STUDY OF HEAVY METALS (Cd, Cu, Ni, Pb & Zn) IN SOME MEDICINAL PLANTS AT AREA OF KHANOZAI IN THE REGION OF BALOCHISTAN

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ABSTRACT: *Therapeutic plants for the creation of herbal medicines should be taken from the contamination-free normal land, thus this study aims to investigate the concentration of heavy metals found in various plants collected from the Khanozai area of Balochistan. Analyses were performed using atomic absorption spectroscopy, and the data gathered was discussed in the report's conclusion section. Then, it was decided that these medicinal plants should be gathered in areas that are not contaminated with heavy metals since they are waste from domestic or pharmaceutical assessments. As a result, the selected medicinal plants were analyzed for their trace element concentration prior to any domestic or medical use. In addition, heavy metals are the most valuable and toxic metallic ions, meaning they are dispersed everywhere on Earth. Accordingly, it is today of utmost importance to eradicate the heavy metal ions from our environment in order to ensure a healthy, active life span.*

Key Words: Medicinal Plants, Heavy Metals, and Atomic Absorption Spectroscopy.

1 INTRODUCTION

Herbal remedies are advocated for those who are sick since it is thought that they will have less if any, negative side effects. There is a global market for medicinal plants. The pharmaceutical industry makes use of these plants. The heavy metal contents in these plants, however, vary widely. The majority of the plants utilized in these medications pose a health concern since they absorb heavy metals and other hazardous contaminants. Metals with a high atomic number are more likely to pollute the environment than those with lower atomic numbers. Heavy metal cations, which are present in many polluting metals, pose a particularly serious hazard when attached to short carbon chains [1]. Plants may take up pollutants from the environment, including heavy metals. Fertile soils may provide a greater risk of contamination to medicinal plants. Plants' capacity to selectively acquire critical elements varies by species and is affected by the geochemical features of the soil in which they are grown [2].

Heavy metals from point sources, such as metalliferous mining, smelting, and other industrial operations, are often found in the atmosphere and rain down onto the Earth's surface, causing pollution. The use of fertilizers, insecticides, sewage sludge, and organic manures are other contributors to soil contamination [3]. They are easily absorbed by plants through their roots. Metal ions are soluble in water and may be stored there. Rainfall, air dust, and plant protection agents are additional sources of these elements that plants may absorb via their leaf surfaces. High levels of heavy hazardous metals in the environment have been observed, and this has led to public concern that these metals may be present as residues in the food they consume on a regular basis. Due to the neurotoxic, carcinogenic, and other effects of ingesting even small amounts of heavy metals, their toxicity should have been notified worldwide. However, the general population is uncertain and worried about the security of their drugs [4].

Ghiyasi *et al*. [5] heavy metals have been found in topsoil and loam for a long time since their presence is linked to the longevity of pedogenesis and the parent rocks. Heavy metals in cations are highly interrelated with the topsoil's environment, which may lead to mobility and a subsequent shift in conservation and environmental status. Plants are able to tolerate potentially harmful ions in their environments, and as a result, trace elements, especially heavy metals, may accumulate in plant tissues. It is of great worry that there has been an increase in the possibility for a definite number of deadly components of heavy metal absorption through plants into the food towline, as well as consideration of how these elements grow via food network food webs and how they affect animals. [6-7]

From a medical point of view, heavy metals aren't well-defined, and they commonly include fully dangerous elements that are lighter, as well. Iron, aluminum, manganese, beryllium, arsenic, and mercury are all elements that might contribute to heavy metal poisoning if present in high enough concentrations [8]. Bismuth, one of the almost constant basics, is discounted in this definition because of its low toxicity. Some metals are redox active, meaning they undergo redox cycling processes, whereas others are redox inactive. Metal concentrations in soil may be anywhere from below 1 mg/kg (ppm) to well over 100,000 mg/kg [9].

A plant's roots have the potential to absorb heavy metals, so contaminating the plant. Deposition of polluting substances from the environment may cause heavy metal infection on plant surfaces [11-10].

Sarma., [12] proved the impacts and repercussions of phytoremediation, showing that there is now a global issue in heavy metal transportation using plant-based metallophytes that can withstand exposure to the elements. When compared to civil engineering and conformist techniques and systems, plantation-based approaches to restoring unhealthy soils are seen as having far more promise. Although a wide variety of plants have been scouted for use in phytoremediation, this does not mean that all of them are free of metals [13].

Heavy metal poisoning in humans and animals may have its roots in the use of medicinal plants. Therefore, the World Health Organization suggests screening medicinal plants for heavy metal contamination using curative florae. In addition, the application of studies focused on medicinal plants proves critical in raising quality-of-life requirements for herbal remedies via inspection and assessment of maximum allowable levels of heavy metals in medical remedial plants, [14-15].

In this case, it's possible that plants will take them up and store them. When hydrogen power (pH), clay, and carbon-based components are depleted, the aggressiveness, kinesis, and access to heavy metals in the topsoil are often reduced.

Accumulations of metallic compounds in medicinal plants have been shown to be affected by climate, plant species, air effluence, and other conservational factors [16].

The plants are a bioaccumulation/absorbing unit for metallic compounds is made more plausible by the aforementioned categorization requirements. Toxic metal absorption might halt development [17].

Traditional medicinal plants are defined by the World Health Organization (WHO) as organic remedies used locally or in the absence of industrialized methods to treat illness [18]. Natural and ubiquitous, leading to relatively slow growth, herbal medicines have been used for centuries in both developing and developed nations. Herbal medicine has a long and storied history as a type of treatment dating back to antiquity. Several plant names and their Latin names emerged in the 1500 B.C. texts of the Ebers Papyrus, the first medical literature, [18].

More than 80% of the global population now relies on traditional medical treatments and therapies, with florae species acting as the primary cradle of health preservation [18]. Some medicines cause the body to suffer specific destructions and harms, despite the fact that ailments, infestations, and infections are presently being healed substantially by pharmaceuticals of synthetic foundation and clearly advanced in research labs. As a result, the value of medicinal plants and their derivatives is growing, and so too is the public's faith in their safe and effective use. [17].

The effects of Cd buildup on COX-1 and COX-2, as well as defensive action, were recently studied [19] in the plants Eucomis autumnalis (Hyacinthaceae) and Eucomis humilis. Bulbous extracts from E.humilis showed lower inhibition action than the rheostat for both COX-1 and COX-2 upon treatment with Cd-2mgL1, whilst those from E.autumnalis exhibited strong COX-activity in comparison to the rheostat due to the inhibitory effect of COX-2. The study cautioned researchers to be aware of the biotic activity of crude plant extracts and the potentially influencing actions of conservational contaminants. Heavy metal persuaded induction of medicinal plants is strongly influenced by a number of factors, including the stage of floral development, the amount and duration of treatment, and the structural development of the medium, [20-21].

Since this study is the first of its kind to examine the presence of toxic metals (Cadmium, Copper, Nickel, Lead, and Zinc) in medicinal herbs grown on the earth's surface using an analytical, biochemical, and physiological approach, it will serve as a benchmark for future researchers and scientists.

MATERIALS AND METHOD

Sample Collection

In Pushin District,Khanozai, Balochistan, fresh medicinal plant samples were collected with the help of locals and transported to the Department of Botany at the University of Balochistan in Quetta for identification. The most common or dominant medicinal plant species collected were Withania Coagulan, Vitex agnus castus, Solanum nigrum, Forskohlia Tenacissima and Aachillea wilhelmsii. Methanol, deionized water, aquaregia, nitric acid, sodium hypochlorite, and perchloric acid were the chemicals utilised.

Collection of Plant Material

Fresh medicinal plant samples were collected from the various mountain regions with the cooperation of local people of Pishin District, Khanozai, Balochistan, and then brought to the Dept. Chemistry, UOB, Quetta for further identification.

Drying of Plant Materials

After being cleaned with running water, these medicinal plants were dried in the shade away from direct sunlight so that they could be studied in more depth after they were completely dried.

Grinding of Samples

Approximately 2000 grams of each plant were ground individually in a grinder and then labeled and kept for further analysis.

Preparation of Extracts

An extract was prepared by grinding a sample of each medicinal plant to a powder (weighing 1500 grams) and soaking it in methanol (at 25-300 degrees Celsius) for 10 days. Next, the extract was filtered twice through Whatman paper 2, and then it was reduced under pressure at 30-350 degrees Celsius in a rotary evaporator, [22].

Test for metals

The following procedures were used to conduct the study on metals found in various medicinal plants.

Preparation of Sample

The dust was removed from the new plant samples by washing them twice in tap water and once more in deionized water. Next, samples were dried in an oven at 800 degrees celsius for two days in a row and then ground into a powder for further analysis. (Jabeen et al., 2010).

Digestion

The specimen was digested by placing two grams of sample from each medicinal plant into a flask (100 ml) and adding HNO_3, H_2SO_4, and HCl (32.5 ml) in a ratio of 25:05:2.5, before heating the mixture on a hot plate at 800 C until white vapors formed. Afterward. deionized water was poured over the running specimens, and they were left to cool down. Heavy metals were detected using a FAAS (Flame Atomic Absorption Spectrometer) after samples were extracted using Whatman No.42 filter paper.

Preparation of Standard Reagents

To produce the standard for analytical analysis, solutions of Zn, Pb, Cd, and Cu were diluted to 1000 ppm in a standard solution) [23].

Calibration Curve Preparation

One thousand parts per million (ppm) stock solution was generated by adding 100 ml of deionized water, from which five standard solutions of varying concentrations were derived; moreover, a blank solution was run for purposes of comparison. The calibration curve was utilized by AAS to determine the metal content in the sample, as explained by [24-25].

Analysis of Samples

To absorb atoms Metal concentrations of Zn, Pb, Cd, Cu, and Ni were determined retroactively by spectroscopy under circumstances of parametric relevance.

Processing of Data

Data analysis was performed in Microsoft's "Excel 365." Descriptive statistics were used to count occurrences.

RESULTS AND DISCUSSION

Medicinal plants including A.wilhelmsii, F.tenacissima, S.nigrum, V.agnus castus, and W. coagulan were analyzed for heavy metals, and the results are shown in Table 1 below. In all cases where medicinal plants were evaluated, the Cd content was found to be between 0.001 and 0.008 ppm. All of the therapeutic plants examined had Ni concentrations between 0.003 and 0.02 ppm. The concentrations of copper in the medicinal plants we examined varied from 0.01 to 0.095 parts per million. All of the medicinal plants examined had a zinc concentration between 0.01 and 0.135 ppm. All of the medicinal plants examined had lead concentrations between 0.001 and 0.16 ppm. Medicinal plants including A.wilhelmsii, S.nigrum, and W.coagulan have heavy metal concentrations over the World Health Organization's safe limit. Comparable findings were also reported by (Borsato *et al.*, 2000 and Jabeen *et al.*, 2010).

Table-1. Concentrations of trace elements (in parts per million) in Chamman's medicinal plants.

S. No	Name of Plant	Cd	Cu	Ni	Pb	Zn
1	*A. wilhelmsii*	0.005	0.062	0.004	0.02	0.01
2	*F. tenacissima*	0.003	0.045	0.003	0.04	0.01
3	*S. nigrum*	0.007	0.084	0.004	0.16	0.109
4	*V. agnus castus*	0.002	0.01	0.02	0.001	0.05
5	*W. coagulan*	0.004	0.095	0.01	0.12	0.135

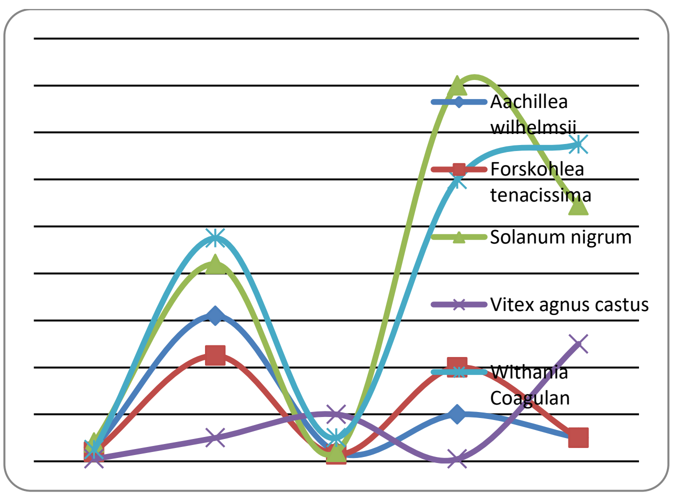

Figure-1:Concentrations of trace elements (in parts per million) in Chamman's medicinal plants

Natural and ubiquitous, leading to relatively slow growth, herbal medicines have been used for centuries in both developing and developed nations. Herbal medicine has a long and storied history as a type of treatment dating back to antiquity. Written in 1500 B.C., the Ebers Papyrus contains the names and descriptions of several plant species; this makes it one of the first medical texts [17]. According to the World Health Organization, [8] traditional therapeutic remedial florae are natural remedies used locally or in the absence of industrialized processes to treat illnesses. Currently, more than 80% of people worldwide trust customary medicinal cures and therapies, primarily from florae species acting as the major source of preserving health, [17] according to the World Health Organization. In addition, the oxidative process is sped up by these toxic metals, making them a contributing factor in a wide range of disorders, including age-related illnesses. This is especially true of Cu(I)/(II) and Fe(II)/(II) when they act as free radicals during the digestive process, [26].

Arsenic, a known pollutant, and poisonous substance, was found in the environment, where it poses a clear threat to the health of all organisms that draw oxygen from their immediate surroundings. Arsenic is an extremely toxic substance that may be found in a wide variety of different animals. It is generally agreed that arsenite[As3+] and arsenate[As5+] are the dominant inorganic species in the vast majority of habitats, despite the existence of carbon-based molecular structures in many settings, [27].

Lead(Pb) exists in a variety of configurations and structures in living and natural bases around the globe, and it is now thought to be one of the most widely and consistently dispersed metallic forms of Lead (Pb). Exhaust from vehicles, dirt, smoke and gaseous emission from a variety of industrial sources may all contribute to lead pollution, which can harm vegetation and soils [28]. It was found that humanoids are very sensitive to Pb2+ and that high concentrations of the element are fatal. Since Pb2+ is not biodegradable, once the soil has been poisoned, the contamination lasts for a very long time. Toxic metals in wastewater have a negative impact on ecosystems and are not degraded by living organisms, [29].

Industrial areas, petroleum sites, aging lead(Pb) drainage pipes, and even defunct orchard woody sites in construction, where lead arsenate is used, all contribute to soil pollution. Lead (Pb) has accumulated to the depth of a high eighth inch in the topsoil and is quite stubborn. Continued affluence and pollution are long-term trends. Lead (Pb) amount in topsoil levels will not be able to control on a standardized point if remedial and health-giving actions are not taken, [29].

There are a plethora of research publications and articles that provide succinct demonstrations of the technical techniques of Phytoremediation. Greek Phyto- (plant) and Latin remedium are the basis for the umbrella word "phytoremediation" (to accurately or eradicate a vindictive),[30].

The bioavailability of pollutants and poisons is diminishing as a result of the exudation process taking place via the roots of plants to achieve equilibrium, demission, and binding in the matrix and medium of topsoil. These plant adaptations are sometimes grouped together under the umbrella term "stabilization." Some plant species have evolved mechanisms to withstand the accumulation of pollutants and poisons in the soil and water table, whether via transpiration through the leaves, absorption by the roots, or deposition within the root zone. In a literal sense, this procedure is carried out to remove organic and metal pollutants from the medium of soil, silt, and sludge, [30].

Specific plant species are able to phytoextract excess metal pollutants and toxins from their growing medium. Toxins, pollutants, and metals (including metalloids, radionuclides, nonmetals, and carbon-based toxins and contaminants) are treated in sludge,[30].

Phyto volatilization is the process by which plants take in atmospheric contaminants. This method is used to remove metal pollutants from groundwater, soils, sediments, and sludges. Because the metabolic process inside the plant or the digestion of poisonous pollutants external to the plant by the influence of substances generated by the plants constitutes the transformation /phyto degradation process. Toxins and pollutants, including metals, metalloids, radionuclides, nonmetals, and carbon-based ones, are broken down in the medium of soils, sediments, and sludge. In this study, we investigate the phenomena of organic and metal contaminants in the medium of soils, sediments, and sludges, specifically the degradation of complex organic molecules into smaller particle pollutants in these environments, [30].

The adsorption, or else precipitation onto floral roots, or absorption into the roots, of pollutants that are in solution around the root area, is the rhizo filtration (=root) process by which plants take up metal contaminants and excess nutrients from growing substrates. Plants' medium processes metals, excess nutrients, and radioactive contaminants found in groundwater, surface water, and wastewater media, [30].

Rhizo degradation, in which microorganisms degrade toxins and pollutants, is facilitated by the presence of the root zone. Microorganisms are used for the consumption and digestion of organic components for nourishment and energy. The roots secrete organic compounds including starch, alcohols, and acidic substances, all of which are composed of carbon-based molecules that provide food for topsoil bacteria and build a sturdy root structure capable of absorbing enormous quantities of water. Regulation of this process applies to organic materials, contaminants, and hazardous materials in the soil medium, [30].

This suggests that plant absorption and translocation systems may be subject to stringent control. Beyond the immediate requirements of catabolism and anabolism, plants often do not store trace components for later use. These requirements are minimal in scope, with maximum trace element sufficiency achieved at concentrations of about 10–15 ppm. Somehow, hyper-accumulator plants are seen as the exception to the rule, despite the fact that they take in poisonous metallic ions at concentrations of 1 part per million or less. The method by which plants store hazardous metal ions, and especially how plants that are hyper-accumulators store them, is a major concern, as is the means by which these plants avoid metal poisoning. Multiple strategies are at play, with the vacuole emerging as a key storage structure,[30].

Plants' roots use water vaporized from their leaves as a conduit to draw in nutrients and other soil components. Transmission to new plant growth may also occur through evapotranspiration. Meanwhile, contamination spreads from the soil's roots to its leaves, which are then picked and cleaned up before being returned to the ground in their former condition. Phyto extraction strategies typically use just a small subset of plant species designated as hyperaccumulators. For these plant species, the concentration ratio of shoot-to-root metals is more than 1, [30].

CONCLUSIONS

All medicinal plants in the Baluchistan area were found to be within the World Health Organization's acceptable limits for heavy metals (WHO). Cd content in S. nigrum was found to be somewhat higher than in A. wilhelmsii. When compared to other therapeutic plants, W. coagulan has a very high Cu content. All of the medicinal plants tested had comparable amounts of Ni. S. nigrum had a somewhat higher Pb content than the other plants examined. The current study found that A. wilhelmsii and F. tenacissima have comparable Zn levels. Flame atomic adsorption spectroscopy revealed that the Zn content of W. coagulan was somewhat elevated.

Recommendations

- Heavy metal buildup in other therapeutic plants might be the subject of future research.
- There should be public disclosure and advice about the use of medicinal plants for non-polluting therapeutic purposes.

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