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Determination of total phenolic content and total antioxidant activity in locally consumed food stuffs in Moodbidri, Karnataka, India

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ABSTRACT

In the present study, a total of forty locally consumed food stuffs (vegetables, fruits, seeds, berries, cereals, herbs and tree materials) in Moodbidri, Karnataka, India were examined for their total phenolic content and total antioxidant activity. Total phenolic content is determined spectrophotometrically according to the Folin-Ciocalteu procedure and calculated as gallic acid equivalents (GAE). The total antioxidant capacity was evaluated by phosphomolybdenum method. Among screened plant materials, remarkable high phenolic content was found in curry leaves (18.40mg GAE/g) which contributed its high antioxidant activity (48.94 mg AAE/g). This study reveals that some of the common food stuffs could be utilized as a source of natural antioxidants.

Key words: Total phenolic content, Total antioxidant activity, Spectrophotometry, Moodbidri.

INTRODUCTION

Oxidative stress in human body contributes to the pathogenesis of many human diseases. The elimination of free radicals by the intake of antioxidative agents is important to reduce the oxidative stress and hence for the prevention of chronic diseases [1]. Antioxidants have already been found in plant materials and supplements. Due to their natural origin, the antioxidants obtained from plants are of greater benefit in comparison to synthetic ones [2, 3]. The use of natural antioxidants from plants does not induce side effects, while synthetic antioxidants were found to have genotoxic effect [4, 5]. Therefore, the investigations of biological activity and chemical composition in plants as a potential source of natural antioxidants are numerous.

Plants synthesize compounds with biological activity, namely antioxidant, as secondary products, which are mainly phenolic compounds serving in plant defense mechanisms to counteract reactive oxygen species (ROS) in order to avoid oxidative damage. Phenolics are secondary plant metabolites ranging from simple structures with one aromatic ring to complex polymers such as tannins and lignins [6]. The interests in phenolic compounds, particularly flavanoids and tannins have considerably increased in recent years because of their broad spectrum of chemical and diverse biological properties [7]. In addition to their antioxidant properties, these compounds have been reported to be potential candidates in lowering cardiovascular diseases [8] and anticarcinogenic activities [9, 10], antiallergenic, anti-arthrogenic, anti-inflammatory, antimicrobial and antithrombotic effects [11]. Plant phenolics, in particular phenolic acids, tannins and flavonoids are known to be potent antioxidants and occur in vegetables, fruits, nuts, seeds, roots and barks [12]. In the case of phenolic compounds, the ability of the phenolics to act as antioxidants depends on the redox potential of their phenolic hydroxyl groups that allow them to act as reducing agents, hydrogen donators, and singlet oxygen quenchers. In addition, they have a metal chelation potential [13].

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 [14-17]. In view of the importance of natural antioxidants, in the present study it is aimed to determine

the total phenolic content and total antioxidant activity of locally consumed food stuffs (vegetables, fruits, seeds, berries, cereals, herbs and tree materials) in Moodbidri, Karnataka, India; and hence, to give an awareness about antioxidant properties of the food stuffs in the locality.

MATERIALS AND METHODS

Materials and Reagents

A total of forty different varieties of food used in in Moodbidri, Karnataka, India were analyzed include vegetables, fruits, seeds, berries, cereals, herbs and tree materials. Food samples were purchased from the retail market of Moodbidri. All the reagents and solvents were purchased from Merck, India. Materials used for standard preparations include gallic acid and ascorbic acid were purchased from Sigma Aldrich. The determination of total phenolic content and total antioxidant activity was carried out by spectrophotometry using Systronics UV-vis spectrophotometer.

Preparation of plant extract

Grounded dry food material (500 mg) was weighed into centrifuge tube, 10 mL of solvent (80% aqueous acetone) was added, and the sample was homogenized for 1min. Tubes were centrifugated (15 min), and the clear supernatant was collected. Supernatants were taken to dryness. The solid residue was dissolved in methanol (25ml) [14].

Determination of total phenolic content

The amount of total phenolics in extracts was determined according to the Folin-Ciocalteu procedure [18]. Samples (2mL, triplicates) were introduced into test tubes; 1.0 mL of Folin-Ciocalteu's reagent and 0.8 mL of sodium carbonate (7.5%) were added. The tubes were mixed and allowed to stand for 30 min. Absorption at 765 nm was measured (Systronics UV-vis spectrophotometer). The total phenolic content was expressed as gallic acid equivalents (GAE) in milligrams per gram dry material.

Determination of total antioxidant capacity

The total antioxidant capacity of the food stuffs was evaluated by phosphomolybdenum method [19]. To 2 mL of the extract, added 1 mL of reagent solution (0.6 M sulfuric acid, 28 mM sodium phosphate and 4mM ammonium molybdate). The tubes were capped and incubated in a boiling water bath at 50°C for 90 min. After the samples cooled to room temperature, the absorbance of each solution was measured at 695 nm against reagent blank using spectrophotometer. The results were expressed as ascorbic acid equivalent (AAE) in milligrams per gram dry material.

RESULTS AND DISCUSSION

A total of forty locally consumed food stuffs (vegetables, fruits, seeds, berries, cereals, herbs and tree materials) in Moodbidri, Karnataka, India were examined for their total phenolic content and total antioxidant activity. The results are presented in the Table 1. Each value is the mean value of triplicate analysis.

In analyzed food stuffs, total phenolic content ranged from 0.38mg GAE/g to 18.40mg GAE/g of dry weight of the sample. The total antioxidant activity of analyzed samples varied from 2.75 mg AAE/g to 48.94 mg AAE/g of dry weight of the sample. The high total phenolic content of curry leaves (18.40mg GAE/g) contributed to its high antioxidant activity (48.94 mg AAE/g). However, it is found that high total phenolic content do not always contribute to antioxidant activity (**Fig. 1**). Even though some of the food stuffs showed high total phenolic content, they showed moderate antioxidant activity.

The other food stuffs which showed elevated total phenolic content are: Clove (11.78 mg GAE/g), Spinach (5.84 mg GAE/g), Water apple white (5.69 mg GAE/g) and Chilli (4.93 mg GAE/g). The total antioxidant activity of Sesame seeds is found to be 42.02 mg AAE/g where as that of white pea is 41.67 mg AAE/g and red chilli is 40.28 mg AAE/g.

Table 1

S.No.	Local Name	Botanical Name	Total phenolic content (mg GAE/g)	Total Antioxidant activity (mg AAE/g)
1	Cumin seed	*Cuminum cyminum*	3.96 ± 0.24	25.28 ± 2.12
2	Fenugreek seed	*Trigonella foenum-graecum*	1.33 ± 0.11	6.92 ± 0.59
3	Coriander seeds	*Coriandrum sativum*	3.73 ± 0.23	16.66 ± 1.21
4	Tomato	*Solanum lycopersicum*	4.71 ± 0.32	8.88 ± 0.73
5	Poppy seeds	*Papaver somniferum*	0.56 ± 0.06	33.16 ± 2.12
6	Sesame seeds	*Sesamum indicum*	1.67 ± 0.14	42.02 ± 3.40
7	Banana	*Musa paradisiaca*	3.63 ± 0.21	5.34 ± 0.47
8	Garlic	*Allium sativum*	0.95 ± 0.08	6.34 ± 0.39
9	Cashew nut	*Anacardium occidentale*	0.94 ± 0.06	29.53 ± 2.07
10	Clove	*Syzygium aromaticum*	11.78 ± 1.05	12.20 ± 1.02
11	Jackfruit*(seed)*	*Artocarpus heterophyllus*	1.26 ± 0.12	9.84 ± 0.85
12	Cardamom	*Elettaria cardamomum*	2.10 ± 0.18	11.19 ± 0.98
13	Potato	*Solanum tuberosum*	1.52 ± 0.13	7.61 ± 0.57
14	Chick pea	*Cicer arietinum*	0.80 ± 0.06	9.62 ± 0.82
15	Masoor Dal	*Lens Culinaris*	2.08 ± 0.17	7.19 ± 0.34
16	Black gram	*Vigna mungo*	3.42 ± 0.23	9.32 ± 0.79
17	Bogade	*Bogade*	1.94 ± 0.15	19.61 ± 1.12
18	White pea	*Pisum sativum*	0.53 ± 0.04	41.67 ± 2.73
19	Black eyed pea	*Vigna unguiculata*	0.65 ± 0.05	7.88 ± 0.68
20	Ridge gourd	*Luffa. aegyptiaca*	2.65 ± 0.19	15.05 ± 1.03
21	Ivy gourd	*Coccinia grandis*	3.53 ± 0.24	8.75 ± 0.87
22	Beetroot	*Beta vulgaris*	2.21 ± 0.26	16.24 ± 1.23
23	Onion	*Allium cepa*	3.07 ± 0.19	24.93 ± 1.98
24	Flax seed	*Linum usitatissimum*	1.57 ± 0.09	31.57 ± 2.42
25	Green gram	*Vigna radiata*	0.84 ± 0.04	9.10 ± 0.69
26	Cabbage	*Brassica oleracea*	1.70 ± 012	15.77 ± 1.14
27	Horse gram	*Macrotyloma uniflorum*	0.75 ± 0.04	14.39 ± 1.05
28	Red chilli	*Capsicum annuum*	2.87 ± 0.12	40.28 ± 2.18
29	Wheat	*Triticum aestivum*	1.70 ± 0.08	21.58 ± 1.78
30	Mustard seed	*Brassica nigra*	2.11 ± 0.15	10.20 ± 0.91
31	Black pepper	*Piper nigrum*	1.76 ± 0.12	10.84 ± 0.82
32	Water apple white	*Syzygium aqueum*	5.69 ± 0.34	8.70 ± 0.42
33	Water apple red	*Syzygium samarangense*	4.02 ± 0.18	11.04 ± 0.85
34	Green pea	*Pisum sativum*	0.38 ± 0.02	27.86 ± 1.69
35	Pigeon pea	*Cajanus cajan*	0.65 ± 0.03	5.65 ± 0.26
36	Lablab	*Lablab purpureus*	0.44 ± 0.02	8.85 ± 0.53
37	Chilli	*Capsicum frutescens*	4.93 ± 0.29	24.26 ± 1.49
38	Curry leaves	*Murraya koenigii*	18.40 ± 1.23	48.94 ± 2.45
39	Spinach	*Spinacia oleracea*	5.84 ± 0.42	30.49 ± 2.26
40	Bilimbi	*Averrhoa bilimbi*	2.19 ± 0.16	2.75 ± 0.11

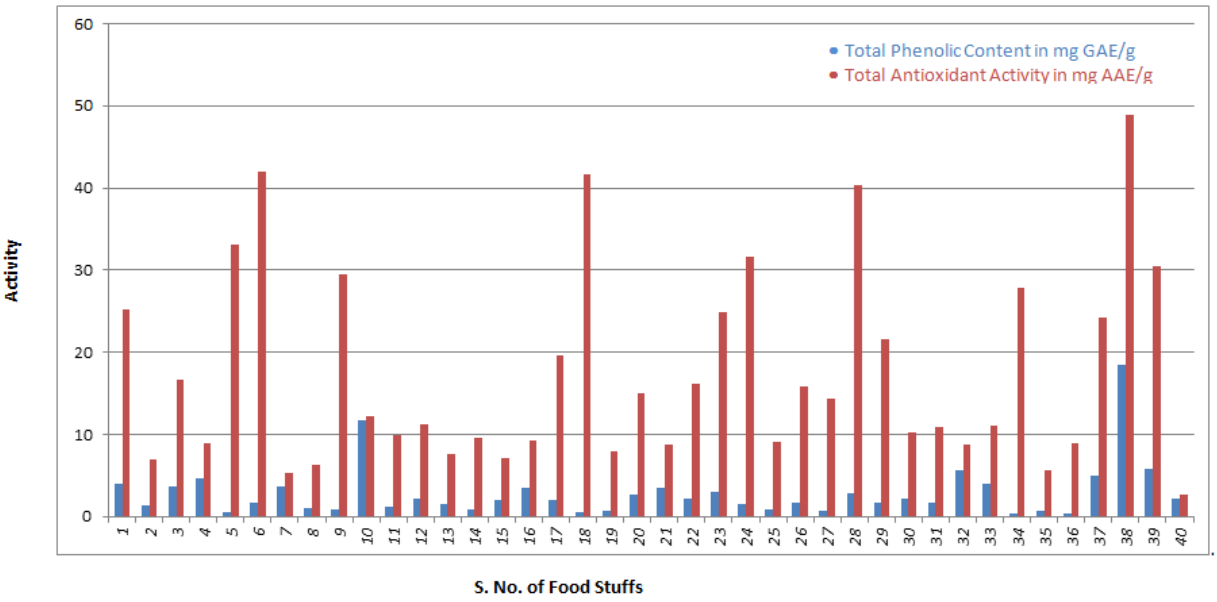

Figure 1: Correlation between total phenolic content and total antioxidant activity of analyzed samples

CONCLUSION

The present study revealed the total phenolic content and total antioxidant activity of locally consumed food stuffs in Moodbidri, Karnataka, India. The high contents of phenolic compounds indicated that these compounds contribute to the antioxidant activity. The Curry leaves can be regarded as promising plant species for natural plant sources of antioxidants.

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