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Determination of Heavy Metals in *Jaubertia aucheri,* a medicinal plant of Balochistan, Pakistan

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Abstract

Since the emergence of human civilization, various herbal plants have been used as home remedy. Jaubertia aucheri is a medicinal plant that is used commonly as a homeopathic remedy by local people of Baluchistan. The current study aimed to analyze the accumulation of heavy metals in Jaubertia Aucheri plant. The samples were collected from Panjgur, the region of Baluchistan. The heavy metals were detected using atomic absorption spectrometer. The increasing order of detected metals in the seed of a plant is Fe > Mn > Co > Cu > Cd > Ni. Whereas in the stem of plant the order is Fe > Co > Mn > Cu > Cd > Ni. Almost all detected metals were found within the range of permissible limit fixed by FAO/WHO.

Keywords: Heavy Metals, Atomic Absorption Photometer, *Jaubertia Aucheri.*

INTRODUCTION

Various herbal plants are used as medicines since from beginning of human civilization. Out of 2, 50,000 species of plants 80,000 species are used as medicines. China, France, Italy, UK, Japan and USA are the current largest global markets [1]. Eighty percent of world population use medicinal plants for their health care. According to WHO repot 40 % pharmacological industries rely on herbal plants [2]. Pakistan is blessed with rich floral diversity of 57,000 species, out of which 2000 species have medicinal values. In Pakistan medicinally rich areas are less developed like Baluchistan, FATA, Gilgit and Baltistan. The prosperity of Pakistan can be enhanced by promoting medicinal plant trading [3]. People of these areas are fully acquainted with these medicinal plants and their use, this knowledge should be transferred to successive generations [4].The use of natural herbs for therapeutic purpose has been increased in the end of century [5]. Heavy metals are the main cause of contaminating ecosystem. The major role in contamination is played by human beings [6]. High rate of contamination of natural resources is excessive use and disposal of chemicals. These toxic chemicals not only effect the potency of herbs but also cause biotic and abiotic changes in the ecosystem [5].

The medicinal plant "*Jaubertia aucheri"* common name Tussoo is a very common specie of southern and lower Baluchistan, usually grows in sandy soil, leaves

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and seeds are said to be medicinal [7]. This plant is used to cure gum bleeding, miscarriage in female and abdominal problems. The purpose of research is to evaluate level of heavy metals in *Jaubertia aucheri* [8]. The effort was also made to correlate content of heavy metals with WHO values.

MATERIALS AND METHODS

Sample Collection and Preparation

The plant sample was collected from Panjgur, the regions of Balochistan. Then, it was brought the lab of the Department of Chemistry, University of Balochistan, Quetta. The collected plant was washed properly with deionized water to remove dust particles. The washed plant was chopped and dried in microwave oven at 150 ℃ for 2 hours. The sample size reduction was carried out by grinding dried sample in pestle and mortar. The fine powdered sample was stored in polythene bags for further analysis.

Acid Digestion

Accurately weighed 1 g of fine powdered sample was taken and transferred into a Pyrex beaker of 100 ml. A mixture of three concentrated acids (HNO_3, H_2SO_4, and $HCLO_4$) in the ratio of 10:2:1 respectively was added into beaker. Then, the mixture was heated at 80℃ until fumes obtained. The formation of white fumes indicated the completion of digestion. Digested sample was allowed to cool at room temperature and then, it was filtered by using whatman filter paper No. 42 into 50 ml Pyrex beaker and later, the volume was made up to the mark. The prepared sample was stored for further elemental analysis [9].

Blank and standard

0.5 M HNO_3 was used as blank. By using 1000 ppm stock solution three standards of different concentrations were made for each elements and used for calibration.

Analysis of the Sample

Total eight metals (Pb, Cd, Mn, Cu, Co, and Ni) were analyzed in triplicate using Atomic Absorption Spectroscopy method. Heavy metals were estimated in stem and seeds of medicinal plant.

RESULT AND DISCUSSION

Heavy metal accumulation in medicinal plants is a result of a variety of circumstances. Industries, chemical wastes, polluted water, and other factors are some of these causes [10]. In this study, the FAAS method was used to assess the heavy metals in *Jaubertia Aucheri.* Medicinal plant *"Jaubertia Aucheri*" seeds and stems were examined for heavy metal accumulation (Table 1). This table displays the mean concentration value with standard deviation. The maximum permissible limits (MPL) set by the WHO are compared to the content of heavy metals in plants (Table 2) [11].

Table 1: Mean concentration of heavy metals with standard deviation (mg/L).

Sample	Heavy Metals ± SD					
	Fe	**Co**	**Cu**	**Mn**	**Ni**	**Cd**
Seed	3.8 ± 0.1	0.26 ± 0.05	0.099 ± 0.001	0.56 ± 0.03	ND*	0.013 ± 0.004
Stem	0.6 ± 0.04	0.3 ± 0.03	0.086 ± 0.009	0.26 ± 0.04	ND	0.010 ± 0.003

ND* = Not detected **SD**** = Standard Deviation

Table 2: Recommended dietary allowance and maximum permissible limit in medicinal [11].

Elements	RDA (mg/day)	WHO's MPL Medicinal plants(mg/L)
Cadmium	-	0.3
Copper	2-5	10
Iron	8 (males), 18 (females)	15
Manganese	2.3 (males), 1.8 (females)	200
Nickle	80-130 µg/day	1.5
Cobalt	5-40 µg/day	—

Cobalt (Co):

Cobalt (Co) is a synthetic element with atomic number 27 and belongs to the progress metals bunch. It is a fundamental minor component expected for the proper functioning of different catalysts and proteins in the human body. Cobalt is a significant part of Vitamin B12 (cyanocobalamin), which is fundamental for the proper functioning of the sensory system, DNA union, and red platelet development [12]. The human body contains around 1-2 milligrams of cobalt, which is mostly stored in the liver, kidneys, and heart. Notwithstanding, an excessive amount of cobalt through food or supplements can lead to cobalt poisoning, which might cause cardiomyopathy, hypothyroidism, and sickness. The World Wellbeing Association (WHO) has set the suggested dietary remittance (RDA) for cobalt at 5-40 micrograms each day [13]. Cobalt is likewise utilized in herbal plants as a cofactor for the biosynthesis of alkaloids and other optional metabolites. Nonetheless, the Plant Material Cutoff (PML) of cobalt for medicinal plants has not been defined, and unreasonable admission of cobalt through plant-based enhancements might cause harmfulness. During the current study, the level of cobalt was detected as 0.26 milligrams per liter.

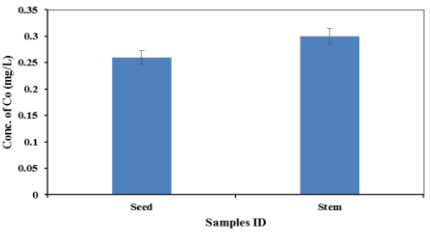

Figure 1: Concentration of Cu in seed and stem of medicinal plant

Copper (Cu):

Copper (Cu) is a fundamental element that plays an important role in different physiological cycles, including the development of red platelets, proper functioning of the immune system, and upkeep of the sensory system. Overdoses of copper in the human body can be poisonous and a cancer-causing agent. Copper overabundance can lead to a variety of different medical problems, such as kidney damage, sickness, liver poisonousness, and paleness. Ingesting elevated levels of copper can also cause gastrointestinal problems, including retching and running [14]. Exposure to elevated levels of copper over a long period of time can harm the liver and kidneys. As indicated by the World Wellbeing Association, the suggested dietary allowance (RDA) for copper is 0.9 mg/day for grown-ups. Nonetheless, the decent upper admission level (UL) for copper is 10 mg/day, demonstrating that inordinate admission of copper is a worry [15]. Copper concentration in plant-based food sources changes depending on the soil type and the kind of plant. In present research study, the copper level in stem was

determined 0.086 mg/L while in seed, it was found 0.099 mg/L. In this regard, it is fundamental to consume copper according to the recommended dietary allowance.

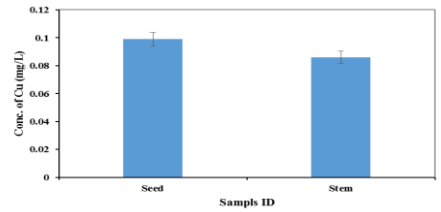

Figure 2: Concentration of Cu in seed and stem of medicinal plant

Iron (Fe):

Iron is involved in different physiological cycles. One of its most significant capabilities is in the arrangement of hemoglobin, the protein responsible for carrying oxygen in the blood. Iron is also critical for the development of myoglobin, a protein found in muscle tissue that is responsible for oxygen capacity and conveyance. Moreover, iron is a cofactor for a few chemicals that play a crucial role in digestion and other cell processes. Iron can be gotten through diet, from sources including meat, poultry, fish, as well as oats that are consumed daily. Be that as it may, iron deficiency continues to be a problem around the world, especially in agricultural nations and specific populations [16]. Therapeutic plants have been reported as a possible iron source, with studies showing iron concentrations as high as 15 mg/L [17]. In current study, the plant Jaubertia Aucheri was observed with iron concentration in the 3.9 mg/L in seed and 0.6 mg/L in stem, respectively (Figure 3). While iron is fundamental to human wellbeing, excessive amounts can be hazardous. Iron overburden can cause oxidative stress and harm organs like the liver, heart, and pancreas. In this regard, it is critical to keep an equilibrium between iron admission and screening iron levels. This is especially important for people with specific ailments, for example, hemochromatosis [5].

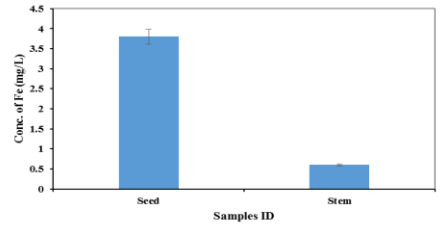

Figure 3: Concentration of Fe in seed and stem of medicinal plant

Manganese (Mn):

Manganese is a minor component tracked down in the human body, and considering that it's vital for legitimate physical processes, excessive amounts of it can result in neurological problems. In contrast, a lack of manganese can cause a variety of issues, like deafness, baldness, insulin resistance, and hypercholesterolemia [18]. It's significant that the suggested optimum breaking point (MPL) for manganese is 200 mg/L for herbal and medicinal plants. Regarding explicit models, Jaubertia Aucheri, a

plant was found to have a concnetration of 0.56 mg/L of manganese in its seeds and 0.26 mg/L in its stem (Figure 4).

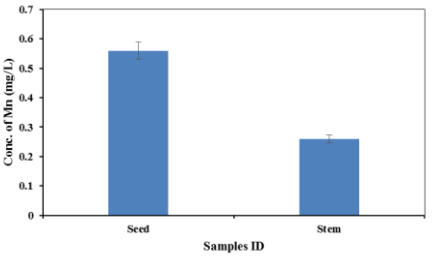

Figure 4: Concentration of Mn in seed and stem of medicinal plant

Nickel (Ni):

Nickel is a synthetic element that is found in the climate in modest quantities. Despite being available in the following amounts, it tends to be unsafe for human wellbeing when its fixation is increased. Elevated degrees of nickel openness can lead to different medical issues, like malignant growth of the nose, larynx, and lungs [19]. There are certain cutoff points for how much nickel is permitted in therapeutic plants. The most extreme reasonable cutoff (MPL) for nickel in medicinal plants is 1.5 mg/L, it is 1.63 mg/L [17]. These cutoff points guarantee that the plants are safe for human consumption. However, in current study, nickel was not detected.

Cadmium (Cd):

Cadmium (Disc) is a poisonous heavy metal that can have serious health consequences when present in high concentrations. Studies have demonstrated that elevated levels of cadmium in the body can cause kidney and liver problems [20]. The presence of cadmium in medicinal and herbal plants is a concern. Cadmium convergence in medicinal plants ranges from 0.3 mg/L to 0.81 mg/L, while in dietary plants it ranges from 0.1 mg/L to 0.5 mg/L [17]. One concentrates on examining the concentration of cadmium in the seeds and stems of the Jaubertia Aucheri plant. In current study, it was determined as 0.013 mg/L and 0.01 mg/L, separately. It is vital to screen and control the amount of cadmium in the climate and in food sources to forestall medical problems related to its openness [6].

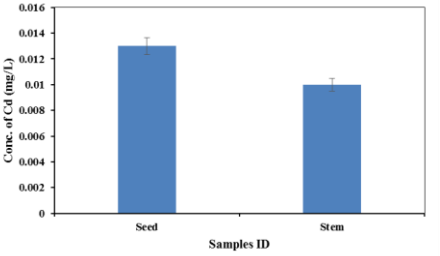

Figure 5: Concentration of Cd in seed and stem of medicinal plant

CONCLUSION

All in all, the utilization of medicinal plants as home remedies in Baluchistan is common, however it is essential to know about the side effects associated with heavy metal pollution. Based on the results of the current study performed, Jabertia Aucheri might be appropriate for use as a home remedies, since its detected heavy metal concentration was found within range of WHO guidelines. As a result, it is recommended that you take caution when using other restorative plants. It is also recommended to check for heavy metal pollution before using them as a cure.

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