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Evaluation of mineral contents in some Medicinal plants used by traditional healers

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Abstract
A total of four mineral elements (Na, K, Mg and Zn) were determined in five medicinally important plants such as *Glycyrrhiza glabra* (L.), *Gymnema sylvestre* (R.Br.), *Solanum trilobatum* (L.), *Alpinia Calcarata*(Rox.) and *Centella asiatica* (L.). From the study, it was revealed that all the four elements were accumulated to higher or lower extents by all the five plants species studied. Among the nutrients, Na content varied from 169.02 to 357.26ppm. *Glycyrrhiza glabra* had the lowest Na content and *Solanum trilobatum* the highest. The concentration of K ranged from 137.36ppm in *Glycyrrhiza glabra* to 499.06 in *Centella asiatica*. *Alpinia calcarata* had the lowest Mg content (197.25ppm) and *Gymnema* sylvestre had the highest (571.10ppm). The Zinc content in the studied plants ranged between 13.06 ppm in *Alpinia calcarata* and 87.12ppm in *Gymnema* sylvestre.

Keywords: *Glycyrrhiza glabra*(L.), *Gymnema sylvestre*(R.Br.), *Solanum trilobatum* (L.), *Alpinia Calcarata* (Rox.) and *Centella asiatica* (L.), nutrients

Introduction
Since ancient time, mankind depended mainly on the plant kingdom to meet its need for medicine, fragrance and flavours. Medicinal and aromatic plants and their derivatives to the tune of nearly Rs 200 crores are produced annually in India (Anonymous, 2002) [3]. Plant-based traditional knowledge has become a recognized tool in search for new sources of drugs and neutraceuticals (Ghosh, 2003; Sharma and Mujumdar, 2003) [9, 29].

In India, around 20,000 medicinal plants have been recorded (Dev, 1997) [6], however traditional communities are using only 7,000 - 7,500 plants for curing different diseases (Perumalsamy, and Ignacimuthu, 1998; Perumalsamy, and Ignacimuthu, 2000 and Kamboj, 2000) [22, 23, 13].

During the last few decades there has been an increasing interest in the study of medicinal plants and their traditional use in different parts of the world (Pei-Sheng-ji, 2001) [21]. India is endowed with rich wealth of medicinal plants which are widely used by all section of peoples either directly as folk remedies or different indigenous system of medicine or indirectly in the pharmaceutical preparations of modern medicines (Alagesaboopathy, 2011) [2].

Interviewing traditional healers for accurate information about medicinal recipes, their component herbs and their medicinal and other uses constitutes an important activity in ethno pharmacological field investigation (Lipp, 1899) [15]. The knowledge and experience of a traditional healer is considered valuable as it comes from thousands of years of trial and errors and forms the basis of modern medicine and therapeutics. Majority herbal ingredients used by traditional healers are collected from the wild directly by these healers or brought from market places.

Traditional healers provide considerable information about the use of many plants or plant parts as medicine (Rodgers, 1991) [26]. Traditional healers use their eyes, ear, nose and hands to diagnose the diseases, this way diagnosis is exclusive because they live in their areas and lack modern scientific equipment for treatment they however treat diseases using medicinal plants (Santhya *et al*., 2006) [27].

In Tamil nadu, traditional health practitioners depend on selective harvesting of both vegetative and reproductive plant materials including fruits and seeds in crude herbal medicine preparation and most of these plant materials are harvested from the wild.

Traditional healers provide considerable information about the use of many plants or plant parts as medicine. Medicinal value of the plant is due to the presence of a variety of phytochemical and elemental composition. The active constituents of medicinal plants are the metabolic products of plant cells wherein number of trace elements play an important role can be used medicinally for their therapeutic effect (Rasheed, 1995) [25]. Therefore, it is essential to investigate the phyto constituents, elements present in the medicinal plants to assess their medicinal values.

Plant minerals can be divided in to macro and micro trace minerals based on the requirements of metals for the normal functioning of human body (Underwood, 1981; Centra and Dayton, 1982) [5]. As the components of enzyme related with anti-oxidation, the importance of trace minerals such as Se, Mn, Cu, Zn, Fe, is being gradually emphasized with relation to their participation in maintaining normal cell metabolism, delaying aging, preventing cardiovascular, diabetes immune diseases (Centra and Dayton, 1982) [5].

Metals and their compounds have been used since ancient times for their therapeutic and cosmetic effects on the skin. Aluminium acetate solution is used as disinfectant and cleansing agent. Copper sulphate probably still used in some countries as an astringent and antiseptic preparation to treat vitiligenous skin (Walker and Keats, 1976) [33].

In leprosy seven elements found to therapeutic effect such as the use of Zn tape for the treatment of leprosy wounds (Stromberg and Agren, 1984; Michaelsson and Vahlquist, 1977 and Wolva and Jablonska, 1978) [30, 17, 34].

Although the medicinal properties of the plant are well recognized, the information of their nutritional properties is scanty, may be because they have not received attention as nutrition supplements. However in addition to those active compounds present in the plants these minerals also play important role in promoting in health care. The Main objective of the present study is to collect some medicinal plants used by traditional healers and to analyse Na, Mg, Zn and K content in that medicinal plants.

Material and Methods

Study plants

1. *Glycyrrhiza glabra* (L.)
2. *Gymnema* sylvestre (R.Br.)
3. *Solanum trilobatum* (L.)
4. *Alpinia Calcarata* (Rox.)
5. *Centella asiatica* (L.)

Plant description

***Glycyrrhiza glabra* (L.)**

It is a perennial herb/sub shrub. The plant attains a maximum height up to 2m. The underground stem grow horizontally up to 2m length, highly branched consisting of short taproot with large number of rhizomes. It has a characteristic pleasant. Leaves alternate, pinnate, yellow green leaflets 4-7 pairs are covered with soft hairs on underside. Flowers appear in axil of terminal and axillary leaves in raceme, pea-like, lavender to purple in color. Seed pod is 2- 2.5cm long containing 2-5 seeds.

***Gymnema* sylvestre (R.Br.)**

Woody plants with young parts puberulous to tomentose. Petiole 0.4-about 1.2 cm long. Leaf blade 2-about 6 cm long, rarely 8.5 cm long, and 1-3(-5.5) cm wide, pubescence to glabrous above, pubescence to tomentose beneath. Cymes umbel-like. Corolla about 0.3 cm in diameter. Merocarps 5-7 cm long, 0.5-0.7 cm in diameter, glabrous.

***Solanum trilobatum* (L.)**

Perennial bright green prickly diffuse plant, reaches up to 2–3 m height;Leaves deltoid or triangular, irregularly lobed; Flowers purplish-blue, in cymes;Fruits or berries globose, red.

***Alpinia Calcarata*(Rox.)**

A rhizomatous herb with 60-120 cm high leafy stem. Leaves 15-30 cm long, lanceolate, acuminate, glossy. Flowers large, in dense terminal panicles, up to 13.5 cm long. Lip ovate-oblong, yellow, streaked with purple veins.

***Centella asiatica* (L.)**

It is a prostrate, faintly aromatic, stoloniferous, perennial, creeper herb, attains height up to 15cm (6inches). Stem is glabrous, striated, rooting at the nodes. The leaves, 1-3 from each node of stems, long petioled, 2- 6cm long and 1.5-5cm wide, orbicular-renniform, sheathing leaf base, crenate margins, glabrous on both sides. Flowers are in fascicled umbels, each umbel consisting of 3-4 white to purple or pink flowers. Fruits are borne throughout the growing season in approx 2 inches long, oblong, globular in shape and strongly thickened pericarp. Seeds have pendulous embryo which are laterally compressed.

Sample collection

The above said five medicinal plants (Table 1) were collected from local traditional healers in Tenkasi, Tirunelveli district, Tamilnadu. After washing, the plants were dried at shade and powdered. The powdered materials were directly used for analysis.

Determination of Na, K, Zn and Mg

Sample preparation

To the powdered plant sample, 5ml of 65% HNO_3 was added and then the mixture was boiled gently for 30-45 minutes. After cooling, 2.5ml of 70% $Hclo_4$ was added and the mixture was gently boiled until dense white fumes appeared. Later the mixture was allowed to cool and 10ml of deionised water was added followed by further boiling until the fumes were totally released (Hseu, 2004) [10]. The contents were allowed to cool and then filtered through what man No_4 filter paper in a flask. The filtrate was diluted to 50ml with deionised H_2O and stored for further analysis.

Table 1: Details of plants selected for study and their medicinal values

S. No	Botanical name	Local name	Family	Parts used	Medicinal uses
1.	*Glycyrrhiza glabra*(L.)	Athimathuram	Fabaceae	Bark	Used for cough, asthma, arthritis, bronchitis, peptic ulcer and for allergic complaints. Glycyrrhizin and glycyrrhizic acid reported from Licorice, have remarkable biological activities.
2.	*Gymnema* sylvestre(R.Br.)	Sirukurinjan	Asclepiadaceae	Leaf	Helps to cure Diabetes Mellitus, Constipation, Gas trouble, wounds due to snake bite, Cough, Rhinitis and Asthma.
3.	*Solanum trilobatum* (L.)	Thuthuvalai	Solanaceae	Leaf	Used for curing diseases such as asthma, cough, and tuberculosis.
4.	*Alpinia calcarata*(Rox.)	Chitraratta	Zingiberaceae	Rhizome	Rhizome is stomachic, stimulant, aphrodisiac, tonic, diuretic, expectorant, carminative; useful in headache, lumbago, rheumatic pains, sore throat, stuttering, pain in the chest, diabetes, burning of the liver, tubercular glands. It is also used in bronchitis and dyspepsia.
5.	*Centella asiatica* (L.)	*Vallarai*	Apiaceae	Leaf	Used to treat cough, consumption, diseases of voice, insanity, as intellect promoting, rejuvenative, boils, chronic coryza, and jaundice.

Table 2: Operating parameter of AAS for studied elements

Elements	Wavelength	Lamp intensity(mA)	Silt width(nm)	Correlation coefficient (r)
Na	589.0	12	0.2	0.999 1
K	766.5	10	0.7	1.000 0
Mg	285.2	8	0.7	0.999 9
Zn	213.9	8	0.7	0.999 6

Analytical procedure

Na, K, Mg and Zn in plant samples were analysed using atomic absorption spectrometer (AA-7000) equipped with flame furnace. The absorption wavelength for the determination of each mineral together with its linear working range and correlation coefficient of calibration graphs are given in Table -2)

Results and Discussion

A total of four elements (Na, K, Mg and Zn) were determined in the powdered medicinal plant samples (table-3). From the study, it was revealed that all the four elements were accumulated to higher or lower extents by all the five plants species studied.

Na content varied from 169.02 to 357.26ppm. *Glycyrrhiza glabra* had the lowest Na content and *Solanum trilobatum* the highest. Sodium is essential to all living organisms. Sodium remains one of major electrolytes in the blood. Without sodium the body cannot be hydrated, it would dry off. At the point when some vital processes are taking place sodium is not needed, too much of sodium will cause the cell to break down (Gbolahan, 2001) [8]. The minimum daily intake of Na recommended by Elements Food and Nutrition Board, Institute of Medicine, India is 1.4 to 4.7g.

Among the nutrients, the concentration of K ranges from 137.36ppm in *Glycyrrhiza glabra* to 499.06 in *Centella asiatica*. Potassium has the highest concentration in the leafy materials than other nutrients as it is activator of some enzymes. Na and K are of great importance for many regulation systems in the body.

Potassium is accumulated within human cells by the action of the Na^+, K^+- ATPase (sodium pump) and it is an activator of some enzymes; in particular co-enzyme for normal growth and muscle function (Birch and Padgham, 1994) [4]. Because of the solubility of salts, Na plays an important role in the transport of metabolites. K is of importance as a diuretic.

Venketaraman and Gopal Krishanan, 2002 [32] reported maximum concentration of Ca, Fe and K in nine plants traditionally used for jaundice and concluded that high concentration of K in the medicinal plants could be related to the diuretic action of drugs prepared from plants.

Alpinia calcarata had the lowest Mg content (197.25ppm) and *Gymnema* sylvestre had the highest (571.10ppm). Magnesium, a ubiquitous element that plays a fundamental role in many cellular reactions in which food is catabolized and new chemical products are formed (Ailawa, 1981) [1].

The Zinc content in the studied plants ranged between 13.06 ppm in *Alpinia calcarata* and 87.12ppm in *Gymnema* sylvestre.

Moscow and Jothivenkatachalam, 2012 found that high concentration of Zn was found in Acalypha indica Linn 47.18 ppm followed by *Nelumbo nucifera* Gaertn 45.00 ppm, *W.somnifera* 43.01 ppm, *Sphaeranthus indicus* Linn. 38.14 ppm, *Enicostemma littorale* Blume, 32.87 ppm. Zinc is an essential trace element for plant growth and also plays an important role in various cell processes including normal growth, brain development, behavioural response, bone formation and wound healing. Zinc deficient diabetics fail to improve their power of perception and also cause loss of sense of touch and smell (Hunt, 1994) [11]. The dietary limit of Zn is 100 ppm (Jones, 1987) [12].

Saraf and Samant, 2013 reported that the amount of zinc concentration in roots of Achyranthes asperaLinn, was 3.523ppm, 1.34ppm in stem and 1.34 in leaves.

In blood, about 85% of the zinc combines with protein for transport after its absorption and its deficiency causes diabetic hyposima, hypogeusia or coma (Rajurkar, Pardeshi, 1997). The availability of Zn in the range of 14.8-28.4ug/g may be beneficial for diabetic patients as its deficiency has been correlated with acute and chronic mal absorption (O' Dell and Sunde, 1997) [20].

Kashif and Ullah, 2013 reported that the concentration of Zinc, *Azadirachta indica* (43ppm), Na+ in *Punica granatum*(14ppm), K+ in *Hippophae rhamnoides*(27ppm) and in *Ocimum tenuiflorum*(36ppm).

Regular dietary use of *D. cordata, H. cordata, A. sessilis and L. Plukenetii* is so much beneficial for the people who have diabetic complications because micronutrients present in these plants (Fe, Zn, Mg, Cu, Na and K) can activate B-cells of the pancreas to produce insulin (Narendhirakannan *et al*., 2004) [19].

In recent years, there has been a growing interest in trace element concentrations in the environment and they are considered a factor indispensable for its proper functioning. These elements are contained in enzymes and activate them, thereby in an essential way influencing the biochemical process in cells (Lozak, *et al*., 2002) [16].

In view of above facts, the need to screen medicinal plants in traditional medicine for elemental composition is highly desirable.

Table 3: Mineral content of selected medicinal plants (in ppm)

Sample	Na	K	Mg	Zn
Glycyrrhiza glabra (L.)	169.02	137.36	219.06	39.738
Gymnema sylvestre (R.Br.)	186.75	475.37	571.10	87.120
Solanum trilobatum (L.)	357.26	244.14	426.28	40.850
Alpinia calcarata (Rox.)	238.24	359.09	197.25	13.061
Centella asiatica (L.)	276.43	499.06	358.09	71.835

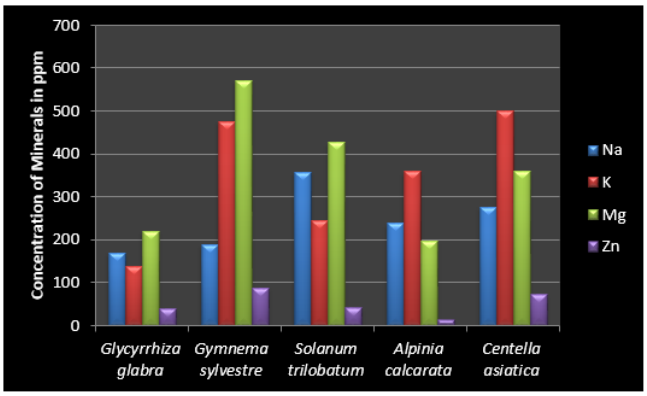

Fig 1: Concentration of Minerals in five different medicinal plants.

Summary and Conclusion

The result of present study revealed that all the medicinal plants possess except *Alpinia calcarata* the highest Mg and lowest Zn content was observed in all the five studied plants. All the studied plants may be used as a good source of minerals and very particularly for Magnesium and Potassium. The mineral content in all the samples were found at different levels. The variation of elemental content from plant to plant is mainly attributed to the differences in botanical structure, as well as in the mineral composition of the soil in which the plants are grown.

In view of medicinal values, plants studied in the present work are source of biologically important elements, and they may play a part in the therapeutic uses. Hence, it could serve as supplement of macro and micro elements in the body. Presumably Ayurvedic medicines contain trace elements in a bioactive form and their impact on the overall pharmalogical action cannot be ruled out.

Although the direct link between elemental content and curative power is yet to be established, such studies are vital to understanding the pharmacological action of herbs. The data obtained in the present study will be helpful in the synthesis of new ayurvedic drugs which can be used for the control and cure of various diseases. The data obtained on individual element concentration in each plant will be useful in deciding the dosage of herbal drugs prepared from these plant materials for the management of various metabolic disorders.

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