) and SJ sample found to be highest pH value (less acidic). Conductivity was measured in MS/cm and the range found to be 0.657-2.303. Sample UJ was lowest while sample SJ was found to be highest conductivity among all four samples. Density was found in the range of 1.030 – 1.061 g/ml. Sample MJ found lowest while sample UJ found highest density value. But overall samples are very close to each other.

Table 1. Result of different physico-chemical parameters

Parameter/ Sample	MJ	SJ	RJ	UJ
pH	3.23	3.52	3.2	2.99
Conductivity (MS/cm)	1.149	2.303	1.23	0.657
Density (g/ml)	1.03	1.041	1.032	1.061
TSS	11	12	12	12
Total Acidity (g/100ml)	0.219	0.24	0.189	0.1
Water content (%)	87.38	85.96	86.38	61.48
Carbohydrate (g/100ml)	13.6	16.26	16.55	13.4

Total soluble solid measured and it was found in the range of 11 - 12%. It shows total sugar in the sample of juice. MJ was lowest and SJ, RJ and UJ are having the same value. Total titratable acidity calculated in terms of hydrochloric acid. The results were 0.1

g/100ml – 0.24 g/100ml range. UJ was found lowest and SJ found to be highest amount of titratable acidity. Water contents of all juice sample was calculated in %. It was found that sample UJ was having lowest 81.48% while MJ has highest i.e. 87.38% of water contents. The comparison of all results of various physico-chemical parameters are shown in figure 1. The amount of carbohydrate was calculated in g/100ml of sample and all values are present in the range of 13.4 – 16.55 g/100ml range.

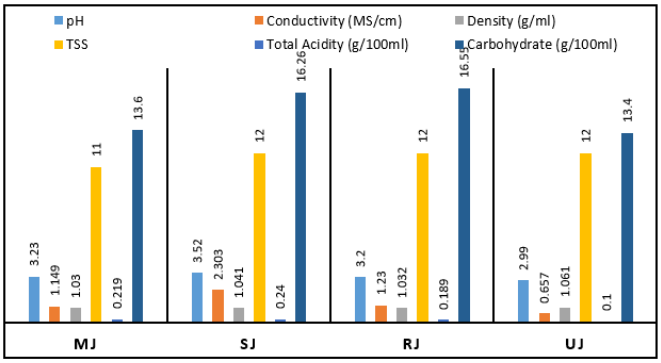

Figure 1. Comparison of different physico-chemical parameters.

Sample UJ was lowest amount of carbohydrate i.e. 13.4 g/100 ml, while SJ was found to be highest i.e. 16.26 g/100ml of carbohydrate. Vitamin C is one of the important component in fruit juice. It is naturally available as well as externally added during the manufacturing process. Sample UJ was found to lowest 0.49% of vitamin C while all other sample found to be quite good amount of vitamin C i.e. 0.82 – 0.93%. So all fruit juice except UJ was found rich in vitamin C content.

Mineral analysis.

Different mineral present in the samples were determined and result of all minerals are shown in Table 2. The comparison of all results are also shown in graphical form and is shown in figure 2.

Sodium content was found in the range of 23 – 37.9 mg/100 ml of sample. The calibration graph, equation of least square and the R^2 value 0.9418 are shown in figure 3. Amount of sodium is not good for health as it will increase the blood pressure in the body. So SJ sample was found to highest amount of sodium while other samples were MJ 28.1, RJ 28.6 and UJ which was lowest of sodium content i.e. 23 mg/100 ml of sample. Potassium is very important mineral in any fruit or vegetable source. It is very helpful in various metabolic activities in the body. The calibration graph, equation and R^2 are shown in figure 4. We found amount of potassium in the range of 23.3 mg/100 ml in RJ while – 50.2 mg/100 ml highest in SJ sample. Apple juice found very less amount of potassium.

Iron was measured by colorimetric method. The calibration curve, equation and R^2 value is shown in figure 5. Iron is also one of the important component in fruit juice sample. Sample UJ found lowest 0.054 while sample SJ found highest i.e. 0.144 mg/ 100 ml of sample. Calcium and magnesium was calculated together and it was found in the range of 19.84 – 23.84 mg/100ml of juice samples.

Table 2. Result of analysis of various minerals in apple juice sample.

Parameter/ Sample	MJ	SJ	RJ	UJ
Carbohydrate (g/100ml)	13.6	16.26	16.55	13.4
Vitamin C (%)	0.82	0.93	0.93	0.49
Sodium (mg/100 ml)	28.1	37.9	28.6	23
Iron (mg/100ml)	0.144	0.136	0.074	0.054
Potassium (mg/100ml)	49.2	50.2	23.3	28.9
Calcium & Magnesium	19.84	21.86	23.28	23.84

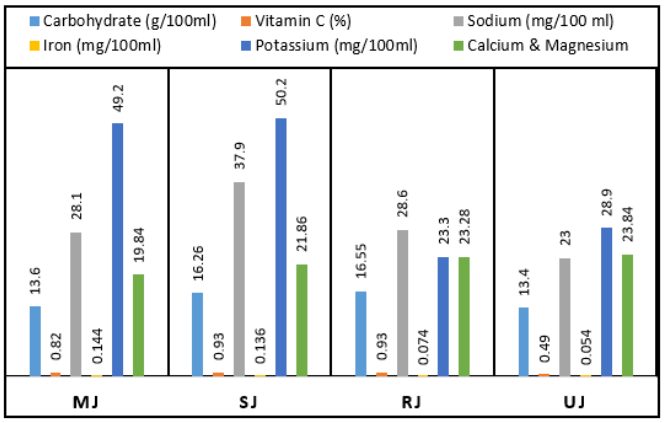

Figure 3. Comparison of different minerals present in juice sample.

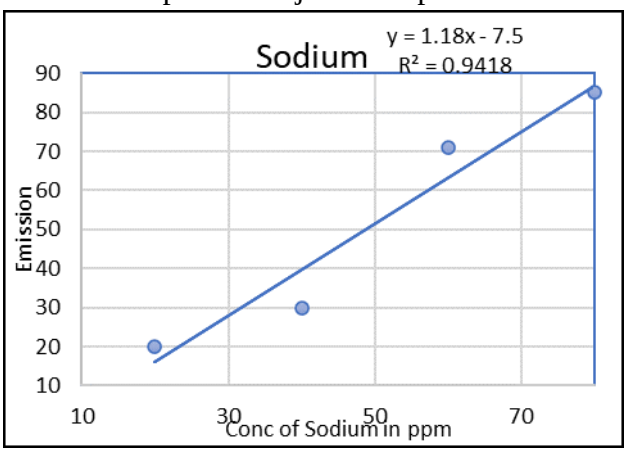

Figure 4. Analysis of Sodium

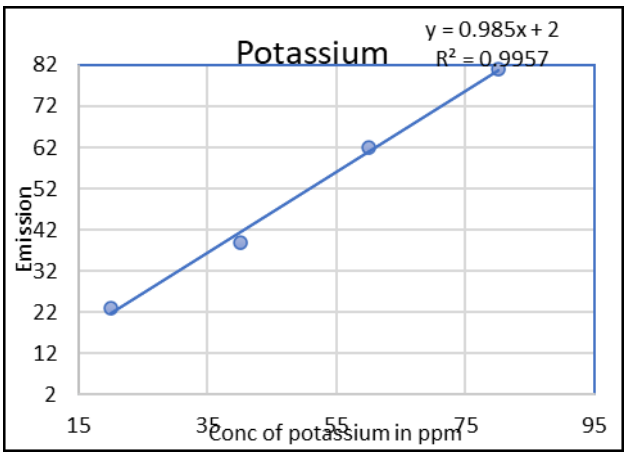

Figure 5. Analysis of sodium

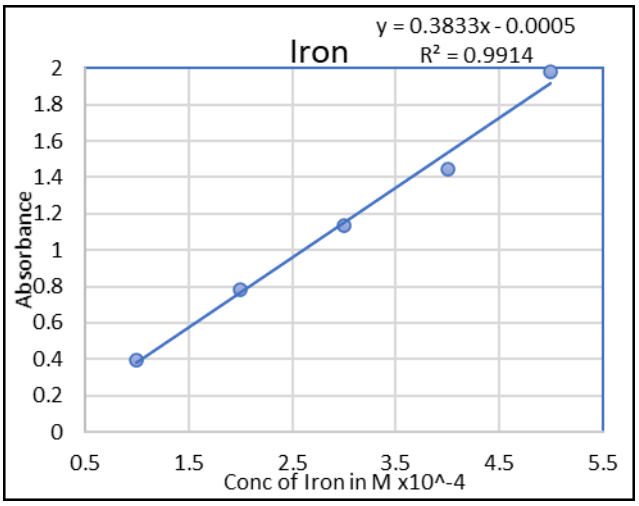

Figure 6. Analysis of Iron

IV. CONCLUSION

The results obtained in our study shows that water content in sample MJ was comparatively high while Vitamin C and carbohydrate were high in SJ and RJ sample. Amount of Iron was highest in MJ and potassium was higher in SJ while calcium and magnesium was found to high in SJ and UJ samples. Nutritional point of you SJ and RJ samples was found to be little higher nutritional values.

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