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Anti oxidant composition of indigenous plants grown in western region Rajasthan

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Anti oxidant content of food is one of the key components which help in maintaining the healthy living. Keeping this thing in view, the present study had been conducted on forty one indigenous plants to know their antioxidant potential. Part of the plant utilized by the tribal community were analysed for its vitamins content (*i.e.* vitamin-C and β-carotene), non- nutrient component (*i.e.* oxalic acid and tannin) and total per cent of antioxidant inhibition activity by using DPPH. The present study concluded that the indigenous plants consumed in tribal areas are rich in antioxidant content and can be used in daily diet. Hence these indigenous plants may be recommended to achieve healthy living.

Key Words : Tribal, Underutilized plants, Nutrient, Food security

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INTRODUCTION

In present scenario, conventional crops are not enough to feed the world's growing population. Besides this, cultivation of such crops requires lots of resources as well as inorganic fertilizers. Hence, it is demand of current time to look at indigenous crops those grow in stress condition with no/minimal use of inorganic fertilizers.

Non-communicable diseases are multistage process that involves a series of events comprising of genetic and epigenetic changes leading to the initiation, promotion and progression of such diseases. Prevention from these diseases involves use of nontoxic natural compounds, synthetic chemicals or their combinations. Increased consumption of plant-based food, has emerged as a most promising and potentially cost-effective approach to reducing the risk of cancer (George *et al.,* 2017). These beneficial effects have been partly attributed to the compounds which possess antioxidant activity. These antioxidants scavenge radicals and inhibit the chain initiation or break the chain propagation (the second defense line).Vitamin E, carotenoids, vitamin C etc. contribute to the first defense line against oxidative stress, because they quench singlet oxygen (Krinsky, 2001).

Indigenous plant foods help to provide a steady supply of fruits and vegetables during the dry season when cultivated plants are scarce and expensive for low-income earners that traditionally have large family. Some of these indigenous plants have higher nutritional values compared with cultivated fruits and vegetables (Eromosele *et al.*, 1991 and Barminas *et al.*, 1998). The indigenous plants play an important role in many food systems, either through direct and indirect provision for human nutrition, particularly in developing countries (Vinceti *et al.*, 2008; Sunderland, 2011 and Bhati and Jain, 2015). Especially indigenous plants are mostly consumed locally or traded

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in local/regional markets (Akinnifesi *et al*., 2006). Indigenous edible plants contribute significantly to the nutritional security of mankind across the globe. However, detailed analyses of health promoting bioactive compounds and antioxidants are lacking. Hence, the present study was conducted to analyse the antioxidant content of forty one indigenous plants.

METHODOLOGY

In present study all samples were collected from five tribal blocks *i.e.* Jhdol, Kotra, Kherwada, Sarada and Salumber of Udaipur district of Rajasthan India. On the basis of consumption by the local population residing in the study area, a total of 41 indigenous plants were selected for the study as per the feasibility of availability of samples. The edible part of the plant was analysed for further study.

All the samples were washed thoroughly in running tap water to remove dust and dirt etc. and tender part of stems and leaves were collected for study purpose. Each sample was divided into two portions, one fresh sample was stored till final analysis in seal poly begs at – 18 ± 5^0C for analysis where as another sample was dried at 45 ± 5^0C in hot air oven. They were ground to fine powder in a sieve through 1.0 mm mesh and stored in airtight container for analysis.

All selected samples were analysed for moisture content suggested by AOAC (2009). The tannin content was estimated by the titerametric method by AOAC (2009). The oxalic acid content was analysed by the standard method of NIN (2003). Ascorbic acid was analysed by method suggested by the Association of vitamin chemist (1966) and β carotene content in the samples was estimated by using HPLC (Chiosa *et al.*, 2005). The per cent free radical scavenging activity was measured by using 2, 2-diphenyl-1-picryl-hydrazyl (DPPH) by the modified method suggested by McCune and Johns (2002).

Beta-carotene extraction from sample:

In order to avoid possible degradation, the samples were extracted directly with solvent without saponification. Five grams of samples of selected indigenous plants were extracted with acetone: hexane (4:6). After the extraction, the solvent was evaporated to dryness under a stream of nitrogen and the residue was reconstituted with 1 ml of eluent solution and was collected in a screw-cap vial for HPLC analysis Chiosa *et al.* (2005). All used chemicals were of analytical or HPLC grade. Ultra-pure water generated by the Milli-Q system was used. All standards compounds were purchased from Sigma. All used chemicals were of analytical or HPLC grade.

Sample extraction for per cent free radical scavenging activity:

Ten g of dried powder was taken with 100 ml of methanol in a conical flask, plugged with cotton wool and then kept on a rotary shaker at 120 rpm for 24 h. After 24 h, the extract was filtered with eight layers of muslin cloth; centrifuged at 5000 rpm for 10 min. Supernatant was collected and the solvent was evaporated and the dry extract was stored at 4ºC in air tight bottles (Parekh and Chanda, 2007). The reaction mixture consisting of DPPH in methanol (0.3 mM, 1 ml) 1 ml methanol and solvent extracts (1000µg/ml) was incubated for 30 min in dark, after which the absorbance was measured at 517 nm. Ascorbic acid was used as positive control.

Statistical analysis:

All analyses were performed in triplicate (n = 3), and the data was presented as means and standard deviation.

OBSERVATIONS AND ASSESSMENT

Results of all analysed plants are presented under Table 1. Wide variation was observed among all the analysed plants.

Moisture content:

Wide variation was observed in moisture content among all the analysed plants. Maximum moisture content was noted in *Euphorbia royleana* leaves (93.53 ±0.64 %). *Averrhoea carambola, Cissus quandrangula* and *Dendrocalamus strictus* had almost similar moisture content *i.e.* 91.96 %, 91.87 % and 91.54 %, respectively. Lowest moisture content was recorded in *Holoptelea integrifolia* and *Tribulus terrestris* (Table 1).

-carotene:

The β-carotene content among analysed plants are present under the Table 1. Wide variation was observed in β-carotene content i.e. from 6300.74 µg (*Cassia tora* leaves) to nil (*Feronia limonia* and *Holoptelea*

Table 1 : Different parameters analysed among indigenous plants

Sr. No.	Botanical Name	Local name	Part analysed	Moisture (%)	*Vitamins		Non- Nutrient Factors		Per cent inhibition (DPPH)
					β-Carotene (µg)	Vitamin-C (mg)	*Oxalic acid (mg/100g)	Tannin (g/100g)	
1.	*Acacia nilotica*	Babul Fali	Immature pods	62.43± 0.12	23.80±0.36	27.04 ±2.41	255.00 ± 2.60	28.00 ± 0.50	79.26 ± 0.65
2.	*Aloe barbadensis*	Sinduri	Inflorescence	89.52± 0.63	182.43±0.46	63.21 ±1.02	97.50 ± 2.60	6.93 ± 0.00	68.29 ± 1.08
3.	*Amorphophallus paeoniifolius*	Suran	Root	75.78± 0.87	83.10 ±0.11	Nil	84.00 ±2.60	7.79 ±0.00	72.52 ± 0.31
4.	*Asphodelus tenuifolius*	Piyagi	Leaves	89.21±0.17	849.38 ±1.58	67.84±2.23	172.50 ± 2.60	8.08 ± 0.50	83.21 ± 0.67
5.	*Averrhoea carambola*	Kamrakh	Immature fruit	91.96 ± 0.64	240.38 ±1.11	45.37 ±1.11	85.50 ± 0.00	10.39 ± 2.29	73.99 ± 1.78
6.	*Bombax ceiba*	Samble Dodi	Inflorescence	75.90 ± 0.37	20.38 ±1.13	22.28±0.70	93.00 ± 2.60	6.93 ± 0.00	67.75 ±1.37
7.	*Carissa congesta*	Jangli Karonda	Immature fruit	81.58 ± 0.33	12.98±0.12	105.93 ±0.93	7.50 ± 2.60	4.62 ± 0.50	81.46 ± 0.63
8.	*Cassia tora*	Puariya	Leaves	84.92 ± 0.05	6300.74 ± 1.54	38.33±0.19	31.50 ±0.00	9.24 ± 0.50	85.20 ± 1.08
9.	*Centella asiatica*	Brahami Buti	Leaves	85.71 ±0.31	2890.75 ± 1.57	69.38±0.39	75.00 ± 2.60	6.64 ± 0.50	85.74 ± 1.35
10.	*Cicer arietinum*	Liliya	Leaves	77.08 ± 0.12	590.17 ±1.02	67.84±2.95	117.00 ± 4.50	8.08 ± 0.50	87.89 ± 0.44
11.	*Cissus quandrangula*	Hadjood	Stalk	91.87 ± 0.03	622.61 ±1.48	62.53 ±1.95	213.00 ± 2.60	7.79 ± 0.00	84.91 ±0.29
12.	*Citrus medica*	Bijura	Fruit	89.13 ± 0.40	18.33 ±0.06	123.01±0.61	123.00 ±2.60	8.37 ± 0.50	86.95 ±1.04
13.	*Cordia dichotoma*	Gunda ka More	Inflorescence	78.48 ± 1.35	661.21 ±1.80	43.89 ±1.88	75.00 ± 2.60	7.79 ± 0.00	90.95 ± 1.14
14.	*Cordia gharef*	Gundi	Bares	55.29 ± 0.27	758.90±1.64	39.52±0.97	10.50 ± 2.60	9.82 ± 1.00	76.15 ±0.41
15.	*Crotalaria juncea*	San	Inflorescence	75.20 ± 0.75	503.77 ±0.52	5.56 ±1.85	10.50 ± 2.60	9.53 ± 0.00	72.85 ±1.61
16.	*Dendrocalamus strictus*	Bans/ Karel	Shots	91.54± 0.29	21.52 ±0.34	39.32 ±1.34	157.50± 0.00	6.64 ± 0.50	40.05 ±1.80
17.	*Dioscorea esculanta*	Aamchai	Root	81.09 ± 0.31	289.93 ±0.87	0.49 ± 0.11	114.00 ±6.87	6.93 ±0.00	69.75 ± 0.44
18.	*Dioscorea hispida*	Kanda	Root	82.28 ± 1.40	98.55 ±1.42	0.56 ±0.19	138.00 ±2.60	6.93 ±0.00	66.55 ± 0.07
19.	*Dioscorea petaphylla*	Suwari	Root	82.55 ±0.76	41.13 ±0.17	Nil	145.50 ±2.60	7.51 ±0.50	74.76 ± 0.29
20.	*Dioscorea* sp.	Alitha	Bulbil	72.08 ±0.90	57.33±1.45	0.43 ±0.21	223.50 ± 2.60	3.75 ± 0.50	46.60 ± 0.92
21.	*Dioscorea* sp.	Alitha Kand	Root	84.68 ± 0.27	50.98±0.33	4.51 ±0.57	70.50 ±2.60	3.46 ±0.00	71.35 ± 0.12
22.	*Dioscorea* sp.	Amaliya Kand	Root	65.03 ± 0.71	72.34 ±0.59	2.78 ±0.96	24.00 ±2.60	6.35 ±0.50	66.36 ± 0.51
23.	*Dioscorea tomentosa*	Jangli Kanda	Root	75.99 ± 0.25	96.29±0.44	Nil	114.00 ±2.60	6.64 ±0.50	65.74 ± 0.18
24.	*Diospyros melanoxylon*	Timru	Fruit	62.57 ± 1.55	260.75 ±0.77	49.01±0.43	22.50 ± 0.00	7.51±0.50	82.03 ± 0.24
25.	*Euphorbia royleana*	Thour	Leaves	93.53 ±0.64	850.71 ±0.70	68.02 ±1.93	337.50 ± 0.00	8.08 ± 1.00	78.56 ± 1.46
26.	*Feronia limonia*	Kotambadi	Fruit	70.34 ± 0.87	Nil	9.38 ±1.50	264.00 ±2.60	7.79 ±0.87	67.54 ± 0.19
27.	*Ficus benghalensis*	Bad	Fruit	73.00 ± 1.39	26.04 ±0.15	47.47±1.02	10.50 ±2.60	2.31 ±0.50	77.61 ± 0.51
28.	*Ficus recemosa*	Gullar	Fruit	81.32 ± 1.58	17.52 ± 1.17	47.78 ± 0.85	16.50 ±2.60	11.26 ±0.87	70.71 ± 0.15
29	*Holoptelea integrifolia*	Bandar Batti	Seed	2.18 ± 0.05	Nil	Nil	15.00 ±2.60	6.93 ±0.00	58.20 ±0.40
30.	*Leptedenia reticulate*	Shani Dhodi	Immature fruit	88.44 ± 0.40	152.40 ±1.42	98.46 ±2.34	90.00 ± 0.00	8.95 ± 1.00	89.00 ± 1.21
31.	*Manilkara hexandra*	Rayna	Fruit	84.70 ± 0.35	560.72 ±0.70	12.53± 0.77	22.50 ±0.00	7.51 ±0.50	81.19 ± 0.50
32.	*Marsilea minuta*	Jhalod Ri Bhaji	Leaves	70.14±1.32	491.59 ±1.54	33.70 ±2.36	10.50 ± 2.60	7.79 ± 0.00	81.37 ± 1.08
33.	*Medicago sativa*	Rajka	Leaves	72.66 ±0.97	680.35 ±1.49	58.83 ±1.13	244.50 ± 2.60	8.08 ± 1.00	85.45 ± 1.00
34.	*Melilotus indica*	Pili Sangi	Leaves	79.57 ±0.69	960.31 ±1.12	88.15 ±0.56	166.50 ± 0.00	8.37 ± 0.50	80.48 ±0.53
35.	*Nelumbo nucifera*	Kamal Kokari	Seeds	47.88±1.30	92.47 ± 1.10	47.84 ± 0.75	6.00 ±2.60	7.79 ±0.87	76.16 ± 0.41
36.	*Phoenix sylvestris*	Khazoor	Root	82.79 ± 0.07	472.53 ±0.82	4.02 ±0.54	9.00 ± 0.00	2.60 ± 0.00	69.49 ± 0.69
37.	*Pithecellobium dulce*	Jangal Jalebi	Mature Pods	82.93±1.34	19.20 ±0.14	95.58±0.95	12.00 ± 2.60	7.51 ± 0.50	68.12 ± 2.12
38.	*Polygonum glabrum*	Pani vala	Leaves	84.86 ± 0.83	849.71 ±0.59	40.43 ±2.47	91.50 ± 2.60	9.53 ± 0.00	96.07 ±0.37
39.	*Portulaca oleracea*	Lunakiya	Leaves	90.94 ± 0.26	940.64 ±0.65	61.91 ±1.50	601.50 ± 2.60	7.51 ± 0.50	90.18 ± 1.02
40.	*Pueraria tuberose*	Modi	Roots	80.46 ± 0.03	23.98 ±0.07	0.86 ±0.28	112.50 ±0.00	7.22 ±0.50	78.54 ± 0.77
41.	*Tribulus terrestris*	Gokhru	Dry Fruits	8.52 ± 0.36	16.41 ±1.15	1.73 ±0.39	246.00 ± 2.60	5.48 ± 0.50	73.31 ± 1.80

* On fresh weight basis ± Standard deviation

integrifolia). The variation is due to the difference in the part of plant used for analyses. In general the β-carotene content is more in leaves as compare to any other part of the plant.

Sauvaget *et al.* (2003) found that the consumption of green and yellow vegetables and fruits reduces different types of cancer. Green and yellow vegetables are good sources of the carotenoidβ-cryptoxanthin which has been proposed to have protective effects, particularly against lung cancer (Yuan *et al.*, 2003).

Vitamin C:

Maximum vitamin C content was observed in *Citrus medica*, followed by *Carissa congesta, Leptedenia reticulate* and *Pithecellobium dulce* (Table 1). The cause of reported variations in vitamin C content might be related to the differences in genotype (Vallejo *et al.*, 2002). Climatic conditions also might alter vitamin C level (Howard *et al.*, 1999).

Biological function of vitamin C can be defined as an enzyme cofactor, a radical scavenger, and as a donor/ acceptor in electron transport at the plasma membrane. Vitamin C is able to scavenge the superoxide and hydroxyl radicals, as well as regenerate α-tocopherol (Davey *et al.*, 2000).

Oxalic acid:

Wide variation was observed in oxalic acid content among all the analysed plats. Oxalic acid content was ranging between 6.00 mg/100g (*Nelumbo nucifera*) to 601.50 mg/100g (*Portulaca oleracea*). The anti nutritional factors interfere with metabolic process so that growth and bioavailability of nutrients are negatively influenced (Binita and Khetarpaul, 1997). Oxalate for instance binds to calcium to form complexes (calcium oxalate crystals). These oxalate crystals formed prevents the absorption and utilization of calcium by the body causing diseases such as rickets and osteomalacia (Ladeji *et al.*, 2004). The calcium crystal may also precipitate around the renal tubules thereby causing renal stones. The formation of oxalate crystal is said to take place in the digestive tract (Thompson and Yoon, 1984).

Tannin:

Tannin is one of the important polyphenol content and bears an antioxidant activity. Hence, it is analysed among all the selected plants. The highest tannin content was found in *Acacia nilotica* pods and minimum in *Ficus benghalensis* fruits (Table 1).

Per cent free radical scavenging activity:

The highest per cent of free radical scavenging activity was observed in leaves of *Polygonum glabrum* (96.07 %), followed by *Cordia dichotoma* (90.95 %), *Portulaca oleracea* (90.18 %), *Leptedenia reticulate* (89.00 %) and *Cicer arietinum* (87.89 %). A free radical is any atom or molecule that has one or more unpaired electrons and is therefore highly reactive, seeking to acquire electrons from other substances. Free radicals are normally scavenged from tissues by the various antioxidants present in food. The amount of free radical scavenged by a particular food is expressed in terms of per cent free radical scavenging activity of that particular food. Hence all the selected samples were analysed for free radical scavenging activity by using DPPH.

Conclusion:

The indigenous plants are locally available, easy to access, affordable and potentially more acceptable especially to the local communities. Such plants may help to meet the high nutrient needs of women and children whose diets are founded predominantly based on cereals and legumes. Still more researches are required to find out the bioavailability of nutrients and various other aspects such as stage of harvesting, growing conditions, method of utilization etc. to know optimum use of antioxidants.

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