

Asian Journal of Food and Agro-Industry

ISSN 1906-3040

www.ajofai.info Available online at

Research Article

Comparative study on polyphenol content in some food plants

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Abstract

Eight food plants that are used as traditional fruit and vegetables and are well-known sources of antioxidants were chosen for this study. Total phenolic contents were determined using the spectrophotometric technique, based on the Folin-Ciocalteu reagent, according to the method of Spanos and Wrolstad and calculated as gallic acid equivalents GAE/g dw. Total phenolic contents ranged from 0.87 to 7.02mg gallic acid/g dw in *Alocacia indica* and *Solanum indicum*, respectively. The food plants studied possess valuable antioxidant properties for culinary and possible nutritive use.

Keywords: antioxidant compound, total phenolic content, *Alocacia indica*, *Eulophia ochreata*, *Momordica dioicia*, *Asparagus officinalis*, *Chlorophytum comosum*, *Codia myxa*, *Portulaca oleracia*, *Solanum indicum*, Iran, India

Introduction

Among the various food plants, 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 [1].

Crude extracts of fruit, 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 [2]. Many food plants contain large amounts of antioxidants other

than vitamin C, vitamin E and carotenoids [3]. Many herb and spices, especially those belonging to the Lamiaceae family, such as sage, oregano and thyme, show strong antioxidant

activity [2]. The genus *Ocimum*, a member of the Lamiaceae family, contains between 50 and 150 species of herbs and shrubs [4, 5]. A number of phenolic compounds with strong antioxidant activity have been identified in extracts from these plants [6].

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 food with specific health effects [7]. 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 [3]. The antioxidative effect is mainly due to phenolic components, such as flavonoids [8], phenolic acids and phenolic diterpenes [9]. 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 triplet oxygen, or decomposing peroxides [10]. 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 [3]. The purpose of this study was to evaluate some food plants as new potential sources of natural antioxidants and phenolic compounds.

Materials and Methods

Plant material

Three species of fruit and vegetables namely; *Alocasia indica* Sch, *Eulophia ochreatea* Lindl., *Momordica dioicia* Roxb., were purchased or were collected from various localities of Maharashtra, India. Five wild edible plants were collected from Iran namely; *Asparagus officinalis*, *Chlorophytum comosum*, *Codia myxa*, *Portulaca oleracia* and *Solanum indicum* in April 2008. Efforts were made to collect these plants in flowering and fruiting conditions for the correct botanical identification. Healthy and disease free edible plant part/s selected each variety of fruit and vegetables were collected to assess total phenolic contents. Table 1 shows the selected plants.

Samples preparation

Fresh fruit 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 blender 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-sulphonic acid)] was purchased from CALBIOCHEM (Darmstadt, Germany). All other chemicals used were of analytical and HPLC grade and obtained from Sigma Co. (St. Louis, MO).

Table I. Species, habitat and consumption of fruit and vegetables in Behbahan, South Iran and Pune, South India.

Plant	Family	Part	Habitat	Typical Consumption	Country
<i>Alocacia indica</i> Sch.	Araceae	Stem	Roadside weed	During famine	India
<i>Asparagus officinalis</i> DC	Liliaceae	Stem	Garden	Regularly	Iran
<i>Chlorophytum comosum</i> Linn.	Liliaceae	Tuber	Garden	During famine	Iran
<i>Cordia myxa</i> Roxb.	Boraginaceae	Fruit	Disturbed	Regularly	Iran
<i>Eulophia ocherata</i> Lindl.	Orchidaceae	Tuber	Disturbed	Regularly	India
<i>Momordica dioica</i> Roxb.	Cucurbitaceae	Fruit	Disturbed	Regularly	India
<i>Portulaca oleracia</i> Linn.	Portulacaceae	Stem/leaves	Garden	Regularly	Iran
<i>Solanum indicum</i> Linn.	Solanaceae	Fruit	Disturbed	Regularly	India

Total phenolic compound analysis

The amount of total phenolics in eight food plant extracts was determined with the Folin-Ciocalteu reagent using the method of Spanos and Wrolstad [11], as modified by Lister and Wilson [12]. To 50 ml of each sample (three replicates), 2.5 ml 1/10 dilution of Folin-Ciocalteu's reagent and 2 ml of Na₂CO₃ (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 milligrams of gallic acid equivalent per gram of dry weight (mg GAE/g 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

The amount of total phenolics varied in different food plants and ranged from 0.87 to 7.02 mg GAE/g 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 food plants was higher than for other Lamiaceous plants reported such as *Thymus*

vulgaris [13], *Mentha piperita*, *Melissa officinalis* and *Rosmarinus officinalis* [5]. Some selected phenolics of these food plants have previously been separated and identified by

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

PLANT	<i>A. indica</i>	<i>A. officinalis</i>	<i>P. oleracia</i>	<i>M. dioica</i>	<i>E. ocherata</i>	<i>S. indicum</i>	<i>C. myxa</i>	<i>C. comosum</i>
Total phenols	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.

comparison with authentic standards using reversed-phase high performance liquid chromatography (HPLC) and rosmarinic acid was the predominant phenolic acid in these food plants [11]. Typical phenolics that possess antioxidant activity have been characterized as phenolic acids and flavonoids [13]. Phenolic acids have repeatedly been implicated as natural antioxidants in fruit, vegetables and other plants. For example, caffeic acid, ferulic acid and vanillic acid are widely distributed in the plant kingdom [14]. Rosmarinic acid, an important phytochemical, has been found to be a potent active substance against human immunodeficiency virus type 1 (HIV-1) [15].

Acknowledgements

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

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