Int.J.Curr.Microbiol.App.Sci (2019) Special Issue-8: 73-80

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Special Issue-8 pp. 73-80**
Journal homepage: http://www.ijcmas.com

Original Research Article

Nutrient Potential of Selected Indigenous Vegetables Grown in Udaipur, Rajasthan, India

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A B S T R A C T

Tribal consume various indigenous vegetables since ages in their diet. The present study was undertaken with the objective to assess the nutrient potential of selected indigenous vegetables grown in Udaipur region. Survey was conducted in five *tehsils* viz., Jhadol, Kotada, Kherwada, Sarada and Salumber of Udaipur. A list of 79- green leafy vegetables, 48- other vegetables and 32- roots and tubers were prepared. Among these 12 – green leafy vegetables, 11- other vegetables and 8 roots and tubers were selected and analysed for proximate and DPPH free radical scavenging activity. Wide variation was observed for proximate composition among all the three groups i.e. green leafy vegetables, other vegetables and roots and tubers. Anti oxidant activity in green leafy vegetables, other vegetables and roots and tuber varied between 96.07 to 78.56 per cent, 89.00 to 40.05 per cent and 78.54 to 65.74 per cent as per DPPH scavenging activity were noted respectively. The study concluded that the indigenous vegetables consumed in tribal areas are rich source of various nutrients and can be used in daily diet. Hence these indigenous vegetable can be recommended to achieve food and nutritional security.

Keywords

Tribal, Indigenous plants, Fruits and Vegetable, Food and Nutrition security

Introduction

In more general terms, sustainability is the endurance of systems and processes. The organizing principle for sustainability is sustainable development, which includes the four interconnected domains: ecology, economics, politics and culture. Indigenous vegetables are considered as "minor foods" because they are less important than conventional vegetables in terms of global production and market value. These foods are often known by various names such as neglected, tribal, uncultivated or wild, etc. However, from the standpoint of the rural poor who depend on many of these species for their food and economic security, they are hardly minor.

Tribal lives as part of nature and they exploited nature to meet their food/nutritional demands. Tribal instantly collect vegetables from the surrounding at the time of weeding at agriculture farm or grazing their cattle in forest and consume it in either or in cooked form. Analysis of such indigenous fruits and vegetables consumed by the tribal provide an important tool for assessing actual nutrient contribution of these indigenous fruits and vegetables. The

present study was therefore undertaken to find out the proximate composition and DPPH scavenging activity among thirty one indigenous vegetables consumed by the tribal population Udaipur District, Rajasthan.

Materials and Methods

The field survey was conducted in the five tribal blocks i.e. Jhdol, Kotra, Kherwada, Sarada and Salumber of Udaipur district of Rajasthan India. The main tribes of the area are Bheel, Meena, Garasia and Kathodi. In order to collect relevant information an open end proforma with group discussion were used. Total of 450 tribal people were contacted to gather required information. For an effective communication, the help of forest guards and *Van Mitra* were utilized. Plants were collected, photographed, identified and voucher specimens prepared for the herbarium. Ethnobotanical information about fruits and vegetables was gathered through personal observations and discussions with the villagers. On the basis of consumption by the local population residing in the study area, a total of thirty one vegetables were selected for the study as per the feasibility and availability of samples. All the selected samples were sub divided into four groups i.e. fruits, green leafy vegetables, other vegetables and roots and tubers.

Samples were washed thoroughly in running tap water to remove dust and dirt etc. and tender and edible part of were collected. Each sample was dried at 45 ± 5 ^{o}C 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 samples were analysed for the proximate principle- moisture, protein (N x 6.25), crude fat (ether extraction), ash and crude fiber (NIN, 2003). The carbohydrate, content was calculated by difference, i.e. 100, the sum of the per cent of ash, protein, fat and fiber. Energy value was calculated by multiplying the values obtained for carbohydrate, protein and fat, with 4, 4 and 9 respectively and adding up the values.

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).

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 analysed in triplicate (n = 3), and the data was presented as means standard error of deviation (± SEM)

Results and Discussions

The nutritional composition of indigenous Green leafy vegetables, other vegetables and roots and tubers are presented in Table 1 to Table 3 respectively.

Green leafy vegetables

Moisture content varies among all the analysed green leafy vegetables and ranged from 70.14 to 93.53 per cent for *Marsilea minuta* and *Euphorbia royleana* respectively. *Marsilea minuta* recorded lower moisture in the present study than Gopalan *et al.,* 2007. This might be due to effect of variation in climatic conditions. Highest protein was observed in *Melilotus indica* leaves (30.45 g/100g) followed by *Cicer arietinum, Cassia tora* and *Polygonum glabrum* on dry weight basis. Crude fat content ranged from 1.63 to 9.47 g/100g for *Tribulus terrestris* and *Euphorbia royleana* respectively. The maximum total mineral ash was in *Portulaca oleracea* leaves (26.37g/100g). Crude fiber was maximum in *Tribulus terrestris* followed by *Medicago sativa, Cordia dichotoma* and *Cicer arietinum*. Energy was found to be more in *Euphorbia royleana* and *Melilotus indica* contained comparatively low fat content but higher protein content. Proximate composition of all the analysed green leafy vegetables was comparable to the conventional green leafy vegetables (Gopalan *et al.,* 2007). Other workers also reported that wild leafy vegetables contained nutrient comparable to the conventional foods (Bhati and Jain 2015; Nazarudeen 2010; Gupta *et al.,* 2005).

Among all the green leafy vegetable *Marsilea minuta* was found to be highest protein content followed by *Cicer arietinum*, *Medicago sativa* and *Melilotus indica* in fresh form. Whereas ash and fiber content was recorded maximum for *Tribulus terrestris* (16.6g/100g) leaves.

The highest percent of free radical scavenging activity was observed in leaves of *Polygonum glabrum* (96.07 per cent), followed by *Tribulus terrestris* (91.36 ± 0.55), *Cordia dichotoma* leaves (90.95 ± 1.14) *Portulaca oleracea* (90.18 per cent) and *Cicer arietinum* (87.89 per cent). 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.

Other vegetables

Wide variation was observed in moisture content among all the analysed other vegetables and ranged between 62.43 to 91.96 per cent. The crude protein range of 27.24 g/100g for the *Dendrocalamus strictus* followed by *Phoenix sylvestris, Acacia nilotica, Leptedenia reticulate* and *Aloe barbadensis* (Table 2). This range of protein, however, is relatively higher than the common conventional other vegetables. The mineral ash ranged from 3.01 to 15.13 g/100g in *Dioscorea* Sp. and *Cissus quandrangula* respectively. The crude fat content in all the other vegetables varied between 2.07 g/100g in *Dioscorea* Sp. and 20.53 in *Carissa congesta.* The results showed the analysed indigenous other vegetables have comparable levels of nutrients to the conventional other vegetables.

Per cent free radical scavenging activity for other vegetable is present under table 2. Wide variation from 40.05 per cent to 89.00 per cent was observed in all the other vegetables. This may be due to genetic variation among the vegetables.

Roots and tubers

Proximate composition of indigenous root and tuber is presented in Table 3.

Table.1 Nutrient composition of indigenous green leafy vegetables (g/100g)

S. No.	Botanical Name	Moisture	Protein	Fat	Ash	Fiber	CHO	Energy (Kcal)	% inhibition
1	*Asphodelus tenuifolius*	89.21±0.17	20.24±0.34	3.67±0.12	10.1 ±0.1	12.3±0.16	53.7 ±0.37	328.74±0.85	83.21 ± 0.67
2	*Cassia tora*	84.92±0.05	29.38±1.18	5.67±0.06	11.69±0.81	9.52±0.16	43.71±0.78	343.66±3.05	85.20 ± 1.08
3	*Centella asiatica*	85.71±0.31	19.17±0.17	2.43±0.21	18.27±0.21	10.63±0.12	49.5 ±0.34	296.56±1.37	85.74 ± 1.35
4	*Cicer arietinum*	77.08±0.12	29.77±0.77	3.97±0.06	12.12±0.03	10.85±0.08	43.29±0.73	327.96 ±0.4	87.89 ± 0.44
5	*Cordia dichotoma*	78.48±1.35	22.47 ±0.0	2.5 ±0.0	13.39±0.09	10.86±0.2	50.78±0.26	315.51±1.04	90.95 ± 1.14
6	*Euphorbia royleana*	93.53±0.64	11.68±0.29	9.47±0.12	14.15±0.05	9.04±0.14	55.67 ±0.1	354.58±0.36	78.56 ± 1.46
7	*Marsilea minuta*	70.14±1.82	24.52±0.77	3.17±0.25	8.32 ±0.13	10.64±0.14	53.29±0.89	340.32±2.39	81.37 ± 1.08
8	*Medicago sativa*	72.66±0.97	24.23±0.58	2.5 ±0.0	11.59±0.05	14.58±0.13	47.11±0.63	307.84±0.35	85.45 ± 1.00
9	*Melilotus indica*	79.57±0.69	30.45±0.61	5.27±0.06	10.58±0.06	7.47±0.41	46.23±0.29	354.13±1.76	80.48 ±0.53
10	*Polygonum glabrum*	84.86±0.83	28.9±0.29	2.37±0.06	12.44±0.54	7.62±0.18	48.68±0.79	331.6 ±2.39	96.07 ±0.37
11	*Portulaca oleracea*	90.94±0.26	19.26±0.51	3.37±0.15	26.37±0.51	7.47±0.26	43.52±0.49	281.45±2.07	90.18 ± 1.02
12	*Tribulus terrestris*	82.16±0.36	20.92±0.45	1.63±0.21	16.55±0.33	16.6±0.25	44.24±0.63	275.92±1.65	91.36 ± 0.55

* on dry weight basis; * ± standard deviation

Table.2 Nutrient composition of indigenous other vegetables (g/100g)

S. No.	Botanical Name	Moisture	Protein	Fat	Ash	Fiber	CHO	Energy (Kcal)	% inhibition
1	*Acacia nilotica*	62.43±0.12	12.36±0.45	2.67±0.12	3.77 ±0.04	11.57±0.06	69.64±0.35	352.00±0.3	79.26 ± 0.65
2	*Aloe barbadensis*	89.52±0.63	11.97±0.51	13.33±0.42	6.2 ±0.09	9.42±0.35	59.08±0.76	404.2±1.66	68.29 ± 1.08
3	*Averrhoea carambola*	91.96±0.64	6.62±0.17	2.7 ±0.1	4.35 ±0.02	7.9±0.11	78.44±0.13	364.52±0.86	73.99 ± 1.78
4	*Bombax ceiba*	76.9 ±0.37	10.63±0.29	2.43 ±0.31	6.76 ±0.07	12.18±0.13	67.99±0.46	336.41±0.97	67.75 ±1.37
5	*Carissa congesta*	81.58±0.33	6.32±0.17	20.53±0.12	4.75 ±0.08	6.37±0.25	62.02±0.25	458.17±1.82	81.46 ± 0.63
6	*Cissus quandrangula*	91.87±0.03	9.15±0.45	3.63 ±0.12	15.13±0.28	11.8±0.28	60.28±0.44	310.41±0.6	84.91 ±0.29
7	*Crotalaria juncea*	75.2 ±0.75	24.13±0.45	2.61 ±0.1	7.08 ±0.07	19.77 ±0.3	46.41±0.64	305.69±0.86	72.86 ±1.61
8	*Dendrocalamus strictus*	91.54±0.29	27.24±0.17	5.1 ±0.1	12.08±0.15	11.47±0.17	44.11±0.57	331.3±0.99	40.05 ±1.80
9	*Dioscorea* Sp.	72.08 ±0.9	8.08 ±0.34	2.07±0.21	3.01±0.01	3.23 ±0.22	83.61±0.47	385.35±0.24	46.60 ± 0.92
10	*Leptedenia reticulata*	88.44 ±0.4	11.97 ±0.0	6.6 ±0.26	5.53±0.08	22.7 ±0.23	53.2 ±0.08	320.08±2.15	89.00 ± 1.21
11	*Phoenix sylvestris*	82.79±0.07	17.61±0.67	9.57 ±0.21	8.01±0.01	4.84 ±0.04	59.97±0.58	396.43±0.96	69.49 ± 0.69

* on dry weight basis
* ± standard deviation

Table.3 Nutrient composition of indigenous roots and tubers (g/100g)

S. No.	Botanical Name	Moisture	Protein	Fat	Ash	Fiber	CHO	Energy (Kcal)	% inhibition
1	*Amorphophallus paeoniifolius*	75.78±0.87	6.03 ±0.17	1.53 ±0.29	6.75 ±0.04	3.74±0.18	81.94 ±0.23	345.43±1.78	72.52 ± 0.31
2	*Dioscorea esculanta*	81.09±0.31	5.93 ±0.34	1.5 ±0.1	3.73 ±0.06	2.23±0.15	86.6 ±0.29	383.64±1.36	69.75 ± 0.44
3	*Dioscorea hispida*	82.28 ±1.4	7.39 ±0.17	1.53 ±0.15	3.35 ±0.06	3.66±0.15	84.07±0.16	379.64±0.66	66.55 ± 0.07
4	*Dioscorea petaphylla*	82.55±0.76	9.63 ±0.29	2.03 ±0.06	4.74 ±0.12	7.56±0.29	76.03±0.49	360.96±0.51	74.76 ± 0.29
5	*Dioscorea tomentosa*	75.99±0.25	9.05 ±0.51	1.97 ±0.06	3.64 ±0.01	2.17±0.11	83.17±0.41	386.57±0.45	65.74 ± 0.18
6	*Dioscorea* Sp.	84.68±0.27	6.52 ±0.17	1.97 ±0.06	4.25 ±0.1	3.51±0.12	83.76±0.13	378.82±1.17	71.35 ± 0.12
7	*Dioscorea* Sp.	65.03±0.71	8.27 ±0.34	1.13 ±0.06	3.88 ±0.02	1.93±0.09	84.79±0.31	354.65±0.9	66.36 ± 0.51
8	*Pueraria tuberose*	80.46±0.03	8.66 ±0.17	1.07 ±0.06	8.55 ±0.2	2.46 ±0.1	79.27±0.5	332.21±1.43	78.54 ± 0.77

* on dry weight basis
* ± standard deviation

The maximum moisture content was found in *Dioscorea* sp (Alitha Kand, 84.68 %) followed by *Dioscorea petaphylla* (82.55 per cent), *Dioscorea hispida* (82.28 per cent) and *Dioscorea esculanta* (81.0 9per cent). Protein content ranged from 5.93 g/100g (*Dioscorea esculanta*) to 9.63 g/100g (*Dioscorea petaphylla*).

Protein contents of all the analysed roots and tubers were found to be comparable with the conventional roots and tubers. Crude fat content was ranged from 1.07 to 20.3 g/100g. The maximum ash content was found in *Pueraria tuberosa* (8.55 g/100g) and minimum in *Dioscorea hispida* (3.35 g/100g) among the analysed roots and tubers. Total carbohydrate content ranged from 76.03 g/100g in *Dioscorea petaphylla* to 86.60 g/100g in *Dioscorea esculanta.* Crude fiber ranged from 1.93 g/100g to 7.56 g/100g in *Dioscorea* Sp. (Amaliya Kand) and *Dioscorea petaphylla* respectively. Energy content was minimum in *Pueraria tuberose* (332.21 Kcal/ 100g) and maximum in *Dioscorea esculanta* (383.64 Kcal/ 100g).

Highest per cent inhibion was observed in *Pueraria tuberose* followed by *Dioscorea petaphylla, Amorphophallus paeoniifolius* and *Dioscorea* Sp. I.

The results showed that analysed roots and tubers from contained almost similar amount of protein, crude fat and crude fiber to the conventional roots and tubers which are common in use. However the carbohydrate and energy was found to be lower than common roots and tubers.

Bhati and Acharya (2016) reviewed nutrient potential of indigenous fruits and vegetables and observed that indigenous foods are rich in nutrients and may play vital role in achieving food and nutrition security.

In conclusion, the result of present study indicates that indigenous vegetables are rich in various nutrients and thus should not be ignored. These vegetables may be used as alternative source of food and nutrition. This study will help propagate knowledge on these lesser known indigenous vegetables promote production and utilization as valuable component of a well balanced diet. Inspit of using invasive species, it is better to use such indigenous vegetables to achieve food and nutrition security especially in the areas where such vegetables are available. *Aravalli* hills possess a rich diversity of plants and rich mineral containing soil. But due to de-forestation, habitat destruction, introduction of exotic species, changes in climatic conditions etc., many plants which were common in the *Aravalli* hills have become rare and endangered. There is thus an urgent need to take a step in the conservation of these vegetables.

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