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Heavy metal content in some therapeutically important medicinal plants

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ABSTRACT

Many Medicinal plants are known to be of potential medicinal value and used in herbal medicine. The therapeutic effect of medicinal plants for the treatment of various diseases is based on the chemical compounds in these plants. The major compounds are organic compounds, some of which have biological activity, but none act independently and they cannot replace the functions of the medicinal plants as a whole. Five of the most important medicinal plants in the literature on India traditional and popular medicine are The selected traditional and popular medicinal plants are *Ocimum sanctum L, Catharanthus roseus L, Trigonella foenum-graecum L, Azadirachta indica* A. Jass.and *Aegle marmelos Roxb*. Determination of Fe, Mn, Zn and Cu in the medicinal plants by using Atomic Absorption Spectrophotometer described.

KEYWORDS

Medicinal plants;
AAS;
Attenuation coefficients;
Trace elements;
Microelements.

INTRODUCTION

Medicinal plants are prescribed by traditional healers for diseases like as common cold, malaria, ulcers and infection across the world since ancient time[1,5]. In the recent years, the use of the phytoterapics has been focused as safer and more congenial to the human body. Medicinal plants come into preparation of various modern drugs or even have been used as the principal source of raw materials for conventional drugs[2]. In the development countries, these plants are easily found in local market. Non-prescription phytoterapics drugs are in the mixtures of medicinal plants to use and the industry promises more quik effects[3]. There is a great interesting in trace and essential elements composition in the medicinal science; it is believed that the great majority of elements act as key components of essential enzyme systems or vital biochemical functions.

In this work the Atomic Absorption Spectrophotometer (AAS) technique was used to multi-elemental determination of Fe, Mn, Zn and Cu elements in the ethanolic extract and parts of medicinal plants (leaves, seeds, fruits).The quantitative inorganic profile these parts of plants showed a different distribution for each part. This information could be used to identify which part of plants is more effective for theoretic use.

MATERIALS AND METHODS

Medicinal plants were collected from different area of Karnataka (See TABLE 1) and were iden-

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TABLE 1 : Medicinal plants collected from Gulbarga, Sandur and Kappattgudda and their medicinal uses

Botanical name	Common names	Part used	Major elements	Medicinal uses
Ocimum sanctum L.	Holy Basil	Leaves	Fe, Cu, Mn And Zn[6,11]	Bad coughs, skin diseases, gastric disorders children, hepatic disorders, piles, eye drops and fevers.
Catharanthus roseus (L.) G.Don.	Vinca	Leaves	Al, Cd, Fe, Co, Cu, Ni, Ld, K, Mn and Zn[17]	Diabetic, cancer, human pathogenic strains and diarrhea
Trigonella foenum-graecum L.	Methi	Seeds	Fe, Mn, Zn and Cu[17]	Neuralgia or pneumonia, facial fever, infection of the sciatic pain at back, skin irritations and mouth ulcers
Azadirachta indica A.Juss.	Neem	Leaves	Na, Zn Cu, Mn, Fe[6,11,17]	Asthma, fever, jaundice, depressed unhappy emotional state heart problem, stomach, dysentery and indigestion.
Aegle marmelos Roxb.	Bael	Leaves	Ca, P, Na, K, Zn, Cu, Mn and Fe[17]	Anemia, sinusitis, indigestion, fever, cough, teeth, mouth problems and ear pain problems

tified with the literature data available and also from experts of this region. The samples were cleaned with the help of AR grade reagents and chemicals. One gram of the plant sample was ashed with (10:1:4) HNO_3+HCl+H_2SO_4 acid mixture in a Teflon Beaker. A 0.5ml HCl acid was added in curved beaker placed on sand bath. The sample mixture was heated until a clear solution was obtained. After removing the cover, the mixture was evaporated until drying. The residue was extracted by 50 ml 2 N HCl and the extract was diluted by slightly with water and filtered through Whatman filter paper No.1. The filtered acid extract was diluted with deionised water and measured by using GBC 932 AA Unicom Flame Atomic Absorption Spectrometer (AAS) with digital and direct readout concentration and air-acetylene burner Single element hollow cathode lamps (Pye Unicom) for Cu, Mn, Fe, Zn were used at the recommended currents for each studied element.

In atomic emission spectroscopy, the metal is exited from the energy imparted to it thermally by the flame and then as it returns to the ground state it emits radiation at a characteristic wavelength. This radiation is then isolated by a monochromatic and subsequently its intensity is directly proportional to the concentration of the element present.

Data analysis

The results were analyzed statistically for each plant the experiment were repeated thrice mean values, standard error (mean±SD) and correlation significance calculated using SPSS package 12 version.

RESULTS AND DISCUSSION

Selection of the plants used for this study was based on their extensive use in traditional medicinal system of India. The botanical as well as common name of the plant, part used the place of collection, major metallic constituents and medicinal uses are listed in TABLE 1. As is evident from the literature, efforts were made to collect the samples from different ecological zones comprising of Gulbarga Sandur and Kappathagudda, the medicinal uses of these plants in Ayurveda cures a number of ailments including hypertension, neurological disorders, asthma, immuno-stimulants, antibacterial, menstrual disorders, rheumatism and urinary tract infection etc. Since the major elements are either direct or indirect involvement in biological activity, analysis of four major elements namely Fe, Zn, Mn and Cu was performed in a total of five plant samples collected from different ecological regions.

Iron

The average content of Fe range between 1370.37±1.17ppm/100g (TABLE 2) in the estimated five medicinal plants. The highest amount of Fe is recorded in the *Catharanthus roseus* (1370.37±1.17ppm). It is also observed that the variation of iron content plants collected from different geographical area. The results clearly indicated that the plants collected from Sandur and Kappadagudda

TABLE 2 : Estimation of Iron from medicinal plants collected from Gulbarga, Sandur and Kappathagudda (ppm/100g)

Plants name	Iron (in ppm)			Average mean of Iron
	Gulbarga	Kappathagudda	Sandur	
Ocimum sanctum	0974.00±3.36	0815.83±2.58	0195.00±0.57	0661.61±2.73
Catharanthus roseus	1099.20±0.35	1437.83±0.59	1574.10±3.25	1370.37±1.17
Trigonella foenum-graecum	1495.20±3.80	1097.53±0.54	0315.43±2.45	0969.38±3.54
Azadirachta indica	1095.80±3.47	1093.40±3.28	1855.40±2.85	1348.20±2.60
Aegle marmelos	0636.63±3.38	0675.90±0.45	1087.10±0.52	0799.87±1.05

samples contains higher amount of iron content, Due to the soil contains high of Mn and Fe contents, while plants collected from Gulbarga samples indicated lesser amount of Fe. The variation due to climatic variability and presence of mining activities in both areas, Fe element is important hemoglobin in component responsible for oxygen transport in human body[4].The normal tolerable range of intake of iron 15-120mg/day, Iron is undoubtedly the most important nutrient and its deficiency is cause of several disorders[1,5].The concentration of Fe in tulsi *Ocimum sanctum* and neem *Azadirachta indica* were 129 and 355mg/g^{-}1 respectively by[6,7,11,12,16,19]. reported that the highest present of Fe is estimated in purgnlaria tomentosa 292mg/g^{-}1 among the estimated plants.

Zinc

The average content of Zn ranged between 240.69±2.29 ppm/100g (TABLE 3) in the estimated five medicinal plants. The highest amount of Zn is recorded in the *Trigonella foenum-graecum* (240.69±2.29 ppm). It is also observed that the plant collected from different ecological area i.e., Gulbarga, Sandur and Kappathagudda, the deposition of mineral elements varies from place to place. However, the plants obtained from Sandur and Kappathagudda contains high amount of Zn content. While, Gulbarga plants samples contains lesser amount of Zn content (TABLE-3). It is clear from the above results accumulation of high amount of Zn content in Sandur and Kappathagudda, the soil contains rich amount of minerals due to mining area and it is a second abundant element in estimated five medicinal plants. The physiological activities of the plant influence the Zn absorption and the interaction with many elements like Fe, Mn and Cu, affects Zn uptake. Zn is the component

TABLE 3: Estimation of Zinc from medicinal plants collected from Gulbarga, Sandur and Kappathagudda (ppm/ 100g)

Plants name	Zinc (in ppm)			Average mean of zinc
	Gulbarga	Kappathagudda	Sandur	
Ocimum sanctum	212.10±0.57	216.50±2.20	201.16±0.31	209.92±4.56
Catharanthus roseus	111.56±0.12	202.96±0.54	216.86±3.36	177.12±3.02
Trigonella foenum-graecum	274.50±1.85	251.56±0.28	196.03±1.63	240.69±2.29
Azadirachta indica	123.60±2.40	076.60±0.30	009.46±0.28	069.89±3.12
Aegle marmelos	036.33±2.18	034.73±0.12	127.90±0.32	066.32±3.79

of more than 270 enzymes[8,9]. and its deficiency causes many physiological disorders. Besides, it is responsible for stimulating growth of epidermal and epithelial cells. The normal per day intake of Zn level is 12-15 mg/day. The similar kind of reports in medicinal plants has been reported by[6,7,11,12,13,16,19].

Manganese

The average content of Mn ranged between 030.10±5.66 ppm/100g (TABLE 4) in the estimated five medicinal plants. The lowest amount was recorded in *Aegle marmelos* (030.10±5.66). From the results it is clear that variation among the different area samples the highest content of Mn was detected in plants collected from Kappathagudda followed by Sandur, So, due to soil contains high amount of Mn. Similarly the least amount of Mn was recoded in the plants samples estimated from the Gulbarga. Mn is an important electrolyte also responsible for proper bones and liver function. It also works as co-factor in more than 300 metabolic reactions[14]. Normal daily intake of Mn is 2-8 mg/day[15,18]. Estimated the manganese from seven medicinal plants, in Acacia ehrenbergiana 339 mgkg^{-1} highest amount were detected. According to[7,12,16,19], most of the plants examined plants are safe.

TABLE 4 : Estimation of Manganese from medicinal plants collected from Gulbarga, Sandur and Kappathagudda (ppm/ 100g)

Plants name	Manganese (in ppm)			Average mean of Manganese
	Gulbarga	Kappathagudda	Sandur	
Ocimum sanctum	076.33±0.60	102.80±0.57	124.60±0.35	101.24±1.95
Catharanthus roseus	204.60±0.57	157.43±3.00	242.30±0.33	201.44±2.55
Trigonella foenum-graecum	048.36±0.88	605.50±2.56	032.93±1.20	228.93±1.30
Azadirachta indica	098.60±0.57	086.83±0.38	118.00±0.38	101.14±9.08
Aegle marmelos	023.00±0.30	026.00±0.57	041.30±0.57	030.10±5.66

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Copper

The average content of Cu ranged between 43.40±1.46 ppm/ 100g (TABLE 5) in the estimated five medicinal plants. The least amount was recorded in *Aegle marmelos* (43.40±1.46). It is also observed that the plant collected from different ecological area i.e., Gulbarga, Sandur and Kappathagudda. The mineral elements is varies from place to place. However, the Cu content is higher in samples estimated from Sandur and Kappathagudda plants obtained from Sandur and Kappathagudda. While, Gulbarga samples least content were recorded. Cu is the main constituent of the bone, connective tissue, brain, heart, and many other body organs[17]. Normal daily intake of copper is 2-5 mg/day. The elements Cu are some of the macronutrients, which are essential to human health and nutrition[15,18] reported that range of cu contents in 50 medicinally important leafy materials growing in India[7,12,16,19].

TABLE 5: Estimation of Copper from medicinal plants collected from Gulbarga, Sandur and Kappathagudda (ppm/ 100g)

Plants name	Copper (in ppm)			Average mean of Copper
	Gulbarga	Kappathagudda	Sandur	
Ocimum sanctum	176.70±1.76	099.06±0.32	273.40±6.00	183.05±0.42
Catharanthus roseus	069.16±0.40	079.46±0.38	087.00±0.49	078.54±5.17
Trigonella foenum-graecum	211.70±0.15	028.26±0.46	098.30±2.45	112.75±3.44
Azadirachta indica	059.13±0.39	027.13±0.81	048.10±1.22	044.78±5.38
Aegle marmelos	015.00±0.47	037.16±0.91	078.06±0.26	043.40±1.46

CONCLUSION

The present study reviles that all the plants selected for elemental study shows their presence but vary in concentration and their presence in also enteritis to cure many of the disease. The plants taken for the study may be contains light concentration but it is not toxic and do not effects on physiological function of the body. Pharmacological studies are necessary enclose it. This study indicates that some of these plants accumulate certain elements, and this property is exploited by the use of these plants for medicinal purposes in addition to their bioactive secondary metabolites constitutient. The elucidation of element specification in these plants helps interpret the therapeutic actions and may help in designing chemically pure medication. Caution, however, should be exercised in using any medicinal plant without establishing a picture of its element contents.

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