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EVALUATION AND INVESTIGATION OF HEAVY METAL POLLUTION ON VEGETABLES FROM MARKET AND PRODUCTION SITE

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ABSTRACT:

Taking up of heavy metal through vegetable may produce many health defect, this study was conducted to determine the concentration of heavy metal like (Pb and Cd), in vegetables. By monitoring levels of heavy metals in vegetables can help to develop as insight towards promoting food safety. Therefore, the present study was carried to find out significant contamination of vegetables sold at the open market sites of Amravati city. Heavy metal (such as Cd and Pb) concentrations were determined in some of the vegetables sold along the major roads and traffic junctions of Amravati city. The results showed that the mean concentrations of heavy metals were highest for Pb followed by Cd. Among the vegetables, the mean concentration of Pb (1.27 ± 0.03) was highest in *Trigonella foenum graecum.* While mean Cd concentration (0.80 ± 0.01) was highest in both the vegetables in this city. The concentrations of heavy metals in different vegetable varied with the vegetable types and collection sites. Leafy vegetables accumulated higher concentration of heavy metals. In has been reported that the concentration of Cd was higher in *Brassica oleracea* than *Trigonella foenum – graecum* it may because cauliflower having a higher exposed area of inflorescent and porus nature to absorb toxic metals. The concentration of Pb was higher in *Trigonella foenum - graecum* than *B. olerocea.* But at concentrations below the World Health Organisation (WHO) and Food and Agriculture Organisation (FAO) safe limit. Overall, this study indicates that vegetables are contaminated by toxic metals. Overall, this study indicates that vegetables are contaminated by few toxic metals.

Key words: - *Vegetables, Heavy metals, market place, heavy traffic*

INTRODUCTION:

Atmospheric exhaust have an important influence on human health globally. Air pollution caused by automobiles has been described as the disease of wealth. Exhaust emission and combustion of fossil fuels were identified as primary sources of atmospheric metallic burden (Aribike,1996) , and it is now well established that a variety of motor vehicles are significant source of ultra-fine particles and introduce a number of toxic metals into the an urban environment especially adjacent to roadways (Williamson ,1973 ; Moore and Moore,1976) .

The term “heavy metals” refers to any metallic element that has a relatively high density and is toxic or poisonous even at low concentration. Fe, Co, Ni, Cu, Zn, Cd, and Pb, and tire dust pollution contributes to some of these elements in the form of airborne dust through an automobile exhaust emissions. Excessive accumulation of one or several heavy metals, such as Cd, Hg, Cr, As, and elevated concentrations of Pb in vegetables (Motton *et al.,* 1970). The heavy metal deposition on vegetable sold along road side pose risk to human health due to vehicular traffic.

High concentrations of heavy metals (Cu, Cd and Pb) in fruits and vegetables were leading to cardiovascular, nervous, kidney and bone diseases (WHO, 1992; Jarup, 2003). Intake of relatively low dose of these elements over a long period of time can lead to malfunction of certain organs such as kidney and chronic toxicity to human (Pier and Bang, 1980; and Hg and Pb are associated with the development of abnormalities in children (Pitot and Dragan, 1996). Hartwig (1998) have reported that long-term intake of Cd caused renal, prostate and ovarian cancers. Lead poisoning has severe adverse impacts on the nervous system and has been specifically linked to neurological, neurobehavioral and developmental problems in children that may be irreversible (IAEA, 1994).

Several studies of heavy metal concentrations in the vegetables from the market sites have been carried out in some developed and developing countries (Parveen et al., 2003; (Jorhem and Sundstroem, 1993; Milacic and Kralj, 2003). But, limited published data are available on heavy metals concentrations in the vegetables from the market sites of India (Agrawal, 2003; ; Tripathi et al., 1997; Sharma et al., 2008).Heavy metals are persistent in nature as well as it has potential toxicity effects . Consumption of leafy vegetables loaded with heavy metals may cause long term health effects.

In our country hygiene is one of the most neglected part of our life style. Most of the people even having wrong food habits like they use unwashed vegetables as a food and if washed then not in proper way. The objectives of this study is to assess the heavy metal content of vegetables sold on markets in two areas of Amravati city where comparatively more traffic present . It was hypothesized that atmospheric depositions in urban areas may increase the levels of heavy metals leading to significant contamination of vegetables sold at the open market sites than that at the production sites. Therefore, the present work realized that there is need to test and analyze these food items to ensure that the levels of these trace elements meet the agreed international requirements.

MATERIAL & METHODS:

Sampling.

A total of two samples consisting leafy vegetables were purchased from two major markets in Amravati city, during Feb. 2011. In each market, three vendors were identified and samples collected, I as exposed sample and II as control from each site. Edible portions of the samples were used for analysis while bruised or rotten samples were removed. The leafy vegetables include Cabbage (Brassica oleoracae L.) and Methi (Trigonella foenum-graecum) third Sample was collected from field. The samples were stored in polythene bags until analysis under refrigeration condition

Sample preparation and treatment:

Samples were taken at random from two areas and were processed for analysis by the dry-ashing method. The sample were first over dried at 1050C for 24 hr. The dried samples were powdered in a mixer grinder taking care not to overhear the sample. Powdered samples were accurately weighed and placed in crucibles as an ashing aid. Dry-ashing process was carried out in a muffle furnace by stepwise increase of the temperature up to 5500C and then left to ash at this temperature 4 hours. The ash was left cool and weighed.

Standards:

Standard solutions of heavy metals namely lead (Pb), Cadmium (Cd) were provided by Merck (Darmstadt, Germany). The standards were prepared from the individual 1000 mg/l. Standards (Merck), in 0.1 N HNO_3. Working standards were prepared from the previous stock solutions.

Atomic absorption spectrophotometer analysis for heavy metals:

Determination of the heavy metals such as Cd and Pb in the filtrate of vegetables and blanks was achieved by atomic absorption spectrophotometers (Shimandzu Pvt. Ltd. Model No.AA 6300). The instrument was calibrated using manually prepared standard solution of respective heavy metals. Acetylene gas was used as the fuel and air as the support. An oxidizing flame was used in all cases. Estimation were carried out using hollow cathode lamps depending upon the element to be tested.

Quality assurance:

Appropriate quality assurance procedures and precautions were carried out to ensure reliability of the results. Samples were generally carefully handled to avoid contamination. Glassware was properly deemed, and the reagents were of analytical grade. Double distilled deionized water was used throughout the study. Reagents blank determinations were used to correct the instrument readings.

RESULT AND DISCUSSION:

Table 1 show the traffic count from study area. Traffic density were made at two sites of Amravati city for two successive days for an hour. The total traffic density ranged from Rajapeth is 690 vehicles/hr. and Gadge Nagar is 575 vehicles/hr.

Both the areas experiences very high traffic load of vehicles as Rajapeth is the centre of Amravati city and Gadgenagar has maximum number of schools and colleges. The samples were dried and powdered. Dry ashing was carried out after collection of samples from heavy traffic area. The weight of dried powder and ash of respective powder were shown in table 2.

Tables 3 show the concentrations of heavy metals investigated in vegetables commonly consumed in Amravati. . The values are given as mean ± SD and the results are means of three replicates. The heavy metal levels determined were based on plants dry weight. Levels of cadmium and Lead were observed to be the lowest for the contol samples while the levels were highest in exposed samples

The mean concentrations of heavy metals were highest for Pb followed by Cd. Among the vegetables, the mean concentration of Pb (1.27 ± 0.03) was highest in *Trigonella foenum graecum.* While mean Cd concentration (0.80 ± 0.01) was highest in both the vegetables.

The concentrations of heavy metals in different vegetable varied with the vegetable types and collection sites. In has been reported that the concentration of Cd was higher in *Brassica oleracea* than *Trigonella foenum - graecum.* Result suggest that cauliflower having a higher exposed area of inflorescene and porus nature has greater capacity to absorb heavy metals from atmosphere.

The concentration of Pb was higher in *Trigonella foenum - graecum* than *B. olerocea.* This is because leafy vegetables accumulate maximum level of Pb than other vegetables. This may be due to the porus nature of different species to absorb toxic metals.

In all the samples analyzed, its level was observed to be low varying between 0.80and 1.27 mg/kg; Various values have been slightly greater than previously reported for fruits and leafy vegetables which include 0.05, 0.14 and 0.003 mg/kg for apple by Radwan and Sharma (2006), Parveen et al. (2003).

Variations in metal contents for these vegetables depends on the physical and chemical nature and the absorption capacity for each metal by each plant, which is altered by numerous environmental and human factors as well as the nature of the plant (Zurera - Cosano *et al.* 1989). Mahakalkar et al, (2015) stated that vegetables take up metals by absorbing them from contaminated soils, as well as from deposits on different parts of the vegetables exposed to the air from polluted environments. The high levels of these toxic metals in vegetables could be ascribed to deposits from vehicle emission.

But Pb and Cd in all vegetables tested from both production and at market site were found slightly higher than both the field area and but acceptable standard permissible level at both sites crowded with heavy traffic.

CONCLUSION

The present study have shown that the levels of heavy metals in major vegetable crops found in the city are within the acceptable levels. Although lead were reported high in some of the samples examined especially in leafy vegetables. It is Therefore, suggested that regular monitoring of Heavy Metals in plant tissues is essential in order to prevent excessive build-up of these metals in the human diet in near future.

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Table 1 : Traffic count from study area.

Sites	No. of heavy vehicles/hr.	No. of light vehicles/hr.	Total no. of vehicles/hr.
Rajapeth	303	387	690
Gadge Nagar	227	348	575

Table 2 : Weight of Dry powder and ash of respective samples

Sites	Samples	Dry Powder (gm)		Ash (gm)	
		A	B	A	B
Rajapeth	I	4.619	7.124	0.584	0.618
	II	3.550	3.235	0.475	0.928
Gadge Nagar	I	6.218	4.490	0.890	0.771
	II	8.513	3.795	3.75	0.709
Field	III	3.979	3.306	1.074	0.115

A - Cauliflower (*Brassica Oleracea*) B - Methi (*Trigonella foenum - graecum*)

I - Exposed Sample II - Control Sample, III - Field Sample

Table 3 : Pb and cd concentration in vegetable samples from respective sites.

Sites	Sample	Pb Concentration in sample (ppm)		Cd Concentration in sample (ppm)	
		Cauliflower	Methi	Cauliflower	Methi
		Mean ± SD	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**
Rajapeth	I	1.12 ± 0.01	1.27 ± 0.03	0.80 ± 0.01	0.76 ± 0.01
	II	1.07 ± 0.02	1.26 ± 0.01	0.79 ± 0.01	0.78 ± 0.01
Gadge Nagar	I	1.24 ± 0.02	1.22 ± 0.01	0.80 ± 0.01	0.78 ± 0.01
	II	1.17 ± 0.004	1.22 ± 0.01	0.80 ± 0.01	0.78 ± 0.007
Field	III	1.02 ± 0.01	1.11 ± 0.007	0.72 ± 0.01	0.73 ± 0.02