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# Contamination of Heavy Metals in Selected Green Leafy Vegetables Obtained From Various Metro City

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**Abstract:** Substantial metal levels in eleven leafy vegetables from different market yards in twin urban areas (Hyderabad and Secunderabad), Telangana, India.The samples were resolved utilizing atomic absorption spectrometry. The outcomes demonstrated that the levels of the Lead, Cadmium, Copper, Zinc, Cobalt and Nickel for the leafy vegetables individually were found to be 0.09±0.01 to 0.21±0.06; 0.03±0.01 to 0.09±0.00; 0.02±0.00 to 0.07±0.00; 0.01±0.00 to 0.10±0.00; 0.02±0.00 to 0.36±0.00 and 0.05±0.04 to 0.24±0.01 mg/kg respectively. These levels are similar with those accessible in the writing and inside mediocre breaking points of some dangerous metals. The levels of Pb and different metals were below the FAO/WHO suggested limits for metals in leafy vegetables. Low convergences of Pb and non-appearance of Cd in all the tests are signs that these plants contribute less harmful impacts of metals. The results show that, these leafy vegetables are the principle wellsprings of basic follow components. The day-by-day human admissions of metals have likewise been figured and were seen below prescribed values by the FAO/WHO.

**Keywords:** Substantial metals, Leafy Vegetables, Inductively Coupled Plasma Mass Spectrometer (ICP-MS), Toxicity.

## 1. Introduction

Vegetables and leafy vegetables are generally utilized for culinary purposes. They are utilized to build the nature of soups (leafy vegetables) furthermore for their dietary purposes (Sobukola et al., 2007) [1]. They are comprised of predominantly cellulose, hemi-cellulose and pectin substances that give them their surface and solidness (Sobukola and Dairo, 2007). Crisp foods grown from the ground are of extraordinary significance in the eating regimen due to the nearness of vitamins and mineral salts. What's more, they contain water, calcium, iron, sulfur and potash (Sobukola et al., 2007). They are essential defensive sustenance and helpful for the upkeep of wellbeing and the counteractive action and treatment of different sicknesses (D'Mello, 2003). Notwithstanding, these plants contain both fundamental and lethal metals over a wide scope of focuses (Radwan and Salama, 2006). Overwhelming metals have been accounted for to have positive and negative parts in human life (Adriano, 1984; Slaveska et al., 1998; Divrikli et al., 2003; Dundar and Saglam, 2004; researchers have additionally focused on that these metals could bioaccumulate in products, particularly when developed along development locales and are devoured by man and animals (Tulonen et al., 2006). Human exposures to substantial metals have been the concentration of expanding consideration among Researchers, wellbeing and nourishment specialists due to their effect on general wellbeing. Green Leafy Vegetables (GLVs) are imperative piece of eating regimens in the South-South Locale of Andhra Pradesh and Telengana

Vegetables, particularly those of leafy vegetables developed in overwhelming metals debased soils, collect higher measures of metals than those developed in uncontaminated soils as a result of the way that they retain these metals through their underlying foundations (Muhammad et al., 2008). Vegetables gather substantial metals in their eatable and non-palatable parts. Ingestion limit of substantial metals relies on the way of vegetables and some of them have a more noteworthy potential to amass higher convergences of substantial metals than others (Akan et al., 2009). Atayese et al. (2009) researched substantial metal tainting of Amaranthus developed along major expressways in twin cities in hyderabad and secunderabad. Ladipo and Doherty (2011).

## 2. Experimental details:

Samples of 6 fresh leafy vegetables were collected randomly from local markets in twin cities of hyderabad, India. Leafy vegetables are preferred as they accumulate heavy metals in greater capacity than other vegetables.

### 2.1 Pretreatment:

All glass ware and containers required for experimentation were first washed with milli Q water followed by soaking in 10% nitric acid(AR Grade) for few hours.Surface contaminants of the leafy samples collected were removed by washing with deionized water twice and then with deionized double distilled water. The leaves were air dried in a clean drying chamber and then dried at 80$^{o}$C for overnight in a oven(ref PravinSingare,RamLokhande, MahadeoAndhale, Raghunath Acharya, Availability of essential trace elements in ayurvedic indian medicinal herbs using instrumental neutron activation analysis and atomic absorption spectroscopy, world Journal of Science ,Technology and sustainable Development,Vol.7,No.2,2010, page no 175-180). The samples were powdered in agate mortar and passed through -80 mesh sieve. Sampling is done from this powder.

### 2.2 Preparation of samples :

The 0.5g of homogenized sample was weighed into a clean 100 ml beaker and 5ml of nitric acid was added and heated on a hot plate at 80$^{o}$C,untill the solution reduced to 2.5 ml and then add 2.5 ml nitric acid and heated to 80$^{o}$C until it is reduced to 2.5 ml .Now 2ml of Hydrogen peroxide is added drop by drop heated at 80$^{o}$C ,until it reduced to 2ml filtered and make up with 100 ml Milli Q water, from this 5 ml of the solution is take and make up to 100ml.

Sample blank solutions were prepared using the same procedure described for the samples.All chemicals used were of analytical grade.Elemental analysis of both sample and blank solutions were determined using an Inductively Coupled Plasma Mass Spectrometer(ICP-MS) ELAn DRC II,perkin –Elmer Sciex Instrument(Balaram et al. 2003)

Balaram,V., & GnaneshwarRao, T.(2003) .Rapid determination of REEs and other trace elements in geological samples by microwave acid digestion and ICP-MS.Atomic Spectroscopy, 24(6), 206-212.

## 3. Results and discussion:

Table (1) and figure (1) shows the result of heavy metal analysis in all leafy vegetable samples such as Cr, Mn, Fe,Co, Ni,Cu,Zn,As,Cd and Pb. The levels of Mn and Fe in all the green leafy vegetable samples. The maximum concentration of Fe (1364.911 mg/kg) found in Amaranthus followed by Mn (779.815mg/kg) in Rumex vesicarius. It is observed that Fe (428.788 mg/kg) is very minimum in Moringa Olifera and Mn(174.38 mg/kg) is very low in Mentha Spicata. Actual safe limit of Fe and Mn according to WHO/FAO standards (--Iron is the most abundant element, by weight, in the earth's crust. Iron is the second most abundant metal in earth's crust. It is an essential element in human nutrition. The minimum daily requirement of iron is ranged from about 10 to 50 mg/day (FAO/WHO 1988).

The Food and Nutrition Board of the Institute of Medicine (IOM, 2002) set adequate intake levels for manganese at 2.3 mg/day for men and 1.8 mg/day for women. In all the samples, the concentration of Fe and Mn are found to be exceeding the safer limits (Fig 2). Similarly, Zn levels were ranged in between 10.029 mg/kg - 23.928 mg/kg i.e., Foetid cassia and Coriander respectively. Nickel also plays some role in body functions including enzyme functions. It occurs naturally more in plants than in animal flesh. It activates some enzyme systems in trace amount but its toxicity at higher levels is more prominent (Divrikli et al., 2006). The Ni levels in the samples tested varied between 0.941 and 1.734 mg/kg with the lowest observed in (P2) Jews mallow and highest observed in (P9)fluted pumpkin plant with range contents of 0.01 - 0.1 to 0.23 and 0.25, respectively. However, Ni level of 0.067 mg/kg for Indian Basil have been reported by Divrikli et al. (2006) which is not within the range of values obtained from this study.

Fig. 3 shows that the Cd, Pb concentration in selected in the leafy vegetable samples. According to WHO/FAO standards even low level of Cd may cause health disorders and even toxic to environment. Cd is a non-essential element inputs and natural waters and it bio accumulate principle in the kidney and liver Divrikly et. Al 2006. Hence, with safe limit regular monitoring is required. Hence, it is very important result as human health directly affected by consumption of leafy vegetables. The regular monitoring of heavy metals in leafy vegetables is to be continued. Because 45% of main source of food for humans, 65% of main source of food for

cattle in many parts of the world and are considered as bio indicators of environmental pollution. Cd levels ranged in between 0.708mg/kg – 5.232 mg/kg in the samples Spinaca Oleracea and Amaranthas respectively. Actual safe limit of Cd is 0.3mg/kg.

Pb is a toxic element that can be harmful to plants although plants usually accumulate large amount of lead without visible changes in their appearance or yield. In many plants Pb accumulation can exceed several hundred times the threshold of maximum level permissible for human consumption (Muhammad et al., 2008). Pb level in the leafy parts of the vegetebles examine since not to be alarming except in case of excessive consumption. The levels of Pb reported in the study are higher when compared to that reported in the leafs of lettuce is 0.01mg/kg by adu et. Al 2012. In our study, it is found that Pb levels ranged in 0.761mg/kg – 2.448mg/kg in the samples Fennel and Spinacia Olaracea respectively. The safe limit of Pb is 0.3mg/kg (according to FAO/WHO). The study shows that, in all the sampled leafy vegetables Pb content is very high.

## Conclusions:

In the present study, Cd and Pb are found with higher amounts in sample (5) followed by sample P8 and P7. According to FAO/WHO daily intake of metals suggest that the consumption of contaminated leafy vegetables pose a health risk for the consumers. Henceforth, the higher levels of these heavy metals accumulated in the body causing organ related disorders. Hence, the authors noticed that a lot heavy metal accumulation takes place in leafy vegetables which further damage the human health. In addition to this industrial contaminated sites not preferably used for commercial vegetable farming of leafy vegetables due to biological magnification. The above areas have been treated suitable bio remediation techniques.

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Fig. 1. The concentration of heavy metals in leafy vegetables from Twin cities of hederabad and secunderabad, Telangana, India (mg/kg, fresh weight)

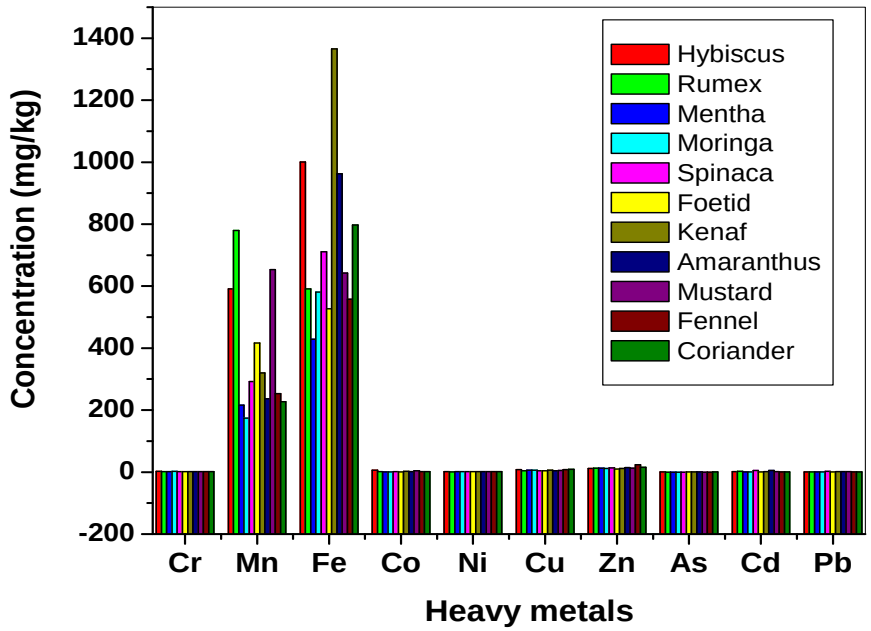

Fig.2. The concentration of heavy metals ( Mn, Fe) in leafy vegetables from Twin cities of hederabad and secunderabad, Telangana, India (mg/kg, fresh weight).

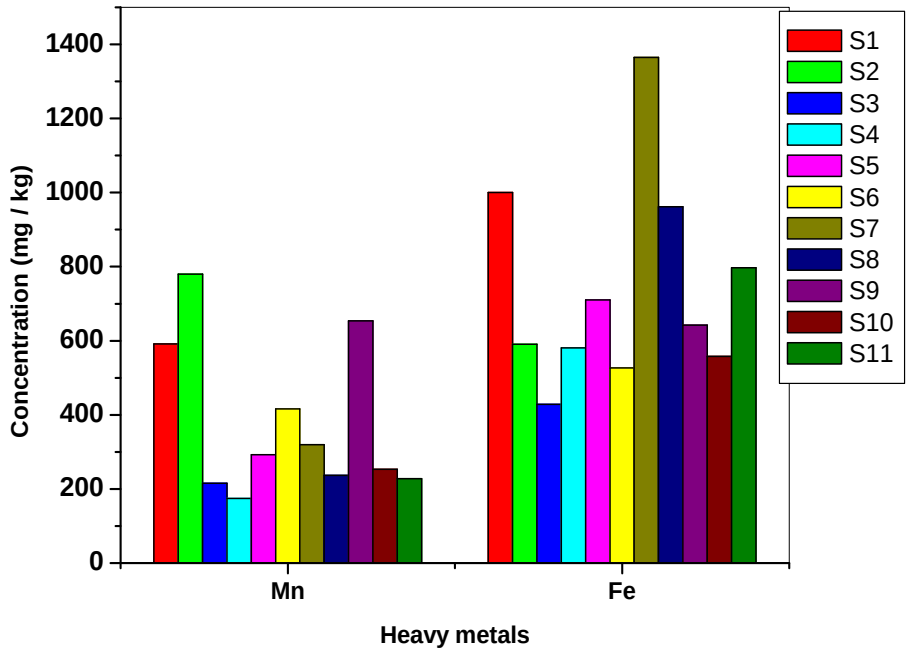


Fig. 3. The concentration of heavy metals (Cd, Pb) in leafy vegetables from Twin cities of hederabad and secunderabad, Telangana, India (mg/kg, fresh weight)

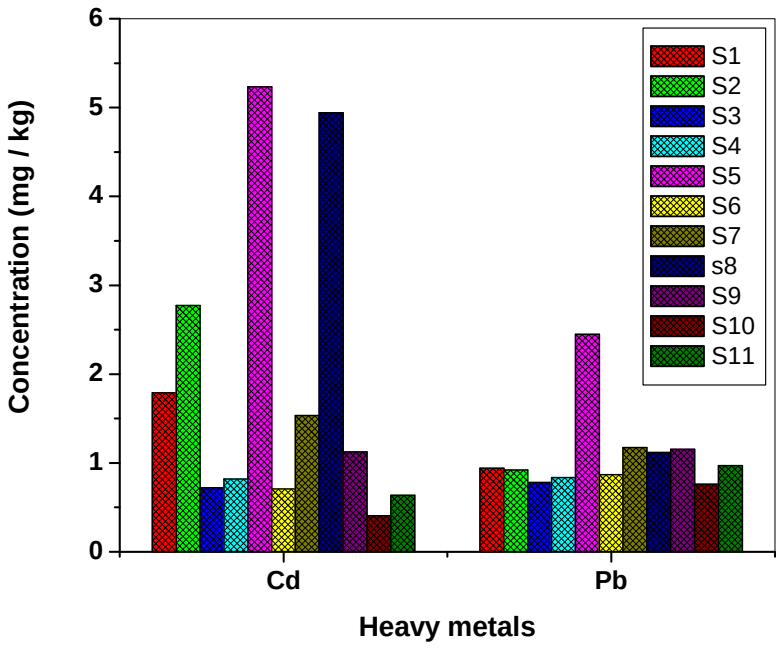

**Table 1: The concentration of heavy metals in leafy vegetables from Twin cities of hederabad and secunderabad, Telangana, India (mg/kg, fresh weight).**

| | Element name | p1 | p2 | p3 | p4 | p5 | p6 | p7 | p8 | p9 | p10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cr | 1.965 | 1.898 | 1.937 | 1.95 | 1.905 | 1.885 | 1.931 | 1.82 | 1.83 | 1.755 | 1.891 |
| Mn | 591.385 | 779.815 | 215.817 | 174.38 | 292.12 | 416.293 | 319.882 | 236.527 | 653.38 | 253.12 | 227.439 |
| Fe | 1000.506 | 590.762 | 428.788 | 580.607 | 710.621 | 527.166 | 1364.911 | 962.11 | 642.31 | 557.788 | 797.164 |
| Co | 6.206 | 1.139 | 0.523 | 0.849 | 1.486 | 0.63 | 2.638 | 1.723 | 4.385 | 1.4 | 1.503 |
| Ni | 1.69 | 0.941 | 1.112 | 1.431 | 1.062 | 1.21 | 1.432 | 1.374 | 1.734 | 1.42 | 1.027 |
| Cu | 8.31 | 4.67 | 5.757 | 6.26 | 4.342 | 4.06 | 6.543 | 4.093 | 5.307 | 8.07 | 9.187 |
| Zn | 12.072 | 12.61 | 12.288 | 11.824 | 13.107 | 10.029 | 11.824 | 14.524 | 12.341 | 23.928 | 15.536 |
| As | 0.152 | 0.072 | 0.073 | 0.075 | 0.077 | 0.367 | 0.22 | 0.102 | 0.073 | 0.073 | 0.093 |
| Cd | 1.788 | 2.773 | 0.721 | 0.82 | 5.232 | 0.708 | 1.532 | 4.941 | 1.124 | 0.405 | 0.637 |
| Pb | 0.942 | 0.922 | 0.78 | 0.835 | 2.448 | 0.867 | 1.172 | 1.116 | 1.155 | 0.761 | 0.971 |

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