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Evaluation of Nutritive, Antioxidant and Mineral Composition in Wild Edible Rhizomes of *Pouzolzia hirta* Linn.

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ABSTRACT

The minerals, antioxidants and nutrients composition of *Pouzolzia hirta* rhizomes were determined. The aim of this study is search of new source of nutrients. The rhizomes of *Pouzolzia hirta* (Urticaceae) were collected from Pithoragarh District, Uttaranchal, India and authentic identification was done at B.S.I. Dehradun. The fine rhizomes powder so obtained was used for further nutrients, antioxidants and minerals analysis. The plant rhizomes contain β -carotene, vitamin C, phenolics and tannins (22.77, 108.40, 230.59 and 1663.84 mg 100 g⁻¹), respectively. The rhizomes have been found rich in nutrients such as crude protein, carbohydrate and crude fiber (4.24, 36.52 and 12.35 g 100 g⁻¹), respectively. The rhizomes of the plant have also been found rich in minerals such as Na, K, Ca, S, P, Fe, Mn, Cu and Zn (157.69, 4106.36, 178.42, 464.06, 216.32, 83.04, 8.49, 3.61 and 16.68 mg 100 g⁻¹), respectively. The plants rhizomes powder mixed with wheat and maize flours are used traditionally to make chapatti. In this investigation the plant rhizomes are found as good alternative source of foods.

Key words: Antioxidant, biochemical, aminoacide, *Pouzolzia hirta*, wild edible rhizomes

INTRODUCTION

Nutrition is most important basic need being a major determination of health, labour productivity and mental development but in the most developing countries of the World, hunger and malnutrition are increasing due to population explosion, shortage of fertile land and high food prices. The powder of the plant rhizomes has been used as binder to flour of maize and wheat by the local population of Uttaranchal. The tuberous roots of plants are eaten raw or roasted. The rhizomes of plants are eaten as a vegetable to expel worms (Ambasta, 1994). The rhizomes of plants have been reported to possess good antihelmintic activity (Ong and Nordiana, 1999).

This is the first work of analysis of nutraceutical antioxidants and minerals in *P. hirta* Linn. rhizomes.

MATERIALS AND METHODS

The rhizomes of *Pouzolzia hirta* (Urticaceae) were collected from Pithoragarh District, Uttaranchal, India and authentic identification was done at B.S.I. Dehradun and the deposition No. of the plants is 112173. The rhizomes were dried in shade after collection. The moisture content was estimated by drying in electrical oven at 80°C for 24 h and expressed on a percentage basis. The dry rhizomes were powdered separately in electric mill to 60 mesh size. The fine rhizomes powder so obtained was used for further nutrients, antioxidants and minerals analysis. The

carotenoids in plant sample were extracted, as described by Thimmaiah (1999) and Ranganna (1976) method. Total phenolic content was estimated by method (Singleton *et al.*, 1999) with modification. Dry leaves powder (0.5 g) was extracted with 10 time volume of 80% ethanol. The homogenate was centrifuged at 10,000 rpm for 20 min and the supernatant collected. The residue was extracted three times with 80% ethanol, centrifuged and supernatant was collected. The supernatant was evaporated to dryness. The residue was dissolved in 5 mL double distilled water and 1.0 mL aliquots were added to 0.5 mL Folin-Ciocalteu reagent, followed by addition of 2.0 mL of 20% sodium carbonate solution and the absorbance measured at 650 nm. Tannins content was estimated as described by method (Schanderi, 1970). Ascorbic acid content was estimated by method (Ranganna, 1976) with modification. Dry leaves powder (2.0 g) was extracted with 4% oxalic acid and made up to 100 mL and centrifuged at 10,000 rpm for a 10 min 5 mL supernatant liquid was transferred in a conical flask, followed by addition of 10 mL 4% oxalic acid and titrated against standard dye solution (2.6 dichlorophenol indophenol) to a pink end point. The procedure was repeated with a blank solution omitting the sample.

Total carbohydrate content in plant leaves was estimated by the Phenol Sulphuric method (DuBois *et al.*, 1956), Starch by method (Hodge and Hofreiter, 1962). Total nitrogen was estimated by Micro-Kjeldahl method, according to AOAC (1985a) method. Crude protein was calculated as Kjeldahl $\times 6.25$ (based on assumption that nitrogen constitutes 16.0% of a protein). The content of crude fat was estimated by AOAC (1970) method. Ash content was estimated by AOAC (1985b) method and ash insoluble content was estimated by method (Peach and Tracy, 1956; Mishra, 1968). Mineral content in plant was estimated by wet digestion method. 1.0 g plant material was first digested with two successive aliquots of conc. HNO_3 (5 mL each). After the organic matter was slowly digested with 15 mL of triple acid mixture (HNO_3 , HClO_4 and H_2SO_4 , 10:4:1, v/v) at 200°C and reduced to about 1 mL. The residue after digestion was dissolved in double distilled water, filtered and diluted to 100 mL. This solution was used for the estimation of minerals. Macro minerals viz., Na, K, Ca and Li were estimated by AIMIL, Flame Photometer while micro elements viz. Fe, Cu, Mn, Zn and Co were estimated by Atomic Absorption Spectrophotometer, model 4129, Electronic Corporation of India Ltd. Phosphorous and sulphur content was estimated by method (Allen, 1974). Amylose content in plant leave was estimated, as described method (McCready *et al.*, 1950; Juliano, 1971). Cellulose content was estimated as described by method (Updegraff, 1969). Crude fiber content was estimated as described by methods (Maynard, 1970).

Amino acid analysis was performed using the Waters Associates PICO-TAG method (Bidlingmeyer *et al.*, 1984), an integrated technique for precolumn derivatization of amino acids using phenylisothiocyanate (PITC). The PICO-TAG technique comprises of three steps: (1) Hydrolysis of protein or peptide samples to yield free amino acids, (2) Pre-column derivatization of the samples with PITC and (3) Analysis by reverse phase HPLC.

RESULTS AND DISCUSSION

Antioxidant content in *Pouzolzia* rhizomes is presented in Table 1. β -Carotene in *Pouzolzia* rhizomes was found 22.77 ± 0.33 mg 100 g^{-1} on a dry weight basis. The range of β -Carotene was found 22.30-23.05 mg 100 g^{-1} . The content of vitamin C in *Pouzolzia* rhizomes were found 108.40 ± 0.32 mg 100 g^{-1} on dry weight basis. The range of vitamin C was 108.05-108.83 mg 100 g^{-1} . The content of phenolics and tannins in plant was found 230.59 ± 0.33 and 1663 ± 0.45 mg 100 g^{-1} , respectively. The range of phenolics was 230.15-230.95 and tannin was 1663.33-1664.43 mg 100 g^{-1} .

Table 1: Antioxidant and antinutritional composition investigated in *Pouzolzia hirta* rhizomes

Antioxidants	Composition (mg 100 g ⁻¹)	Range (mg 100 g ⁻¹)
β-Carotene	22.77±0.33	22.30-23.0500
Vitamin C	108.40±0.32	108.05-108.830
Phenolics	230.59±0.33	230.15-230.950
Tannins	1663.84±0.45	1663.33-1664.43

All values are mean of triplicate determinations expressed on dry weight basis. ±Denotes the standard error

Table 2: Nutrients composition investigated in *Pouzolzia hirta* rhizomes

Biochemical parameter	Composition (g 100 g ⁻¹)	Range (g 100 g ⁻¹)
Moisture	66.09± 0.21	65.89-66.38
Crude protein (Kjeldahl N x 6.25)	4.24±0.02	4.22-4.260
Crude fat	6.02±0.59	5.33-6.780
Total carbohydrate	36.52±0.38	36.04-36.97
Starch	33.05±0.64	32.47-33.94
Amylose	4.86±0.21	4.58-5.060
Amylopectin	28.19±0.49	27.79-28.88
Cellulose	4.10±0.39	3.69-4.620
Crude fiber	12.35±0.25	12.14-12.40
Ash	5.79±0.09	5.69-5.900
Acid soluble ash	4.58±0.30	4.17-4.890
Acid insoluble ash	1.17±0.41	0.80-1.630
Calorific value (Kcal 100 g ⁻¹ DM)	217.22±0.00	

The amount of certain nutrients in *Pouzolzia* rhizomes is presented in Table 2. Crude lipid, protein and total carbohydrate content in *Pouzolzia* rhizome were found 6.02±0.59, 4.24±0.02 and 36.52±0.38 g 100 g⁻¹, respectively on dry weight basis. The ranges were 5.33-6.78, 12.86-12.87 and 12.42-14.34 mg 100 g⁻¹ of crude lipid, protein and total carbohydrate, respectively. Starch, amylose and Amylopectin contents in *Pouzolzia* were found 33.05±0.64, 4.86±0.21 and 28.19±0.49 g 100 g⁻¹, respectively. The cellulose, crude fiber and moisture content were found 4.10±0.39, 12.35±0.25 and 66.09±0.21 g 100 g⁻¹, respectively. The ash content was found 5.79±0.09 g 100 g⁻¹ on dry weight basis. Acid insoluble ash was found 1.17±0.41 g 100 g⁻¹ and acid soluble ash was found 4.58±0.30 g 100 g⁻¹. The energy content of plant rhizome was determined by multiplying the crude protein, crude lipid and total carbohydrate content by the factor 4, 9 and 4, respectively (Osborne and Voogt, 1978). Calorific values of the plant rhizome were found 217.22 kcal 100 g⁻¹.

Life is dependent upon the body's ability to maintain balance between the minerals (Watts, 1997). The mineral content of *Pouzolzia* rhizome is presented in Table 3. The contents of Sodium, Potassium, Calcium and Lithium in *Pouzolzia* rhizomes were found 157.69±0.47, 4106.36±0.43, 178.42±0.41 and 42.28±0.13 mg 100 g⁻¹, respectively on dry weight basis.

Ranges were 157.04-158.11, 4105.99-4106.97, 178.04-178.99 and 42.11-42.42 mg 100 g⁻¹ of Na, K, Ca and Li, respectively. The contents of nitrogen, phosphorus and sulphur were found 678.55±2.15, 216.32±0.64 and 464.06±1.00 mg 100 g⁻¹, respectively on dry weight basis. The contents of iron, copper, manganese, zinc and cobalt in *Pouzolzia* rhizomes were found 83.04±0.53, 3.61±0.32, 8.49±0.32, 16.68±0.49 and 0.00, respectively on dry weight basis. The ranges were 82.44-83.72, 3.18-3.96, 8.21-8.93, 16.00-17.12 and 0.0 mg 100 g⁻¹ of Fe, Cu, Mn, Zn and Co, respectively. This is the first work of analysis of nutraceutical antioxidants and minerals in *Pouzolzia hirta* rhizomes.

Table 3: Minerals composition investigated in *Pouzolzia hirta* rhizome

Mineral	Composition (mg 100 g ⁻¹)	Range (mg 100 g ⁻¹)
Sodium-Na	157.69±0.47	157.04-158.110
Potassium-K	4106.36±0.43	4105.99-4106.97
Calcium-Ca	178.42±0.41	178.04-178.990
Lithium-Li	42.28±0.13	42.11-42.4200
Nitrogen-N	678.55±2.15	676.04-681.300
Phosphorus-P	216.32±0.64	215.49-217.070
Sulphur-S	464.06±1.00	462.64-464.820
Iron-Fe	83.04±0.53	82.44-83.7200
Copper-Cu	3.61±0.32	3.18-3.96000
Manganese-Mn	8.49±0.32	8.21-8.93000
Zinc-Zn	16.68±0.49	16.00-17.1200
Cobalt-Co	0.00±0.00	-

Table 4: Amino acid content of three plants in mg g⁻¹ dry weight basis

Amino	<i>P. hirta</i>	Total AA (%)
Aspartic acid ^a	12.75±0.60	5.65
Glutamic acid ^a	14.00±0.09	6.20
Serine ^a	8.03±0.06	3.56
Glycine ^a	8.16±0.05	3.61
Histidine ^a	-	-
Alanine ^a	36.59±0.05	16.21
Proline ^a	0.38±0.03	0.17
Lysine ^a	1.44±0.04	0.64
Threonine ^a	40.74±0.08	18.05
Tyrosine ^a	10.06±0.10	4.46
Valine ^a	25.04±0.03	11.09
Methionine ^a	4.24±0.02	1.88
Cysteine ^a	1.95±0.03	0.86
Isoleucine ^a	17.50±0.08	7.75
Leucine ^a	27.90±0.01	12.36
Phenylalanine ^a	12.06±0.02	5.34
Arginine ^a	4.89±0.04	2.17
TEAA	145.82±0.00	63.96
TNEAA	79.91±0.00	36.04
TAA	225.73±0.00	

All values are mean of triplicate determinations expressed on dry weight basis. ±Denotes the standard error, ^a-TEAA: Total essential amino acid, ^bTNEAA: Total non essential amino acid, AA: Amino acid

The amino acid content of plants viz., *P. hirta* is summarized in Table 4. Quantitative determination of amino acid concentration was conducted by HPLC and the amino acid profile is shown in the chromatogram (Fig. 1). Seventeen amino acids were detected and the separation of these amino acids in the sample is reasonably resolved. All the essential amino acids i.e. methionine, leucine, lysine, cysteine, phenylalanine, tyrosine, arginine, isoleucine, threonine and valine and seven non-essential amino acids were found to be present in the plants rhizomes. The total amino acid content in *P. hirta* was 225.73 mg amino acid g⁻¹ sample (dry weight) and the total essential amino acids 145.82 mg amino acid g⁻¹, respectively.

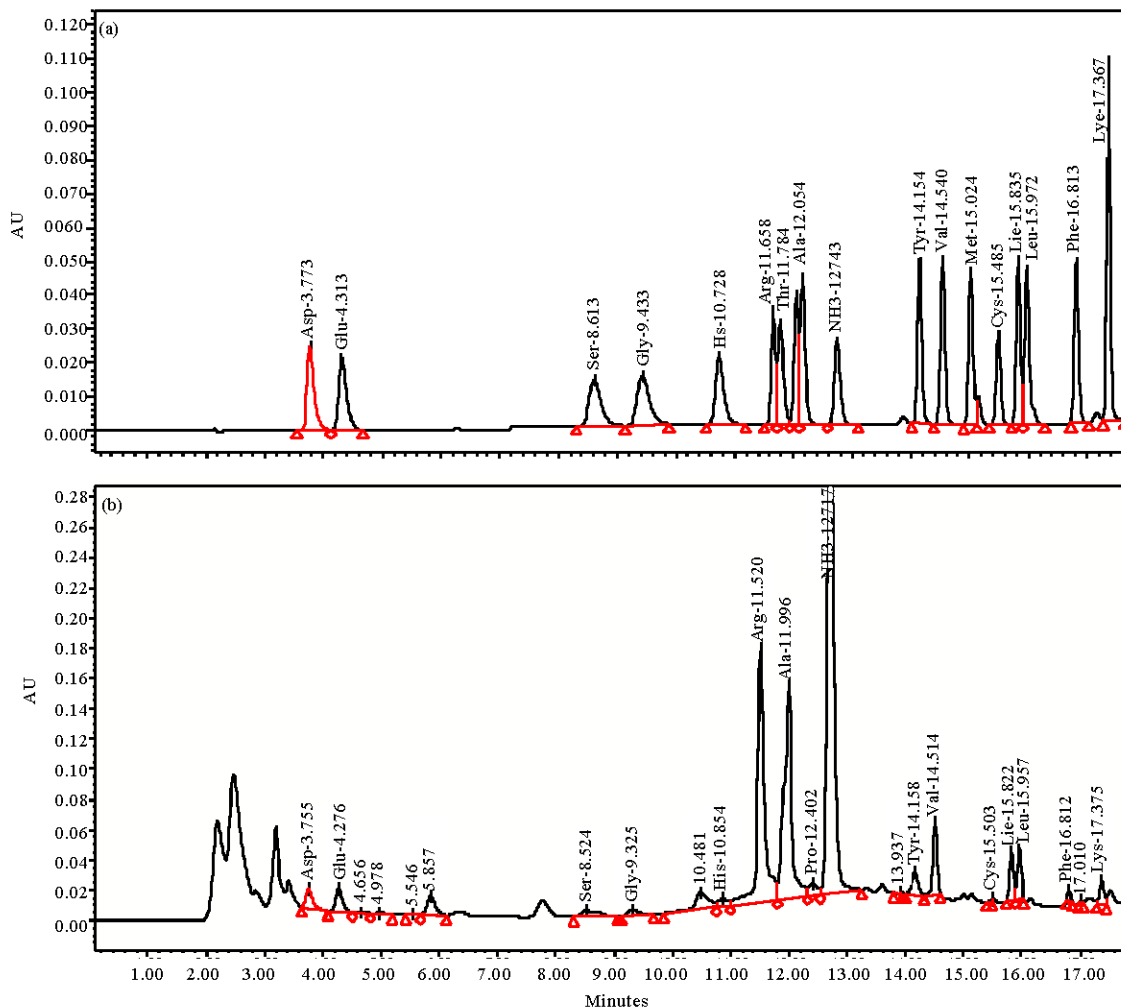


Fig. 1(a-b): Amino acid profile of standard and amino acid profile of *Pouzolzia hirta*

Table 5: Comparison of the content of selected essential amino acid of *P. indica* with that of the WHO ideal pattern

Plant specimen	ILE	LEU	VAL	PHE+TYR	LYS	THR	MET+CYS	SCORE*
WHO standard	4.00	7.00	5.00	6.00	5.50	4.00	3.50	---
<i>P. hirta</i>	7.75	12.36	11.09	9.80	0.64	18.05	2.74	5/7

*This pattern is based on the essential amino acid need for the preschool child; WHO/FAO. Energy and protein requirements. WHO

P. hirta is rich in alanine, glycine, phenylalanine, threonine, valine, methionine, arginine, alanine, glutamic acid, proline and aspartic acid. Lysine and cysteine are present in lower amount as compared to the other amino acids. Data on histidine is not included in this work since this amino acid may be destroyed during acid hydrolysis.

In this study, compared the amino acid composition of each of three specimens to that of a World Health Organization standard protein (FAO/WHO, 1973). According to the WHO reference protein, the highest quality plant proteins were found in *Pouzolzia hirta* (Table 5) each of these scored at or above the score of the WHO standard for 5 of 7 amino acids or amino acid pairs.

CONCLUSION

It can be concluded that the rhizomes of *P. hirta* are excellent source of nutrients, antioxidants, amino acid and minerals. The distribution of these compounds in common wild plants has important application for the health of people in addition to the basic need of developing countries. There is a great need to further research which the plants rhizomes easily available in the local markets.

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