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Evaluation of total antioxidant levels in fresh and packed fruit juices

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Abstract

Fruits health benefiting properties are because of their richness in vitamins, minerals, micro-nutrients, antioxidants etc., which helps the body prevent or at least prolong the natural changes that causes by the or during the disease process. Considering so many benefits of antioxidants, this study was designed to find out which fruit provide us with the highest levels of antioxidants. Since now-a-days majority of people prefer drinking commercially available fruit juices, this research will also focus on the comparison of the freshly extracted fruit juices with the commercially available fruit juices. The total amount of the antioxidants in different fruit juices were determined using two methods Ferric ion reducing antioxidant power assay and Phosphomolybdeum method. The results obtained showed that the antioxidants levels of freshly extracted fruit juices were higher when compared to commercially available juices. Also freshly extracted pomegranate juice exhibited the highest antioxidants when compared with other fruit juices.

Keywords: Total antioxidant level, fruit juices, pomegranate, apple, pineapple, apple

Introduction

"An apple a day keeps the doctor away" is a common English-language proverb of Welsh origin. It espouses that apple consumption has identifiable benefits. It's a very well-known fact that fruits rich diet are capable of preventing or delaying the onset of many diseases viz. aging, common cancers, diabetes, neurodegenerative diseases etc ^[1].

Apples are crisp, white fleshed fruit with red, yellow or green skin. Apples has been more dynamic area for researchers due to its polyphenols. Apples are abundantly rich in antioxidants, flavonoids and dietary fibres. It deserves to be called as "nutritional powerhouses" as it contains many key elements like vitamin C, B-complex vitamins (riboflavin, Vitamin B6, thiamine etc), phytonutrients, minerals such as calcium, potassium, phosphorus and is rich in dietary fibre ^[2]. Apples are found to have strong ability to decrease oxidation of cell membrane fats ^[3] This benefits the cardiovascular system as oxidation of fat in the membranes of the cells that line or blood vessels is a primary risk factor for atherosclerosis further leading to cardiovascular diseases (CVD) ^[4].

Orange are citrus fruits with finely-textured skins that are coarse. In many research studies the healing properties of citrus fruits have been associated with a wide variety of phytonutrient compounds viz. flavanones (hesperetin, andnaringenn), hydroxycinnamicacids etc. Theses phytonutrients in combination with oranges-vitamin C shows surprising antioxidant properties. Linus Pauling, American Biochemist (1970) stated that citrus fruits works wonders, it can cure conditions right from common cold to cancer. Vitamin C plays a vital role in the body's immune system ^[5].

Pomegranate in French literally means "seeded apple". The edible part of fruit are the seeds and the red seed pulp around them. Pomegranate seeds are a great source of fiber and the juice contains vitamin C, potassium, iron and polyphenol antioxidants. The antioxidants found in pomegranate have become the source of scientific study for many researchers. Pomegranate juice contains important antioxidants like oleanolic, ursolic and gallic acid. These acids help regulate blood sugar and there by prevent diabetes, they help problems arising from diabetes in the diabetic patients (nerve damage, neuropathy, etc.) ^[6, 7]. It is also said to prevent the hardening of arteries by lowering blood pressure and reducing inflammation ^[8] However the limelight of the unique biochemical composition which helps in preventing cancer draws attention of many researchers. Recent studies displayed that the growth of prostate, colon, breast and lung cancer cells in culture is suppressed by pomegranate extraction ^[9].

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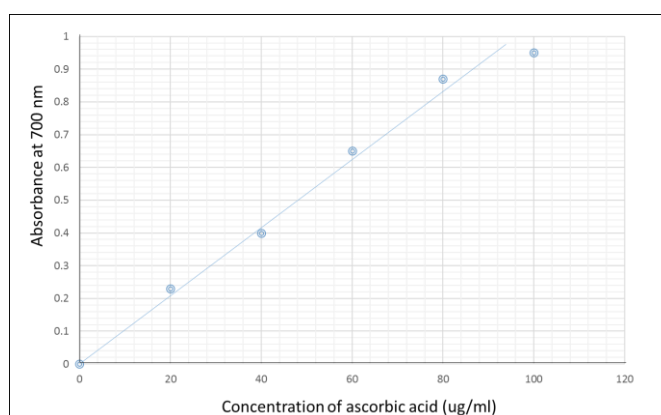
Pineapple is also considered as most important health-promoting fruit which belongs to family Bromeliaceae. Bromelain is used as a phytochemical compound. It can be obtained from both fruit core and stems of pineapple. The combination of other nutrients with it protects many disease conditions like, CVD's, stroke, hypertension, rheumatic heart diseases etc [10]. It also relieves osteoarthritis by reducing the pain and inflammation [11]. It also has beneficial effects in blood coagulation and fibrinolysis [12].

These antioxidant actions have been reported in a large number of papers, however the information correlating the antioxidant profile with the physicochemical characteristics derived from the industrial processing of fruit juices is limited. There is very scanty literature available regarding the extraction, its antioxidant capacity and its relative comparison between freshly prepared juices with the commercially available readymade juices. Therefore, this study was designed to extract and compare the freshly prepared juices from apple, orange, pineapple and pomegranate with the commercially available packaged juices.

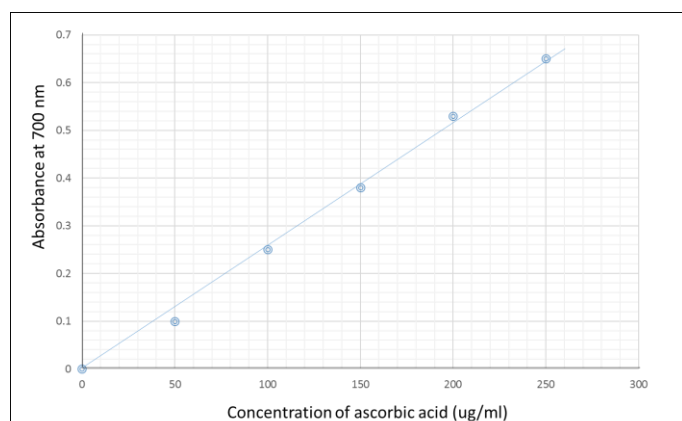
Materials & Methods

Selection of Fruits – There are various kinds of fruits available in the market, but since our study is focused on its antioxidant effect, the fruits were selected taking care that, the fruits were fresh and naturally ripen. Then fresh juice was extracted from all 4 fruits using a grater and then filtering it with a clean muslin cloth. These juices were further diluted as necessary. Commercially available juices of two brands were taken and labelled it as Brand A & B respectively and were stored in refrigerator for use. The antioxidant capacity was estimated using Ferric ion reducing antioxidant power (FRAP) assay using Oyaizu method (1986) and total antioxidant capacity by Phosphomolybdenum (PM) method using Prieto method (1999).

FRAP assay and Phosphomolybdenum method standard curve was made using ascorbic acid as standard of different concentrations. The optical density (OD) was noted at 700nm and 695nm respectively on a spectrophotometer and a graph was plotted with the help of the reading. (Graph 1 & Graph 2)



Graph 1: Standardization Chart for Ferric ion reducing power assay.



Graph 2: Standardization Chart for phosphomolybdenum method.

Various trails were made to fix the dilution for getting appropriately measurable Prussian blue colour for FRAP assay and green colour for PM method.

In FRAP assay Fe^{3+} to Fe^{2+} transformation was investigated in presence of samples for measurements of reductive ability. The ions formed in the sample gets conjugated with the ferricyanide ion to form a Prussian blue coloured product, which is spectrophotometrically measured at wavelength 700nm. The reducing power of freshly extracted pomegranate juice was found to be 0.800/100ml, which was higher than of brand A and B pomegranate (Table 1)

In PM method is used to determine the total antioxidant capacity based on reduction of molybdenum (Mo) VI to Mo V by extract and subsequent formation of green phosphate Mo V complex at acidic pH.

Results

Total antioxidant capacity of all fruit juices is mentioned in Table No. 1. All results were expressed in \pm SD. Statistical analysis was done using MS Office EXCEL programme.

Table 1: Total antioxidant levels in different fruit juices

Samples	By FRAP method (g/100ml of AA*)	By Phosphomolybdenum Method (g/100ml of AA*)
Fresh Pomegranate Juice	0.8100 \pm 0.13	0.9468 \pm 0.10
Brand A Pomegranate Juice	0.6020 \pm 0.11	0.6720 \pm 0.12
Brand B Pomegranate Juice Added antioxidants	0.6900 \pm 0.09	0.8024 \pm 0.08
Fresh Orange Juice	0.5332 \pm 0.10	0.5900 \pm 0.05
Brand A Orange Juice	0.3740 \pm 0.03	0.4184 \pm 0.04

Brand B Orange Juice Added antioxidants	0.4360 ± 0.05	0.4764 ± 0.06
Fresh Pineapple Juice	0.4150 ± 0.06	0.4564 ± 0.07
Brand A Pineapple Juice	0.1968 ± 0.04	0.2700 ± 0.03
Brand B Pineapple Juice Added antioxidants	0.4000 ± 0.08	0.4000 ± 0.07
Fresh Apple Juice	0.4812 ± 0.07	0.4182 ± 0.09
Brand A Apple Juice	0.2882 ± 0.09	0.2478 ± 0.09
Brand B Apple Juice Added antioxidants	0.5867 ± 0.05	0.4398 ± 0.06

*AA- Ascorbic Acid

Discussion

The antioxidant activity is seen to be more by PM method in pomegranate, pineapple and orange juices of all brands compared to FRAP assay, whereas for apple juice antioxidant activity was found more by FRAP assay as compared to PM method. (Table 1)

The above table also displays higher antioxidant levels of freshly extracted juices as compared to commercially available juices. Brand B of all fruit juices, showed more levels of antioxidant capacity as compared to Brand A. High levels in brand B juice were evident as they were already fortified with some amounts of antioxidants. Commercially available fruit juices undergo various processes at industrial scale such as squeezing, mild pasteurization, standard pasteurization, concentration, and freezing. These processes may cause deterioration of compounds responsible for antioxidant power of fruit juices^[13]. Further to enhance its presentable quality of juices sugars and additional flavours may be added.

When fruits are compared with each other we found difference in the pomegranate and other fruit juices. Pomegranate showed significant ($p < 0.005$) high levels as compared with rest. Punicalagins and gallic acid were revealed to be the most abundant phenolic compounds, followed by ellagic acid and vanillic acid. These constituents were mainly responsible for the effective antioxidant capacity of pomegranate^[14]. Orange juice being a citrus species contain ascorbic acid, which is known antioxidant. However, though orange juice found to be the best with antioxidant capacity followed by pomegranate, the levels are not much significant with rest of the fruits studied. In some fruits, the antioxidant action was distributed between the soluble and non-soluble fractions this is hurdle to detect exact antioxidant properties if insoluble part remains unmeasured. Therefore, processing of fruit juices also affects antioxidant levels.

Apart from processing which part of fruit used to prepare fruit juice also seems to have influence on antioxidant levels. Many researchers recognized that the more brighter and darker colour of the fruit, more is the antioxidant levels in it.^[13-15]

Conclusion

The antioxidant levels of freshly extracted fruit juices and commercially available fruit juices of two brands were measured by performing FRAP assay and PM method. It was accomplished that pomegranate provided highest antioxidants as compared to other fruits. It was also observed that fresh fruits always serve high levels of antioxidants as compared to commercially available juices. Commercially available juices undergoes processing due to which the antioxidants maybe lost. So it is recommended to always consume fresh fruit juices rather to have commercially available fruit juices.

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