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ELEMENTAL ANALYSIS OF MEDICINAL PLANTS USED AS DRUGS IN UNANI SYSTEM OF MEDICINE

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Abstract

Modern medicine starts the study of human body from the level of cell and tissues while Unani Medicine starts its study from the very lowest level of organization and that is an element. Leaves seeds and roots of some selected medicinal plants collected from the Lora, Abbottabad were analyzed for elemental concentration such as Al, Ca, Cr, Fe, K, Mg, Mn, Mo, Na and Zn using Atomic Absorption Spectrometer. Among the leaves it was observed that calcium was maximum (98.2 ppm) in *Justacia adhatoda* and minimum (0.396 ppm) in *Oxalis corniculata* followed by K which was greater (59.06 ppm) in *Mentha viridis* and lower (0.127 pm) in *Zanthoxylum armatum*. Among the seeds the results showed that calcium was maximum (301.4 ppm) in *Punica granatum* and minimum (0.5 ppm) in *Avena sativa* followed by K and it was greater (60.64 ppm) in *P. granatum* and lower (1.082 ppm) in *Pinus roxburghii*. Other elements like Al, Ca, Cr, Fe, K, Mn, Na and Zn contents were higher in *Berberis lycium* roots than *Taraxicum officinale* roots. The present investigation revealed that various plant parts of medicinal plants of Lora, Abbottabad are rich source of important minerals and calcium contents will help the local people in hypertension, osteoporosis and in bones strength. Potassium contents in leaves may be effective in blood pressure and in constipation.

Key words: Medicinal Plants**,** Elemental analysis, Unani medicine system

Introduction

Medicinal plants play a significant role in providing primary health care services to rural people and are used by about 80% of the marginal communities around the world. In China, medicinal plants form an integral part of the formal health system and are used in about 40 % cases at the primary level. Special encouragement has been given for the cultivation of medicinal plants and agriculture departments at all levels take part in formulating policy and establishing plantations covering 300,000 hectares. Medicinal plants form a central tenet of Lao traditional medicines and a total of 61 medicinal plants were on sale. In India the coverage of rural population by the modern health system varies between different regions from 3 to 30 %. Some 400 to 500 million people use traditional medicine for health care in the absence of the ailing government-run health-care systems. Traditional Indian ayurvedic preparations have 70 % of the formal medicine market share in India (Singhal, 2005). In Brazil phytotherapy is present in about 350 locations in primary health care. Khana *et al.,* (2009) worked on the use of medicinal plants in healthcare practices by Rohingya refugees in a degraded forest of Bangladesh and 34 plant species were frequently used by the Rohingyas to treat 45 ailments (headaches, complex eye and heart diseases). For medicinal preparations and treating various ailments, aboveground plant parts were used more than below ground parts. Some other workers have also highlighted the importance of medicinal plants in health care such as Payyappallimana, (2009); Pathak & Das, (2013); Dastagir *et al*., (2014).

In recent years, increasing interest has been focused on phytomedicines as safer and more congenial to the human body. Medicinal plants are used for the preparation of various drugs singly or in combination or even are used as the principal source of raw material for the other medicines. More than 40 elements have been considered essential to life systems for the survival of plants (Bachheti *et al*., 2012). Many scientists highlighted the importance of minerals which enhanced the awareness of minerals in these plants (Koe & Sari, 2009). The elements like Mg, Fe, Cu, Ca, and K are important medicinally. Fe deficiency is associated with myocardial infarction. Mg lowers the cholesterol. Cu plays an important role in controlling blood lipid level (Zafar *et al*., 2010). The literature showed that the deficiencies of minerals cause many problems in human bodies (Djama *et al.*, 2011). Many workers investigated the mineral composition of medicinal plants e.g., (*Oxalis corniculata* Ashok *et al.,* 2010; *Amaranthus viridis*, *Chenopodium murale*, *Nasturtium officinale*, Imran *et al*., 2007; *Anethum graveolens*, *Sisymbrium irio*, *Vernonia anthelmintica* Fatima *et al.,* 2012). References are not available on the elemental composition of medicinal plants of Lora, Abbottabad, Pakistan. The detection of minerals of the widely used medicinal plants is highly desirable. In our country medicinal plants are used in different forms either in the form of decoction or infusion or by the local communities in different regions of KP. The objective of the present study was to find out the minerals composition of some selected medicinal plants of Lora, Abbottabad which are being used for the treatment of different diseases presently.

Materials and Methods

Collection of samples: The plants were collected from Lora Valley, Abbottabad during 2009.They were oven dried at 65ºC for 72 h. The ground samples were stored in plastic bags for elemental analysis. The plants after

identification with the help of flora of Pakistan were deposited in Peshawar University Herbarium, Department of Botany, University of Peshawar.

A small amount (0.5g) of the powdered plant material was taken in a 50 ml conical flask and 10ml nitric acid (HNO_3) was added in it and allowed to stand overnight. Next day, perchloric acid (4 ml) was added in it and it was boiled on a hot plate in a fume hood. After few minutes the yellowish color of plant material changed into white fumes and it indicated that digestion was completed. The flasks were removed, cooled down and distilled water (100 ml) was added. It was filtered with filter paper (Whatman # 42) and filtrates were collected in labelled plastic bottles. These solutions were analyzed for the elements through Atomic Absorption Spectrometer (Zafar *et al*., 2010).

Table 1. Instrument Operation Parameters

Elements	Symbol	Wave Length (nm)	Slit with (nm)	Sensitivity (mg/L)
Aluminum	Al	309.3	0.5	
Calcium	Ca	422.7	0.7	0.092
Chromium	Cr	357.9	0.7	0.041
Iron	Fe	248.3	0.2	0.039
Potassium	K	766.5	0.7	0.043
Magnesium	Mg	285.2	0.7	0.008
Manganese	Mn	279.5	0.2	
Molybdenum	Mo	320.9	0.2	
Sodium	Na	589.0	0.2	0.012
Zinc	Zn	213.0	0.7	0.018

Recommended Flame: Air- Acetylene

Results and Discussion

Ethno-medicinal uses of plants: In the study areas *Amaranthus viridis* leaves were cooked as spinach. The leaves of *Zanthoxylum armatum* were used as fodder, while plants were also used for gas trouble, cholera, stomach disorder, piles, toothache and indigestion. The dried leaves of *J. adhatoda*, *Trachyspermum ammi*, black pepper, ginger and *Terminalia bellerica* are mixed and ground and this powder was given to the patients suffering from asthma, T.B, stomach problems and cough. The dried leaves of *Mentha longifolia, T. ammi*, and common salt are ground together and this powder was given to the patients suffering from indigestion, gas trouble and stomach disorder.

In the present study areas dried seeds of *Punica granatum* and sugar are ground and the powder was given to the patients suffering from indigestion, jaundice, fever, vomiting, diarrhea, dysentery, and stomach disorder. Fresh roots of *Berberis lycium* are cut into small pieces and boiled in water for 4-6 hours. This root decoction is mixed with sugar, flour and cooking oil and is cooked. This sweet meal was given to the patients suffering from rheumatism, and backache problems.

Elemental analysis

Leaves: Aluminium concentration was highest (53.36 ppm) in *Amaranthus viridis* and lowest (4.631 ppm) in *Pyrus pasha*.

Calcium helps in hypertension, osteoporosis, colon cancer and in bones strength (Sanjay *et al*., 2010; Chowdhary & Rasool, 2010). Calcium was maximum (98.2 ppm) in *J. adhatoda* and minimum (0.396 ppm) in *O. corniculata* (Table 2). Hossen *et al*. (2014) reported higher calcium contents in the leaves of *J. adhatoda*. The necessary daily intake is between 350 and 1100 mg/day (Stef, 2010).

Chromium plays an important role in the synthesis of fatty acids and cholesterols. The permissible limit of Cr in plants is 1.5 µg/g (Markert, 1994). Chromium was richest (0.056 ppm) in *Mentha longifolia* and poorest (0.023 ppm) in *Olea ferruginea* and *A. viridis*. Iron is also an essential element for plant and animal growth. Its deficiency can cause various types of diseases. Iron was highest (7.145 ppm) in *M. longifolia* and low (0.562 ppm) in *Pistacia chinensis* (Table 2). Jena *et al*., (2013) reported that leaves of *M. longifolia* had (4980 mg kg-1) Fe content. Ahmad *et al*. (2011) stated that Fe content decreased in *M. longifolia* matured through the autumn and winter. Ahmad *et al*. (2011) also reported that *M. longifolia* leaves are used as a domestic herbal remedy, due to its antiseptic and digestive properties while tea made of leaves is used in fevers, headaches and digestive disorders**.**

Potassium maintains body water balance, blood pressure, cardiac rhythm and helps in constipation. Its deficiency or excess can affect human health (Haq *et al*., 2012). It was greater (59.06ppm) in *Mentha viridis* and lower (0.127 pm) in *Z. armatum* (Table 2). Sulieman *et al*., (2011) reported less K contents in *M. spicata.*

Magnesium is responsible for proper nerve and muscle function (Yamashita *et al.*, 2005). It was highest (7.5 ppm) in *A. viridis* and lowest (0.63 ppm) in *Adiantum capillus veneris* (Table 2). Imran *et al*. (2007) reported high Mg in *A. viridis*. The necessary daily intake is 350 mg/day for men and 300 mg/day for women (Stef *et al*., 2010).

In the present study, manganese was maximum (0.434 ppm) in *Azadirachta indica* and low (0.042ppm) in *P. chinensis* and it was not detected in *M. longifolia*. Singh *et*

al. (2010) reported higher (60.3 ppm) Mn in *A. indica* and this plant was used in diarrhea, dysentery, jaundice, asthma and leprosy in Manipur. Atangwho *et al*., (2009), Sher *et al*. (2011) and Khattak and Khattak (2011) also reported higher level of Mn in *A. indica* and was used as anti-diabetic plant. Adazabraa *et al*. (2012) also reported higher Mn in *A. indica*.

Sodium was highest (15.82 ppm) in *M. longifolia* and lowest (3.877ppm) in *Vitex negundo* (Table 2**).** Ghani *et al*., (2012) reported that *M. longifolia* had (373.1 mg/I) calcium content. Zinc causes healing of wounds, helps in coronary artery disease and ulcer problems (Singh *et al.*, 2010), and has an essential role in diabetes and had low toxicity compared with other trace elements (Rajendran *et al.*, 2007). Zinc was highest (0.089 ppm) in *M. viridis* and lowest (0.314 ppm) in *V. negundo* (Table 2).

Seeds: Aluminium is distributed in the whole food chain. The possible connection between elevated tissue Al content and problems such as encephalopathy, dementia and Alzheimer's disease has awakened interest in Al intake via the diet. Its intake ranged from 0.7 and 11.5 mg/day **(**Cabrera *et al*. 2003). Aluminium content was highest (11.49 ppm) in *Juglans regia* and lowest (4.564 ppm) in *Punica granatum* (Table 2). Cabrera *et al*., (2003) also reported higher Al concentration in *J. regia*.

Calcium helps in hypertension, osteoporosis, colon cancer, and in bones strength (Sanjay *et al.*, 2010). It was maximum (301.4 ppm) in *P. granatum* and minimum (0.5 ppm) in *Avena sativa* (Table 2). Dadashi *et al*., (2013) reported (378.0 %) Ca contents in *P. granatum* seeds. It is one of the oldest edible fruits that has been used extensively in the folk medicine of many cultures and contains considerable amounts of seeds. The seeds contain lipid, protein, sugars and essential minerals (Dadashi *et al*., 2013). Israr *et al*., (2012) stated that *P. granatum* fruit, barks and leaves are used in leprosy, dyspepsia, antipasmodic and anthelmintic. Chromium was richest (0.051ppm) in *Z. armatum* and poorest (0.05 ppm) in *P. roxburghii* (Table 2).

Iron is a component of hemoglobin and myoglobin and maintains a healthy immune system and digestive action (Ahmed & Chaudhary, 2009). In the present study iron was high (1.928 ppm) in *J. regia* and low (0.256 ppm) in *Zea mays* (Table 2). On the other hand Ibrar *et al*., (2013) reported higher Fe contents in *Zea mays*. Muradoglu *et al*., (2010) and Özcan (2009) reported low Fe in *J. regia*. Potassium was greater (60.64 ppm) in *Punica granatum* and lower (1.082 ppm) in *P. roxburghii*. These results disagree with Haq *et al.*, (2012) and Dadashi *et al*., (2013) who reported poor or absence of K in *P. granatum.* The necessary daily intake of K is between 2-4 g/day (Stef *et al*., 2010). In the present study magnesium was highest (6.1 ppm) in *J. regia* and lowest (0.95) in *Z. mays*. Manganese increased (0.29 ppm) in *J. regia* and reduced (0.0 ppm) in *P. roxburghii, P. granatum*, *A. sativa* and *Z.mays* (Table 2). Muradoglu *et al*. (2010) reported higher Mn in *J. regia*. Sodium was highest (9.475 ppm) in *P. roxburghii* and lowest (4.98 ppm) in *J. regia*. Zinc was highest (0.85 ppm) in *P. roxburghii* and lowest (0.304 ppm) in *J. regia* (Table 2).

Roots: Aluminium, calcium, chromium, iron, potassium, manganese, sodium and zinc was highest in *Berberis lycium* as compare to *Taraxacum officinale* (Table 2). These results disagree with Stef *et al*., (2010) who reported higher K (11420 ppm) in *T. officinale* while Ata *et al*., (2011) reported (180 ppm) K in *T. officinale*. Traditionally, *B. lycium* has been used as antidiabetic, hepatoprotective, and for healing wounds. It is mentioned in Indian and British pharmacopoeias and now this plant needs to be protected in the study areas for future nutritional and medicinal requirements**.** Molybdenum (Mo) was not detected in any part of the investigated plants in the present study.

Other plants: In the present study *Bauhinia variegata*, *Allium sativum*, *Morus alba* and *Acacia nilotica* parts showed variation of minerals and it was observed that Ca, K, Cr, Fe and Al were maximum in *A. sativum* while Mg, Na, and Zn were highest in *M. alba*, *B. variegata* and *A. nilotica*. Similarly, Na and Zn were lowest in *A. sativum*; Ca and Mg were lowest in *A. nilotica*; K, Fe, and Al were lowest in *B. variegata* and Cr was lowest in *M. alba* (Table 2).

Trend of accumulation: It was observed that Ca > K > Al > Na > Mg > Fe > Zn >Mn >Cr > Mo in the seeds of the studied plants. It was seen that Ca > K > Al > Na > Mg > Fe > Mn > Zn > Cr > Mo in the leaves of the investigated plants. It was found that Ca > K > Al > Na > Mg > Fe > Zn > Cr > Mn and Mo in the roots of the studied plants.

These plants are being used in Lora, Abbottabad for the treatment of different diseases (e.g., skin infections, carminative, lower blood pressure, healing of internal wounds, leucorrhoea, indigestion, gas trouble and stomach disorder, brain weakness, toothache, hoarseness and throat sore**.** They are effective in liver, bladder inflammation, jaundice, to purify blood, fever, vomiting, diarrhea, and dysentery. These plants are also being used in the herbal medicines for the treatment of various diseases.

Conclusion

Among the studied plants it was observed that Ca was highest in the leaves of *Justacia adhatoda* followed by K which was maximum in the leaves of *Mentha viridis*. Among the plants it was observed that Ca and K were highest in the seeds of *Punica granatum*. Aluminium, Ca, Cr, Fe, K, Mn, Na and Zn were found to be maximum in *Berberis lycium* roots as compare to *Taraxacum officinale* roots. Literature review states that elements like K, Ca, Cr, Mn, Cu, and Zn are responsible for the secretion of insulin and are involved in potentiating insulin action. The present results will be helpful for understanding the pharmacological action of these plant parts. In addition, the cultivation of *Otostegia limbata*, *Azadirachta indica*, *Olea ferruginea*, *Zanthoxylum armatum*, *Mentha* spp., *Bauhinia variegata*, and *Morus alba* should be carried out in the studied areas to improve the socio-economic condition of the local people. Booklets containing the proper methods of cultivation and the ethnobotanical and ethnomedicinal uses of the present useful medicinal plant parts should be published for the awareness of the local people and this must be carried out on urgent basis due to prevailing effects of the climate change on different medicinal plants and trees of the Lora region.

Table 2. Elemental analysis of medicinal plants used as drugs in Unani system of medicine.

Plants	Parts	Vou Spec	Local Name	Ca (ppm)	K (ppm)	Mg (ppm)	Na (ppm)	Cr (ppm)	Fe (ppm)	Mn (ppm)	Mo (ppm)	Zn (ppm)	Al (ppm)
Pinus roxburghii Sargent	Seeds	Z.A. Abbasi Bot.01 (PUP)	Siraj	54.11	1.082	2.75	9.475	0.05	0.936	0.0	0.0	0.85	6.237
Zea mays Linn	Seeds	Z.A. Abbasi Bot.02 (PUP)	Makki	141.3	11.13	0.95	6.082	0.046	0.256	0.0	0.0	0.092	5.161
Avena sativa L.	Seeds	Z.A. Abbasi Bot.03 (PUP)	Joo	0.5	11.35	1.1	8.54	0.048	0.302	0.0	0.0	0.096	5.252
Juglans regia L	Seeds	Z.A. Abbasi Bot.04 (PUP)	Akhroat	63.6	54.64	6.1	4.98	0.035	1.928	0.29	0.0	0.304	11.49
Punica granatum Linn	Seeds	Z.A. Abbasi Bot.05 (PUP)	Daruna	301.4	60.64	1.0	8.65	0.049	0.317	0.0	0.0	0.081	4.564
Zanthoxylum armatum DC. Prodr	Seeds	Z.A. Abbasi Bot.06 (PUP)	Timar	44.2	56.59	3.1	9.46	0.051	0.776	0.092	0.0	0.141	5.312
Justicia adhatoda L.	Leaves	Z.A. Abbasi Bot.07 (PUP)	Bhekkar	98.2	57.72	6.5	9.01	0.027	1.647	0.146	0.0	0.095	12.62
Amaranthus viridis Linn	Leaves	Z.A. Abbasi Bot.08 (PUP)	Ganhar	49.9	55.15	7.5	12.43	0.023	2.272	0.154	0.0	0.239	53.36
Mentha longifolia (L.) Huds	Leaves	Z.A. Abbasi Bot.09 (PUP)	Safedpodina	48.8	57.64	3.7	15.82	0.056	7.145	0.0	0.0	0.274	29.85
Mentha viridis (L.) L	Leaves	Z.A. Abbasi Bot.10 (PUP)	Kala pudina	80.2	59.06	4.6	8.317	0.041	4.282	0.353	0.0	0.089	35.1
Otostegia limbata (Benth) Boiss	Leaves	Z.A. Abbasi Bot.11 (PUP)	Booi	74.5	57.19	4.0	9.832	0.024	2.591	0.264	0.0	0.26	13.86
Azadirachta indica A. Juss	Leaves	Z.A. Abbasi Bot.12 (PUP)	Dreek	65.1	58.12	3.4	8.5	0.039	6.19	0.434	0.0	0.106	51.98
Olea ferruginea Royle	Leaves	Z.A. Abbasi Bot.13 (PUP)	Kaho	30.9	58.45	1.7	5.746	0.023	0.971	0.123	0.0	0.121	38.4
Zizyphus jujuba Mill.	Leaves	Z.A. Abbasi Bot.14 (PUP)	Ber	36.5	58.39	1.75	8.372	0.043	1.3	0.286	0.0	0.131	5.041
Zanthoxylum armatum DC. Prodr.	Leaves	Z.A. Abbasi Bot.06 (PUP)	Timar	11.5	0.127	1.5	9.01	0.043	0.722	0.22	0.0	0.095	5.385
Vitex negundo Linn	Leaves	Z.A. Abbasi Bot.15 (PUP)	Marwano	33.9	54.5	3.3	3.877	0.028	2.054	0.238	0.0	0.314	13.88
Adiantum capillus-veneris L.	Leaves	Z.A. Abbasi Bot.16 (PUP)	Siraj	100.303	58.63	0.63	10.11	0.043	1.158	0.109	0.0	0.098	5.01
Pistacia chinensis Bunge	Leaves	Z.A. Abbasi Bot.17 (PUP)	Kangar	15.05	60.72	2.45	8.789	0.04	0.562	0.042	0.0	0.079	3.774
Convolvulus arvensis L.	Leaves	Z.A. Abbasi Bot.18 (PUP)	Lialibooti	71.6	59.34	4.6	8.317	0.039	4.123	0.371	0.0	0.61	38.74
Malva neglecta Wallr	Leaves	Z.A. Abbasi Bot.19 (PUP)	Sonchal	229.8	63.08	7.2	11.98	0.033	6.663	0.308	0.0	0.316	73.3
Ficus auriculata Lour	Leaves	Z.A. Abbasi Bot.20 (PUP)	Phagwara	21.7	58.95	4.8	8.201	0.043	1.289	0.15	0.0	0.115	5.229
Oxalis corniculata Linn	Leaves	Z.A. Abbasi Bot.21 (PUP)	Jundora	0.396	55.09	5.0	11.31	0.032	3.22	0.537	0.0	0.208	29.25
Rumex hastatus D. Don	Leaves	Z.A. Abbasi Bot.22 (PUP)	Khatimal	1.368	55.37	29.3	9.942	0.048	1.783	0.743	0.0	0.114	20.75
Pyrus pashia Buch.-Ham. ex D. Don	Leaves	Z.A. Abbasi Bot.23 (PUP)	Batangi	8.0	60.22	1.0	7.653	0.041	0.928	0.124	0.0	0.128	4.631
Dodonaea viscosa Linn.	Leaves	Z.A. Abbasi Bot.24 (PUP)	Sanatha	63.4	57.21	7.1	5.307	0.025	5.559	0.328	0.0	0.248	18.87
Celtis caucasica Willd	Leaves	Z.A. Abbasi Bot.25 (PUP)	Batkair	91.1	58.1	3.25	5.259	0.045	2.067	0.231	0.0	0.202	9.865
Berberis lycium Royle	Roots	Z.A. Abbasi Bot.26 (PUP)	Sumbal	101.15	60.99	1.7	7.398	0.048	3.736	0.032	0.0	0.299	20.61
Taraxacum officinale Weber;	Roots	Z.A. Abbasi Bot.27 (PUP)	Hand	3.65	32.28	1.85	7.843	0.045	0.308	0.0	0.0	0.106	5.373
Bauhinia variegata L.	Flowers buds	Z.A. Abbasi Bot.28 (PUP)	Kalyar	22.3	56.4	4.2	9.948	0.049	0.586	0.0	0.0	0.15	6.631
Allium sativum L.	Bulb	Z.A. Abbasi Bot.29 (PUP)	Thoom	53.6	60.04	3.05	4.618	0.052	1.636	0.0	0.0	0.104	19.38
Morus alba Linn	Fruit	Z.A. Abbasi Bot.30 (PUP)	Chitta toot	23.95	58.22	6.6	8.137	0.048	1.174	0.103	0.0	0.127	7.011
Acacia nilotica Linn	Resin	Z.A. Abbasi Bot.31 (PUP)	Kikar	8.75	56.54	2.0	9.153	0.05	1.251	0.0	0.0	0.165	8.598

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