Phenolic, ascorbic Contents and Antioxidant activities of 21 Iranian Fruits

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Abstract: Fruits are a rich source of diverse antioxidants, and phytochemical compounds which useful for public health. **Materials and Methods:** A total of twenty one (21) types of fruits from Iran were examined. Fresh fruits of different varieties *Musa sapientum,* Prunusarmeniaca, *Prunuspersica , Prunusdomestica, Ficuscarica, Maluspumila, Prunusavium, Citrus limonia*,*Cucumismelo,* Citrus paradisiMacf*, Citrulluslanatus, Citrus sinensis, Reticulatus, Rubuscoesins, Prunuscerasus, Vitisvinifera and Actinidiadeliciosa*were collected from local markets in Yasuj Iran on June - July 2012. The total phenolic and flavonoid contents of fruit extracts were estimated using theFolin-Ciocalteau and aluminium chloride (AlCl3) respectively.For determination of L-ascorbic acid, Mehboobali and Iqbalmethod was used .For antioxidant capacity of samples dipheny-l-picrylhydrazyl (DPPH). **Results:** Amongst all fruits tested, blackberry, sour cherry,plum and black grape had the highest DPPH and TP whereassour cherry, blackberry, kiwi and banana had the highest AA per 100 gram freshweight. Plum, sour cherry, blackberry and white grape had the highest–flavonoid content per 100 gram fresh weight.There was reported ahighrelationship between antioxidant capacity and total phenol (0.9392), totalflavonoid (0.7441). However, a low association was reported between AA with antioxidant activity (0.322) and totalphenol (0.3752). **Conclusion:** Fruits with highantioxidant potentials were also revealed high phenolic and flavonoid concentration.Amongst all fruits tested sour cherry, blackberry, Plum, and black and white grape were reported with maximum potential in all assay systems.
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Keywords: fruits; ascorbic acid; total phenol; flavonoids; antioxidant capacity.

1. Introduction

A free radical with an unpaired electron are very reactive, short lived, unstable and high energetic molecules.They caused many age related degenerative diseases such as atherosclerosis, arthritis, heart disease, and cancers by biochemical damages to cells and tissues. The lipids, proteins and DNA compounds also oxidized and damaged by free radicalin human body **[**Pourmorad 2006**,** Dillard 2000**]**. Antioxidantsprotect of body by neutralization of free radicals and oxidationdamages.**(**Turkoglu, 2007**)**. According to the World Health Organization, About 80 per cent of world population more focusing on traditional medicine for their healthcare practice **(**Tripathi,2003**)**. Fruit and vegetables are mostly used for diet by most of people in all of world .They contain important chemical materials which called phytochemicals with antioxidant activity **[5]**.Phytochemicals are natural occurring substances with wide range of biological potential . Phenolic compounds especially flavonoids are one of the most important components of phytochemicals. Phenolic compounds are frequently established in all plant-derived foods, they have variousroles in food such as taste, odor and physic- chemical properties. The antioxidant potential of phenolic compounds ismostlydue to their redox activity that permits them to performance as reducing agents, free radical scavenger or metal chelators **)**Canadanovic-Brunet, 2005:Marimuthu , 2008**).** The antioxidant activities of phenolic compounds also useful for anti-degenerative, anti-inflammatory, anti-bacterial , anti-allergic and cardio-protective potential .Flavonoids are big class of phenolic compounds with many biological potential such as; potent antioxidant activity , anti-inflammatory and anticarcinogeni **(**Lam**,**2007**)**. The purpose of present study was to evaluate of the antioxidant activity and total phenol, flavonoid and ascorbic acid contents and estimation of their relationship in 21 common fruit types. Some characteristics of fruits was expressed in Table 1.

2.Materials and methods

2.1Plant materials and sample preparation

Fresh fruits of different varieties *Musa sapientum,* Prunusarmeniaca, *Prunu spersica, Prunus domestica, Ficus carica, Maluspumila, Prunus avium, Citrus limonia*,*Cucumis melo,*Citrus paradisiMacf*, Citrulluslanatus, Citrus sinensis,*

Reticulatu, Rubuscoesins, Prunuscerasus, Vitis vinifera and Actinidiadeliciosa were collected from local markets in Yasuj Iran on June - July 2012. Fruit samples were also botanically identified by plant biologist in Biology Department of the Yasuj University, Iran. Most fruits samples have reached physiological maturity. Fruits without damage were cleaned and whenever necessary, the peels and seeds were removed when they were not edible. All samples were washed and chopped into small pieces before extraction. Samples 5g were extracted 3 times for 2 h with 50 ml of 70% ethanol at room temperature on an orbital shaker set at 200 rpm. The mixture was centrifuged at 1400 _ g for 30 min and the supernatant was collected. Supernatant was used immediately for analysis of total phenol, flavonoid, antioxidant and ascorbic acid or L-ascorbic acid content.

2.2 Determination of total phenol

The total phenolic contents of fruit extracts were estimated using theFolin-Ciocalteau reagenttechnique with slight change. Total phenol was expressed as Gallic acid equivalent (GAE) /g extract [Karim, 2011].

2.3 Determination of Total Flavonoid

The total falavonoid level was measured with aluminium chloride (AlCl3) according to method Kosalec*et al*.) The total flavonoid values were determined in terms of rutin equivalents/g extract [Kosalec, 2004].

2.4 Determination of L-ascorbic acid (Vitamin C)

For determination of L-ascorbic acid, Mehboobali and Iqbalmethod was used with some modification. Data were expressed as miligram ascorbic acid per 100gram fresh weight (mg AA/100g FW). In a test tube, sample extract 20-300µl, orthophosphoric acid (85%) 20 µl, α, ά-dipyridyl(1%) 160 µl and ferric chloride(3%) 20 µl were mixed.For standard curve instead of plant extract ascorbic acid (0.25 µg – 4 µg) 20-300 µl was used .For blank preparation, trichroacetic acid (TCA 5%) 300 µl was used in place of standard ascorbic acid or extract.The final reaction volume was 500 µl. The tubes were mixed and incubated for 20 min at room temperature .The absorbance all reactions tubes were determined at 525 nm against the blank in a spectro photometer.(Perwaiziqbal, 2006)

2.5 Antioxidant Activity of Diphenypicrylhydrazyl (DPPH)

Antioxidant capacity of fruit extracts determined with some modification. Percent of inhibition was estimated as follow: Inhibition % = [(A0 - A1)/A0] ×100 (17)

A0 is the absorbance of control and A1 is the absorbance of the plan extracts (Ebrahimzadeh, 2011).

2.6 Statistical Analysis

All data were expressed as means ± standard deviation of (n=3) measurements. For detect of significant differences in fruit extracts one-way analysis of variance (ANOVA) was applied. For Correlation between the antioxidant activity and total phenolic, flavonoids and ascorbic acid was carried out using the correlation and regression in the Excel program (Microsoft Excel v. 2007).

3. Results

In this study, 21 different fruits from Iran were screened for their total phenol, flavonoids, ascorbic acid and their antioxidant potential. The fruit samples are arranged from the lowest to the highest total phenols concentration, which ranged from 40.67 to 445.3 mg GAE/100 g sample FW (Figure 1). Amongst all fruits tested, blackberry, sour cherry, plum and black grape had the highest DPPH and TP whereas sour cherry, blackberry, kiwi and banana had the highest AA per 100 gram fresh weight. Total flavonoids content, which expressed as mg rutin/100g fresh table (2) and, varied widely among fruit samples and ranged from 4.8 mg Rutin E/100gr in grapefruit to 103.3 mg Rutin E/100gr in plum (red) as fresh (Figure2). Plum, sour cherry, blackberry and white grape had the highest –flavonoid content per 100 gram fresh weight. Many fruits are regarded as good source of ascorbic acid, of the 21 fruits tested are presented in figure 3. According to present study, ascorbic acid content of fruit tested varied widely ranging from 2.8 for water melon to 90 for sour cherry mg100 g-1 of fresh weight (Figure3). Amongst the fruits with high Ascorbic acid content were Sour cherry, Blackberry kiwifruit, Banana and orange. Blackberry and water melon had the highest (16.4) and the lowest (2.27 mMTrolex in kg/ fresh fruit) antioxidant activity respectively. The maximum order of antioxidant activities were reportedin blackberry, sour cherry, plum, grape, were 16.4, 15.1,13.2 and 9.4 um trolex / 100 g fresh fruit respectively (Figure4). The antioxidant activities of the fruit extracts can be attributed to their total phenolic contentAntioxidant potential and total phenolic content revealed a high correlation ($r2 = 0.9392$, $P < 0.01$). Total phenolic content of blackberry and watermelon similar to antioxidant capacity had the highest and lowest levels respectively (Figure5). Concentration of total phenol in fruits was similarly to antioxidant activities, in descending order: Blackberry, Sour cherry, Plum, grape. There was a positive relationship between total

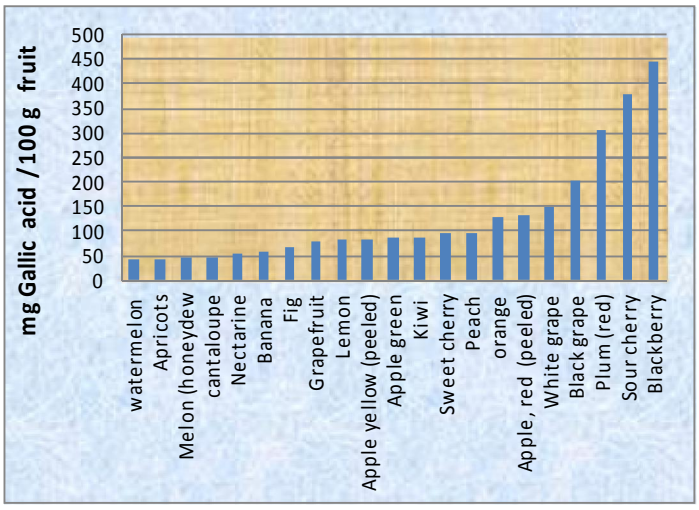

Figure: 1 Rank order for total phenol in 21 samples expressed as mg Gallic acid (GAE) equivalents /100g fresh fruit extracts. Results are mean (n = 3).

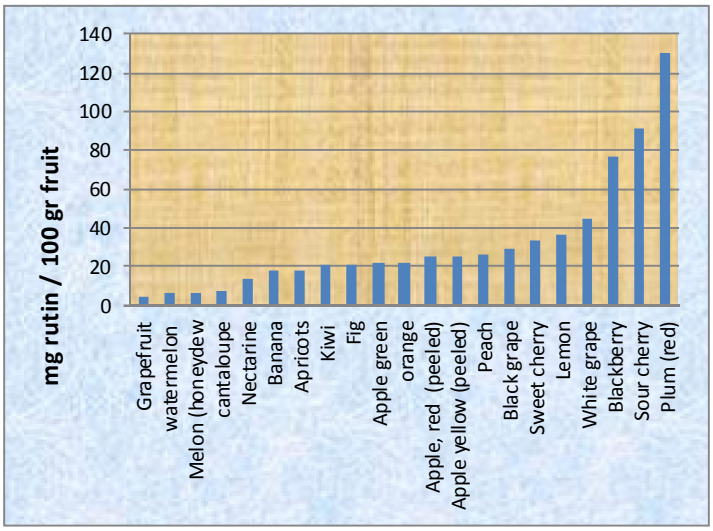

Figure 2: Rank order for total flavonoid levels expressed as Rutin equivalent in 100 g fresh weight for twenty one fruit extracts .Results are mean (n = 3).

antioxidant activity and total flavonoids content of Iranian fruit in Yasuj area with correlation coefficient of *R2*=0.7441 (Figure6). This result suggests that more than 73% of theantioxidant activity of selected fruit results from the contribution of flavonoids compounds (Figue5).There was a low correlation was shown between AA with antioxidant activity (0.322) and total phenol (0.3752) (figure 7-8).

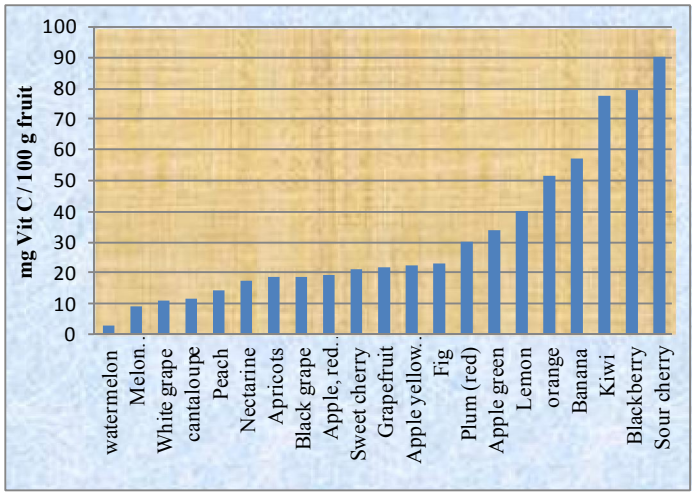

Figure 3: Rank order for ascorbic acid content (mg/100gfw) in twenty one fruit extracts. Results are mean (n = 3).

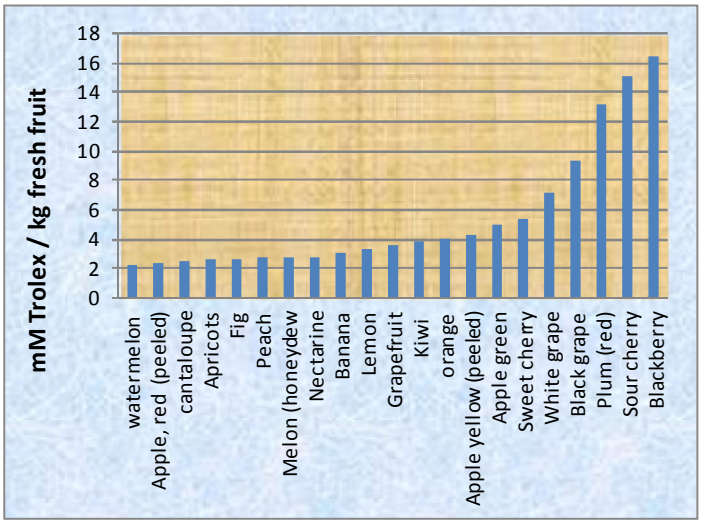

Figure 4: Rank order for antioxidant potential oftwenty one fruit base on the DPPH value expressed as milimoles of Trolox equivalen/ kg fresh fruit of 21 common fruit in Iran

4. Discussion

Fruit is one of the most important diverse nutritional source antioxidant for humans. Nutrition specialists agree that consumption of fruits and vegetablescontribute to reducing risks of certain diseases such as, blood pressure, cardio and cerebro-vascular diseases (Martin, 2002). These beneficial effects have been attributed to the various antioxidants in fruits and vegetables, including polyphenol, ascorbic acid, carotenoids, and tocopherols(Huxley & Neil, 2003). They can scavenge

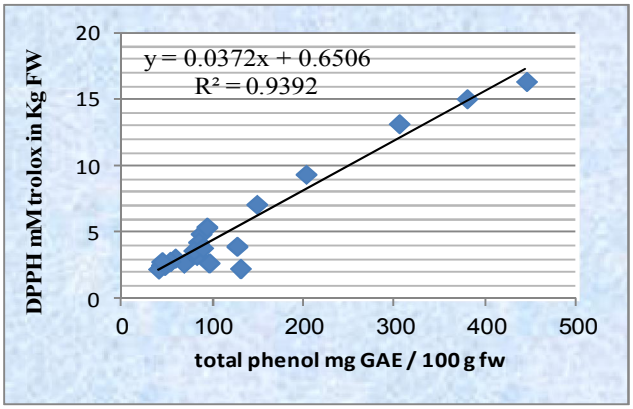

Figure 5: Significant correlation between antioxidant activity and phenolics content of 21 common fruit in Iran

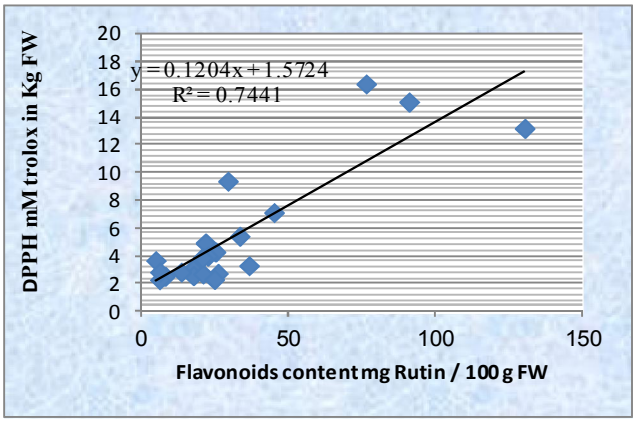

Figure 6: Significant correlation between antioxidant activity and flavonoids content of 21 common fruit in Iran

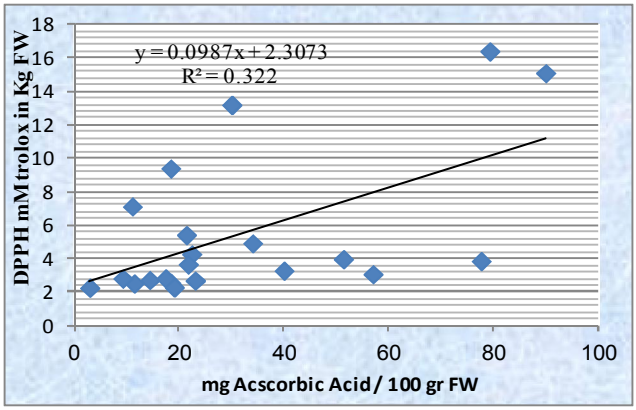

Figure 7: A positive correlation between antioxidant activity and ascorbic acid content of 21 common fruit in Iran

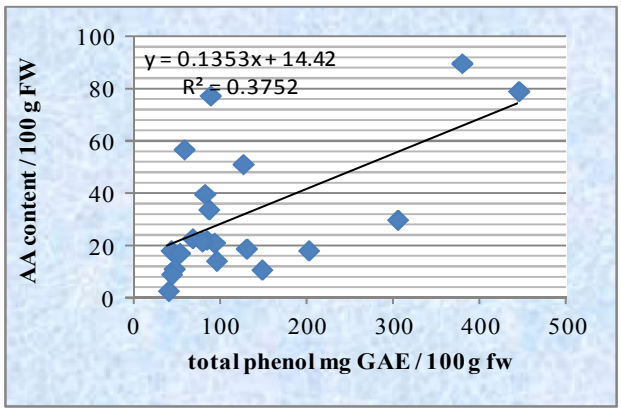

Figure 8: A positive correlation between ascorbic acid (AA) and total phenol content of 21 common fruit in Iran

Table 1. Some characteristics of 21 common fruit in Iran

Scientific name	Common name	Part used
Musa sapientum	Banana	pulp
Prunusarmeniaca	Apricots	pulp
Prunuspersica	Peach	pulp
Prunusdomestica	Plum (red)	pulp
Ficuscarica	Fig	all
Maluspumila	Apple green	pulp
Maluspumila	Apple yellow (peeled)	Pulp+peel
Prunus avium	Sweet cherry	pulp
Prunus persica	Nectarine	pulp
(*Citrus limonia*)	Lemon	Pulp+peel
Cucumismelo	cantaloupe	Pulp+peel
Citrus paradisiMacf	Grapefruit	Pulp+peel
Citrulluslanatus	watermelon	Pulp+peel
Maluspumila	Apple, red (peeled)	Pulp+peel
Citrus sinensis	orange	Pulp+peel
Cucumismelo L. reticulatus	Melon (honeydew	Pulp+peel
Rubuscoesins	Blackberry	pulp
Prunuscerasusvulgaris	Sour cherry	Pulp+peel
Vitisvinifera	Black grape	pulp
Vitisvinifera	White grape	pulp
Actinidiadelicios	Kiwi	Pulp+peel

radicals by inhibit of breaking chain propagation or suppress of free radicals by binding to the metal ions, reducing hydrogen peroxide, and quenching superoxide and singlet oxygen. So they are supposed to play an important role in the prevention of degenerative diseases. Many studies have revealed that intake of natural antioxidants is correlated with low incidence of cancer, heart disease, diabetes, and other diseases associated with ageing, but there are still controversial opinions (Yizhong Cai, 2004). Phenolic compounds in fruits and medicinal plants possessed strong antioxidant potential might preventing cancer via antioxidant potential and/ or the modulation of numerous protein functions.

Phenolics may inhibit carcinogenesis by change the initiation, promotion, and progression phases (YizhongCai, 2004).

It is well known that flavonoids are a big class of phenolic substances with antioxidant potential .It was observed that the antioxidant capacity of the samples was also associated with the flavonoid level ($r2 = 0.74$, $P < 0.01$).

According to phenolic compounds and antioxidant activity of fruit results in present study two groups were clearly distinguishable; the first group including Blackberry, sour cherry, black grape and plum, the second group including all the other samples.Comparing these results with literature, similar values were reported for strawberry (264 and 368 mg GAE/100 g FW), and plum (366–478 mg GAE/100 g FW (Wu et al., 2004).

In another study of plum genotypes contents ranging from 150–300 mg GAE/100 g FW were obtained.However, values that differed from our results werefound, e.g., 660 mg GAE/100 g FW for common blackberry,(Wu et al., 2004).

The variation could be owing todifferences in varieties, temperature, maturity, extraction technique,

etc. For the rest of the fruits, there is no accessible textinformation regarding the concentration of phenolic substances or theantioxidant activity but the results are usually in the organize to magnitudes reported for fruits, i.e., apple (211–347), apricot (133–178), banana (52–231), blueberry (531–795) , grape (145–196)and orange(31–337 mg GAE/100 g (Wu et al., 2004).

In this work also two groups of samples can be distinguished. The first group contained the samples with high DPPH antiradical efficiency and high total phenolic content .The second group of fruits which were considered to have low antiradical potential with low total phenolic content.

The reasons for the low antioxidant activity of group 2 fruits might be that the phenolic compounds in these fruits are bound to other molecules, such as polysaccharides and proteins, which considerably reduce the activity, or are weak antioxidants property.

In this study, ascorbic acid content of fruits was poorly associated with either total phenolic content or DPPH.This is expected as ascorbic acid usually offers minor impact to the antioxidants in fruits .Other than Ascorbic acid, there were several other substances that can associate more significantly to antioxidant potentials of these fruits. Moreover, the synergism amongst a mixture of antioxidants may explain why antioxidant capacity of fruit is higher than the individual vitaminor phenolic compound (Vinson, 2001).

5. Conclusion

According to present results it can be concluded that fruit and vegetables contain a wide variety of antioxidant activity and phenolics , flavonoids and ascorbic acid content. Blackberry, sour cherry, black grape and plum were rich in phytochemical and antioxidant activity.

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