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Research Article

DETERMINATION OF MACRO AND MICRO ELEMENTS IN THREE SELECTED STUDIED MEDICINAL PLANTS OF SOON VALLEY, KHUSHAB, PAKISTAN

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ABSTRACT

Several Pakistani plants are known to be of potential therapeutic value and are used in traditional herbal medicinal system of country. In this work, three of the most important routinely used medicinal plants (*Justicia adhatoda, Achyranthus aspera* and *Olea ferruginea*) are reported in literature and belong to Soon valley, are studied first time for their macro (K, Na, Mg) and micro (Cu, Ni, Zn, Mn, Cr, Cd, Co and Fe) elemental composition by atomic absorption spectrophotometer. In addition, some relevant aspects such as medicinal uses of some studied plants, diseases due to toxicity and deficiency of trace elements are also discussed.

Keywords: *Medicinal Plants, Soon Valley, Macro and Micro Elemental Composition*

INTRODUCTION

Medicinal plants have always been valued as a mode of treatment of variety of ailments in urban areas and have played a very important role in discovering the modern day medicines with different chemical constituents. Medicinal plants have been used for centuries as remedies for human diseases because they contain components of therapeutic value. Medicinal plants are a considered as a main source of biologically important elements, which may play a part in the observed curative uses of these plants. Therefore, the researchers have interest to establish the levels of some elements in common herbal plants because at elevated levels, these elements can also be dangerous and toxic. In recent years many scientists from all over the world, reported on the importance of elemental constituents of the herbal drug plants which promotes the awareness about trace elements in these plants. About 60 percent of the population in Pakistan uses herbal medicines, from which 350 medicinal plants are found in wild because according to a survey Pakistan has a wide floral diversity approximately containing 600 taxa in Pakistan, salt range of Soon valley was investigated to determine the distribution pattern of vegetation especially medicinal plant diversity at different sites and seasons. Three sites were selected on the basis of variation in their environmental [elevation, slope, aspect (western/northern), altitude, topography and soil composition] and community attributes [habitat, vegetation type and plant community structure].

The dominant vegetation of this valley comprises of *Justicia adhatoda, Achyranthus aspera, Acacia modesta, A.nilotica, Albizzia lebbeck, Melilotus alba, Capparis deciduas, Chenopodium album, Calotropisprocera, Datura metel, Fumeriaindica, Olea ferruginea, Peganum hermala* and *Mentha longfolia* (Ahmad *et al.*, 2002; Hussain, 2002). All these plants are traditionally popular as healing agents and local people used them for the treatment of various diseases (Ahmad *et al.*, 2002). Although a number of surveys were conducted in salt range reporting the biodiversity and floral composition (Ahmad, 2002), little information is available on the Ahmad *et al*., (2009)

It is reported that commercially available herbal drugs formulated from many medicinal plants were also found to contain a large number of heavy metals. Therefore, there is demand in monitoring of heavy metals in medicinal plants growing in different environmental conditions, and for scientific awareness help to protect people from the harmful effects of possible metal toxicity effect. The mainly three studied plants are listed below in Table 1:

Table: 1 Three Selected Medicinal Plants with their Common Name and their Parts which are used as Disease Cure

Sr. no	Plant Species	Local Name	Part Use	Disease Cure	References(s)
1	*Achyranthes aspera*	Puthkanda	Whole plant	Cough, asthma, kidney stone, anti inflammatory, diuretic	Abbasi 1999; Marwat *et al*.,2004 Hussain *et al*., 2008
2	*Justicia adhatoda*	Bhekkar	Whole plant	Cough, asthma, mouth gum, tuberculosis, toothache, jaundice, diarrhea	Abbasi 1999; Abbasi *et al*.,2009
3	*Olea ferruginea*	African olive, kao	Whole plant	Used as pain killer, good tropane alkaloids, skin diseases	Mehreen *et.al*.,2011

MATERIALS AND METHODS

General Experimental Data

The research work presented in this manuscript was aimed to determine the heavy metals on selected medicinal plants of soon valley. The analysis of selected studied plants was performed in the laboratory of Pharmacy Department, University of Sargodha, Pakistan.

General Detail

This study analyzed the vegetation of Soon valley in Salt Range of Pakistan during (2010-2011). Soon Valley was extensively surveyed and the available species at selected sites were enlisted. In order to collect a comprehensive list of plant parts used for medicinal purposes, meetings were arranged with local herbalists (people curing various diseases with plant extracts).

Selection of Sites

On the basis of a preliminary survey three ecologically diverse studies sites namely Khabeki, Dape Sharif, Knotti Garden and were selected based on differences in their environmental attributes especially soil composition topography variations in elevation, slope, altitude and community attributes.

Meteorological data for rain fall, maximum and minimum temperature were obtained from Horticultural Research. Station of Soon Valley for the entire study period (Ahmad *et al.*, 2008). The plants were collected from their natural habitats from different sites of Soon Valley. The description of sites is given in Table 2.

Table 2: The Description of Sites and Time

No. of Sites	Site of Collection	Time of Collection	Names of Plants
Site 1	Knotty Garden	October, February.	*Justicia adhatoda, Achyranthes aspera, Olea ferruginea*
Site 2	Deep Sharif	October, February.	*Justicia adhatoda, Achyranthes aspera, Olea ferruginea*
Site 3	Khabi jheel	October, February.	*Justicia adhatoda, Achyranthes aspera, Olea ferruginea*

Sample Collection

Two field trips were arranged throughout the Soon valley in order to collect selected studied medicinal plants from October 2010 to February 2011. Of these plants are given in Table 3.

Table: 3 Metrological Data for the Time of Collection for the Year 2010-11

Month	Temperature (C) Max Average	Temperature (C)Min Average	Rainfall (mm)
October	28.16	16011	**27.5**
February	**12.7**	**3.03**	**49.6**

Digestion

Dried ground powder (.5g) leaf material was digested in a mixture of concentrated nitric acid and per choleric acid (3:1) on a heating block for about 1hour by gradually raising a temperature up to 250ºC. Filter and volume made up to 50ml. The analysis of (P, Ca, and Mg) was carried out by using flame Photometer.

The dried ground material (0.2g) was placed in test tubes and then added 4 ml of digestion mixture and incubated it overnight at room temperature. Placed the tubes in the digestion block and heated up to 250ºC until fumes were produced. Removed the tubes from the block after 60 minutes and cooled. Slowly added 2 ml of H_2O_2 and placed the tubes back into digestion block. Repeated the above process until the cooled material was colorless and transparent. The volume of extract was made up to 50ml in volumetric flask.

RESULTS AND DISCUSSION

The concentration pattern of macro elements such as potassium (K), magnesium (Mg) and sodium (Na) and micro elements such as copper (Cu), iron (Fe), manganese (Mn), zinc (Zn), cadmium (Cd), cromimum (Cr), nikal (Ni), cobalt (Co) and lead (Pb) varies in studied medicinal plants with respect to season and sites from where these plants were collected..

Copper

The plant *J. adhatoda* collected from Knotty Garden has maximum value of Cu (0.199), while *O.ferruginea* has minimum value of Cu which is (0.147) mgg^{-1}.Similarly, *J. adhtoda* collected from Khabeki Jheel has maximum value (0.193) mgg^{-1} for Cu content and *O.ferruginea* shows minimum value (0.141) mgg^{-1} for Cu. The concentration of Cu in the selected medicinal plants collected from Dape Sharif. *J. adhatoda* also contain high Cu content here which is (0.178) mgg^{-1} but *A. aspera* contains minimum value of Cu (0.121) mgg^{-1}.

Nickel

A. aspera has maximum value (0.359) and minimum value exists in *J. adhatoda* (0.155) mgg^{-1} for Ni in the habitat of Knotty Garden, in Khabeki Jheel the concentration of Ni is high in *O.ferruginea* which is 0.469mgg^{-1} and low in *J. adhatoda* which is (0.214) mgg^{-1}. Dape Sharif contains maximum content of Ni (0.417) mgg^{-1} in *O.ferruginea,* while *J. adhatoda* collected from Dape Sharif has minimum value (0.147) mgg^{-1} of Ni content.

Zinc

Concentration of Zn is highest (0.597) mgg^{-1} in *O.ferruginea,* while *J. adhatoda* has least value (0.160) mgg^{-1} for Zn in the plants obtained from Knotty Garden. Whereas the plants collected from Khabeki Jheel shows *A. aspera* with greater concentration value for Zn which is (0.387) mgg^{-1} and *O.ferruginea* shows lowest Zn concentration value (0.157) mgg^{-1}. *J. adhatoda* from Dape Sharif possesses maximum value of Zn (0.470) $mgg^{-1,}$ while *O.ferruginea* has minimum Zn content value (0.287) mgg^{-1}.

Cobalt

Concentration of Co is highest (0.370) mgg^{-1} in *O.ferruginea* and *J. adhatoda* has least value (0.160) mgg^{-1} for Co in the plants obtained from Knotty Garden. Whereas the *A. aspera* collected from Khabeki Jeel shows greater concentration value for Co (0.312) mgg^{-1} and *O.ferruginea* shows lowest Co

concentration value (0.234) mgg-1. *A. aspera* from Dape Sharif possesses maximum value of Co (0.311) $mgg^{-1,}$ while *O.ferruginea* has minimum Co content value (0.234) mgg^{-1}.

Cromium

Cr^{3+} varied as it is maximum (0.363) mgg^{-1} in *J. adhatoda* and minimum (0.286) mgg^{-1} both in *O.ferruginea* and *A. aspera* from Knotty Garden. Cr^{3+} in Khabeki Jheel is highest (0.271) mgg^{-1} in *O. ferrugianea* and minimum value (0.246) mgg^{-1} for *A. aspera*. In the medicinal plants of Dape Sharif the Cr^{3+} content gains maximum value (0.320) mgg^{-1} in *A. aspera* and minimum value (0.203) $mgg^{-1}$of Cr^{3+} content in *O. ferruginea*.

Cadmium

In Knotty Garden, *O.ferruginea* with 0.361 mgg^{-1} and *J. adhatoda* with minimum value 0.147mgg^{-1}. Khabeki Jheel has high content of Cd^{2+} (0.332) mgg^{-1} in *O.ferruginea* and low in (0.204) mgg^{-1} in *J. adhatoda*. On the other hand plants of Dape Sharif site shows maximum value (0.363) of Cd^{2+} content in *O.ferruginea* and minimum (0.174) mgg^{-1} in *J. adhatoda*.

Iron

Aspera with 0.270 mgg^{-1} concentration and *J. adhatoda* with minimum content value 0.123 mgg^{-1} from Knotty Garden. *A. aspera* has minimum content of Fe 0.176 mgg^{-1} and *J. adhatoda* with 0.299 mgg^{-1}content value from Khabeki Jheel.

Potassium

In Knotty Gareden, the range of K^+ varied between in *O. ferruginea 1083.5*mgg^{-1} *and* minimum value 686 mgg^{-1} in *A. aspera*. Similarly, in Khabeki Jheel, *O. ferruginea* strands with high content 1272 mgg^{-1} of K^+ *and A. aspera* have 592mgg^{-1} content. Whereas in Dape Sharif the high content of K is present in O. *ferruginea* that is 1170 mgg^{-1} and *J. adhatoda* with minimum 450 mgg^{-1} value of K^+ content**.**

Magnesium

In Knotty Garden the *J. adhatoda* gained maximum value (0.521) mgg^{-1} and minimum value for *O. ferruginea* is (0.420) mgg^{-1}. Same in case of Khabeki Jheel that *J. adhatoda* is with high Mg^{2+} content (0.627) mgg^{-1} and *O. ferruginea* with low value (0.415) mgg^{-1} of Mg content. Dape Sharif also keeps the *J. adhatoda* with greater concentration of Mg which is (0.494) mgg^{-1} and *O. ferruginea* with minimum content of Mg 0.317 mgg^{-1}.

Sodium

The lowest content value of Na^{2+} is 315mgg^{-1} in *J. adhatoda* and maximum concentration value is 914mgg^{-1} in *A. aspera* the plants of Knotty Garden. In Khabeki Jheel that *O. ferruginea* exists with maximum 863 mgg^{-1} content value and *A.aspera* has 372 mgg^{-1} minimum ranges. *A.aspera* from Dape Sharif contains high content of Na which is 834mgg^{-1} and *J. adhatoda* has minimum value that is 460mgg^{-1}

Conclusion

This study shows that selected studied medicinal plants are good source of macro and micro elements. However, in some cases they carry very high concentration or sometimes very low concentration which creates toxicity and deficiency of such elements respectively, and cause different diseases in plants as well as in human beings. In accordance to seasonal differences, data reveals that studied plants collected in winter shows high content of trace elements as compare to plants collected in summer season.

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