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RESEARCH ARTICLE

NUTRIENT ANALYSIS OF UNDERUTILISED INDIGENOUS WEEDS IN COIMBATORE

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ABSTRACT

Certain plants, intentionally grown in gardens and other cultivated settings are termed as "weeds". Certain weeds have very good potential nutrients which are essential for human needs. Some plants were still considered as leafy vegetables in certain tribal and rural areas with or without the nutritional knowledge behind it. In this study, five such edible weeds like *Alternanthera sessilis, Coccinia grandis, Acalypha indica, Boerhavia diffusa* and *Digera Arvensis* were selected and analyzed for key nutrients like Vitamin C, Calcium, Phosphorous, Iron and Fiber**.** In general, elemental contents were found in varying amounts with different ranges. Many of these elements are bio-available in natural form in combination with organic constituents and are easily assimilated by human bodies.

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INTRODUCTION

A weed is a plant considered undesirable in a particular situation. Plants unwanted in human-controlled settings, such as farm fields, gardens, lawns, and parks. *Alternanthera sessilis* (Ponnanganni) belongs to Amaranthaceae family. It is popularly known as "Water Amaranth". In India it is found throughout hotter parts. It occurs in both wet lands and uplands and can grow on a variety of soil types. The plant spreads through its seeds, which are wind and water dispersed and by rooting at stem nodes. It is a weed found throughout the tropical regions and in the areas where cereal crops, sugarcanes and bananas are cultivated (Sudha, 2013). The whole plant is used for medicinal purpose. It is accredited with galactogouge properties and antibacterial properties (Sahu, 1994) useful in night blindness due to its high carotene content. Siddha literature mentioned *Alternanthera sessilis* as Kaya Kalpa drug (i.e. drug which prevents and cures chronic diseases and rejuvenates the body) and as compatible diet. The antioxidant carotene is found in large amounts in *Alternanthera sessilis* (Jerajoni *et al*., 2004; Chandrika et al., 2005). It is used for the treatment of biliousness, dyspepsia, sluggish liver (Gayathri,, 2006).

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The plant is also used traditionally as coolant, intellect promoting, in burning sensation, liver disorders, skin diseases and in children for overall development. The herb has been reported to have antipyretic (Nayak *et al*., 2010), hepatoprotective (Lin *et al*., 1994), antiulcer (Purkayastha, 2006), antibacterial (Sahu, 1994), hematinic (Arollado, 2010) and diuretic activities (Roy, 2008). Leaf extract is given to expecting mothers to increase lactation. Leaf decoction is given 2 times a day for 14-30 days to cure nervous disorders. The leaf juice is mixed with boiled cow's milk and given in morning on empty stomach to improve the eyesight (Vijayalakshmi, 2011). *Coccinia grandis* (Kovai keerai) belongs to Cucurbitaceae family. It grows abundantly all over India, Tropical Africa, Australia, Fiji and throughout the oriental countries (Sudha, 2013). The roots, stems, leaves and fruits are used in indigenous system of medicine for treating diabetes (Nadkarni, 1976). Studies have reported that ethanolic extract of leaves possess hypoglycaemic and antioxidant properties. Root and leaves have anti-lipidemic effects (Ajit, 2003; Baizid, 1993; Eshrat, 2003; Venkateswaran, 2003). Aqueous extract of fresh leaves had anti-inflammatory, analgesic, antipyretic (Junaid, 2009) and anti-nociceptive activities (Rao *et al*., 2004). Aqueous methanolic and ethanolic extracts of aerial parts showed antihyperglycaemic, hypolipidemic (Kumar *et al*., 2010; Chhanda *et al*., 2007), antitussive (Shakti, 2009), antilithiatic (Jayaweera, 1980) and antimutagenic activities (Kusamran, 1998). It is also used to

cure ring worm, psoriasis, small pox, scabies, other itchy skin eruptions and ulcers (Perry, 1980; Behl, 1993). Leaves of this plant are used in Indian folk medicine for treatment of number of ailments including diabetes, wounds, ulcers, inflammation, in eruptions of skin, fever, asthma and cough.

Boerhaavia diffusa L. (Saranai) is a perennial creeping herb found throughout the waste land of India. It is found in Ceylon, Australia, Sudan and Malay Peninsula, extending to China, Africa, America and Islands of the Pacific (Oudhia, 2011). As an antioxidant, it reportedly reduces the risk of arteriosclerosis, cardiovascular diseases and some forms of cancer (Rekha *et al*., 2012). The root is mainly used to treat gonorrhea, internal inflammation of all kinds, dyspepsia, oedema, jaundice, menstrual disorders, anaemia, liver, gallbladder and kidney disorders, enlargement of spleen, abdominal pain, abdominal tumours, and cancers (Kirtikar, 1956). It cures corneal ulcers and night blindness (Gupta, 1962), and helps restore virility in men. People in tribal areas use it to hasten childbirth (Shah, 1983). The juice of *Boerhaavia diffusa* leaves serves as a lotion in ophthalmia. It is also administered orally as a blood purifier and to relieve muscular pain (CSIR, 1988).

Digera muricata L. (Thoya keerai) is an annual herb, growing to 20-70 cm tall. It is an important medicinal herb belongs to the Amaranthaceae family, found as a weed throughout India. All parts of the plant have been used as crude drug for the treatment of kidney stone and urinary tract disorders (Neha, 2013). *D. muricata* ethnopharmacologically has been used in renal disorders, constipation, refrigerant (Anjaria, 2002; Chettleborough, 2006). This plant is also used as an alternative for secondary infertility (Hocking, 1962). *D. muricata* is used internally against digestive and urinary disorders. Leaf paste is applied locally to prevent pus formation (Katewa, 2004. *Acalypha indica Linn*. (Kuppaimeni) is commonly known as copper leaf (Indian Nettle) belongs to the family Euphorbiaceae and is seen in many parts of Asia including India, Pakistan, Yemen, Sri Lanka and throughout Tropical Africa and South America (Ramachandran, 2008). Tribes of Kerala, Rajasthan and Madhya Pradesh use fruits: in asthma, cough, bronchitis and ear ache; plant and fruit: as an expectorant, laxative, pneumonia and rheumatism; leaf: in skin diseases like scabies. This plant is used as diuretic, antihelmintic and for respiratory problems such as bronchitis, asthma and pneumonia (Varier, 1996). Rahman *et al*., (2010) has reported that *A. indica* having analgesic and anti-inflammatory effects (Rahman, 2010). Previous studies on *A. indica* revealed that this plant has antibacterial activity against several gram positive bacteria (Govindarajan *et al*., 2008; Krishnaraj *et al*., 2010). *Amaranthus polygonoides (siru keerai)* is a flowering plant of Amarathacae family. This species has been widely used for medicinal purposes. Invitro studies by Naveena *et al.,* 2012, had demonstrated the plant extract posess antioxidant and antimicrobial potential (Naveena, 2012).

MATERIALS AND METHODS

Selection of Samples: For this study, plants like *Alternanthera sessilis, Coccinia grandis, Acalypha indica, Boerhavia diffusa* and *Digera Muricata* were selected from the Western ghats of Walayar belt. These weeds were abundantly spread all over the region and it was observed that the utilization of these weeds was less common and only the tribal population consumed these weeds with or without the nutritional knowledge behind. The fresh samples were cleaned, washed and removed inedible part and shade dried. The dried samples were powdered and stored in sealed polyethene covers. The powdered samples were subsequently used for chemical analyses. Estimation of key nutrients such as Vitamin C, Calcium, Phosphorous, Iron and Fiber were analyzed for both fresh and dried samples using the standard procedures adapted from "A manual of laboratory techniques" (Raghuramulu, 2003). Triplicate determination of each analysis was made and average obtained was tabulated and the availability of the nutrients was compared for both fresh and dried samples. The chemicals used for the study were of SD FINE make and were purchased from technico laboratory products, Coimbatore. The photo electric colorimeter had a range from 400-700 nm with its resolution at 1% transmission and absorbance at zero. The weighing balance used for the study was Electronic top pan Balance of Shimadzu make with an accuracy of 0.0001 gm.

Preparation of Ash: Five grams of the sample was weighed accurately in a tarred platinum or porcelain crucible (which had been previously heated to about 600° c and cooled). The crucible was then heated over a low flame till all the materials was completely charred, followed by heating in a muffle furnace for about 3-5 hours, at 600° c. The crucible was then cooled in a desiccator and it was weighed. The ash was dissolved in HCl and made up to 100 ml with distilled water. The test solution was further used for the nutrient estimation.

Estimation of calcium: Calcium was determined by precipitating it as Calcium Oxalate and titrating the Oxalate solution with dilute Sulphuric acid against standard Potassium Permanganate solution- Hundred ml of the ash solution was pipetted out in a conical flask and 90 ml of distilled water was added to it along with 2 drops of methyl red indicator. It was made alkaline by adding ammonia and kept for boiling. 20 ml of saturated ammonium oxalate was added to the solution, 10 ml each time to ensure complete precipitation directly. While it was hot, a few drops of acetic acid was added to transfer the solution into acidic medium. The precipitate was allowed to settle overnight and it was filtered using Whatman No.40 filter paper. The precipitate was washed first with ammonical water and then with hot water several times until it was free from chloride. To test it, 5 ml of the washing was collected in a test tube and a drop of silver nitrate/calcium chloride solution was added. The filter paper was collected in a flask by making a hole in the filter paper. To this, 2 ml of 2N sulphuric acid was added and heated to 60-80°C and it was titrated against N/ 100 potassium permanganate solution. From the volume of potassium permanganate solution used up, the milligram of calcium present in 100g of the sample was calculated.

Estimation of Phosphorus: Phosphorous reacts with ammonium molybdate to form phosphomolybdic acid. Phosphomolybdic acid was reduced by the addition of 1,2,4 Amino Naphthol Sulphonic Acid (ANSA) reagent to produce a blue colour which was apparently a mixture of oxides of molybdenum- To the Aliquots of the standard solution, 1 ml of ammonium molybdate II and 0.4 ml of ANSA was added and made upto 10 ml with distilled water, simultaneously a blank was prepared. Similarly, to the test sample, 1 ml of ammonium molybdate I and 0.4 ml of ANSA was added and made upto 10 ml with distilled water. All the samples were incubated at room temperature for 15- 20 minutes to develop the colour. The colour developed was read in the colorimeter using red filter of wavelength 660 nm.

Table 1. Nutrient analysis of selected under utilised weeds

Nutrients/100gm	*Alternanthera sessilis (Ponnanganni)*		*Coccinia grandis (Kovai keerai)*		*Boerhaavia diffusa(Saranai)*		*Digera muricata (Thoyakeerai)*		*Acalypha indica(Kuppaimeni)*		*Amaranthus polygonoides (Sirukeerai)*	
	Mature	Dry	Mature	Dry	Mature	Dry	Mature	Dry	Mature	Dry	Mature	Dry
Iron (mg)	6.5	72.3	3.1	32.3	7.3	98.5	7.72	106.4	15.2	83.5	2.6	26.7
Phosphorous (mg)	54.3	328.2	32.5	240.9	25.6	150.7	63.8	378.5	75.2	503.6	55.6	313.5
Calcium (mg)	521.1	1121.8	575.3	1225.3	218.4	685.4	505.5	997.2	603.7	1289.1	240.8	556.3
Vitamin C (mg)	23.76	4.3	61.5	7.8	67.2	11.4	66.6	13.5	126.1	22.1	48.5	12.2
Fibre (g)	2.0	11.6	4.3	16.5	9.4	23.8	5.1	17.6	2.1	8.6	1.8	9.8

Estimation of Iron: Ferric Iron reacts with ammonium thiocyanate or with Potassium thiocyanate to form ferric thiocyanate which is red in colour. The colour which is a measure of the concentration of iron was measured colorimetrically- Different aliquots of the standard solution in a series of test tubes were taken. 2ml of the test solution was taken in the test tube. 1ml of 30% Sulphuric acid, 1 ml of Potassium per sulphate and 1.5 ml of Potassium thiocyanate was added to all the test tubes. This was made upto 10 ml with distilled water. A blank was prepared simultaneously. The colour was allowed to develop for 20 minutes and the intensity was read at 530-540 nm filter in the colorimeter.

Estimation of Vitamin C: Ascorbic acid, a good reducing agent is oxidised to dehydro ascorbic acid. In the absence of interfering substances, the capacity of an extract of the sample to reduce the standard solution of the dye (2,6 dichlorophenol indophenols) as determined by titration is directly proportional to the vitamin C content. Oxalic acid is used to reduce the pH of the extracting medium and it forms complexes with metals preventing the catalytic oxidation, thereby establishing vitamin C content- A known amount of the sample was weighed and soaked in 4% oxalic acid for ten minutes, ground in a mortar, centrifuged and the supernatant was collected. The extraction was repeated with oxalic acid for three to four times. All the supernatants were collected in the standard flask and was finally made upto the mark with acid. The dye was titrated against 5 ml of the extract in a beaker. The end point was the appearance of pink colour which persisted for 30 seconds. The titration was repeated till concordant values were obtained.

Estimation of crude Fibre: A known amount of the sample was weighed in a beaker and two hundred ml of boiling O.255N sulphuric acid was added. The mixture was boiled for 30 minutes; keeping the volume constant by adding water at frequent intervals. The mixture was filtered through a muslin cloth and the residue was washed with hot water till it was free from acid. The mixture was then transferred to a beaker containing 200 ml of boiling 0.313N sodium hydroxide. After boiling for 30 minutes (keeping the volume constant as before) the mixture was filtered through a muslin cloth. The residue was washed with hot water till it was free from alkali, followed by washing with some alcohol and ether. It was then transferred into a crucible, dried overnight at 80-l00°C and weighed. The crucible was heated in a muffle furnace at 600°C for 2-3 hours. It was cooled and weighed again. The difference in the weight represents the weight of the fibre.

RESULTS AND DISCUSSION

The nutritive value of the selected underutilized weeds is given in TABLE I. From the table it could be inferred that the availability of Iron in mature leaves *Alternanthera sessilis, Coccinia grandis, Boerhaavia diffusa*, *Digera muricata, Acalypha indica and Amaranthus polygonoides* was 6.5, 3.1, 7.3, 7.7, 15.2 and 2.6 mg correspondingly.

The amount of iron in dry samples was 72.3, 32.3, 98.5, 106.4, 83.5 and 26.7 mg respectively. Among all the weeds dry samples of *Digeria Muricata* showed higher iron content (106.4 mg) when compared to all the dry samples. Inadequate dietary intake and poor bioavailability of iron from food are considered as prime etiological factors of anaemia. Some leafy vegetables have been identified and used locally in treating anaemia (Hamlin, 2011). The mature leaves of *Acalypha indica* contain 75.2mg and the dry sample contains 503.6 mg of phosphorous. There found to be a considerable amount of phosphorous in the mature leaves of all selected weeds ranging from 25.6-75.2mg.

As calcium remains one of the most important nutrients required through the different stages of life, consuming foods rich in this nutrient is critical to maintain good health. Although rich in calcium, green leafy vegetables also contain a high amount of oxalic acid, which forms an indigestible complex with calcium, thereby reducing the bioavailability of calcium from green leafy vegetables. Thus calcium bioavailability from green leafy vegetables is very low compared to its bioavailability from dairy products and other vegetables (Sheela *et al*., 2004).

The calcium content in dry sample *Acalypha indica* was found to higher (1289.1mg) when compared to all other weeds, whereas all other samples showed a considerable amount of calcium in both the mature and dry samples. Dark green leafy vegetables are good sources of many vitamins (such as vitamins A, C, and K and folate) and minerals (such as iron and calcium). Vitamin C acts as a good antioxidant. Research studies suggest that the nutrients found in dark leafy vegetables may prevent certain types of cancers and promote heart health (Murillo, 2001). The Vitamin C content of the selected weeds is 23.76, 61.5, 67.2, 66.6, 126.1 and 48.5 mg/100gm of mature leaves correspondingly for *Alternanthera sessilis, Coccinia grandis, Boerhaavia diffusa*, *Digera muricata, Acalypha indica and Amaranthus polygonoides*. When the leaves are dried the Vitamin C gets oxidised to atmospheric oxygen and thus the Vitamin C content was found to be less when compared to fresh mature leaves. Fiber affects the rate of digestion of foods, the absorption of nutrients, and the movement of waste products (stool) through the colon. It also provides a substrate for beneficial intestinal bacteria. Ongoing research on fiber continues to explore these potential long-term benefits like lowering risk of heart disease, Decreased colon cancer, Healthy weight management and Controlled blood glucose levels [(49)]. It was noticed that the fibre content in the selected weeds was found to be 11.6,16.5, 23.8, 17.6, 8.6 and 9.8 g/100gm of dry samples for *Alternanthera sessilis, Coccinia grandis, Boerhaavia diffusa*, *Digera muricata, Acalypha indica and Amaranthus polygonoides* respectively. Many of these elements are bio-available in natural form in combination with organic constituents and are easily assimilated by human bodies.

These weeds can be used as food supplements in the form of capsules, instant mixes, sweet balls and therapeutic foods like kashayam, lehiyam and decoctions. The extracts of active components could be isolated and they can be used by pharmaceutical industries for medicinal preparations.

Conclusion

As the green leafy vegetables are inexpensive foods rich in micronutrients, utilization of unconventional green leafy vegetables can be explored to overcome some of micronutrient malnutrition. Further studies can also be carried out to throw light on these under-utilized weeds so as to acquire their benefits in a more effective way.

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