Journal of Food Technology 8 (3): 131-133, 2010
ISSN: 1684-8462

Total Phenolic Contents of Some Plant Foods as a Antioxidant Compound

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Abstract: Eight plant foods were used as traditional vegetables and fruits well-known sources of antioxidant. Total phenolic contents were determined using a spectrophotometric technique based on the Folin-Ciocalteau reagent according to the method of Spanos and Wrolstad (Journal of Agricultural and Food Chemistry) calculated as gallic acid equivalents GAE g^{-1} dw. Total phenolic contents ranged from 0.87-7.02 mg gallic acid g^{-1} dw in *Alocaccia indica* and *Solanum indicum*, respectively. The plant foods possess valuable antioxidant properties for culinary and possible nutritive use.

Key words: Antioxidant compound, total phenolic content, plant foods, fresh fruits, dry material, Iran, India

INTRODUCTION

Among the various plant foods, some endemic species are of particular interest because they may be used for the production of raw materials or preparations containing phytochemicals with significant antioxidant capacities and health benefits (Exarchou *et al*., 2002). Crude extracts of fruits, herbs, vegetables, cereals and other plant materials rich in phenolics are increasingly of interest in the food industry because they retard oxidative degradation of lipids and thereby improve the quality and nutritional value of food. The preservative effect of many plant spices and herbs suggests the presence of antioxidative and antimicrobial constituents in their tissues (Hirasa and Takemasa, 1998).

Many plant foods contain large amounts of antioxidants other than vitamin C, E and carotenoids (Velioglu *et al*., 1998). Many herb spices especially those belonging to the Lamiaceae family such as sage, oregano and thyme show strong antioxidant activity (Hirasa and Takemasa, 1998). The genus Ocimum, a member of the Lamiaceae family contains between 50 and 150 species of herbs and shrubs (Simon *et al*., 1999). A number of phenolic compounds with strong antioxidant activity have been identified in these plant extracts (Nakatani, 1997).

The potential of the antioxidant constituents of plant materials for the maintenance of health and protection from coronary heart disease and cancer is also raising interest among scientists and food manufacturers as consumers move toward functional foods with specific health effects (Loliger, 1991). Antioxidants are compounds that can delay or inhibit the oxidation of lipids or other molecules by inhibiting the initiation or propagation of oxidative chain reactions (Velioglu *et al*., 1998). The antioxidative effect is mainly due to phenolic components, such as flavonoids (Pietta, 1998), phenolic acids and phenolic diterpenes (Shahidi *et al*., 1992). The antioxidant activity of phenolic compounds is mainly due to their redox properties which can play an important role in absorbing and neutralizing free radicals, quenching singlet and tripletoxygen or decomposing peroxides (Osawa, 1994).

Many of these phytochemicals possess significant antioxidant capacities that may be associated with lower incidence and lower mortality rates of cancer in several human populations (Velioglu *et al*., 1998). The purpose of this study was to evaluate some plant foods as new potential sources of natural antioxidants and phenolic compounds..

MATERIALS AND METHODS

Plant material: Three species of fruits and vegetables viz *Alocacia indica Sch*, *Eulophia Ochreata Lindl Momordica dioicia Roxb* were purchased and collected from various localities of Maharashtra, India. Five wild edible plants were collected from Iran viz *Asparagus officinalis*, *Chlorophytum comosum*, *Codia myxa*, *Portulaca oleracia and Solanum indicum* were collected from Iran in April 2008.

Table 1 shows the efforts made to collect these plants in flowering and fruiting conditions for the correct botanical identification. Healthy and disease free edible plant parts selected each variety of fruit and vegetables were collected to assess total phenolic contents.

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Table 1: Species, habitat and consumption of vegetables and fruits in Behbehan, South Iran and Pune, South India

Botanical name	Family	Plant parts used	Habitat	Typical consumption	Country
Alocacia indica Sch.	Araceae	Stem	Roadside weed	During famine	India
Asparagus officinalis DC	Liliaceae	Stem	Garden	Regularly	Iran
Chlorophytum comosum Linn.	Liliaceae	Root tubers	Garden	During famine	Iran
Cordia myxa Roxb.	Boraginaceae	Fruits	Disturbed	Regularly	Iran
Eulophia ocherata Lindl.	Orchidaceae	Tubers	Disturbed	Regularly	India
Momordica dioica Roxb	Cucurbitaceae	Fruits	Disturbed	Regularly	India
Portulaca oleracia Linn.	Portulacaceae	Stem and leaves	Garden	Regularly	Iran
Solanum indicum Linn.	Solanaceae	Fruits	Disturbed	Regularly	India

Table 2: Total phenolics (antioxidant) of eight edible plants obtained from India and Iran

Name of plants	*A. indica*	*A. officinalis*	*P. oleracia*	*M. dioica*	*E. ocherata*	*S. indicum*	*C. myxa*	*C. comosum*
Total phenols (mg g^{-1})	0.87±2.1^{F}	3.17±2.1^{A}	5.86±2.1^{D}	3.69±2.1^{A}	2.43±2.1^{AB}	7.02±2.1^{E}	4.02±2.1^{B}	1.36±2.1^{F}

Bold values indicate good sources of antioxidant compounds

Samples preparation: Fresh fruits and vegetables were cleaned with water and external moisture wiped out with a dry cloth. The edible portion of the individual fruits was separated, dried in a hot air oven at 50°C for 1 h. The dried samples were powdered in blander for further study. Some of the plants dried under shade so as to prevent the decomposition of chemical compounds.

Chemical reagents: The chemical reagent ABTS (2, 20-Azino-bis (3-ethylbenzthiazoline-6-sulfonic acid)) was purchased from CALBIOCHEM (Darmst adt, Germany). All other chemicals used were of analytical and HPLC grade and obtained from Sigma Co. (St. Louis, MO).

Total phenolic compound analysis: The amount of total phenolics in eight plant foods extracts were determined with the Folin-Ciocalteu reagent using the method of Spanos and Wrolstad (1990) as modified by Lister and Wilson (2001). About 50 mL of each sample (3 replicates), 2.5 mL 1/10 dilution of Folin-Ciocalteau's reagent and 2 mL of Na_2CO_3 (7.5%, w/v) were added and incubated at 45°C for 15 min. The absorbance of all samples was measured at 765 nm using a SPECTRAmax-PLUS384 UV-vis spectrophotometer. Results were expressed as milligrammes of gallic acid equivalent per gramme of dry weight (mg GAE g^{-1} dw).

Statistical analysis: Three replicates of each sample were used for statistical analysis. Data were subjected to analysis of variance and means were compared by Least Significant Difference (LSD). Differences at $p<0.05$ were considered to be significant.

RESULTS AND DISCUSSION

Total phenolic content: The amount of total phenolics varied in different plant foods and ranged from 0.87-7.02 mg GAE g^{-1} of dry material. The highest total phenolic levels were detected in *Solanum indicum* and the lowest in *Alocaccia indica* (Table 2). The amount of total phenolic compounds in all tested plant foods was higher than the other Lamiaceous plants reported such as *Thymus vulgaris* (Kahkonen *et al*., 1999), *Mentha piperita*, *Melissa officinalis* and *Rosmarinus officinalis* (Zheng and Wang, 2001).

Some selected phenolics of these plant foods have previously been separated and identified by comparison with authentic standards using reversed-phase. High Performance Liquid Chromatography (HPLC) and rosmarinic acid was the predominant phenolic acid in these plant foods (Velioglu *et al*., 1998).

Typical phenolics that possess antioxidant activity have been characterized as phenolic acids and flavonoids (Kahkonen *et al*., 1999). Phenolic acids have repeatedly been implicated as natural antioxidants in fruits, vegetables and other plants. For example, caffeic acid, ferulic acid and vanillic acid are widely distributed in the plant kingdom (Larson, 1988).

CONCLUSION

In this study, Rosmarinic acid, an important phytochemical has been found to be a potent active substance against Human Immunodeficiency Virus type 1 (HIV1) (Mazumder *et al*., 1997).

ACKNOWLEDGEMENT

The researchers are grateful to the Head Department of Botany University of Pune for providing necessary laboratory facilities and for encouragement. The first researcher is thankful to Head Department of Food Science Technology of Ramin Agricultural University of Iran for the grant of this research.

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