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Element Content of Some Ethnomedicinal Ziziphus Linn. Species Using Atomic Absorption Spectroscopy Technique

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ABSTRACT

Ziziphus species have wide distribution and uses worldwide traditionally as medicine. The flame atomic absorption spectroscopy was employed for the estimation of element contents of different plant parts of Ziziphus species collected from different areas of Pakistan. The results of the present study provide justification for the medicinal usage in the treatment of different diseases. The metal contents in the samples were found at different levels which play a vital role in cure of diseases. These results can give the importance about the herbal drugs prepared from these plant materials in herbal remedies and in pharmaceutical companies.

Keywords: Ziziphus, elements, medicinal plants.

INTRODUCTION

The genus Zizyphus belongs to the buckthorn family (Rhamnaceae). It is a genus of about 100 species of deciduous or evergreen trees and shrubs distributed in the tropical and subtropical regions of the world (Lawton, 1985). Now a day, traditional herbal medicine has been widely used not only in the developing countries but also in the industrialized world as an alternative. In addition to the identity of organic compounds, knowledge of the elemental content in medicinal plants is also very important. Many trace elements play a significance role in the formation of active constituents which are responsible for their curative properties (Yamashita et al 2005: Balaji et al 2000). The Ziziphus (Rhamnaceae) species is used in folk medicine for the treatment of some diseases, such as digestive disorders, weakness, liver complaints, obesity, urinary disorders, diabetes, skin infections, fever, diarrhea and insomnia (Steiner (1986): Scartezzini and Speroni (2000).

Medicinal plants contain both organic and inorganic constituents, and many medicinal plants are found to be rich in one or more individual elements, thereby providing a possible link to the therapeutic action of the medicine (Ray et al 2004: Singh et al 1997). Abundant research work has been carried out on the organic constituents of the medicinal plants while little attention has been paid on the role of inorganic elements in the medicinal use of these plants. Most of these plants are found to be rich in one or more individual elements, thereby providing a possible link to the therapeutic action of the medicine (Ray et al., 2004; Singh and Garg, 1997). The studies related with therapeutic plants aim to characterize the active components of plants for scientific evidence of its therapeutic properties (Naidu et al 1999: Ferreira et al 2003). In addition, the interest in chemical composition of medicinal herb products is growing because of ongoing developments in nutrition and in biochemical surveying and mineral prospecting (Rodushkin et al., 1999).

Macro, micro and trace elements are known to have important biological functions in plants and in human metabolic reactions. In medicinal plants, these elements make up active compounds or participate in reactions which lead to the formation of these compounds.1 Trace elements play a vital role in the formation of bioactive chemical constituents in medicinal plants and are therefore responsible for both their medicinal and toxic properties (Rajurkar and Damame. 1998).

Continuous clinical research suggests that the body’s balance of mineral trace elements is disrupted by diabetes. Traditional medicine plays an important role in the general state of health of a population. Many medicinal herbs and their mixtures can present a health risk due to the presence of toxic elements such as Pb, Cd, Al, Hg and other elements like Cr, which are hazardous to humans, depending on their oxidation states and present at high concentrations(Garcia et al., 2000; Lekouch et al., 2001; Lo´pez et al., 2000).

A number of techniques such as atomic absorption spectrometry (AAS), voltammetry, inductively coupled plasma atomic emission spectrometry (ICP-AES) and instrumental neutron activation analysis (INAA) is routinely used to determine trace elements in medicinal herbs. AAS is a versatile, non-destructive analytical tool widely used for the determination of minor and trace elements in complex biological samples. Present work was undertaken to determine the minor and trace element concentrations in 14 samples of 5 plants of genus *Zizyphus* from different regions of Pakistan. For this study, we focused on the determination of Na, K, Zn, Cr, Co, Cu, Ni, Pb, Mg, K, Ca, Cd, Mn and Fe as they are nutrient elements in plants.

Methodology

Sampling

Various parts of Genus Zizyphus plants were collected from and around the Quaid-i-Azam University campus and Lakki Marwat Pakistan. Surface contaminants of the plant samples were removed by washing with deionized water twice The leaves,barks,roots and fruits were air-dried in a clean drying chamber and then dried at 80°C overnight in an oven. The samples were powdered in pistil and mortar and passed through a 100-mesh sieve. Sampling is done from this powder. These samples were then weighed and used for ASS analysis.

Atomic absorption spectrometric (AAS) measurements.

According to Khan et al., (2011), the samples in the powdered form were accurately weighed and digested in a 5: 1:0.5 mixtures of nitric acid, sulphuric acid and perchloric acids. The solution was heated gently and then filtered.The entire filtrate was diluted suitably with distilled deionized water. The dilute filtrate solution was used for analysis of elements of interest by AAS (Model:AA 240FS Company:Varian) using suitable hollow cathode lamps.the concentrations of different elements in these samples were determined by the the corresponding standard calibrations curves obtained by using standared AR grade solutions of the elements.The examined plants and data on their medicinal use are given in Table 1.

RESULTS

Plants analysed in the present work with their botanical name, local name, part of plant used,medicinal uses (table 1). The results of elemental analysis obtained by comparator method of ASS technique are shown in table 2 in mg /g dry weight of the samples.it is to be noted that each result is an average of at least three independent measurements**.**

The elemental concentrations obtained for the leaves and extracts of the three *Zizyphus species* are presented in Table 2. As can be seen in this table, Ca, K, Na and Mg are the most abundant elements in leaves barks and fruits presenting concentrations ranging from 1 to 13 mg/g levels. The concentrations for trace elements Fe, Mn, Cu, Co, Cr and Zn were found in the medium range of 0.006 to 1.69 mg/g and Ni , Pb and Cd are toxic elements and occurs naturally in plants as a result of uptake, mainly in places with high concentration due to atmospheric and industrial fallout. These are found in 0.0001 to 0.0052 mg /g level. The ethno botanical uses of plants are supported by the elemental concentration of these plants parts. As locals use specific plant for curing any disease these plants are rich in those elements to cure that disorder.

Leaves of *C. sylvestris*, *C. decandra* and *C. oblique* present concentrations of comparable magnitude for most elements. The exceptions were Cl, Co, Mn and Na since *C. decandra* presented slightly higher concentrations of these elements. In the case of the extracts, *C. sylvestris* shows the highest concentrations for elements such as Ca, Cl, Co, Cr, La, Mg, Na, Sc, Se and Zn data.

DISCUSSION

Fe

Iron is an essential element for humans. It is a constituent of hemoglobin, myoglobin and a number of enzymes, and as much as 30% of the body iron is found in storage forms such as ferritin and hemosiderin, in the spleen, liver, and bone marrow, and a small amount is associated with the blood transport protein transferrin. Iron deficiency results in anemia, which ranges from a fall in plasma ferritin with no functional impairment to severe iron deficiency characterized by small red blood cells with low hemoglobin concentrations (NAS, 1989). Fe is important because it eliminates phlegm and strengthens the function of stomach. Hence the daily intake of iron is necessary. The requirement of Fe for an adult is 20 mg/day and for a child is 10 mg/day. The Fe concentration in the plants samples analyzed ranges from 0.64 to 1.69 mg/g. The Zizyphus plant parts contain a higher amount of Fe compared to the results of Ighodalo et al (1990).

Ca

It is required for the absorption of dietary vitamin B, for the synthesis of the neurotransmitter acetylcholine, for the activation of enzymes such as the pancreatic lypase. The recommended daily allowance for Ca is for children between 500 and 1000 mg and for adults 800 mg. To achieve a Ca level of nearly one percent of the total diet would be rather difficult. The concentration of Ca ranges from 1.6024 mg\g(*Z.jujuba* fruit) to 13.49mg\g(*z.nummelaria* leaves). The leaves are richer in Ca and are good for milk yielding cattels.

According to Ighodalo et al, (1990) Zizyphus spina-christi fruit pulp contains 2.25mg\g Ca while fruits of *Zizyphus mauritiana* contains 7.125mg\g Ca) which support present findings.

Na and K

The concentration of Na ranges from 0.3913 to 143.27 mg/g and K ranges from 5.75 to 11.47 mg/g. Potassium and sodium is one of the most abundant elements in the plant materials. The regulation of potassium is intimately involved with that of sodium and the two are largely interdependent. Plants absorb sodium and potassium in the form of Na ions and K ions from soils. Our data indicate that medicinal and edible plant parts are not deficient in potassium. The fruits of Zizyphus Jujuba contain highest conc of Na 143.27mg/g while Z.nummularia leaves contain the lowest 0.3913The use of fruits as food by humans and leaves as fodder by cattle which are rich in K (5.57- 11.42 mg/g) might help in the case of a potassium deficiency.

Mg

Mg is considered the most important mineral for stress relief. Zizyphus samples contain 1.912to 5.85 mg/g Mg which is greater as compared to Ighodalo (1990) findings.

Zn

Zinc is a component of a wide variety of enzymes, including the ribonucleic polymerases, alcohol dehydrogenase, carbonic anhydrase, and alkaline phosphatase (Institute of Medicine, 2001). Studies in animals have shown that zinc deficiency during pregnancy may lead to developmental disorders in the offspring (Hurley and Baley, 1982).). Zinc is an important constituent of viable sperm especially human sperm. It is necessary for the growth and multiplication of cells (enzymes responsible for DNA and RNA synthesis), for skin integrity, bone metabolism and functioning of taste and eyesight (Thunus and Lejeune, 1994). Zinc deficiency in humans may be caused by high intake of phytates or fibers and several diseases as cirrhosis of the liver. The concentration of Zn in Zizyphus ranges from 0.01832 to 0.49mg\g and is higher than that found by (Ighodalo et al., 1990).

Cu

Under normal circumstances, dietary copper deficiency has not been observed in adults, Human and animal studies suggest a correlation between the zinc-to-copper ratio in the diet and the incidence of cardiovascular disease (Klevay, 1984). in Zizyphus plant parts Cu ranges from 0.0116 to 0.066mg\g these values are greater as compared to Ighodalo (1990) found 0.0064 mg\g Cu in fruits of *Zizyphus spina-christi* and 0.0060 mg\g in fruits of *Zizyphus mauritiana.*

Co

Cobalt is essential for the B12 vitamin and the thyroid metabolism.The Co concentration varied from 0.006 to 0.03 mg\ g in Plants samples.0043mg Co is present in fruits of Zizyphus (Ighodalo et al, 1990; Rajurkar and Damame, 1998) found a high concentration of Co (84 mg/g) in Bore (zyziphus jojobar) leaves.

Mn

There are two enzymes known to contain manganese; pyruvate carboxylase and superoxide dismutase (NAS, 1989). The Mn content of 0.00052 to 0.0212mg/g was observed in the same plant samples.

Cr

Chromium deficiency can cause an insulin resistance, impair in glucose tolerance. The Cr content in the plants parts analyzed is relatively low (0.02-0.05 mg/g).

Pb, Cd and Ni

The plants samples contain Ni 0.0006 to 0.0016 mg/g,Cd 0.0001 to 0.005 mg/g and Pb 0.0002 to0.0028mg/g., These elements are supposed to be toxic in nature, and their presence in trace amounts in various medicinal plant samples analyzed may be due to the pollution arising from automobile and industrial activities.

CONCLUSION

Among the various elements detected in different plants of genus Ziziphus used in the cure of various diseases. The data obtained in present study will be helpful in the synthesis of modern drugs with various combinations of plants. There is a need to study further pharmacological activity as they are an ideal alternative drugs in especially under develop countries.

Table 1. List of Rhamnaceae plants investigated with location, status and Accession number.

Species	Locality	Status in Pakistan	Distribution World Wide	Accession no
Zizyphus spina-christi (L.)	Lakki Marwat	Wild	North & East Africa, Arabia, Egypt, Syria, Palestine, Lebanon, Iraq, South.Iran,Eastern Afghanistan, Pakistan, and North West India.	N-44
Z. .sativa	Sawat	Wild	Pakistan, India , Afghanistan and China.	N-45
Z.oxyphylla Edgew	Islamabad	Wild	Pakistan, (Punjab, N.W.F.P.), Kashmir, India, Temp. Himalayas.	N-46
Z.mauritiana Lam.	Islamabad	Wild	India, Pakistan, Afghanistan, Ceylon, China, Australia, Trop Africa.	N-47
Z.nummularia (Burm.f)	Islamabad	Wild	Palestine, Iraq, Afghanistan, Pakistan, and India.	N-48
Z.jujuba Mill	Lakki Marwat	Cultivated	South Europe, Mediterranean region, Afghanistan, Iran, Pakistan, India, Mongolia, Japan, China, Tibet , South & East Asia.	N-49
Helinus lanceolatus Wall	Margala Hills	Wild	Pakistan, western Himalayas, and India.	Accession no 18288
Sageretia brandrethiana	Muzaffarabad	wild	Afghanistan, North West India, Pakistan, South West Asia (Iran)	Accession no 74855
S. thea (Osbeck.)	Sargodha	Wild	Iran, Pakistan, India, Nepal, Afghanistan, Arabia, China and North East Africa.	Accession no 89724
S. thezanus (L.) Borgn.	Gilgit	Wild	Thivan and North Pakistan	Accession no 64044
Rhamnuspurpurea Edgew.	Hazara	Wild	Pakistan, Kashmir, India (North Punjab), Kumaon and Nepal.	Accession no 96807
R. virgata Robex.	Hazara	Wild	Afghanistan, North West Pakistan, Kashmir, India, Bhutan and Burma.	Accession no 11954
R.pentapomica Parker.	Attock	Wild	Pakistan, Afghanistan, India and Kashmir.	Accession no 10087
R. triquetra (Wall.)	Swat	Wild	Pakistan, Western Himalayas and Kashmir.	Accession no 74859

Table 2. Elemental analysis of genus *Ziziphus*

Species	Na	K	Zn	Fe	Cr	Co	Cu	Ni	Pb	Mn	Ca	Mg	Cd
Zizyphus jujuba leaves	65.94	60.38	0.25	11.39	0.05	0.08	0.018	0.003	0.0001	0.048	52.01	30.61	0.0001
Z.jujuba fruits	72.89	60.38	0.25	6.84	0.05	0.08	0.004	0.002	0.0002	0.0166	8.82	10.89	0.006
Z.*jujuba* roots	3.91	55.72	0.21	6.14	0.04	0.04	0.003	0.0009	0.001	0.009	42.40	15.06	0.004
Z.*spina-christa* leaves	44.62	60.13	0.25	7.52	0.05	0.01	0.014	0.002	0.0003	0.026	57.15	22.76	0.001
Z.*spinna-christa* fruits	65.90	60.79	0.23	6.88	0.10	0.02	0.01	0.002	0.001	0.018	9.45	10.94	0.001
Z.spina-christa bark	48.39	32.58	0.10	24.98	0.12	0.07	0.029	0.006	0.0003	0.0356	62.39	27.07	0.002
Z.mauritiana bark	65.05	49.67	0.25	7.27	0.05	0.01	0.003	0.002	0.001	0.0229	62.17	11.72	0.006
Z.mauritiana fruit	34.16	60.21	0.23	7.21	0.13	0.04	0.004	0.002	0.001	0.0234	22.82	15.88	0.003
Z.muaritiana leaves	77.74	58.83	0.23	9.72	0.15	0.01	0.006	0.003	0.001	0.0395	66.10	28.46	0.0002
Z.nummularia leaves	5.10	58.50	0.20	8.86	0.16	0.07	0.002	0.005	0.0001	0.0389	68.28	29.18	0.001
Z.nummularia leaves fruits	3.53	60.91	0.19	6.72	0.15	0.01	0.017	0.005	0.0001	0.0268	23.57	26.27	0.001
Z.oxyphylla leaves	44.40	60.51	0.17	8.73	0.19	0.00	0.004	0.005	0.001	0.1203	41.36	32.60	0.004
Z.oxyphylla bark	54.14	57.15	0.14	8.55	0.14	0.00	0.005	0.003	0.003	0.0455	33.17	19.78	0.003
Z.oxyphylla fruits	24.50	60.90	0.11	6.71	0.17	0.04	0	0.003	.0020	0.0466	18.57	18.38	0,001

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