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NUTRITION POTENTIAL OF UNCULTIVATED FRUITS GROWN IN UDAIPUR DISTRICT OF RAJASTHAN

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ABSTRACT

Eleven un-common and uncultivated fruits consumed in tribal region of Udaipur district of Rajasthan selected and analysed for proximate composition, minerals, vitamins and free radical scavenging activity. The major findings of study are as follows: Protein, fat, ash, fibre, carbohydrate and energy were ranged from 2.04 to 21.79 g/100g, 1.40 to 43.33 g/100, 3.47 to 7.38 g/100g, 2.20 to 32.74 g/100g, 27.05 to 81.69 g/100g and 286.62 to 585.38Kcal/100g on dry weight basis respectively. Mineral content showed greater variations among all the analysed fruits. Calcium, magnesium, iron, zinc and copper were ranged from nil to 795.02 mg/100g, 61.70 to 75.65 mg/100g, 2.41 to 32.85 mg/100g, 1.28 to 13.46 mg/100g and nil to 5.53 mg/100g respectively on dry weight basis. Among vitamins beta carotene and vitamin C was ranged from nil to 768.90 μg/100g and nil to 123.01 mg/100g on fresh weight basis. Methenolic extract of all the analysed fruits possess anti oxidant activity. Antioxidant activity was ranged from 58.20 per cent to 86.96 percent.

INTRODUCTION

Most of uncultivated fruits are uncommon generally, referred as underutilized, neglected and "minor" as they get less importance than conventional fruits and agricultural commodities in terms of global production, market value and lack of awareness of their potential in general population (Eleazar and Cesoiv, 2012). Rural people traditionally harvest wide range of uncultivated fruits because of its taste, cultural uses, as food supplements or to tide over food shortages. In India, most of the rural people and tribal, especially the poor, consume uncultivated crops at least 50-80 days in a year. Earlier these were eaten more frequently (Deccan Development Society, 2002).

"Fruits" are important constituent in daily diet of normal and healthy subjects, which comes with vegetables under the food group system. In a report from the expert group of the Indian Council of Medical Research (ICMR, 2009) reported that, the dietary intake of normal and healthy Indians needs to take 500-600 gm/ day of fruits and vegetables to take care of oxidant damage and repair cellular and tissue defects. This requirement increases in case of pre-mature infants, alcoholics, smokers and the people expose to environmental pollution including carcinogens, individuals with chronic infection etc. The uncultivated fruits may play a vital role in meeting this increased dietary requirement and could assist in narrowing the gap between population growth and food deficiency currently escalating areas. Many of these uncultivated fruits may have the potential in contribution to food security at local and national level. Although the uncultivated fruits are very popular among the local people and play an important role in their nutrition, however there is very less information is available their nutrient potential. Thus in the present research attempt was made to find the nutritional potential of eleven uncultivated fruits grown in tribal region of Udaipur district.

MATERIALS AND METHODS

All the collected fruits samples were washed thoroughly in running tap water to remove dust and dirt etc. and tender part of stems and seeds and foreign material and edible portion were separated. Each sample was divided into two portions, one was fresh sample stored till final analysis in seal poly begs at - 18 $\pm$ 5°C for fresh analysis where as another part of sample was dried at 45 $\pm$ 5°C in hot air oven. They were ground to fine powder through 1.0mm mesh and stored in airtight container for analysis.

Proximate composition

All the selected fruits were analysed for the proximate principle- *i.e.* moisture, protein (N x 6.25), crude fat (ether extraction), ash and crude fibre (NIN, 2003). The carbohydrate, content was calculated by difference, *i.e.* 100, the sum of the per cent of ash, protein, fat and fibre (NIN, 2003). Energy value was calculated by multiplying the physiological values obtained for carbohydrate, protein and fat, with 4, 4 and 9 respectively and adding up the values (NIN, 2003).

Minerals

All samples were analysed for calcium, magnesium, iron, zinc and copper through Atomic Absorption Spectrophotometer method suggested by Bishnoi and Brar, 1988.

Vitamins

Ascorbic acid in samples was analysed by method suggested by the Association of Vitamin Chemit, 1966. â carotene content in the samples was estimated through the HPLC method suggested by Chiosa *et al.,* 2005. Sigma standards were used as â carotene standards.

Beta-carotene extraction from sample

In order to avoid possible degradation, the samples were extracted directly with solvent. Five grams of samples of selected fruits and vegetables 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 e*t al.,* 2005).

DPPH free radical scavenging activity

The free radical scavenging activity was measured by using 2, 2-diphenyl-1-picryl-hydrazyl (DPPH) by the modified method of McCune and Johns, 2002. 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 (Blois, 1958).

Antioxidant extraction from samples

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 4°C in air tight bottles. (Parekh and Chanda, 2007)

RESULTS AND DISCUSSION

Proximate composition

Wide variation was observed in almost all the parameters analysed fruits (Table 1).

Holoptelea integrifolia (2.18 $\pm$ 0.05 per cent) has recorded minimum moisture content whereas *Citrus medica* had maximum moisture (89.13 $\pm$ 0.40 per cent). *Holoptelea integrifolia* seed were consumed after drying of the fruit. Protein and crude fat was noted highest for *Holoptelea integrifolia* i.e. 21.79 $\pm$ 1.61 per cent and 43.33 $\pm$ 0.35 per cent respectively. Hence *Holoptelea integrifolia* has a great potential to be use as a source of protein and oil to meet the growing demand of general population. Proteins however are needful diet consumption of human beings. It is essential for growth and cell replacement. Ash content of *Nelumbo nucifera* (6.47 $\pm$ 0.13), *Tribulus terrestris* (6.38 $\pm$ 0.02) and *Ficus benghalensis* (6.06 $\pm$ 0.04) was almost similar (Table: 1). Wide variation was observed for crude fibre among all the analysed tribal fruits. *Ficus benghalensis* fruits contained highest crude fiber content (32.74 $\pm$ 0.38 mg/100g). This fruit could be incorporated in recipes to make fiber rich product especially for hypercholestrolemia, obesity and diabetic individuals. *Manilkara hexandra* fruits were found to contain highest total carbohydrate followed by *Diospyros melanoxylon, Citrus medica, Pithecellobium dulce* and *Ficus recemosa*. Energy was found to be abundant in *Holoptelea integrifolia* and least in *Ficus benghalensis*. This was due to presence of fat content in *Holoptelea integrifolia* and crude fibre content in *Ficus benghalensis*.

Mineral content

Mineral content of the analysed fruits (Table-2) varied with fruit type. Calcium was found to be highest in *Ficus benghalensis* (795.02 $\pm$ 0.88 mg/100g), Magnesium ranged from 61.70 mg/100g to 75.25 mg/100g in *Diospyros melanoxylon* and *Ficus benghalensis* respectively. *Nelumbo nucifera* had recorded maximum iron and zinc i.e. 32.85 $\pm$ 0.70 mg/100g and 13.46 $\pm$ 0.71 mg/100g respectively. *Holoptelea integrifolia* seeds were found to be rich in zinc content as compared to iron hence could be utilized as a zinc rich source. Copper was noted nil in *Manilkara hexandra* and highest for *Ficus benghalensis*. Climatic factors especially rainfall and temperature, genetic variation, soil and the kind of plant might influence the mineral composition (Crisosto and Costa, 2008)

Vitamins

Analysis of selected fruits for beta-carotene and vitamin C (Table: 3) marked variation among all the analyed uncultivated fruits were recorded. Beta carotene was found to be absent in *Feronia limonia* and *Holoptelea integrifolia* whereas *Cordia gharaf* contained maximum beta carotene i.e. 768.90 $\pm$ 1.64 μg/100g. Ascorbic acid was observed highest in *Citrus medica* (123.01 $\pm$ 0.61 mg/100g) and nil in *Holoptelea integrifolia*. Lim *et al* 2006, suggested that the significant increase in the biosynthesis of ascorbic acid are mainly due to the breakdown of starch into glucose. The biosynthesis and

Table 1: Proximate composition of uncultivated fruits grown in tribal region of Udaipur (per 100g of edible portion

S. No.	Botanical Name	Moisture	Protein	Fat	Ash	Fibre	CHO	Energy (Kcal)
1	Citrus medica	89.13 ± 0.40	9.15 ± 0.73	1.83 ± 0.35	5.17 ± 0.01	12.37 ± 0.37	71.49 ± 0.93	339.03 ± 1.38
2	Cordia gharaf	56.29 ± 0.27	8.17 ± 1.01	13.13 ± 0.15	4.62 ± 0.08	5.98 ± 0.25	68.09 ± 0.85	423.25 ± 1.13
3	Diospyros melanoxylon	62.57 ± 1.55	2.04 ± 0.29	1.90 ± 0.53	3.75 ± 0.06	11.28 ± 0.24	81.02 ± 0.88	349.36 ± 2.71
4	Feronia limonia	70.34 ± 0.87	8.76 ± 0.77	11.70 ± 0.10	5.20 ± 0.07	7.48 ± 0.11	66.87 ±0.89	407.80 ± 0.46
5	Ficus benghalensis	73.00 ± 1.39	4.86 ± 0.17	8.37 ± 0.25	6.06 ± 0.04	32.74 ± 0.38	47.97 ± 0.44	286.62 ± 2.06
6	Ficus recemosa	81.32 ± 1.58	4.57 ± 0.34	3.43 ± 0.49	7.38 ± 0.04	14.18 ± 0.06	70.44 ± 0.49	330.94 ± 2.54
7	Holoptelea integrifolia	2.18 ± 0.05	21.79 ± 1.61	43.33 ± 0.35	3.76 ± 0.04	4.06 ± 0.07	27.05 ± 1.54	585.38 ± 1.94
8	Pithecellobium dulce	84.70 ± 0.35	18.68 ± 0.51	1.40 ± 0.17	5.07 ± 0.11	3.93 ± 0.12	70.92 ± 0.39	371.00 ± 1.01
9	Manilkara hexandra	47.88±1.80	4.28 ±1.18	8.37 ± 0.12	3.47 ± 0.06	2.20 ± 0.09	81.69 ± 1.23	419.17 ± 0.45
10	Nelumbo nucifera	82.93±1.84	21.11 ± 0.17	3.10 ± 0.20	6.47 ± 0.13	3.94 ± 0.15	65.38 ± 0.24	373.87 ± 0.50
11	Tribulus terrestris	8.52 ± 0.36	14.98 ± 1.11	7.23 ± 0.32	6.38 ± 0.02	27.10 ± 0.23	44.30 ± 1.12	302.23 ± 2.62

* on dry weight basis; *Average of three replications; * ± standard deviation

Table 2: Per cent Mineral composition of fruits grown in tribal region of Udaipur (mg/100g of edible portion)

S. No.	Botanical Name	Calcium	Magnesium	Iron	Zinc	Copper
1	*Citrus medica*	176.43 ± 1.15	68.74 ± 0.93	2.64 ± 0.56	9.60 ± 1.20	1.80 ± 0.18
2	*Cordia gharaf*	15.85 ± 1.60	64.69 ± 0.21	6.76 ± 0.86	3.34 ± 0.33	1.13 ± 0.26
3	*Diospyros melanoxylon*	118.05 ± 1.08	61.70 ±1.53	3.40 ± 0.18	1.28 ± 0.18	0.20 ± 0.11
4	*Feronia limonia*	493.75 ± 1.14	71.73 ± 0.68	14.64 ± 0.38	2.65 ± 0.21	0.35 ± 0.20
5	*Ficus benghalensis*	795.02 ± 0.88	75.25 ± 0.79	6.06 ± 0.67	3.61 ± 0.34	5.53 ± 0.63
6	*Ficus recemosa*	217.77 ± 0.63	72.60 ± 0.98	6.70 ±0.95	2.48 ±0.26	0.58 ± 0.05
7	*Holoptelea integrifolia*	77.42 ± 0.32	71.07 ± 0.87	8.43 ± 0.56	11.09 ± 0.48	3.80 ± 0.21
8	*Pithecellobium dulce*	Nil	65.73 ± 0.97	13.73 ± 0.50	5.02 ± 0.75	0.73 ± 0.09
9	*Manilkara hexandra*	149.28 ± 0.65	67.93 ± 0.48	2.41 ± 0.27	2.20 ± 0.20	Nil
10	*Nelumbo nucifera*	68.69 ± 0.91	72.38 ± 1.12	32.85 ± 0.70	13.46 ± 0.71	2.13 ± 0.10
11	*Tribulus Terrestris*	65.85 ± 1.60	75.65 ± 0.74	6.98 ± 1.38	6.73± 0.18	1.06 ± 0.21

* on dry weight basis; *Average of three replications;* ± standard deviation

Table 3: Vitamin content of fruits grown in tribal region of Udaipur (per 100g of edible portion)

S. No.	Botanical Name	â-Carotene (μg/100)	Vitamin-C (mg/100)	Antioxidant (Per cent inhibition)
1	*Citrus medica*	18.33 ± 0.06	123.01 ± 0.61	86.96 ± 1.04
2	*Cordia gharaf*	768.90 ± 1.64	39.52 ± 0.97	76.16 ± 0.41
3	*Diospyros melanoxylon*	260.75 ± 0.77	49.01 ± 0.43	82.03 ± 0.24
4	*Feronia limonia*	Nil	9.38 ± 1.50	67.54 ± 0.19
5	*Ficus benghalensis*	26.04 ± 0.15	47.47 ± 1.02	77.61 ± 0.51
6	*Ficus recemosa*	17.52 ± 1.17	47.78 ± 0.85	70.71 ± 0.15
7	*Holoptelea integrifolia*	Nil	Nil	58.2 ± 0.4
8	*Pithecellobium dulce*	19.20 ± 0.14	95.68 ± 0.95	68.12 ±2.12
9	*Manilkara hexandra*	560.72 ± 0.70	12.53 ± 0.77	81.19 ± 0.5
10	*Nelumbo nucifera*	92.47 ± 1.10	47.84 ± 0.75	76.16 ± 0.41
11	*Tribulus Terrestris*	16.41 ± 1.15	1.73 ± 0.39	73.31 ±1.8

* Vitamins on fresh weight basis and antioxidant on dry weight basis; *Average of three replications; * ± standard deviation

metabolism of carotenoids in plants can significantly affect by the differences in growing environment, such as temperature, nutrient availability, soil, intensity of sunlight and stage of harvesting (Mukhim *et al.*, 2015; Cazzonelli and Pogson, 2010)

Free radical scavenging activity by DPPH

The free radical scavenging activity of all the analysed fruits is present in table 3 and shown in figure 1. The highest DPPH inhibition observed in *Citrus medica* (86.96 per cent) followed by *Diospyros melanoxylon* (82.03 per cent) and *Manilkara hexandra* (81.19 per cent). Minimum DPPH inhibition was found in *Holoptelea integrifolia* followed by *Feronia limonia*, *Pithecellobium dulce* and *Ficus recemosa*. The variation may be attributed to the genotype and other environmental factors such as geographic location, soil type, soil nutritional status, temperature, precipitation, and sunlight, can also influence the phyto-nutrient concentrations of crops (Lumpkin, 2005).

Study conducted by Pal *et al*. (2013) on underutilized horticultural crops and found that underutilized fruits and vegetables are valuable source of natural antioxidant, which can be applied in both healthy medicine and food industry. Fruit contain significant amounts of bioactive compounds, which provide a wide range of health benefits beyond basic nutrition (Padulosi, 2013). The benefits are often associated with antioxidant phytochemicals, such as phenolics and carotenoids (Liu, 2003).

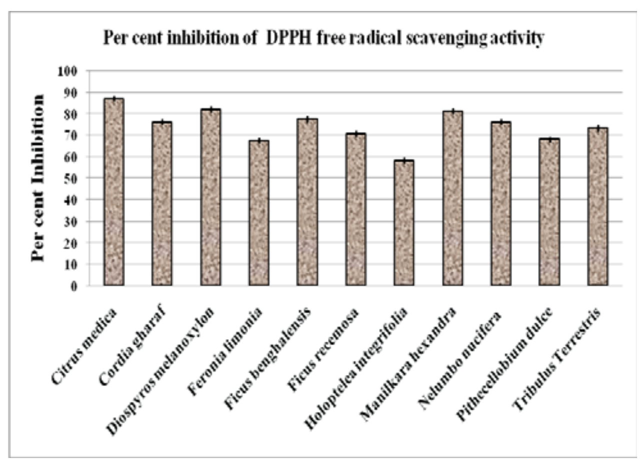

Figure 2: Graph of per cent inhibition of DPPH against antioxidant present in the methenolic extract of the uncultivated fruits

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