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Determination Of Total Carotenoids, Total Phenols, Ascorbic Acid Content And Radical Scavenging Activity Of Pomegranate, Papaya and Orange Peels

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ABSTRACT

Today, fruit peels are major agro wastes or by product of fruit processing industry. Pomegranate, orange and papaya are widely consumed and processed. So their disposal of their waste is a major problem. Their peel contains valuable bioactive compounds that can be used in food products. In the present study, carotenoids, phenolics, ascorbic acid content and radical scavenging activity of peels of pomegranate, orange and papaya were observed. Pomegranate peels have highest total phenolic content. Orange peels are good source of ascorbic acid, while papaya peels have highest radical scavenging activity among these three fruit peels.

KEYWORDS : Pomegranate Peel, Papaya Peel, Orange Peel, Total Carotenoids, Ascorbic acid, Radical Scavenging Activity

INTRODUCTION

Several types of plant materials such as vegetables, fruits, leaves, oilseeds, cereal crops, barks, roots, spices and herbs have been sought out for their potential antioxidants (Choi et al. 2007; Iqbal et al. 2007; Kim, 2005; Sikwese and Duodu, 2007). However, relatively less information is available on the antioxidant principles of the agro wastes which are usually discarded in huge quantities. As a result, in the last few years, increased attention has been focused on the antioxidant prospective of food processing products and agro-industrial wastes (Iqbal et al. 2007; Moure et al. 2001; Zia-ur-Rehman, 2006).The determination of antioxidants in peels, brans, seed coats and oilseed residues etc. has been gaining importance with the recognition that these parts of the fruits and seeds are often rich sources of natural antioxidants.

Pomegranate (Punica granatum) is a deciduous shrub which is widely cultivated in Mediterranean and South Asian region. India is one of the leading countries in pomegranate production. Because of its low maintenance cost, high yield, better keeping quality and ability to grow when irrigation potential is low, it is cultivated in semiarid, drought prone regions of the country. For centuries, various parts of the plant have been used for medicinal purposes. Practitioners of Ayurvedic and Unani system of medicine have used pomegranate as a therapeutic agent for the treatment of inflammatory diseases and disorders of the digestive tract (Seeram et al. 2005; Lansky & Newman, 2007). Its juice, peel and oil have also been reported to have anticancer and cardiovascular preventing properties (Kim et al. 2002). Pomegranate fruit arils are also very popular due to their taste. The arils are processed to delicately flavored juice, squash, jelly, jam, wine, anardhana, etc.

Papaya (Carica papaya L.) is a kind of tropical evergreen fruit tree. Much peel and seeds waste is produced after the processing and consumption of papaya fruits. This waste, that usually polluted our habitat, could actually be utilized. A huge amount of fruit peel waste is thus produced, disposal of which has become an environmental problem (Zhou et al. 2011).

Orange constitutes about 60% of the total citrus world production. A large portion of this production is addressed to the industrial extraction of citrus juice which leads to huge amounts of residues, including peel and segment membranes. Peels represent between 50 to 65% of total weight of the fruits and remain as the primary byproduct. Major quantities of the peel are not further processed. Some attempts were made to use these residues as livestock feed, although their low nutritional value (Bampidis & Rabinson, 2006).

In this study, pomegranate, papaya and orange peels extract were studied.

MATERIALS AND METHODS

Chemicals -All chemicals and reagents used in the study were of analytical grade.

Preparation of fruits peel extract

Fruits having no visible external cuts or spoilage were purchased from the local market. The fruit was washed and peel was separated and dried. Air-dried peel was ground into a fine powder using a blender. Powdered material (20g) was extracted with 200 mL of 80% methanol, overnight at room temperature using a shaker. The extracts were separated from the residue by filtering through Whatman No. 1 filter paper and centrifugation at 8654 g for 10 min at 5°C. The dry extracts were weighed to calculate the yield and stored in a refrigerator (40C), until used for further analyses (Al-Zoreky, 2009).

Determination of Total carotenoids

Total carotenoids (mg/100g) were determined by a modified method of Ranganna (1997) using methanol as extracting solvents and measuring the absorbance at 450nm. Preparation of sample extract - Two grams of sample was mixed with10 ml of 80% ethanol. The extract was centrifuged at 10000×g for 15 min at 40C. The pellet following was centrifuged and the resulting supernatant was combined with initial extract. Triplicate supernatant extractions were made for each sample. The ethanolic extract volume was reduced in the evaporator to 20ml.

Total Phenolic Compounds (TPC)

Total phenolic compounds (TPC) were quantified by Folin-Ciocalteu method (Singleton et al. 1965). One hundred microliters of sample, dissolved in 70% ethanol or water, were mixed with 2 ml of 2% sodium carbonate solution containing 100 µl Folin-Ciocalteu reagent (Folin-Ciocalteu: methanol, 1:1, v/v) and incubated for 30 min. The optical absorbance was measured at 760 nm. TPC content was expressed as micrograms of gallic acid equivalents (GAE) per milligrams dried extract.

Ascorbic Acid Content (AA)

The amount of ascorbic acid (AA) in ME was spectro- photometry determined using standard solutions of AA (Haas & Dunkley, 1969).

Free Radical Scavenging Activity (RSA)

The free radical scavenging activity (RSA) of extracts was assessed using procedure the DPPH (1, 1-diphenyl-2- picrylhydrazyl) assay (Sanchez-Moreno et al. 2003). Fifty microliters of sample were mixed with 1.95 ml of DPPH reagent, dissolved in methanol as in instruction, allowed to stand in the dark for 45 min and then measured the absorbance at 515 nm. Ascorbic acid (AA) was served as positive controls. Radical scavenging activity was calculated using the following formula and expressed as median inhibition concentration, extracted in 500 ml of 70% ethanol or water for 24 hrs.

Scavenging activity (%) = 1– (As / A0) × 100

Where A0 is the absorbance at 517 nm of the blank control and As is the absorbance of the sample. The percentage of free radical scavenging activity was plotted against the amount of the sample.

Statistical analysis - Three replicates of each sample were used for statistical analysis. Analysis of the data was performed on the original data by one-way analysis of variance (ANOVA) or regression analysis. Differences at $P < 0.05$ were considered significant. The data was also analyzed with the help of SPSS 16.0 Software package.

RESULTS

Yield & Total Carotenoids

The yield of pomegranate peel's methanolic extracts was 25.7g/100g of dry matter, while yield of orange peel and papaya peel extract were 21.5 g/100g and 28.32g/100g of dry matter, respectively. Total carotenoids content was highest for papaya followed by pomegranate peel and lowest for orange peel.

Table 1

Table.1 Total Carotenoids, Total Phenolic Content of three fruit peels.

	Total Carotenoids Content (mg/100g)	Total Phenolic Content (GAE g/100g)	Ascorbic Acid Content (mg/100g)	Radical Scavenging Activity (%)
Pomegranate Peel	5.81b +0.017	32.2a +0.020	3.11c +0.040	66.45b +0.021
Orange peel	3.41c +0.026	2.4c +0.016	65.26a +0.022	33.22c +0.042
Papaya Peel	6.42a +0.021	13.2b +0.019	46.11b +0.020	95.0a +0.080

Means followed by the same letter within a column do not differ significantly ($p<0.05$).
Means (+ standard deviation) of triplicate analysis.

Total Phenolic Compounds & Ascorbic Acid Content

The TPC amount of pomegranate peel was 32.2 (g GAE /100g) of dry matter, which was higher than TPC observed by Shiban et al. (2012) for methanolic extract of pomegranate peel. While TPC amount of orange and papaya peels was 2.4 and 13.2 (g GAE /100g) of dry matter, respectively. Ascorbic acid content of orange peel was highest followed by papaya. However pomegranate peels have much lower ascorbic acid content than orange and papaya.

Figure 1

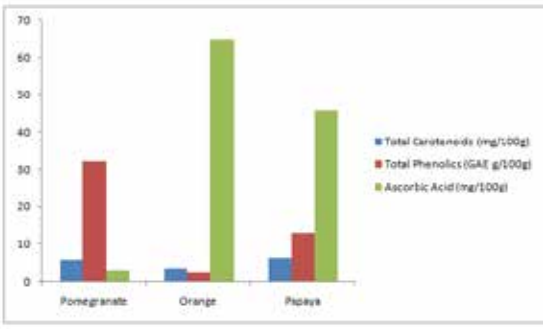

Figure1. Total Carotenoids, Total Phenolic, Ascorbic Acid Content of three fruit peels.

Free Radical Scavenging Activity

The pomegranate peel extracts exhibited proton-donating ability by DPPH assay. PPE exhibited proton-donating ability by DPPH assay, demonstrated high free radical scavenging activity (66.45%), which is higher than the RSA observed by Shiban et al. (2012) for methanolic and water extract of pomegranate peel (upto 25ppm concentration). While papaya peels have highest RSA (95%) among these three fruits.

Figure 2

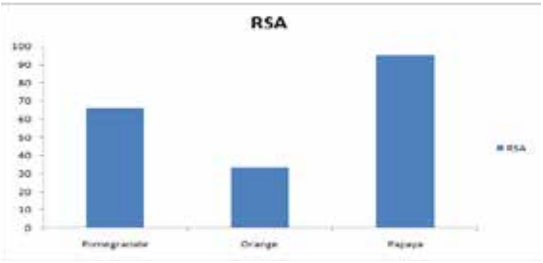

Figure2. Radical Scavenging Activity (RSA) of three fruit peels in %

CONCLUSION

This study showed that fruit peels are not wasteful; they can be utilized for various purposes. Fruit peels, are by-product of fruit processing industry, and could be a rich source of bioactive compounds. They are rich source of antioxidants. Pomegranate peels are rich in total phenolics. Papaya peels have good RSA while orange peels are good source of ascorbic acid (vitamin C). This new source will be potential as a functional food or value added ingredients in future in our dietary system. Fruit peels if conveniently processed, could furnish useful products that may balance out waste treatment costs and also decrease the cost of main product. Therefore, there is a scope for the isolation of these active ingredients and also use of Fruit peels as an ingredient in processed food products such as bakery products, breakfast cereals, pasta products, bars and beverages.

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