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The Study of The Presence of Heavy Metals and Microbial Contamination

Ritwik Mishra [1], Dr. Vivek Gupta [2]

[1]Research Scholar, Sunrise University Alwar

[2] Associate Professor, Sunrise University Alwar

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Corresponding author: Ritwik Mishra

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Abstract:

Herbal medicine has a long history of use for the treatment and prevention of illness all throughout the globe, including Palestine. Heavy metal and microbiological pollutant levels in medicinal plants used for quality assessment.

Keywords: Herbal medicine, heavy metals contamination, microbiological contamination.

INTRODUCTION

The use of therapeutic plants is steadily increasing on a global scale. The growing demand for medicinal compounds derived from plants is supported by the rise of illnesses that lack effective treatment options, as well as the expanding scientific understanding of herbal medicines as significant alternatives for therapy. So, it's no surprise that many are worried about the efficacy and security of herbal medicines. The reference elucidated that the fundamental factor for achieving consistent effectiveness and safety of herbal pharmaceuticals is quality. To guarantee the study on herbal medicines meets the required standards, the ultimate significance lies in the standards for the plant-based ingredients or compounds. The public and health officials in several nations are becoming more concerned about the efficacy and security of herbal remedies as a result of their growing popularity and the industry's rapid international development. This is owing to the presence of several pollutants and residues that have been shown to potentially pose damage to consumers.

Various variables dictate the microbial load of plants. Herbal medications may get contaminated by germs from the earth, air, and water, which may include potentially harmful pathogens for humans. Factors outside of our control, including as the amount of precipitation before and after harvesting, might influence the prevalence of microbes in medicinal plants. Additionally, the way the herbs are handled and the circumstances in which they are stored, both in their raw and processed forms, can also impact microbial contamination. To enhance the purity and safety of the goods, it is important to adhere to fundamental hygiene practices during preparation and standardize physical

properties include humidity, acidity, and degrees of microbial contamination.

Patients using non-sterile pharmaceutical medicines run the risk of injury from microbiological contamination, which may reduce or eliminate the products' therapeutic value. Due to their biological origins, herbal medical products are intricate combinations that need significant efforts to ensure consistent and appropriate quality. The microbiological quality of the final goods is mostly influenced by manipulation and processing parameters. Prior research has shown the existence of possible impurities in herbal remedies. Manufacturers must guarantee that the substance, finished medicine, and its container parts of natural goods have the minimum amount of microorganisms feasible in order to preserve the right quality, safety, and effectiveness.

LITERATURE AND REVIEW

Luo, Lu & Wang, Bo & Jiang, Jingwen& Fitzgerald, Martin (2021) The presence of high amounts of heavy metal pollution in herbal remedies poses a worldwide risk to human health, particularly when these levels exceed established threshold limits. There were a total of 1,773 samples taken from all around the world. There was at least one metal present in 30.51% (541) of the samples that exceeded the permitted amount, according to the Chinese Pharmacopoeia. Out of the total, 5.75 percent was lead, 4.96% was cadmium, 4.17% was arsenate, 3.78% was mercury, and 1.75% was copper (31). According to the results of the exposure assessment, 25 different kinds of herbs have indicated hazards that are higher than the acceptable levels of lead, cadmium, arsenate, and mercury. Lead, cadmium, mercury, and arsenic all had maximum daily intakes that were higher than the provisional acceptable limits for seven plants, five herbs, and three herbs, respectively. According to the Hazard Quotient or Hazard Index, twenty-five different kinds of herbs provide an intolerable risk. Additionally, all carcinogenic risks were within acceptable limits. Estimated Daily Intake, Hazard Index, and carcinogenic dangers all pointed to Asas the most dangerous substance. Hence, it is essential to do more research on the impact of various forms of arsenic and give particular emphasis to the monitoring of arsenic-related pollution.

Alengebawy, Ahmed & Abdelkhalek, Sara (2021) Scientists have consistently devoted significant attention to environmental issues. The contamination of toxic substances is a critical environmental problem that has jeopardized human health and agricultural output. Among the many environmental toxicants, heavy metals and pesticides are the most dangerous to animals. The harmful effects of pesticides (insecticides, herbicides, and fungicides) and heavy metals (cadmium, lead, copper, and zinc) on agricultural ecosystems (soil, plants, and humans) are the focus of this investigation. Furthermore, an examination has been conducted on the attributes of polluted soil and the physiological parameters of plants. Additionally, there have been reports of human illnesses resulting from exposure to both heavy metals and insecticides. Both heavy metals and pesticides are examined with respect to their bioaccumulation, action mechanism, and pathways of transmission. Additionally, the evaluation has included the soil bioavailability and plant absorption of these contaminants. Heavy metals and pesticides have been discussed in regard to their mutually beneficial and antagonistic interactions and the harmful effects of both substances alone and in combination. In order to thoroughly cover all aspects of this investigation, all relevant prior research has been incorporated. Environmental toxicants and their dangerous effects are better understood thanks to this review.

Chen, Yi-Gong & He, Xing-Li-Shang & Huang, Jia-Hui (2021) The presence of heavy metals is pervasive in the environment as a result of both natural processes and human activity. Their spread into uncontaminated places leads to the contamination of ecosystems, such as soils, plants, water, and air. Heavy metals are known for their toxicity and ability to survive in nature. As a result, they may accumulate in the trophic chain and disrupt the functioning of organisms. The rising global popularity of herbal medicine is accompanied by a significant concern: heavy metal toxicity. This issue has a profound influence on herbal plants, resulting in consequences for the efficacy, safety, and commercial viability of pharmaceuticals as well as herbal extracts and herbal raw materials. These issues are thus thoroughly examined in this analysis. This analysis further suggests potential management solutions to restore environmental sustainability and ensure drug safety. This report provides a comprehensive assessment of 276 published research conducted between 1988 and 2021.

Shelar, Maruti &Gawade, Vaibhav & Bhujbal, Santosh (2021) World Health Organization (WHO) statistics show that between 70 and 80 percent of the world's population uses alternative medicine, which is frequently derived from botanical plants. Herbal remedies serve as the primary ingredients in many herbal preparations, including herbal medications, herbal teas, and herbal oils. These preparations have gained global use owing to their therapeutic potential and their safety in comparison to allopathic drugs. There have been claims of lead, cadmium, chromium, nickel, arsenic, and mercury contamination in many herbal medicines and components, making these dangerous metals an especially pressing issue. As a measure for safety, the least allowed limits have been set. Using these techniques, we can track the evolution of herbal remedies' heavy metal content and their therapeutic efficacy.

Ałtyn, Iwona &Twarużek, Magdalena (2020) The plants and medicinal herbs sold on the market often fail to fulfill the required quality and safety criteria. A specific worry revolves on the potential for mycotoxin contamination. Herbal products often include aflatoxins and ochratoxin A, two of the most common mycotoxins consistently been shown to surpass the legal limits imposed by the European Union (EU). Potential remedies include the implementation of current restrictions, as well as the establishment of more stringent limitations for novel substances, along with the imposition of requirements for the cultivation of medicinal plants in European Union member states under more rigorous circumstances.

HERBAL REMEDIES CONTAMINATED WITH MICROBES AND HEAVY METALS

1. Biological Contaminants

Table 4 demonstrates that the analysis of all herbal medicine samples revealed contamination with micro-organisms. The cough samples had a significantly high level of contamination, whilst the ulcer samples showed a relatively lower level of contamination. The diabetes and malaria samples, on the other hand, had the least amount of contamination. The samples studied revealed that fungus and Escherichia coli were the most prevalent microbes, followed by staphylococcus aureus, moulds, Enterobacter aerogenes, and penicillium was the least common. Various samples of herbal remedies exhibited a diverse range of microbiological contamination. The quantity of contaminated samples for each specific condition is shown in Table 1.

Table 1: Number of micro-organisms in various herbal medicines for different diseases

Micro-organisms	Number of samples contaminated			
	Cough	Malaria	Ulcer	Diabetes
Escherichiacoli	04	03	02	04
Enterobacteraerogenes	02	-	03	02
Fungus	04	03	04	03
Penicillium	-	03	-	-
Moulds	02	02	04	02
Staphylococcusaureus	03	01	02	03

The results indicate a high percentage of contamination in the analyzed samples. Fungus contamination was approximately 70%, Escherichia coli contamination was 65%, mould contamination was 50%, staphylococcus aureus contamination was 45%, Enterobacter aerogenes contamination was 35%, and the lowest contamination was observed in penicillium at approximately 15% for all samples analyzed. Malaria samples had the lowest level of microorganism contamination, while diabetes samples showed a moderate level. In contrast, cough and ulcer samples displayed a much higher contamination rate, reaching almost 75%.

1.1 Morphological characteristics of bacterial isolates

Various bacterial isolates were isolated and described from various culture medium, as shown in Table 2.

Table 2: Morphological characteristics of bacterial isolates

Organisms identified	shape	colour
Escherichiacoli	spherical	Pink
Staphylococusaureus	Rod shaped	White
Enterobacteraerogenes	Spherical	Purple
Fungus	Filamentous	white
Moulds	Filamentous	Dark

Among all the isolated microbial species, Enterobacter aerogenes was the least numerous, while Staphylococcus and Escherichia coli were shown to be the most prominent. These findings indicate that herbal remedies might heighten the risk of infections and subsequently lead to the development of various illnesses due to the elevated likelihood of airborne contamination, since they are manufactured and marketed in open environments. The materials were examined by conducting plate counting for microbial and fungal isolates. The figures were derived based on the average values of colony forming units (cfu g-1) of microorganisms. The presence of fungal species was detected in samples of several herbal medications used for treating cough, malaria, diabetes, and ulcer, as shown in Table 3.

The cough and ulcer samples exhibited the highest level of microorganism contamination, while the diabetes samples showed a moderate level and the malaria samples showed the least amount of contamination.

Table 3: Microbial and Fungal Counts for Samples Obtained from Usafi, Nateete and Mengo Markets

Diseases	Sample Code	Microbial Count (cfu/ml)	Fungal Count (cfu/ml)
Cough	C_1	$5.00X10^6$	$4.20X10^6$
	C_2	$2.61X10^3$	$2.04X10^7$
	C_3	$2.21X10^5$	$2.00X10^7$
	C_4	$2.50X10^7$	$2.84X10^6$
	C_5	$3.80X10^7$	$2.23X10^7$
Malaria	M_1	$1.56X10^7$	$1.07X10^7$
	M_2	$2.03X10^8$	$7.1X10^8$
	M_3	$2.01X10^4$	$2.05X10^7$
	M_4	$1.56X10^7$	$2.48X10^7$
	M_5	$3.14X10^7$	$1.14X10^7$
Ulcer	U_1	$6.00X10^5$	$5.30X10^4$
	U_2	$4.50X10^5$	$4.40X10^5$
	U_3	$2.50X10^7$	$6.80X10^7$
	U_4	$1.50X10^8$	$7.40X10^6$
	U_5	$2.50X10^5$	$4.10X10^6$
Diabetes	D_1	$1.94X10^7$	$2.63X10^7$
	D_2	$1.80X10^7$	$1.56X10^9$
	D_3	$2.6X10^3$	$4.00X10^5$
	D_4	$2.73X10^7$	$3.07X10^7$
	D_5	$4.66X10^5$	$2.86X10^7$

Escherichia coli and Staphylococcus aureus exhibited higher counts compared to other species, particularly in samples of ulcer and cough, which displayed elevated levels of contamination. In contrast, Enterobacter aerogenes was isolated in lower numbers, and herbal medicines used for diabetes and malaria exhibited the least contamination. The samples of diabetes and malaria had the lowest levels of bacterial contamination; nevertheless, they showed a significant presence of fungus and molds. When compared to other herbal medications, samples of diabetes and cough had the

lowest levels of fungal and mold contamination, but had the greatest levels of bacterial contamination. The microbiological levels of the herbal remedies analyzed in this investigation, All of the samples included microbiological contamination, as reported in Table 3. The microbial counts determined using the plate approach varied from 1.5×10^8 (colony-forming units per gram) to 6.0×10^5 (colony-forming units per gram).

Enterobacter aerogenes was the least prevalent species among all isolated species, whereas Staphylococcus aureas and Escherichia coli were the most abundant in herbal remedies used for ulcer and cough. These medications were also found to have significant levels of moulds and fungal species.

Table 4. Microorganisms identified in different samples

Diseases	Sample Code	Microorganism Identified
Cough	C_1	*Escherichiacoli*, *Enterobacteraerogenes*, fungus,
	C_2	*Escherichiacoli*, *Enterobacteraerogenes staphylococcus aureus*, moulds.
	C_3	*Staphylococcus aureus*, *Escherichiacoli*, fungus.
	C_4	*Staphylococcus*, Moulds, Fungus
	C_5	*Escherichiacoli*, *Enterobacteraerogenes*, fungus.
Malaria	M_1	*Penicillium*, fungus
	M_2	*Escherichiacoli* moulds.
	M_3	*Escherichiacoli*, *Staphylococcus aureus*, moulds.
	M_4	*Penicillium*, fungus
	M_5	*Penicillium*, *Escherichiacoli*, fungus.
Ulcer	U_1	*Enterobacteraerogenes*, Moulds, Fungus
	U_2	*Staphylococcus aureus Escherichiacoli*, Moulds, Fungus
	U_3	*Staphylococcus aureus, Escherichia coli, Enterobacter aerogenes, moulds*
	U_4	*Enterobacteraerogenes, Fungus*
	U_5	Moulds, Fungus
Diabetes	D_1	*Escherichiacoli*, Fungus, *Enterobacteraerogenes*
	D_2	*Staphylococcusaureus, Escherichiacoli*, fungus.
	D_3	*Staphylococcusaureus*, *Escherichiacoli*
	D_4	Moulds, *Enterobacteraerogenes*
	D_5	*Staphylococcusaureus*, *Escherichiacoli*, Moulds, Fungus

The microbial isolates exhibited distinct bacterial and fungal species, as seen in Table 4. Staphylococcus aureus was the predominant bacterial contaminant in the majority of the analyzed samples, with Enterobacter aerogenes and Escherichia coli being the subsequent contaminants in terms of contamination rate. Fungi and molds were identified in the samples of a cough and ulcer, whereas samples of diabetes and malaria exhibited little fungal proliferation.

This investigation demonstrated the presence of significant microbial contamination in herbal medications, which is likely attributed to inadequate preparation procedures. Microorganisms might potentially contaminate the goods throughout many stages, such as processing, handling of raw materials, and packaging. Furthermore, the habitat and circumstances in which medicinal plants are cultivated and harvested expose them to potential contamination. Reports indicate that

unsanitary equipment and materials may serve as a potential source of microbial contamination. Micro-organisms were found to infect all analyzed herbal remedies used for treating cough, ulcers, and diabetes. The samples mostly included bacteria, namely Staphylococcus aureus and Escherichia coli. These diseases are often spread by direct physical contact, unsanitary equipment, and the use of contaminated water. These issues are widespread in our communities and the regions where these herbal medicine items are manufactured. Contamination with fungus and molds may occur due to elevated levels of pollution in the environment, including market places.

2. Heavy metal Contaminants

The lead content in the examined samples varied from 0.0120 to 2.0808 µg/g, whereas the nickel value ranged from 0.0120 to 0.9548 µg/g. No traces of cadmium and chromium were found in any of the samples examined in this investigation. The analysis of malaria samples revealed a significant presence of metals, with lead being the most prevalent, followed by nickel. In contrast, the examination of ulcer samples shown a higher quantity of nickel compared to lead. The analysis of several samples revealed that the metal content in diabetic samples was much lower than in other samples.

3. Quality control

The cadmium, lead, nickel, and chromium calibration plots metal standards were all linear, with regression values ranging from 0.9953 to 1.0000. Please refer to the appendix for the calibration curves. The concentrations of each herbal medicine sample were tested in µg/g, as shown in Table 5. The table provides a summary of the analysis.

Table 5: Mean metal concentrations (mg/l) in herbs for n=20

Disease	Sample code	Pb	Cd	Ni	Cr
		Mean concentration mg/l±sd)	Mean concentration mg/l ±sd)	Mean concentration mg/l ±sd)	Mean concentration mg/l ±sd)
Malaria	F	0.7292±0.340	<0.0001	0.2260±0.100	<0.0001
	H	0.0001±0.000	<0.0001	0.5308±0.250	<0.0001
	J(mumbwa)	2.0808±0.980	<0.0001	0.9548±0.480	<0.0001
Cough	A	0.1568±0.005	<0.0001	0.3200±0.150	<0.0001
	E	1.0448±0.492	<0.0001	0.2980±0.140	<0.0001
	E_1	0.8010±0.377	<0.0001	0.7940±0.273	<0.0001
Ulcer	D	0.0964±0.045	<0.0001	0.3396±0.160	<0.0001
	G	0.6716±0.045	<0.0001	0.7292±0.340	<0.0001
	G_1	0.1270±0.060	<0.0001	0.0228±0.021	<0.0001
	I	0.0120±0.004	<0.0001	0.0001±0.000	<0.0001
	I_1	0.1808±0.084	<0.0001	0.8010±0.377	<0.0001
Diabetes	B	0.0001±0.000	<0.0001	0.0120±0.004	<0.0001
	C	0.4132±0.194	<0.0001	0.3396±0.159	<0.0001
	C_1	0.5320±0.245	<0.0001	0.4630±0.218	<0.0001

Table 5. displays the comparative levels of metal content found in herbal remedies. The research found that the majority of herbal remedies analyzed included high levels of lead and nickel, ranging from 0.012 0.004 to 2.0808 0.980.Mumbwa had elevated levels of lead, measuring 2.0808 0.980 mg/litre, and nickel, measuring 0.9548 0.480 mg/litre, beyond the minimal thresholds of 0.001mg/litre for lead and 0.003mg/litre for nickel. This is quite concerning since lead, nickel, and their compounds are recognized as human carcinogens.

The techniques for determining dose of herbal medications lack standardization, since each herbalist employs their own unique approach. Patients are subjected to high dosages of these medicines, which results in significant exposure to poisons, including heavy metals. Consequently, the likelihood of health concerns is expected to rise. Furthermore, the labelling and packaging of some herbal medications may provide misleading information, leading patients to have a misguided perception of the safety of the product. Most herbal medications supplied on the market lack information about contraindications, manufacturing details, and expiration dates, hence increasing the hazards to patients. The analysis of herbal medications used for treating malaria revealed a significant presence of metals, with lead being the most often found. Subsequently, there was an increase in the concentration of nickel in the ulcer. The analysis of cough samples revealed modest metal concentrations, with lead levels much higher than nickel. However, the diabetes samples exhibited comparatively high levels of lead. The quantities of lead and nickel differed across the different types of herbal medicine analyzed, which may be related to the variations in the components utilized in the preparations and the market locations. The discoveries are also shown in figure 1. below.

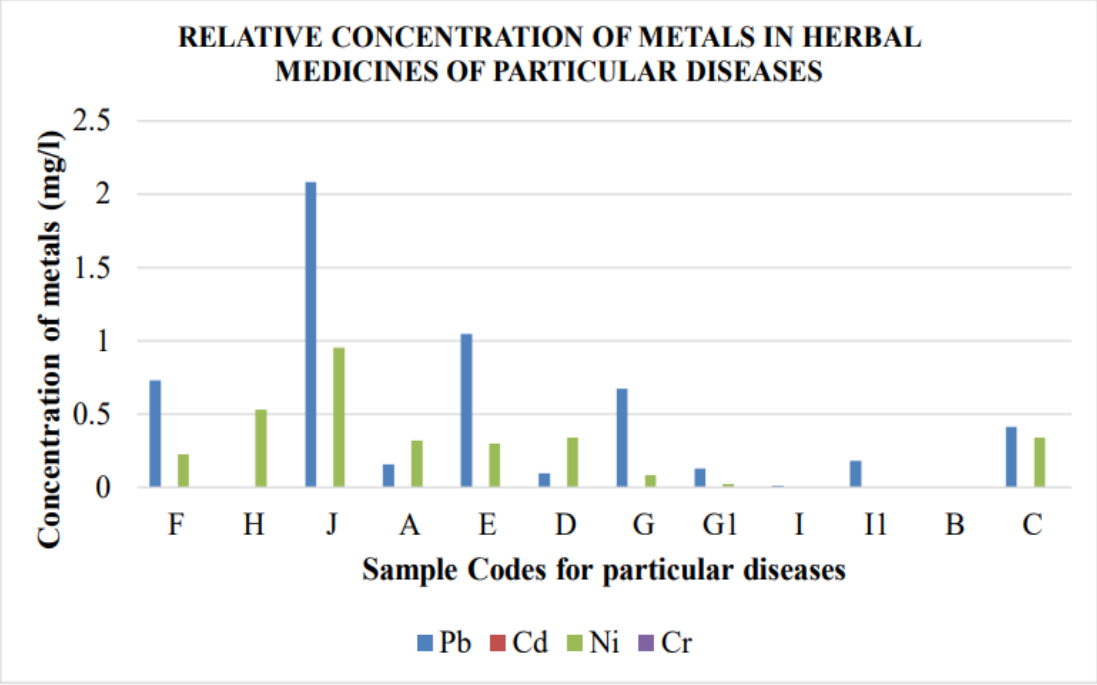

Figure 1: Bar graph showing a relative concentration of metals in herbal medicines of diseases

4. Heavy metal contamination in herbal medicine products

Herbal remedies may get contaminated with heavy metals throughout many phases of preparation, including harvesting, gathering, washing, and drying of the medicinal plants. The inadvertent introduction of impurities These herbal remedies might be contaminated with heavy metals during manufacture due to processes including grinding, mixing, and coming into touch with machinery that releases metals. To ensure the safety of human populations, many organizations such as USEPA and WHO have established guidelines to control the levels of Metals that are found in herbal remedies. Limits for oral components, reference dosages, and allowable daily exposures are all examples of such parameters are established methods aimed at reducing contaminations in herbal medications.

5. Toxicity of heavy metals

Cadmium (Cd), lead (Pb), nickel (Ni), and chromium have been detected in herbal remedies in several nations, as described by Elgorashi (2004). Prolonged exposure to heavy metals may lead to detrimental health consequences including poisoning. These metals has the capacity to accumulate inside living organisms, so disrupting the normal functioning of vital organs such as the brain, kidneys, and liver.

5.1. Cadmium (Cd)

One element that may dissolve in biological systems is cadmium, which is not required but may. Its toxicity and ability to accumulate in living things and impact their organ function are hallmarks of heavy metals. The health risks associated with cadmium exposure are the same whether the exposure is brief or long term. Cadmium has the potential to cause haemolysis and hypertension. Due to their chemical closeness and competition for the binding stage, the cadmium metal ion in the body's metallo-enzyme may easily replace another metal ion. Hence, the substitution of Zn2+ by Cd2+ in some dehydrogenating enzymes results in cadmium poisoning. Cadmium has been identified in herbal remedies via several investigations undertaken throughout different regions of the globe. Research done in Nigeria examined the cadmium levels in herbal remedies and revealed that the quantity cadmium concentrations varied between 16.438 and 29.796 mg/g. However, none of the samples tested for cadmium were found to contain the metal using atomic absorption spectrophotometry (AAS).

5.2 Lead

The investigation revealed that the samples analyzed had lead amounts ranging from 0.0120 to 2.0808 mg|l, with a particularly high concentration seen in MUMBWA. The significant concentration was seen in clay bars due to their composition mostly consisting of clay, a kind of soil. Reports indicate that most of these heavy metals are discharged into wetlands, resulting in elevated concentrations in the soil. These metals are also the primary constituents of clay bars.

The lead concentrations exceed the allowable daily consumption of lead as defined by the World Health Organization (2005) of 0.001mg|l, making them harmful to human health. A major contributor to the high lead content in herbal remedies is the widespread use of gasoline with lead content in developing nations and the improper disposal of untreated garbage, which then contaminates natural ecosystems. Possible causes of lead exposure include plant absorption from polluted soils and a high rate of pollution in our surroundings.

The lead contents exhibited significant variation across the analyzed samples,

except Mumbwa. Notably, herbal medicines used for treating malaria had the highest lead amounts in comparison to other medicinal products. The variance is probable to arise due to the diverse origins of the raw ingredients used in the various herbal medications. The lead amounts found in other herbal medications ranged from 0.004 to 0.377, which exceeds the allowed limits. This poses a concern to human health since lead is known to be carcinogenic. Lead, a dense metallic element, has been shown to have adverse effects on several organs inside the body. Extended exposure to lead diminishes the functionality of the nervous system and decreases renal clearance. Even at modest levels of exposure, lead poisoning is regarded as a substantial environmental health hazard for children. Several clinical instances have been recorded concerning lead poisoning resulting from the ingestion of various forms of traditional medicine. An analysis was conducted on many lots of four different herbal remedies made by Chinese pharmaceutical businesses to find out how much lead they contained. Lead was found in all samples, with concentrations ranging from 0.125 to 4.79 µg/g, according to the results.

5.3 Nickel (Ni)

The analysis revealed that the amounts of Nickel in the analyzed samples ranged from 0.0120 to 0.9548mg|l, with the highest concentration seen in the sample labelled as "MUMBWA". The Nickel concentrations exceed the acceptable daily intake of Nickel set by WHO (2007) at 0.0003mg-l, making them harmful to human health. Many therapeutic plants possess the capacity to collect heavy metals in their natural environment. An example of a plant that is often used for preparing malaria herbs and is known for its ability to accumulate high levels of nickel is the Asteraceae species. Exposure to nickel may lead to a range of pathological consequences. The primary impact of high doses of nickel from oral intake is on the cardiovascular system.

Allergic dermatitis is a prevalent negative health consequence of nickel exposure in individuals with nickel sensitivity. Disruption of physiological processes involving zinc and calcium is the likely source of most of nickel's adverse effects. The analytical findings showed that lead and nickel were found in different amounts, ranging from 0.012±0.004 to 2.0808±0.980 for lead and from 0.012±0.004 to 0.9548±0.480 for nickel, in most of the herbal medicines examined. The amounts of lead and nickel in cough, ulcer, mumbwa, and diabetes beyond the globally acknowledged tolerable values.

The observed variances Changes in pollution levels and changes in plants' ability to absorb and transport metals might be associated with variations in metal concentrations in the herbal treatments that were examined. Heavy metal uptake by plants is affected by several factors, including the species of the plant and its development stage, the kind of soil, and the specific metals being absorbed. Reports have shown disparities in the levels of certain metals found in a diverse range of plant species. Reports on plants have shown elevated nickel transfer values derived from soils watered with wastewater, suggesting a significant buildup of this metal in food crops. The occurrence of metals in herbal remedies may be ascribed to several causes, things including the soil's redox potential, metal concentrations, pH, and other physical and chemical characteristics.

A further study conducted in Austria examined the presence of metallic micronutrients and heavy metals in herbal remedies. The results revealed that some species, such as St. John's wort and poppy, had a greater propensity for accumulating

Nickel. Moreover, the findings of this investigation have shown elevated levels of Nickel in herbal medications.

5.4 Chromium

Chromium has been detected in herbal treatments in several regions worldwide, including Nigeria. Nevertheless, chromium was absent in all the samples examined in this investigation. The research findings indicate that the origins of heavy metal pollution in herbal medicines are associated with the water used during preparation, contaminated soils, fertilizers and pesticides, industrial discharges, transportation, as well as the procedures of harvesting and storage. The potential health hazard resulting from metal contamination is contingent upon the average daily use of these natural medications.

Conclusion

A large amount of the world's medication business is comprised of plant-based goods, which find widespread application as both home cures and in OTC drugs and pharmaceutical raw materials. That is why it is critical to have standards for evaluating their quality that are accepted worldwide. Even if certain plants have grown in popularity, there is still a lack of knowledge on how to safely and effectively utilize herbal medicine among the general population, medical professionals, and the media. New information is surfacing on the risks associated with the careless use of some plants.

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