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Quantification of Total and Water Extractable Essential Elements in Medicinal Plants Used for Stomach Problems

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Abstract

The role of elements particularly trace elements in health and disease is well known. Present study has been undertaken in our laboratories to quantify the commonly occurring elements in three medicinal plants, *Peganum harmala* Linn, *Phyllanthus emblica* Linn, *Tamarix dioica* used for stomach problems using atomic absorption spectrophotometer. Wet digestion method has been used to extract the acid extractable metals. Samples were boiled in water to obtain water extractable metals. The validation of the method was checked with the NBS- 1570 (Spinach) as Standard Reference Material.

Levels of essential elements were found high as compared to concentration of toxic elements. The considerable amounts of essential elements such as calcium, magnesium, potassium, zinc and iron were found in all these plant samples.

Key words: Peganum harmala Linn., Phyllanthus emblica Linn, Tamarix dioica Roxb trace elements, A.A.S

Introduction

Medicinal properties have been attributed to a large variety of plants, cultivated or naturally grown in different parts of Asian countries [1,2]. The effect of *Phyllanthus emblica* on total serum cholesterol of normal and hypercholesterolemic men aged 35-55years was investigated by Jacob *et al* [3]. Extract of this plant was given for 28 days in raw form. Normal and hypercholesterolemic subjects showed decrease in cholesterol levels. Two weeks after the supplement was withdrawn, total serum cholesterol levels of the hypercholesterolemic subjects attained the initial levels. In order to understand the use of medicinal plants and their mode of action, it is necessary to know about their active constituents [4,5].

Elements, especially trace metals play vital role in the medicinal values of plants and have therapeutic effects on health and diseases [6-10]. The trace elements are crucial to virtually all biochemical and physiological processes. A balanced diet provides sufficient intake of mineral elements. Those supplied by the medicinal plants are associated with the other active principals and the medicinal action of such mineral constituents is of supplementary importance [11,12].

Botanical and Pharmacological description of medicinal plants

Peganum harmala Linn. Commonly called *Harmal*, belong to family Zygophyllaceae have many Pharmacological actions in stomach ailments, and the plant is also used as aphrodisiac, emmenagogue, galactagogue and abortifacient, narcotic and is given in fever, cold, hysteria, rheumatism, gallstone in gall duct and jaundice. Seed fumes are useful against palsy and lumbago.

Phyllanthus emblica Linn. commonly called *Amla*, belong to family Euphorbiaceae. It is used in palpitation, scurvy, cardiac debility, and blood heat. Its compound preparations (like Jawarish Amla) are effective against tachycardia and liver dysfunction. It is also diuretic and antiseptic.

Tamarix dioica Roxb. commonly called *Jhau* belong to family Tamaricaceae and has many pharmacological actions such as the ash of it is used as ointment on ulcers, piles, stomach and anal fissure. *Tamarix* species are good astringent, used in leucorrhoea, spleen troubles and liver disorders.

Materials and Methods

Plant samples

Five to ten samples of all plants *Peganum harmala, Phyllanthus emblica, Tamarix dioica* were collected from different areas of Sindh. Some were purchased from commercial suppliers. Samples were identified by coworkers of Botany Department of the University of Sindh , Jamshoro, Pakistan.

Experimental

Reagents and Equipment

All the reagents used were of AR Grade. All the standards and samples solution were prepared in deionized water. Metals analysis of plant samples and reference materials was carried out by Atomic Absorption Spectrophotometer (Hitachi Model 180-50) equipped with background correction. The flame absorption mode was used with air - acetylene and Nitrous oxide-acetylene flame.

Decomposition of plant samples

Medicinal plant samples were washed with distilled water and dried at 120°C in an electric oven to a constant weight. The dried plant material was then ground to powder.

Triplicate samples of each plant and certified reference material was weighed into separate digestion flasks and treated with 5ml nitric acid, the flasks were covered with watch glasses and heated to reflux on an electric hot plate at 80 °C to 100 °C. After heating for one hour, the contents of flasks were treated with additional 5ml of nitric acid, followed by 2ml of 30% hydrogen peroxide in each flask and the heating at gentle reflux was continued until a clear and transparent solution was obtained. The volume of contents was reduced to semi dried mass; the flasks were cooled and diluted with 2N HNO_3 then filtered through Whatman # 42 paper into volumetric flasks sample blanks were prepared following the same procedure. SRM (NBS-1570) spinach solution were also prepared.

Preparation of Decoction of plant materials

2g dried sample of each plant material was heated with 50 ml deionized water in separate flasks on electric hot plate for half an hour. The content of flasks were cooled and filtered through Whatman filter paper No. 42 into volumetric flasks and marked as stock sample solutions. The aqueous extract gave positive test for the presence of glycosides, saponin and sugar only which are water soluble, other water insoluble organic compounds were absent

Metals Analysis

Working standard solutions of aluminum, calcium, cadmium, cobalt, chromium, copper, silver, iron, lead, manganese, magnesium, nickel, potassium, sodium, and zinc were prepared from stock standard solution (1000 ppm), in 2N nitric acid and calibration curves were drawn for each element using Atomic Absorption Spectrophotometer Hitachi model 180-50. The calibration curves obtained for concentration vs absorbance data were statistically analyzed using fitting of straight line by least square method. Fifteen elements were determined in medicinal plants using air-acetylene and nitrous oxide- acetylene flame mode.

Table 1: Acid extractable metal levels in medicinal plants, *peganum harmala* Linn. (harmala), *phyllanthus emblica* Linn. (Amla) and *Tamarix dioica* (Jhau) by atomic absorption spectrometery (mg/100 g on dried weight basis; range values)

Metals	*Peganum harmala* (Seeds)	*Phyllanthus emblica* (Seeds)	*Tamarix dioica* (Leaves)
Sodium	1849– 2705	3876- 4234	1428 -1544
Potassium	1632-1846	3627 - 4349	1248 -1807
Calcium	3813 - 4742	3617 - 4791	2433 – 2818
Magnesium	1744 – 1922	1245 -1583	573.6 – 916
Iron	6.36-9.45	5.26 – 8.75	6.38 – 6.96
Zinc	6.64- 9.45	16.26 – 19.94	5.24 – 7.85
Manganese	1.77- 2.45	1.55 – 3.42	2.21 – 3.25
Cobalt	0.525- 0.677	0.244 – 0.399	0.219 – 0.267
Chromium	0.281 – 0.522	0.181 – 0.266	0.144 – 0.241
Copper	0.351 – 0.665	0.383 – 0.537	0.832 – 0.966
Nickel	0.351 – 0.595	0.388 – 0.538	0.834 – 0.951
Lead	0.416 – 0.891	0.443 – 0.538	0.332 – 0.366
Cadmium	0.316 – 0.796	0.344 – 0.528	0.231 – 0.361
Barium	0.843 -1.34	2.45 - 3.84	8.26 -10.35
Aluminum	12.84 - 19.58	9.45-14.66	5.75- 8.56

Blank solution was also sum. Results were checked by sunning solution of SRE NBS-1570 (Spinach). Results have been presented in Table 1-3

Table 2: Metal levels in decoction of medicinal plants, *peganum harmala* Linn. (harmala), *phyllanthus emblica* Linn. (Amla) and *Tamarix dioica* (Jhau) by atomic absorption spectrometery (mg/100 g on dried weight basis; range values)

Metals	*Peganum harmala* (Seeds)	*Phyllanthus emblica* (Seeds)	*Tamarix dioica* (Leaves)
Sodium	589- 613	757- 871	689 -734
Potassium	621 - 912	839 - 937	619- 840
Calcium	818 - 1214	790 - 990	721- 823
Magnesium	470 -852	712 – 788	416 – 440
Iron	1.24- 3.85	2.64-3.74	4.15 – 4.64
Zinc	2.50- 3.82	3.75 - 4.84	4.16 – 5.24
Manganese	0.277- 0.441	0.266 – 0.386	0.717 – 0.847
Cobalt	0.171- 0.341	0.166 – 0.199	0.112 – 0.218
Chromium	0.139 – 0.278	0.141 –0.184	0.111 – 0.114
Copper	0.153- 0.178	0.122 –0.252	0.383 – 0.442
Nickel	0.082- 0.177	0.125 – 0.156	0.383 – 0.434
Lead	0.141 – 0.157	0.099 – 0.134	0.125- 0.161
Cadmium	0.141 – 0.195	0.089 – 0.128	0.112- 0.139
Barium	0.123- 0.564	1.12- 1.26	2.23 - 3.67
Aluminum	1.38 - 2.55	1.46- 2.64	2.35 - 3.68

Table 3. Analysis of metals in standard reference materials NBS- 1570 (Spinach) mg/100g

Elements	Reference value	Measured value
Na	----	608± 2.8
K	3560 ± 5	3568±12
Ca	----	678±5.6
Mg	-----	145.0 ±1.8
Fe	55 ± 2	53 ± 3.5
Zn	5.0 ± 0.2	4.8 ± 0.28
Mn	16.5 ± 0.6	16.6 ± 0.7
Co	0.15	0.47 ± 0.05
Cr	0.46	0.44 ± 0.05
Cu	1.2 ± 0.2	1.22 ± 0.3
Ni	0.6	0.62 ± 0.04
Pb	0.12 ± 0.02	0.12 ± 0.025
Al	87.0±2	86.5±3.5
Ba	----	2.56 ±0.56
Cd	0.15	0.148 ± 0.004

Result and Discussion

There are many type of stomach problems including gas, abdominal pain, nausea, vomiting, constipation and diarrhea etc. Viruses or contaminated food produces stomach problems. Vitamin "B" complexes, Mg, Ca, Cr, Zn and vitamins (A, E, C), all serve to help people with diarrhea or colitis. Many herbs are used in Asia and Europe for inflammation as well as indigestion problems. Zinc plays an important role in medicating, hunger and digestion. It is an essential trace element for digestion process. Because many digestive enzymes activate with the help of zinc. Many researchers suggested that zinc supplements decrease the incidence of persistent diarrhea in children [13, 14].

The results shown in Table 1& 2 show that the level of sodium, potassium, magnesium and calcium were found in the range of 1428 - 4234, 1248- 4349, 574-1922 and 2433- 4791mg/100g respectively in all three plants. The considerable amount of these elements was also observed in decoction of all these plants. So when the extract of these plants were given in diarrhea and cough they help to maintain the electrolyte balance.

Sodium and potassium participating in maintaining water and mineral equilibrium, acid-

base equilibrium, contraction and relaxation of muscles, sugar metabolism and protein synthesis. Supplements provided by medicinal plants appear to relieve symptoms of stomach problems such as reduced appetite, suppressed immunity and impaired taste.

The other essential elements such as zinc, iron, manganese and cobalt were present in considerable amounts in the ranges of 5.24-19.94 , (5.26-9.45, 1.55-3.25 and 0.219-0.677 mg/100g respectively on dry weight basis. The high level of iron was observed in Peganum harmala and high amount of zinc was present in Phyllanthus emblica. These elements play essential role as cofactors in many enzymes. Zinc also plays a vital role in human body, essential for digestion. Zinc is involved in the production of hydrochloric acid in the stomach and in the conversion of fatty acids to prostglandins, which regulate body process such as heart rate and blood pressure. Zinc supplements provided by medicinal plants appear to relieve symptoms of inflammatory bowl disease, such as reduced appetite suppressed immunity and impaired taste. The body to make tendons uses iron and the presence or absence of iron controls ligaments and certain chemicals in our brain. It is also important for maintaining a healthy immune system and for digesting certain things in the food that we eat. Iron also plays an important role in our body. Manganese is cofactors of many enzymes that help us to digest the food that we eat. The cobalt is necessary for the physiological actions of vitamin B_{12}. This vitamin is to help vitamin C, to perform its function and is necessary for the proper digestion of food.

Conclusion

Mineral elements such as Na, K, Mg, Mn, Zn, Co, Cr, and Fe were present in these medicinal plants. They may be directly or indirectly helpful in the management of many diseases. Level of toxic elements are found to be very low in these medicinal plants.

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