

Original article

## Assessment of Selected Properties and Heavy Metal Concentrations in Soil and Vegetable Samples from Regions Surrounding Derna City, Libya

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### ABSTRACT

Soil and vegetable samples were collected from around the areas of Derna city (Libya) and used in this investigation. The vegetable samples included (Tomato, pepper, Eggplant, Zucchini, peas, lettuce, and beans). The heavy metals of iron, copper, and nickel were estimated in soil and vegetable samples. Besides the PH, TDS, and EC values were measured in soil samples. The results revealed that the soil is an alkaline medium (pH 6.5–8.9), with total dissolved solids (TDS) ranging from 284.44 to 503 mg/L and electrical conductivity (E.C.) ranging from 493 to 751  $\mu\text{s}/\text{cm}$ . These values suggest that the fraction of soil salinity has not increased significantly. All soil samples, according to the results. In the areas where these soil samples were found, the results showed that the soil samples from Al-thaher El-hmar had an 8.210  $\mu\text{g}/\text{g}$  content, while those from Elfatih and Sidi Khalid had 8.190  $\mu\text{g}/\text{g}$  and 8.222  $\mu\text{g}/\text{g}$ , respectively. Additionally, the results showed that the concentrations of the heavy metals under study ranged from 0.35 to 0.98  $\mu\text{g}/\text{g}$ , 0.33 to 1.539  $\mu\text{g}/\text{g}$ , and 1.065 to 2.103  $\mu\text{g}/\text{g}$  for Ni, Cu, and Fe, respectively, for Elfatih, Ain Mara, and Sidi Khaled. In contrast, the concentrations of the aforementioned heavy metals for the soil samples ranged from 0.72 to 3.572  $\mu\text{g}/\text{g}$ , Cu (0.729 to 0.913  $\mu\text{g}/\text{g}$ ), Ni (0.602 to 0.862  $\mu\text{g}/\text{g}$ ), and Fe (2.970 to 3.572  $\mu\text{g}/\text{g}$ ). The Fe, Ni, and Cu values were well below the WHO/FAO-established acceptable limits. The purpose of the study is measurement of the pH, E.C., and TDS levels in soil samples, as well as to determine of heavy metals in the studied samples.

### Keywords:

Vegetables, Soil, Heavy Metals, Libya.

### Introduction

Even in isolated locations where they have never been utilized, these substances can contribute to the soil. The properties of the soil affect the extent to which they are absorbed. Their retention may be impacted by the pH of the soil, the amount of organic matter, and the mineral composition of the clay, depending on their chemical characteristics. The organic matter in soil has a strong attraction for PAHs. As a result, some of their intake may stay in this medium for a long time without being broken down, volatilized, or leached. Additionally, livestock animals may unintentionally eat a significant amount of dirt that is linked to the vegetable roots when grazing, which could expose people indirectly [1]. Both direct contact with soil or ingestion of it, as well as indirect exposure through the eating of crops and grazing animal products, can expose humans to soil pollution. There are three ways that the latter could occur: ingestion (deliberate or unintentional, geophagy), inhalation, and penetration or absorption through the skin.

One potentially significant route of exposure to environmental contaminants may be through the ingestion of dust and soil particles. Hand-to-mouth contact, which is very common in youngsters, airborne dust, and improperly cleaned fruits and vegetables can all result in accidental consumption. Moreover, the main cause of animal product contamination (meat, milk, or eggs) may be farm animals kept outdoors, accidentally consuming soil containing POP. According to recent studies, soil is a significant risk factor for POPs entering the food chain, especially in regions with elevated pollution levels [2]. The same is true with heavy metals in vegetables, which are becoming a bigger problem due to evidence of contamination in some soils and irrigation water. The way that different vegetables absorb heavy metals varies; some vegetables accumulate more heavy metals than others. The two main categories of heavy metal sources identified by scientists are anthropogenic and natural. Anthropogenic sources include mining, industry, agriculture, and household wastewater, whereas natural sources include sedimentary rocks, volcanic eruptions, soil formation, and rock weathering. Anthropogenic heavy metal sources include mining, wastewater, industries, and agriculture. These sources, which include smelting, which releases Cu, Zn, and As; insecticides, which release As; burning fossil fuels, which releases Hg; and vehicle exhaust, which releases Pb, are major

contributors to the rise in heavy metal concentrations and pollution in the environment. Agricultural systems have expanded and developed in response to the growing demand for food. Water, animal feeds, and agrochemicals are misused and overused [3].

Agroecosystems are generally harmed by a variety of pollutants, including agricultural pollutants, which are biotic and abiotic byproducts of farming operations. The nearby agroecosystem is frequently contaminated and deteriorated by these pollutants. The most common agricultural sources of heavy metals are sewage sludge, wastewater, fertilizers, and pesticides. The types of toxic heavy metals and how they build up in plants and soil vary [4]. Therefore, excessive fertilizer use, acidic atmospheric deposition, and inadequate liming may also cause a pH drop and thereby raise the availability of heavy metals, worsening the issue of low-quality food, metal leaching, and effects on soil organisms. Moreover, beef and poultry may have elevated cadmium levels (particularly in the liver and kidneys) as a result of using animal feed crops grown on soil with high cadmium content. Compared to the other grains that are normally produced, wheat gathers more Cd.

Another chemical factor that affects the transit and fate of heavy metals, especially their mobility in soil water, is the pH of the soil; a low pH increases metal ionization, which increases water solubility and mobility [5]. There are two types of fertilizers: inorganic (synthetic) and organic (natural). Organic or biofertilizers in the form of ammonium fertilizers (sulfate and nitrate) are produced by anaerobic digestion (AD). Inorganic fertilizers, sometimes referred to as synthetic or chemically produced fertilizers, are made up of both inorganic and chemical components. Heavy metal production in the soil is caused by fertilizers, both organic and inorganic, and the concentration of heavy metals in various fertilizer types varies [6].

Long-term fertilizer uses lowers soil fertility by causing heavy metal deposition in agricultural soils. Plant production and growth are consequently decreased. When heavy metals damage the soil environment, it is typically very difficult to restore it: 13 mg of Cd, 60 mg of Cr, 26 mg of Cu, 13 mg of Pb, and 236 mg of Zn are found in one kilogram of fertilizer. Multicomponent fertilizers have far lower levels of these elements: 0.9, 3.4, 2.0, 1.9, and 5.0 mg/kg, even though nitrogen fertilizers have a higher accumulation potential in agricultural soil as a result of long-term fertilizer use [7]. Numerous illnesses, including diabetes, Alzheimer's disease, and several forms of cancer, are being caused by heavy metals. Acute metal poisoning in humans causes serious problems with the brain, reproductive, and renal systems. The following have been identified as general symptoms of copper, lead, aluminum, zinc, mercury, cadmium, and arsenic poisoning, in addition to specific metal toxicity signs: gastrointestinal (GI) dysfunctions, diarrhea, stomatitis, shivering, hemoglobinuria that causes a rust-red depression, and chronic exposures. Heavy metals can be harmful to human health even at low environmental concentrations [8].

Copper is a ductile, malleable, reddish-gold metal that effectively conducts heat and electricity. Most copper is used in electrical devices such as motors and wiring. This is because it can be drawn into wires and conducts heat and electricity very well. It is also utilized in industrial machinery (like heat exchangers) and building (like roofing and plumbing). Although copper is necessary for brain function, it can be hazardous if the cellular content is higher than what is needed metabolically. Poor working memory in children has been associated with elevated blood copper levels. High levels of this dangerous element can have negative effects on the brain, liver, and kidneys, in addition to gastrointestinal (GI) side effects like hematemesis and stomach pain [9]. With an atomic number of 28, nickel (Ni) is a transition metal with the electronic structure [Ar] 3d<sup>8</sup>4s<sup>2</sup>. A shiny, silvery white metal with a hint of gold. Because of this, the majority of nickel production is used for alloying elements, coatings, batteries, and a wide range of other products like jewelry, mobile phones, medical devices, kitchenware, structures, and transportation. The majority of nickel enters the body through food and water consumption, even though inhalation exposure in work environments is a major route for nickel-induced toxicity.

Some forms of nickel can be extremely dangerous to humans if taken orally in high doses (> 0.5 g). Nickel is required in trace amounts for the production of red blood cells (RBCs), but at high concentrations, it gradually turns toxic [10]. The heavy metals react with different ligands to produce complexes which have different applications [11-17]. In Libya, many studies on the environmental impact of different compounds as petroleum [18-27], plants [28-61], and waters [62-101], were carried out over the last years. This study aims to estimate some of the hydrological parameters, including PH, TDS, and EC, besides some heavy metals, including Iron, Copper, and Nickel, in some soil samples collected from some areas around Derna city.

## Methods

### **Description of the Studied Area**

The research area is situated in a significant section of AL-Jabal EL-Akhdar, often known as the "green mountain," in northeastern Libya. The region has a semi-humid climate with an average annual rainfall of about 382 mm. The farms cover a sizable portion of the city. Pollutants from the cement industry, a water desalination facility, and agricultural chemicals have had a significant impact on the area. The soil is

categorized under the Rendolls class, which is rich in calcium carbonate and is young with no deep profile on the prospects. It is a member of the order Mollisols, which is prevalent in arid and sub-humid regions. It is renowned for farmers' preference for irrigated farming, which has led to a rise in the use of fertilizers to improve soil fertility and a rise in the use of chemical pesticides for insect control, both of which have increased as a result of irrigated farming's expansion. El-Fatiha, Wadi Derna, Ain Mara, Sidi Khalid, and Al-thaher EL-hmar were among the sample locations selected (Figure 1).



**Figure 1. Map of the locations of the studied area (Source: Google Earth)**

#### **Collection and preparation of the samples:**

About ½ kg of each soil and vegetable sample was collected and placed in sterile plastic bags from the same locations. The samples were obtained with a steel auger from 0 to 20 cm depth and combined to create a composite sample. The soil samples that were gathered were taken to the central chemistry laboratory of the science faculty (Omar El-Mukhtar University). After five days of air drying at room temperature (25 °C) in a dry, dust-free environment, the soil samples were oven-dried for twenty-four hours at 10 °C. The materials were homogenized after being ground with a pestle and passed through a 2 mm sieve. Ultimately, the soil samples that had been dried, sieved, and homogenized were placed in polyethylene bags and preserved in desiccators until they could be digested and examined.

#### **Chemical Analysis**

##### **Hydrographical Parameters Analysis**

Soil pH, electrical conductivity (EC), and total dissolved solids (TDS) are some of the metrics that are used to measure the physicochemical properties of soil samples. The two most crucial natural resources for agricultural cultivation are soil and water. The life layer of plants is formed by the medium of unconsolidated nutrients and materials, which is soil. It is one among the biosphere's fundamental life-sustaining elements. Agricultural chemists rely on physicochemical investigations of factors for soil management and plant growth. Seven distinct sampling locations' worth of soil samples were examined for their physicochemical characteristics.

##### **Hydrogen-ion concentration (pH)**

As soon as the water sample was collected, its pH value was determined on-site using a bench-type (JENWAY, 3410 Electrochemistry Analyzer pH-meter).

##### **Electrical Conductivity (E.C.) and Total Dissolved Solids (TDS):**

An inductive salinometer (Beckman, model RS-10) was used to measure the electrical conductivity (E.C.) in order to calculate the salinity.

##### **Digestion of the vegetable and soil samples for heavy metals determination**

About 0.5 g of the homogenized sample was weighed, put into a 100 ml beaker, and then 5 ml of concentrated HNO<sub>3</sub> was added in order to determine the specific heavy metals. Samples of soil were broken down using the method described by previous studies [63&64]. 0.5 g of finely ground powder was wet digested in a 100-ml conical flask on a hot plate in the digestion chamber (fume hood) by adding 3 ml of distilled water and 5 ml of nitric acid (HNO<sub>3</sub>) in a 3% ratio. The liquid was heated further to a volume of 2-3 ml, then removed to release the heat, allowed to cool, and then diluted with distilled deionized water in a 100 ml volumetric flask.

Lastly, the diluted sample is filtered through filter paper and placed in a polyethylene bottle for heavy metal measurement.

### Heavy Metals (HMs) Analysis

An atomic absorption instrument (Thermo company) was used to measure the heavy metals in the central laboratory of chemistry at the faculty of science (Omar Al-Mukhtar University). The concentration was expressed as(ppm).

### Results

(Table 1) showed the hydrographic characteristics of hydrogen ion concentration (pH), electrical conductivity (E.C.), and total dissolved solids (TDS).

### Hydrogen Ion Concentration (pH)

(Table 1) provides the pH values of soil samples from the chosen sites.

**Table 1. The hydrographical parameter values of the soil samples under study.**

Sites / Agricultural soil	Parameters		
	pH	E.C ( $\mu$ S/cm)	TDS (mg/L)
EL-fatiah 1 Soil (Tomato)	6.55	493	284.4
EL-fatiah 2 Soil(pepper)	7.15	518	347.06
Ain mara Soil (eggplant)	8.16	591	395.97
Sidi Khalid 1 Soil (Zucchini)	8.08	751	503.17
Al-thaher El-hmar Soil (peas)	7.80	582	389.97
Sidi Khalid 2 Soil (bean)	8.94	709	475.03
Wadi Derna Soil (Lettuce)	7.69	602	403.34
<b>Average</b>	7.67	606.57	406
<b><math>\pm</math>SD</b>	0.70	86.89	68.24
<b>WHO Standard</b>	6.5 - 8.5	400 - 600	< 1000

They ranged from a minimum of 6.5 to a maximum of 8.9, with certain places showing a tendency for the pH values to rise. In general, the findings indicated that there were few fluctuations in the pH values. It may be regarded as a very important factor in determining the concentration of un dissociated and ionic compounds because the hydrogen ion concentration is not only a measure of potential hydrogen but also relates to the concentrations of many other substances, especially the weakly dissociated acids and bases, pH may be a very important element in determining or restricting the threshold concentration because un dissociated substances are often more poisonous than their ionic counterparts. It reflects the position of various ecosystem balances, including the carbon dioxide system and the iron and sulfur cycles. These are then connected to vital biological functions as respiration, photosynthesis, and bacterial activity. Because soil pH controls the chemical forms of the various nutrients and affects their chemical reactions, it controls plant nutrient availability, making soil pH research crucial to agriculture. Consequently, the pH value of the soil is associated with crop and soil productivity. The ideal range for the majority of agricultural crops is between 5.5 and 7.5, even though the pH of soil often falls between 1 to 14. The pH values of soil are categorized by the National Resources Conservation Service of the US Department of Agriculture as follows: ultra-acidic (<3.5), extremely acidic (3.5–4.4), very strongly acidic (4.5–5.0), strongly acidic (5.1–5.5), moderately acidic (5.6–6.0), slightly acidic (6.1–6.5), neutral (6.6–7.3), slightly alkaline (7.4–7.8), moderately alkaline (7.9–8.4), strongly alkaline (8.5–9.0), and very strongly alkaline (>9.0).

### Soil alkalinity

This is common in arid regions or areas with inadequate internal soil water drainage, when water either evaporates or transpires through crops instead of moving through the soil. Alkaline soil development is influenced by the following factors:(i) Poor Soil Drainage: When there is a lot of rainfall, salts from the top layer seep down and build up in the bottom layer if drainage is blocked. The salt stays in the soil after the water evaporates. These types of soils are usually found in basin-shaped or low-lying areas. There is an increase in the groundwater table. Wind-blown salts. (iv) Excessive Use of Basic Fertilizers: The use of alkaline fertilizers such as sodium nitrate, basic slag, and others may cause soil alkalinity. (v) Alkaline soils form in other settings as well, such as semi-humid and temperate zones, particularly in depressions where drainage is poor and the subsurface water table is high or close to the surface [102]. There are several ways that soil acidity occurs, including:

Excessive rainfall: The soil often turns acidic when there is a lot of rainfall.

Rainfall is relatively acidic (approximately 5.7) as a result of an interaction with atmospheric CO<sub>2</sub> that generates carbonic acid. Rainfall increases the amount of Al<sup>3+</sup> and H<sup>+</sup> in the soil in comparison to other cations by removing basic cations from the soil as bicarbonates through the soil's pores. Leaching occurs when the concentration of carbonic acid (H<sub>2</sub>CO<sub>3</sub>) rises due to CO<sub>2</sub> produced by both root respiration and the decomposition of organic materials by microbes. Crop growth: NO<sub>3</sub><sup>-</sup>, NH<sub>4</sub><sup>+</sup>, Ca<sup>2+</sup>, and H<sub>2</sub>PO<sub>4</sub><sup>-</sup> ions are taken up by crop roots from the soil. Generally speaking, crop roots absorb cations more quickly than anions. Conversely, for normal physiological processes to occur in crops, their roots must have a neutral charge. Root vegetables emit H<sup>+</sup> ions to counteract the larger positive charges seen in acidic soils. Fertilizer use: Certain fertilizers, including ammonium (NH<sub>4</sub><sup>+</sup>) urea, release H<sup>+</sup> ions as they nitrify, producing nitrate (NO<sub>3</sub><sup>-</sup>), which results in acid soils. When fossil fuels burn, sulfur and nitrogen oxides are discharged into the atmosphere, causing acid rain. Tetraoxosulfate. When precipitation and released oxides mix in the atmosphere, acid is created. Oxidative weathering: During the oxidation process, sulphides and other compounds containing Fe<sup>2+</sup> produce acidity [103].

### Electrical Conductivity (E.C)

The range of conductivity (EC) values is 493–751 μS/cm. The site of Sidi Khalid, 1 recorded the maximum value of 751 μS/cm, while the location of EL-fatiah, 1 recorded the lowest value of 493 μS/cm. (Table 2)

**Table 2. The Salinity values for soil samples.**

Salinity class	EC [μS/cm]
Non-saline	0-200
Slightly saline	200-400
Moderately saline	400-800
Highly saline	800-1600
Extremely saline	>1600

### Total Dissolved Solids (TDS)

Throughout this investigation, the TDS levels ranged from 284.44 to 503.17 mg/L. The highest result, 503.17 mg/L, was recorded at site 2 (Sidi Khalid), and the lowest value, 284.44 mg/L, was recorded at location (1) (EL-fatiah). Both values fall below the WHO's recommended allowable range of TDS, which is less than 1000 mg/L. These values indicate that the soil samples are rich in ions and heavy metals and categorize the soil as saline.

### Heavy Metals

The levels of heavy metals in the samples under study. were given in (Tables 3&4).

**Table 3. The levels of heavy metals (Cu, Ni, and Fe) in several vegetable samples (μg/g).**

Vegetables	Heavy Metals		
	Cu	Ni	Fe
Tomato	0.453	0.438	1.534
Pepper	0.968	0.664	1.364
Eggplant	0.387	1.284	1.829
Zucchini	0.454	0.334	1.065
Peas	0.817	1.539	1.793
Bean	0.774	1.380	1.889
Lettuce	0.356	0.841	2.103

**Table 4. The levels of heavy metals (Cu, Ni, and Fe) in the studied samples (µg/g).**

Agriculture Soil	Heavy Metals		
	Cu	Ni	Fe
Soil (El-fataiah 1)	0.833	0.775	3.103
Soil (El – fataiah2)	0.826	0.782	3.529
Soil (Ain mara)	0.905	0.850	2.970
Soil (Sidikhalid1)	0.740	0.602	3.131
Soil (Althahar EL-hmar)	0.811	0.862	2.948
Soil (Sidikhaled 2)	0.729	0.716	3.103
Soil (Wadi Derna)	0.913	0.670	3.572

## Discussion

The EC values of all the agricultural soil samples under study are higher than the WHO's permissible limit, which is between 400 and 600 µS/cm. These findings provide a reliable indication of the presence of pollutants like sodium, potassium, or sulphate, and the water is brackish. Because soil electrical conductivity is directly correlated with soil salinity, electrical conductivity tests can be used to identify contaminated areas and assess soil salinization. The development and expansion of agricultural techniques are typically linked to salinization, which can be defined as an increase in the concentration of salt in the soil (Hammam and Said,2018). Soil salinity classes are categorized based on their EC levels in Table 2. Total dissolved solids (TDS), which describe the inorganic salts and trace amounts of organic matter found in soil, are a great way to measure the saltiness of the soil.

Increased salt content in soil has a major negative influence on the environment, primarily lowering soil quality and crop productivity by making it harder for plants and crops to absorb water, which results in lower yields and major financial losses in agricultural production. The measurement of a particular ion, such as hydrogen, is called pH. Conversely, electrical conductivity is a non-specific metric that measures the concentrations of the sample's positively and negatively charged ions. The following is the relationship between pH and conductivity: any hydrogen ions present in a substance will affect its pH level, which will most likely affect its conductivity levels. On the other hand, hydrogen ions only account for a minor portion of the ion concentration that a conductivity meter measures. The existence of hydrogen in relation to other ion concentrations will determine how relevant the link is. Total dissolved solids (TDS) and electrical conductivity (E.C.) are highly correlated. The more salts that are dissolved in the soil solution, the greater the soil's electrical conductivity rating. It is employed to determine whether water is suitable for home and agricultural usage. The main components of TDS, which give a quantitative measurement of the quantity of dissolved ions, are typically the anions carbonate, bicarbonate, chloride, sulphate, and nitrate, as well as the cations calcium, magnesium, sodium, and potassium.

Iron (Fe): Tables 3&4 provide the iron concentrations in the soil samples of the studied area, respectively. Fruiting vegetables < legume < leafy vegetable < soil is the decreasing order of the iron distribution pattern in the studied vegetables and agricultural soil. However, aside from lettuce, the soil appeared to be the sample that accumulated the highest amount of iron among those that were collected. When compared to other vegetables, the concentration of lettuce was higher. The majority of the measured amounts of heavy metals were above the FAO/WHO maximum allowed limits. The cumulative concentration levels of heavy metals from consumption through food influence their effects on human health. Age and body weight are correlated with food intake. The WHO/FAO recommends 425.5 mg/kg of iron (Fe) in vegetables as a safe level [104].

Chemical examination has demonstrated the presence of notable amounts of heavy metals (Fe, Cu, and Ni) as a result of long-term, intense usage of chemical pesticides and fertilizers. It is often known that fertilizers are constantly tainted with heavy metals, which leads to heavy metal contamination of the soil. The high concentration of these heavy metals in the soil might have an impact on the plants that are grown. A significant number of heavy metals were found; the quantities of iron (Fe) varied from 1.364 to 2.103 µg/g. The body needs iron as a mineral for growth and development. Iron is necessary for the body to produce certain hormones as well as hemoglobin, a protein found in red blood cells that transports oxygen from the lungs to every part of the body, and myoglobin, a protein that supplies oxygen to muscles [105]. For copper, show the copper contents in the seven species that were the subject of the study for the chosen vegetables in Derna City. Copper values in various vegetable species range from 0.365 to 0.968 µg/g. Conversely, the amounts of copper in agricultural soil range from 0.729 to 0.913 µg/g. There are national and international laws that clearly define the maximum amount of copper that can accumulate in the plant's edible portion, which is 10 mg/kg on a fresh weight basis. This isn't the case for the impact on biomass output, though. Among these detrimental substances, the heavy metals that are regarded as micronutrients are especially important because plants react differently to them, becoming more tolerant and improving their uptake and accumulation in various plant tissues.

Cu is a heavy metal of particular significance since it is used extensively as a fungicide, is a significant ingredient in many chemical fertilizers, and is present in large quantities in animal dung and sewage sludge. Naturally, agricultural soil has a Cu concentration ranging from 5 to 30 g/kg, albeit this fluctuates based on the soil's location and condition [106]. Only minimal amounts (63  $\mu\text{g g}^{-1}$ ) of copper, an important element, are found in the Earth's crust. Both plants and animals require it as a trace nutrient, but at high concentrations (20 mg/kg dry measure), it is toxic. Copper pollution in soil is a serious issue since copper mobility is lower in the higher humus of forest soils than in the mineral layers. At high dosages, it can cause liver and renal damage, anemia, cold sweats, and a weak pulse. Long-term inhalation or absorption may cause death.

Nickel (Ni) displays the nickel distribution in the vegetable samples from the studied area. The nickel values varied between 0.334 and 1.539  $\mu\text{g/g}$ . Fruiting plants, lettuce, legumes, and soil all had significant Ni concentrations. The WHO/FAO recommends 67.9 mg/kg as the safe level of nickel in fruits and vegetables. Generally speaking, soil and surface waters have naturally occurred Ni concentrations of less than 100 mg/kg and 0.005 mg/L, respectively. However, anthropogenic activities such as the burning of fossil fuels for power generation, mining, smelting, vehicle emissions, the disposal of household, municipal, and industrial waste, the production of steel, and the cement industry further accelerate the release of Ni into the soil. An important micronutrient for the growth and development of seedlings is nickel. For the best plant growth, only small levels of it are needed. For instance, at a concentration of 10 M, nickel enhanced biomass accumulation and plant development. Legumes like beans and cowpeas need more nickel than other crops since it is necessary for nodulation and N fixation. Several commonly used fertilizers also contain trace amounts of Ni. Ni fertilizer is typically applied as a foliar spray when it is necessary to address a crop shortage. Sulfates, nitrates, and other nickel salts, as well as organic Ni ligands, are known to cause cancer in humans and have several other pathologic effects. Allergy dermatitis can result from skin contact with metallic or soluble nickel compounds. One of the most frequent side effects of nickel overdose is hair loss [107].

## Conclusion

According to the results obtained in this study there are different values of heavy metals of iron, copper and nickel in vegetables and soil samples selected in this study, most of vegetable samples containing lower concentrations recommended by WHO limits, but small amounts of these elements give negative indication for the environmental impact for presence of the detected elements in vegetable samples, there the control of the concentrations of these and other metals is very important.

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## Conflict

The results shown in this study were not published in any other journals before this time.

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