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Analysis of Recommended Medication Herbs and Heavy Metals

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Abstract: *Atomic absorption spectrometry was used to quantify essential and non-essential heavy metals, such as Zn, Fe, Ni, and, in a few medicinal plants, such as Artemisia vulgaris L., Asparagus adscendens Roxb, Cyamopsis tetragonoloba L., Galium aparine L., Mucuna pruriens L., Stevia rebaudiana, and Withania somnifera L. This study's primary goal was to record any evidence of essential and non-essential heavy metals in these herbs, which are often utilized to make standardized extracts and herbal products. W. somnifera had 204.54 ppm, S. rebaudiana had 204.72 ppm, G. aparine had 179.43 ppm, C. tetragonoloba had 88.25 ppm, A. adscendens had 86.66 ppm, A. vulgaris had 82.80 ppm, and M. pruriens had 33.05 ppm of iron. The chosen herbs also had higher than average concentrations of other heavy metals, namely manganese and zinc.*
Keywords*: heavy metals, plant species, zinc, iron, copper, and chromium, FAAS.*

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I. INTRODUCTION

Medicinal plants have been used for centuries in various cultures around the world as natural remedies to treat a wide range of ailments. These plants contain bioactive compounds chemicals that have effects on the human body which can promote healing, alleviate symptoms, and even cure certain diseases. The use of plants for medicinal purposes is known as herbal medicine, phytotherapy, or botanical medicine (Bone & Mills 2013). With the growing interest in alternative and complementary medicine, medicinal plants have garnered renewed attention in recent years. Modern scientific research is increasingly focused on validating the therapeutic properties of these plants and discovering new ways to utilize them in treating diseases. Pharmaceutical companies also look to nature for new compounds that can be developed into drugs.

For example, the anticancer drug Taxol (paclitaxel), originally derived from the Pacific yew tree, was one of the most successful examples of plant-derived pharmaceuticals. Medicinal plants are an integral part of human health and well-being, offering natural and effective treatments for a wide range of conditions. Whether used in traditional practices or modern medicine, these plants have the potential to improve health and provide sustainable solutions to healthcare challenges. However, as with any form of medicine, it is important to use them wisely, with proper knowledge and guidance (Wear 2000). There is documented evidence of medicinal plants' contributions to the traditional medical system for the treatment of illnesses. These days, growing consumer and scientific interest have aided in the development of herbal products as dietary supplements. Oriental herbal medicines have a significant role to play in the pharmaceutical and health markets of the twenty first century, given the renewed interest in them (Khan & Ahmad 2019). Subject to the permitted upper and lower limits of race m etals, it has been noted that anything consumed as food may result in metabolic disruption (Heindel et al. 2017). Essential micronutrient deficiencies and excesses, as well as the presence of hazardous metals, can have detrimental consequences on human health (Jomova et al. 2022).

In addition to regulating the axim um permanent limits of toxic metals like arsenic, cadmium, and lead, which are set at 1. 0, 0. 3, and 10 ppm, respectively, WHO recommends that medicinal plants that serve as the raw materials for finished products be examined for the presence of heavy metals (WHO 1980). During their growth, development, and preparation, medicinal plants are readily contaminated. The heavy metals contained in plants eventually enter the human body after being collected and transformed into dosage forms. They may disrupt the normal functions of the liver, lungs, heart, kidney, brain, and central nervous system, resulting in hypertension, abdominal pain, skin eruptions, intestinal ulcers, and various cancers. Heavy metals are toxic elements that can accumulate in the environment and the human body, causing various health problems such as neurological damage, kidney disease, and cancer. Common heavy metals of concern include lead (Pb), cadmium (Cd), arsenic (As), mercury (Hg), and chromium (Cr). These metals can enter the body through contaminated water, air, food, or soil, and over time, they can cause severe health complications. Interestingly, certain medicinal plants have shown the potential to help in the detoxification of heavy metals from the body. These

plants either help to chelating (bind) and excreting heavy metals or reduce the oxidative stress and inflammation caused by their presence in the body (Flora et al. 2008).

Medicinal plants offer a promising natural approach to aiding in the detoxification of heavy metals from the body. Many of these plants possess chelating, antioxidant, and liver-supportive properties that can help reduce the toxic effects of metals like lead, mercury, and cadmium. However, it's important to approach heavy metal detoxification cautiously and with the guidance of a healthcare provider to ensure safe and effective use.

II. METHODS AND MATERIALS

2.1 Gathering and Handling Plant Material After Harvest

The PCSI R labs in Peshawar were the site of the experiment. Stevia rebaudiana leaves were purchased from the Sugar Crops Research Institute (SCRI), Agricultural Research Centre (ARC), Egypt. To remove dust, debris, and potential parasites, plant parts particularly the roots were cleaned under running water. They were then treated with deionized water and allowed to dry in the shade at 24 to 29 degrees Celsius. The appropriate precautions were followed during this sample processing to prevent any loss or contamination of heavy materials.

2.2 Digestion of Plant Samples by Acid

To eliminate moisture, weighed amounts of crushed and powdered plant material root, stem, leaf, and flower were placed in a china dish and baked at 115 degrees Celsius. Following charring, the dry sample was heated to 520°C for four hours in a furnace. After cooling the contents of the china dish in a desiccator, 2.5 ml of 6M HNO3 was poured to the dish to dissolve the contents. The solution was diluted to the m ark after being filtered and transferred to a 20 ml flask (Huang et al. 2004). FAAS was employed to measure the esteem at ion of heavy metals.

2.3 Equipment Calibration

We determined the following sensitivity and detection limits for the used FAAS equipment for the elements under study. Zn 0. 05 and 5.0 ppm, Ni 0.5 and 4.0 ppm, Fe 0. 5 and 5. 0 ppm, Cu 0. 5 and 3. 0 ppm (Lagi 2008).

III. RESULTS AND DISCUSSION

Public safety across the world is greatly concerned when essential and non-essential heavy metal concentrations in therapeutic plants exceed allowable limits. In north Africa, the issue is far more severe as quality assurance standards do not adequately govern or manage the medicinal plants that serve as the raw ingredients for the final goods. The pharmacological characteristics of the chosen medicinal plants used as herbal remedies are compiled in Table 1. The levels of Zn, Fe, Ni and Cu in a few selected medicinal plants are listed in Table 2.

Table 1. Drug-diagnostic Features of the Herbs.

No	Typical terms	Plant/Family Species	Health Benefits
1	Mugwort	Asteraceae Artemisia vulgaris L.	Antiseptic, Diaphoretic, Diuretic, Purgative, Stimulant,
2	Musli sufaid	Liliaceae Asparagus adscendens	Galactogogue, Aphrodisiac, Nutritive, Tonic,
3	Guar	Fabaceae Cyamopsis tetragonoloba	Oral hypoglycem ic,Gastrointestinal, Lowers cholesterol level, and Low density lipoprotein level,
4	Cleavers	Rubiaceae Galium aparine	Diuretic ,Anti-inflammatory, Astringent, Psoriasis, Ulcers, as anti- coagulant.
5	bedstraw	Legum inosae Mucuna pruriens	Diuretic, Astringent, Anthelmintic, Anti-diabetic, Analgesic, Febrifuge
6	Sweet herb	Asteraceae Stevia rebaudiana	Diuretic, Hypoglycemic, Hypotensive, Cardio tonic Antimicrobial, Antiviral, Vasodilator, Anti diabetic, Sweetener.
7	Asgandh or Ratti	Solanceae Withania	Diuretic, Sedative, Antiseptic, Astringent, Abortifacient, DE obstruent, Arthritis

3.1 Zinc

Table 2 shows that S. rebaudiana had the highest content of zinc (46.30 ppm), followed by G. aparine (44.11 ppm), W. somnifera (43.11%), A. vulgaris (39.22 ppm), A. adscendens (31.57%), and M. pruriens (33.12%). In addition to being a necessary trace element for plant growth, zinc is also crucial for normal cell growth, brain development, behavioral response, bone formation at ion, and wound healing, among other cell

activities. Diabetics who are zinc deficient lose their sense of touch and smell in addition to failing to increase their perceptual abilities. According to King (2011), the dietary limit for zinc is 100 parts per million.

3.2 Iron

In addition to being a necessary component of hemoglobin, iron is a necessary element for humans and animals. It helps regulate body weight, which is a critical component of diabetes, by facilitating the oxidation of fat, protein, and carbs. W. somnifera had the highest concentration of iron (204.54 ppm), followed by S. rebaudiana (204.72 ppm), G. aparine (179.43 ppm), C. tetragonoloba (88.25), A. adscendens (85.66 ppm), A. vulgaris (82.80 ppm), and M. pruriens (33.05 ppm), according to the results in Table 2. The findings imply that foliar absorption of ambient air may potentially contribute to the elevated levels of iron in plants. According to Schumann et al. (2007), the daily dietary limit of iron in food is 10–60 mg. Myocardial infarction, nasal bleeding, and gastrointestinal infections are caused by low iron levels.

3.3 Nickel

The concentration of Ni in several plants was as follows: S. rebaudiana3.01 ppm, A. vulgaris 4.87 ppm, G. aparine 5.11 ppm, M. pruriens 3.18 ppm, C. tetragonoloba 2.79 ppm, W. somnifera 2.95 ppm, and A. Adscendens 1.01 ppm. Anthropogenic activities may be the cause of the increased Ni content in plants. The most common condition caused by nickel is nickel itch, an allergic dermatitis that often happens when the skin is moist. Nickel has also been found to be a possible carcinogen and has a negative impact on the lungs and nasal canals. Despite being needed in very little amounts by the body, Ni is mostly found in the pancreas and is therefore crucial for the synthesis of insulin. Its insufficiency causes liver disease (Pendias & Pendias, 1992). According to EPA guidelines, daily consumption of Ni should not exceed 1 mg, as this is hazardous (Cempel & Nikel 2006).

3.4 Copper

Even while copper is a necessary enzyme for normal plant growth and development, too much of it can be harmful. If the quantity in plants is more than 20–100 ppm DW (dry weight), phytotoxicity may result. A. vulgaris had the highest concentration of Cu (8.85 ppm), followed by W. somnifera (9.04 ppm), M. pruriens (8.33 ppm), S. rebaudiana (8.06 ppm), G. aparine (5.98 ppm), A. adscendens (5.08 ppm), and C. tetragonoloba (2.39 ppm), as shown in the results (Table 2). Although the concentration of copper in the chosen herbs is high, it is more than what is considered critical for plants (Grzegorczyk et al., 2014). Elevated copper levels can result in methyl fume fever with flu-like symptoms, skin and hair discoloration, dermatitis, irritation of the upper respiratory tract, nausea, and a bitter taste in the mouth. According to Jothivenkatachalam (2012) the maximum daily limit of copper is 20 µg/m g body weight.

Table 2: Concentration of Heavy Metals (ppm) in Plant Material.

Plant Species	**Zn**	**Fe**	Ni	Cu
Artemisia vulgaris	39.22	82.80	4.87	8.85
Asparagus adscendens	31.57	86.66	1.01	5.77
tetragonoloba	17.55	88.25	2.88	3.13
Galium aparine	44.96	179.43	5.04	5.98
Mucuna pruriens	33.12	33.05	3.94	8.33
Stevia rebaudiana	46.30	204.72	3.01	8.06
Withania somnifera	44.65	204.54	2.95	9.04

IV. CONCLUSION

In the traditional medical system, the chosen medicinal plants have been suggested as treatments for a wide range of ailments. Significant advancements have been made in the field of phytotherapy with reference to the worldwide scientific assessment of medicinal plants. The WHO monographs, national pharmacopoeias, and the herb processing businesses are examples of the practical effects of the evolving scenario. The levels of heavy metals found in a few chosen therapeutic plants are well below the crucial threshold. Ni (4.35 ppm), and Cu (9.65 ppm) were found to be the highest concentrations in A. vulgaris, Zn (47.18 ppm) in S. rebaudiana, Fe (206.69 ppm) in W. somnifera. When utilizing the herbs for hum and ingestion, the implications of the findings may be taken into account. The findings imply that medicinal plants should be gathered from an uncontaminated natural environment for human use or for the production of herbal products and standardized extracts.

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