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ASSESSMENT OF HEAVY METAL CONTAMINATION IN LADY'S FINGER AT KARUR, TIRUCHIRAPPALLI AND THANJAVUR DISTRICT,TAMILNADU,INDIA.

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ABSTRACT

The trace essential metals are useful to the physiological activities of human beings. The experimented vegetable has been contaminated by heavy metals in some polluted areas which may cause ill health to mankind. The present investigation finds the level of heavy metals(Fe, Hg, Pb, Cr, Cd, Cu, Zn, and Ar) in the vegetable. The metal toxicity has been estimated in Lady's finger from Karur, (Pugalur station-I and Velayuthapalayam station-II), Tiruchirappalli (Kundur Station-III &Mathur station-IV) and Thanjavur (Patteswaram station-V) Districts, Tamil Nadu, India. As a result, lady's finger vegetable in Mathur and Kundur contain higher concentrations of these elements. Lady's finger in Pugalur, Velayuthapalayam and Patteswaram having lesser amount of heavy metals. The high concentrations of heavy metals indicate that the effluents of industries such as textile, leather factory, mills and chemicals at specified district which contaminate or introduce heavy metals into the soil.

Keywords: Heavy metals, Vegetables, Lady's finger,Pugalur, Velayuthapalayam, Kundur, Mathur and Patteswaram

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1. INTRODUCTION

Vegetables are common diet taken by people throughout the world due to their richness in vitamins, minerals, fibers and anti-oxidative effects. However, leafy vegetables such as amaranth and cabbage ares aid to be good absorber of heavy metals from the soil (Lokeshwari and Chandrappa, 2006; Eslami *et al*., 2007; Arora *et al*., 2008). Reports have shown that, vegetables grown in rich heavy metal soils and are also contaminated (Kawatraand Bakhetia, 2008; Sharma *et al*., 2007). Vegetables take up metals from contaminated soil through the crop roots and incorporated them into the edible part of plant tissues or as a deposit on the surface of vegetables (Haiyanand Stuanes, 2003; Nwajei, 2009).

Heavy metals such as Cr, Mn, Zn, Cu, and Fe are considered as essential components of biological activities in the body, however, in excess are reported to cause problem to human. On the other hand, Pb, Cd, and As have no important functions in human body rather play toxic role to living organism, hence are considered as toxic elements (Lokeshwari and Chandrappa, 2006). Heavy metals are toxic because they react with body's biomolecules, clog up receptor sites, break and bend

sulfur bonds in important enzymes such as insulin, and damage the DNA (Arora *et al*., 2008; Nwajei, 2009). For instance, most of the accumulated Pb in a body is sequestered in skeleton, where will have a half-life 20 - 30 years (WHO, 1995).The high gastrointestinal uptake and the permeable blood barrier make children more susceptible to Pb exposure than adults. Children exposed to high concentrations of Pb may develop behavioral disturbances as well as learning and concentration difficulties (Jarup, 2003).

Cd is carcinogenic even in low concentrations and renal effects may also result due to sub chronic consumption of Cd (WHO, 1992).Heavy metals may accumulate preferentially in leaves, stalks, roots and less commonly in grains (Maina, 1984). Heavy metal contents of different vegetables types have been shown to follow the order leafy vegetable >root tubers > fruit vegetables (Gatubu, 1999). In the present study to analysis the heavy metal content of Lady`s Finger in Kundur, Mathur, Pugalur, Velayuthapalayam, and Patteswaram.

2. MATERIALS AND METHODS

Sample collection and preparation

Approximately 0.5kg of each lady's finger sample was collected from Kundur, Mathur, Pugalur, Velayuthapalayam, and Patteswaram. The collected vegetable carries in polythene bags and transported to the laboratory for preparation and analysis. The colected samples were washed with distilled water to eliminate air-borne pollutants. Dust was removed according to the common household practices. Excess moisture was removed by drying samples on the sheet of paper. The samples were then sliced, weighed and oven dried at 60°C to a constant weight.

Analysis of vegetable samples

The procedures used in the analysis of vegetable samples were adopted from analytical chemistry (Brodie, 1985). A portion of the Lady's finger was oven dried unwashed while the other portion washed before oven drying at 80°C for 48 hours. They were grounding to a fine powder and sieved through plastic sieve of 60µm aperture. One gram of the fine sieved powder of each sample was accurately weighed into a conical flask. The powder was digested using a tri-acid mixture of 5ml of concentrated H_2SO_4, 2ml of concentrated HNO_3 and of 5ml of 30% H_2O_2. The mixture was heated on a hot plate at 100°C for two hours in a fume cupboard.

The resulting solution was left to cool over night and filtered into 100ml conical flask and the filtrate was made to the mark using de-ionized distilled water.

The heavy metals viz. iron, copper, lead, zinc, mercury, cadmium, chromium and arsenic were measured using Atomic Absorption Spectrophotometer (Perkin Elmer Analyst 200). Arsenic was quantified by AAS. Assuming As(V) may be present in the water samples along with As (III),reduction of As (V) to As (III) was performed with potassium iodide solution and ascorbic acid in moderately concentrated (5 mol/l) HCl solution. Time for reduction was 30 minutes. 10 ml of reduced water samples were analyzed using Atomic Absorption Spectrophotometer withMHS-15 (Mercury Hydride Generation System). The selected data were subjected to statistical analysis to test the standard deviations.

3. RESULTS AND DISCUSSION

The mean concentrations of Fe, Hg, Pb, Cr, Cd, Cu, Zn, and Ar in vegetables studied are given in Table 1. A statistically significant difference ($P<0.05$) in metal concentrations was found in lady's finger of Kundur, Mathur and Pugalur as compared to Velayuthapalayam and Patteswaram. There were significant differences in the average Fe, Hg, Pb, Cr, Cd, Cu, Zn, and Ar concentrations (ppm/g of dry wt) in lady's finger in different locations (Kundur, Mathur, Pugalur, Velayuthapalayam, and Patteswaram). The highest content of **Fe** content can be regarded in the order of Mathur> Kundur> Pugalur>Velayuthapalayam>Patteswaram. The highest content of **Hg** content can be regarded in the order of Mathur> Pugalur>Kundur> Patteswaram> Velayuthapalayam. The highest content of **Ar** content can be regarded in the order of Mathur> Kundur>Patteswaram>Velayuthapalayam>Pugalur. The highest content of **Cu** content can be regarded in the order of Pugalur >Kundur >Mathur >Velayuthapalayam >Patteswaram. The highest content of **Cd** content can be regarded in the order of Mathur>Kundur>Pugalur >Velayuthapalayam> Patteswaram. The highest content of **Pb** content can be regarded in the order of Mathur>Kundur> Pugalur>Velayuthapalayam>Patteswaram. The highest content of **Cr** content can be regarded in the order of Mathur> Pugalur>Kundur> Patteswaram> Velayuthapalayam. The highest content of **Zn** content can be regarded in the order of Mathur>Kundur >Pugalur> Velayuthapalayam> Patteswaram.

Several studies have indicated that vegetables grown in heavy metals contaminated soils have higher concentrations of heavy metals than those grown in uncontaminated soils (Guttormsen *et al*., 1995; Dowdy and Larson, 1995; Ambika Asati *et al*., 2016).

Table 1 Heavy metal content of Lady`s Finger in Pugalur, Velayuthapalayam, Kundur, Mathur and Patteswaram

S.No	Name of heavy metals(ppm)	Kundur	Mathur	Pugalur	Velayutha-palayam	Patteswaram
1	Iron	1.94±0.128	2.27±0.158	1.4±0.098	0.9±0.063	0.9±0.063
2	Mercury	0.002±0.0001	0.0023±0.0002	0.0014±0.0001	0.0011±0.0001	0.0009±0.0001
3	Lead	0.007±0.0003	0.006±0.0009	0.001±0.0005	0.003±0.0001	0.002±0.0001
4	Chromium	0.41±0.028	0.44±0.030	0.49±0.034	0.30±0.021	0.30±0.021
5	Cadmium	0.0002±0.00001	0.0003±0.00001	0.0002±0.00001	0.0001±0.00001	0.0001±0.00001
6	Copper	0.22±0.015	0.19±0.013	0.19±0.013	0.09±0.006	0.10±0.007
7	Zinc	0.40±0.028	0.49±0.034	0.39±0.027	0.30±0.021	0.29±0.020
8	Arsenic	0.289±0.020	0.289±0.020	0.09±0.006	0.124±0.008	0.124±0.008

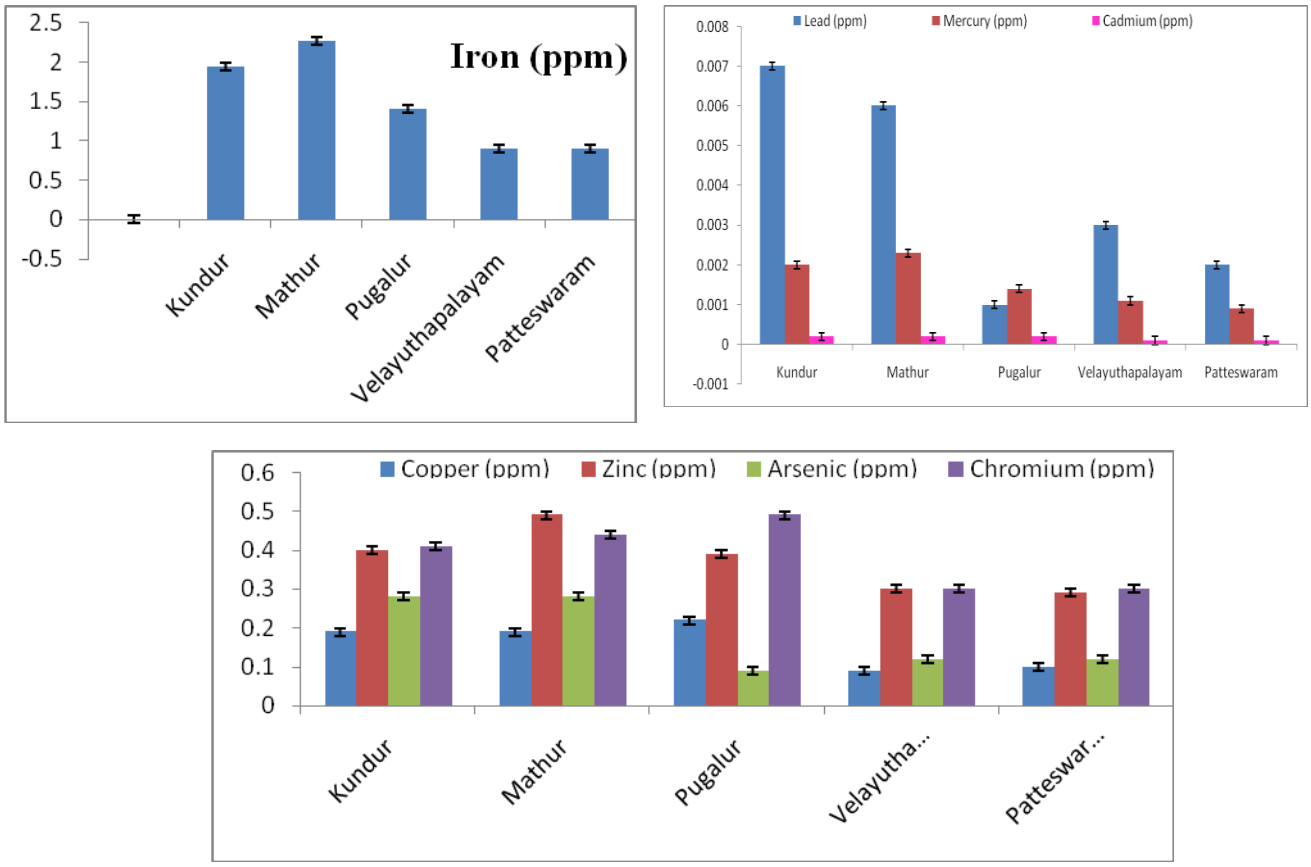

Figure 1 Heavy metal content of Lady`s Finger in Pugalur, Velayuthapalayam, Kundur, Mathur and Patteswaram

Environmental pollution is now-a-days a major problem to society. The intrusion of heavy metals into agricultural soil and vegetables are the most severe ecological problems on a world scale and also in India. The food chain contamination is the major pathway of heavy metal exposure for humans (Khan *et al*., 2008).Some trace elements are essential in plant nutrition, but plants growing in the nearby zone of industrial areas display increased concentration of heavy metals serving in many cases as biomonitors of pollution loads (Mingorance *et al*.,2007).

Cultivated vegetables in toxic metals polluted soils taken up heavy metals and accumulate them in their edible and non edible parts in quantities which high enough to cause clinical problems both to animals and human beings. There is no good mechanism for their elimination from the human body when consuming these metal-rich plants (Arora *et al*., 2008; Alam*et al*., 2003; Ramteke *et al*., 2016).

Therefore, a better understanding of heavy metal sources, their accumulation in the soil and the effect of their presence in water, soil and on plant systems seem to be particularly important issues of present day research on risk assessment.

High concentration of these metals in polluted area's vegetables might be due to high contents of metals in the soil as caused by irrigation with metal contaminated water released from different kinds of industries. Mathur and Kundur are highly polluted by industrial effluents, sewage sludge, municipal waste water, and urban pollution. Comparatively low concentration of heavy metal ions in the vegetable from indirectly polluted area might be due to the pattern of contamination. The higher concentrations of metals indicates that industrial activities, such as leather factory, mills and chemical industries contaminate or introduce heavy metals into the soil.

4. CONCLUSION

Based on the information generated from the study, it may be concluded that industrial effluents and urban pollution associated with sewage sludge and municipal wastes within the vicinity of lady's finger crops grown have increased the levels of heavy metals in the lady's finger. As a result, lady's finger vegetable grown in Mathur and Kundur contain higher concentrations of heavy metals due to industrial effluents and urban pollution as compared to those grown in Pugalur, Velayuthapalayam and Patteswaram.

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