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# The study of elemental profile of some important medicinal plants collected from Distract Karak, Khyber Pakhtunkhwa, Pakistan

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**ABSTRACT**

This effort was aimed to determine the elemental profile of sixteen important medicinal plants including *Silene villosa, Orobanche aegyptiaca*, *Salvia moorcroftiana*, *Chrozophora plicata*, *Withania coagulance*, *Papaver somniferum*, *Prunus amygdalus*, *Sessamum indicum*, *Juglans regia*, *Brassica napus*, *Citrullus colocynthus*, *Phoenix dictylefera*, *Vitis vinifera*, *Ficus carica*, *Punica granatum* and *Musa acumineta* through Flame Atomic Absorption Spectrophotometer. The concentrations of Sodium Na, Potassium (K), Calcium (Ca), Lead (Pb), Copper (Cu), Zinc (Zn), Cadmium (Cd), Iron (Fe) and Nikle (Ni) in case of different medicinal plants were in the range of 18-99, 54-163, 5-265, 0.00-39, 0.00-29, 0.05-18.18, 0.00-18.90, 11.04-46.30 and 8.4-167.1 mg/kg respectively. The highest concentration of Na (99 mg/kg) was detected in *Sessamum indicum.* The Cu (29.85 mg/kg) and Zn (18.18 mg/kg) were found to be present in the highest concentration in *Orobanche aegyptiaca*. The concentrations of Cd (18.90 mg/kg) Fe (46.30 mg/kg) were the highest in case of *Brassica napus.* Maximum concentration (163 mg/kg) of K was noted in *Silene villosa*, Ca (265 mg/kg), Pb39.70 mg/kg and Ni(167.1 mg/kg) were found in the highest concentration in *Chrozophora plicata, Citrullus colocynthus* and *Prunus amygdalus* respectively.

**Keywords:** Heavy metals, Medicinal plants, Atomic Absorption spectrophotometer.

## 1. INTRODUCTION

The exploration of novel phytochemicals needs a lot of research. Nature has bestowed the wild flora with valuable chemistry[1]. Medicinal herbs are globally used for various Purposes such as food, health care, fuel and medicines. Medicinal plants and their constituents are the potential sources of both traditional as well as allopathic drugs [2].

Despite of worldwide popularity of various traditional medicines, a very less attention is paid toward the scientific research concerning the safety and efficacy of their use [3]. Beside the presence of poisonous secondary metabolites, medicinal plants are exposed to contamination with harmful metals which may proves hazardous to the human health. [4-6] These metals are either directly adsorbed by the plants from the atmosphere or absorb through the root system from the soil.

Heavy metals are categorized in to two classes i.e. essential and non essential. Essential heavy metals (Zn, Cr, Cu, Co and Fe) are needed by living organisms within their permissible for normal metabolism. Their deficiency can result in various disease symptoms. [7] While the non essential heavy metals are toxic (Cd, Pb, As and Hg) and can have serious consequences even if they are received by the body in very minute quantity [8].

Many research efforts have revealed that these metals can be easily accumulated in economically important plants [9]. Heavy metals are non biodegradable and cannot be decomposed by the microbes [10]. The present study was to focus on the determination of heavy metal contents of some medicinally valuable plants. The main objective of the study was to measure specific elements and also to create awareness

among the public about the fruits and vegetables having high concentration of these metals.

## 2. MATERIALS AND METHODS

### 2.1. Collection of plants samples

The samples of medicinal plants were collected from District Karak, KPK, Pakistan. The plant specimens were identified by a plant taxonomist Dr, Nisar Ahmad Chairman Department of Botany, Kohat University of Science and Technology. The samples were washed with distilled water to remove the dust.

### 2.2. Grinding and digestion of plant samples

The rinsed plants were dried in shade at $25^0$C. The dried samples were grinded in to fine powder. The dry digestion procedure was adopted. Two gram of the powdered material of each plant was first kept in the desiccators to eliminate the moisture content. The samples were then kept in the furnace at 100 for two hours and then at 600 till to get the ash. After ashing each sample is mixed with 10 ml of diluted HCl. All the mixtures were filtered through whatman (#42) filter paper and the filtrates were further diluted up to 25 ml in graduated cylinders [11].

### 2.3. Elemental Analysis

Flame Atomic Absorption Spectrophotometer (Perkin Elmer 400) was used to analyze elements of interest including Sodium Na, Potassium (K), Calcium (Ca), Lead (Pb), Copper (Cu), Zinc (Zn), Cadmium (Cd), Iron (Fe) and Nickel (Ni) [12].

## 3. RESULTS AND DISCUSSION

The dwellers of District Karak use medicinal plant for curative purposes. These plants are utilized in their crude form. Before using a plant for medicinal purpose one should know the level of heavy metals in that particular plant, because if the level of a particular heavy metal is exceeding its normal permissible limit, it may result in serious harms to the human health as reported by [13]. This demands urgent research efforts to aware the people of the safety and efficacy of using these plants. Keeping in view the hazardous effects of heavy metals on the health some commonly used plants were subjected for studying their elemental profile. The medicinal values of the studied plants are given in the table 1 and the concentrations of all element analyzed are shown in the table 2.

### 3.1. Sodium (Na)

Highest concentration of Na (99 mg/kg) was found in *Sessamum indicum* followed by Citrulus colocynthis and Punica granatum in which the concentration of Na was 60 mg/kg 53 mg/kg respectively. In other plants, the range of Na was 18 to 28 mg/kg. the least amount of Na was found in *Juglans regia.* The level of Na in all the plants investigated is shown in table. 1. The allowed limit of sodium for adults is 2 g sodium/day [14].

**Table -1: Medicinal plants, their common names, family names and uses**

| Scientific name | Common name | Family | Medicinal uses |
|---|---|---|---|
| *Silene villosa* | Silene | Caryophylaceae | Wound Healing |
| *Orobanche aegyptiaca* | Broomrape | Orobanchaceae | Kidney stone removal, scabby ulcer |
| *Salvia moorcroftiana* | Salvia | labiateae | Ematic, cold, cough, itchy skin |
| *Chrozophora plicata* | West african | Euphorbiaceae | Blood purifier, anti ulcer |
| *Withania coagulance* | Shapianga | Solanaceae | Blood purifier, antidiabetic,Constipation |
| *Papaver somniferum* | Opium poppy | Papaveraceae | Hypnotic, sedative, expectorant |
| *Prunus amygdalus* | Almond | Rosaceae | Allergy, bladder cancer, itchy skin |
| *Sessamum indicum* | Sessame | Pedaliaceae | Laxative, carminative, galactogogue |
| *Juglans regia* | Walnut | juglandaceae | Blood purifier, anti diabetic |
| *Brassica napus* | Turnip | Brassicaceae | Emollient, antidiuretic |
| *Citrullus colocynthus* | Bitter apple | Cucurbitaceae | Antimicrobial, antidiabetic |
| *Phoenix dictylefera* | Date palm | Arecaceae | Cystitis, edema, cold, fever |
| *Vitis vinifera* | Grapes | Vitaceae | Treatment of cancer, cholera, small pox |
| *Ficus carica* | Fig | Moraceae | Diabetes, Allergy, Remove skin tumor |
| *Punica granatum* | Pomegranate | Lythraceae | Lower cholesterol and blood pressure |
| *Musa acumineta* | Banana | Musaceae | - |

**Table - 2: Relative concentration of different elements in medicinal plants**

| Scientific name | Concentration of each element (mg/kg) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Na | K | Ca | Pb | Cu | Zn | Cd | Fe | Ni |
| *Silene villosa* | 24 | 163 | 210 | Nd | 8.68 | 8.69 | 12.5 | 25.75 | 8.54 |
| *Orobanche aegyptiaca* | 23 | 147 | 104 | 10.12 | 29.85 | 18.18 | Nd | 29.76 | 9.89 |
| *Salvia moorcroftiana* | 26 | 119 | 219 | Nd | Nd | 8.51 | 10.12 | 17.26 | 11.14 |
| *Chrozophora plicata* | 26 | 144 | 265 | Nd | 10.12 | 14.59 | 4.09 | 11.04 | 8.46 |
| *Withania coagulance* | 25 | 125 | 5 | 13.5 | 3.95 | 1.67 | Nd | 14.70 | 25.05 |
| *Papaver somniferum* | 26 | 66 | 115 | Nd | 3.95 | 12.3 | Nd | 22.18 | 21.27 |
| *Prunus amygdalus* | 23 | 67 | 10 | 13.4 | 0.375 | 5.51 | Nd | 15.42 | 167.1 |
| *Sessamum indicum* | 99 | 64 | 13 | 0.5 | 11.3 | 13.5 | 14.2 | 18.29 | 19.25 |
| *Juglans regia* | 18 | 62 | 16 | Nd | 13.70 | 9.2 | Nd | 25.75 | 18.12 |
| *Brassica napus* | 22 | 54 | 24 | 18.70 | 7.30 | 14.30 | 18.90 | 46.30 | 12.80 |
| *Citrullus colocynthus* | 60 | 83 | 75 | 39.70 | 6.80 | 0.32 | 18.90 | 12.5 | 30.60 |
| *Phoenix dictylefera* | 23 | 74 | 27 | Nd | 12.30 | 0.52 | Nd | 40.00 | 20.90 |
| *Vitis vinifera* | 27 | 140 | 60 | Nd | 9.15 | 0.37 | Nd | 35.00 | 21.45 |
| *Ficus carica* | 28 | 80 | 85 | Nd | 9.30 | 0.45 | 3.50 | 25.00 | 22.47 |
| *Punica granatum* | 53 | 90 | 73 | 0.30 | 7.54 | 0.05 | Nd | 34.00 | 21.50 |
| *Musa acumineta* | 25 | 143 | 115 | Nd | 2.65 | 8.30 | 1.30 | 14.30 | 21.75 |

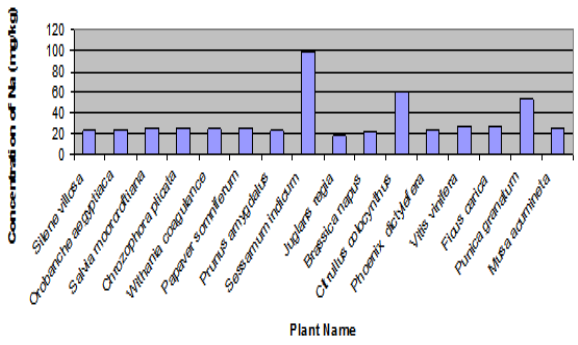


**Figure - 1: Concentration of Na in different medicinal plants.**

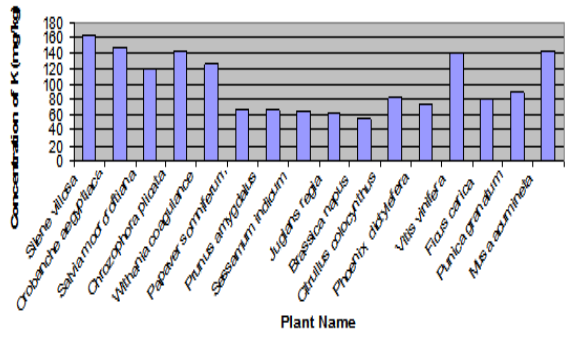


**Figure - 2: Concentration of K in different medicinal plants.**

### 3.2. Potassium (K)

Potassium was found to be present in the maximum amount in *Silene villosa* 163 mg/kg, followed by *Orobanche aegyptiaca* 147 mg/kg. The lowest amount of the element was noted in *Brassica napus* 54 mg/kg. The concentration *values of* K *for Salvia moorcroftiana, Chrozophora plicata, Withania coagulance, Papaver somniferum, Prunus amygdalus, Sessamum indicum, Juglans regia, Citrullus colocynthus, Phoenix dictylefera, Vitis vinifera, Ficus carica, Punica granatum, Musa acumineta* were 119, 144, 125, 66, 57, 64, 62, 83, 74, 140, 80, 90 and 143 mg/kg respectively.

### 3.3. Calcium (Ca)

Maximum amount of Ca content (265 mg/kg) was detected in *Chrozophora plicata.* The same element was found to be present in the lowest concentration (5 mg/kg) in *Withania coagulance. Salvia moorcroftiana* contained (219 mg/kg) of the Ca content. The maximum recommended amount of Ca is 1000 mg/day.

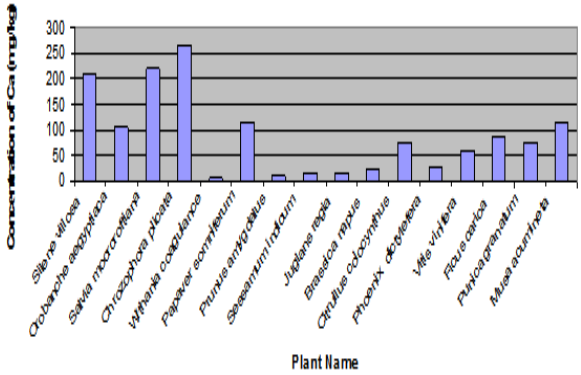


**Figure - 3: Concentration of Ca in different medicinal plants.**

### 3.4. Lead (Pb)

The maximum value for Pb content was noted for *Citrullus colocynthus* 39.70 mg/kg. It was not detected at all in *Silene villosa, Salvia moorcroftiana, Chrozophora plicata, Papaver somniferum, Juglans regia, Phoenix dictylefera, Vitis vinifera, Ficus carica and Musa acumineta.* The concentration values of Pb for *Orobanche aegyptiaca, Withania coagulance, Prunus amygdalus, Sessamum indicum, Brassica napus, Punica granatum* were 10.12, 13.5, 13.4, 0.5, 18.70 and 0.30 mg/kg respectively. The maximum permissible limit of Pb in the food is 3mg/week [15].

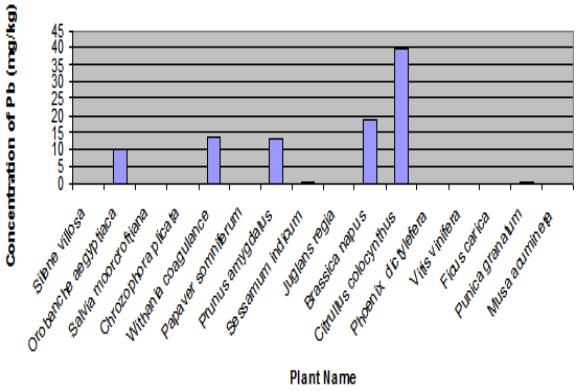


**Figure - 4: Concentration of Pb in different medicinal plants.**

### 3.5. Copper (Cu)

Highest level of Cu content (29.85 mg/kg) was noted for *Orobanche aegyptiaca.*The element was not detected at all in *Salvia moorcroftiana.* The concentration of Cu was found to be the same (3.95 mg/kg) for both *Withania coagulance* and *Papaver somniferum.* The Cu content for *Silene villosa, Chrozophora plicata, Prunus amygdalus, Sessamum indicum, Juglans regia, Brassica napus, Citrullus colocynthus, Phoenix dictylefera, Vitis vinifera, Ficus carica, Punica granatum and Musa acumineta* was 8.68, 10.12, 0.375, 11.3, 13.70, 7.30, 6.80, 12.30, 9.15, 9.30, 7.54 and 2.65 mg/kg respectively. The daily permissible dietary intake of Cu is 200 mg/kg [16].

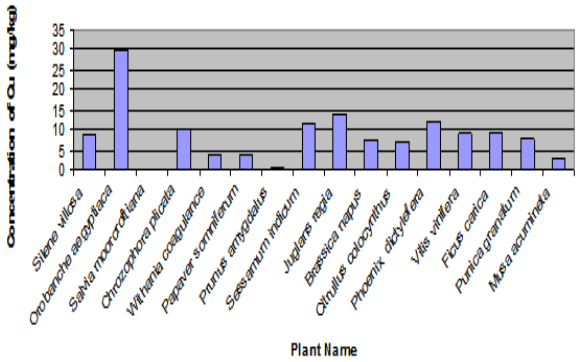


**Figure - 5: Concentration of Cu in different medicinal plants.**

### 3.6. Zinc (Zn)

The Zn was found to the extent (18.18 mg/kg) in *Orobanche aegyptiaca* while its minimum concentration (0.05 mg/kg) was noted in *Punica granatum.* The concentrations of Zn element in *Silene villosa, Salvia moorcroftiana, Chrozophora plicata, Withania coagulance, Papaver somniferum, Prunus amygdalus, Sessamum indicum, Juglans regia, Brassica napus, Citrullus colocynthus, Phoenix dictylefera, Vitis vinifera, Ficus carica* and *Musa acumineta* were 8.69, 8.51, 14.59, 1.67, 12.3, 5.51, 13.5, 9.2, 14.30, 0.32, 0.52, 0.37, 0.45, 8.30 mg/kg Respectively. The allowed limit of Zn is 100 mg/day [17].

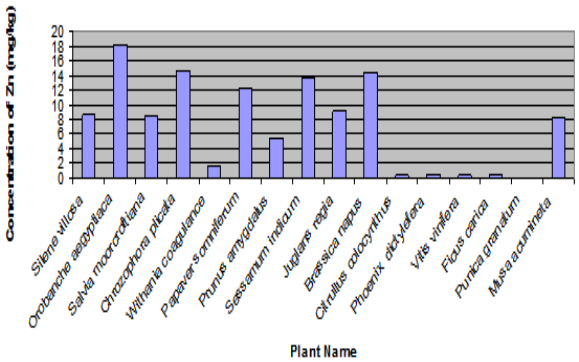


**Figure - 6: Concentration of Zn in different medicinal plants.**

### 3.7. Cadmium (Cd)

Cadmium content was not found in *Orobanche aegyptiaca, Withania coagulance, Papaver somniferum, Prunus amygdalus, Juglans regia, Phoenix dictylefera, Vitis vinifera* and *Punica granatum.* The highest concentration of Cd (18.90 mg/kg) was found in *Brassica napus* and *Citrullus colocynthus.* The concentrations of the same element in *Silene villosa, Salvia moorcroftiana, Chrozophora plicata, Sessamum indicum, Ficus carica* and *Musa acumineta* were 12.5, 10.12, 4.09, 14.2 and 3.50, 1.30 respectively. The Cd concentration above 0.5 mg/kg has been reported to cause live damage [18].

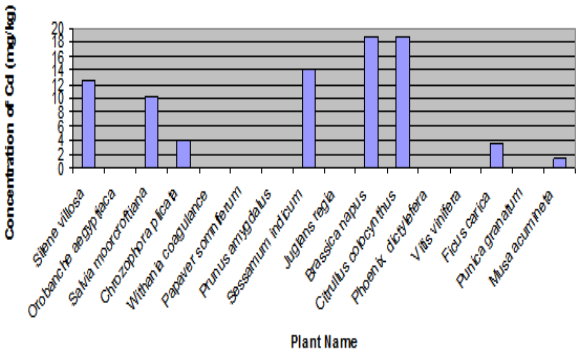


**Figure - 7: Concentration of Cd in different medicinal plants.**

### 3.8. Iron (Fe)

The concentration of Fe was the highest (46.30 mg/kg) in case of *Brassica napus* followed by the *Phoenix dictylefera* (40 mg/kg). The concentration of Fe was 25.75 mg/kg for both *Silene villosa* and *Juglans regia.* Fe concentration values in case of *Vitis vinifera* and *Ficus carica* were found to be 35.00 and 25.00 mg/kg respectively. The maximum permissible limit of iron as dietary intake is 30-150 mg/kg [19].

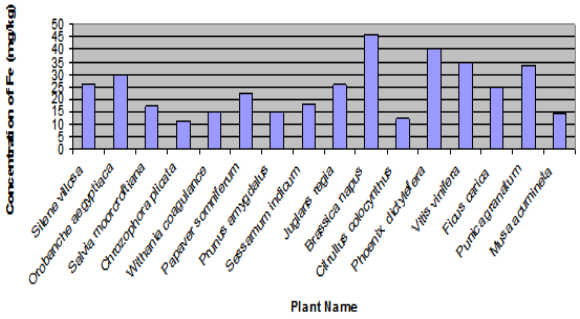


**Figure - 8: Concentration of Fe in different medicinal plants.**

### 3.9. Nickel (Ni)

Ni has been has been known as a causative agent of cancer and negatively affects the respiratory pathways. Ni commonly causes itching to the skin called nickel itch. Environmental Protection Agency (EPA) has reported that the human body require less than 1 mg of Ni daily [17]. As evident from Table # 2 the concentration was the highest (167.1 mg/kg) in case of *Prunus amygdalus* and the lowest (8.46 mg/kg) in case of *Chrozophora plicata.*

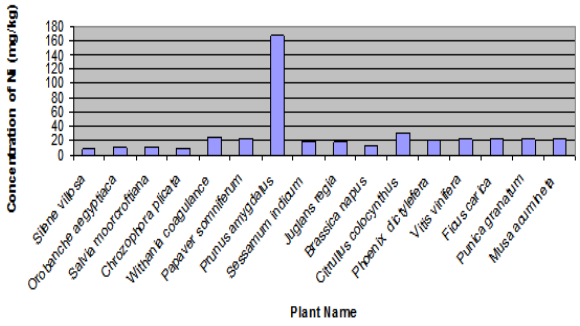


**Figure - 9: Concentration of Ni in different medicinal plants**

## 4. CONCLUSION

The present study was aimed to identify the essential and non-essential elements in the given medicinal plants. These plants were properly identified i.e. their common name, family name and medicinal uses and also checked for the presence of heavy metals. The concentrations of heavy metals were investigated in sixteen medicinal plants which were different in all plants.

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