Heavy Metal Levels in Selected Leafy Vegetables Obtained from Local Market of Kotni Village,Chhattisgarh, India

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ABSTRACT:

The objective of this study was to find out the level of copper Cu, Fe and Zn in vegetable like lal bhaji, Mooli bhaji and Palak bhaji grown in kotni village of New Raipur.The heavy metal levels like copper(Cu), Iron (Fe) and Zinc (Zn) were determined using Digital spectrometer in three different above mentioned samples of leafy vegetables, purchased from Kotni Village near Mantralaya of Chhattisgarh.Atomic absorption Spectroscopy was used to determine the level of these metals. Detected levels ranged from 0.25 to 0.86, 6.23 to 24.01, 1.69 to 5.9 mg/kg for Cu, Fe and Zn respectively. The level of metals Cu, Fe and Zn are below the recommended limits set up by FAO/ WHO for metals in vegetables. Ingestion of vegetables containing heavy metal is one of the main roots through which these elements enter the human body. The result showed that the presence of heavy metals in vegetables in the order of Zn > Cu > Fe based on this findings we conclude that these plants contribute no toxin effects of metal.

KEYWORDS*: Heavy metals, Micronutrients, Leafy vegetables, Local market, Analysis and Public Health:*

INTRODUCTION:

Green leafy vegetables are popular around the world. Leafy vegetables are essential constituent of human being and animal diet that contains important nutrients and trace elements. Minor or traces elements are essential for good health, if they come from an organic or plant source. In contrast, if they come from an inorganic or metallic source, they become toxic. The natural process of plant growth depends on the cycles of nutrients including various traces elements, from soil to plant. Vegetables are rich source of vitamins, fibers, and minerals and it also have anti- oxidative effects. Heavy metal contamination of the food item is one of the most important aspects of food quality assurance. These vegetables are valuable sources of vitamins A and C, iron calcium, folic acid and dietary fibers. Leafy vegetables have greater potential of accumulating Polluted environments. Regular monitoring of these metals in vegetables and in other food material is essential for preventing excessive buildup of the metals in the food chain. The aim of this study was to heavy metals in their edible parts than fruits and grainsMetals accumulationwide range of concentrations. Metals accumulation in vegetables may pose a direct threat to human health. Heavy metals are one of a range of important types of contaminants that can be found on the surface and in tissue of dry vegetables. Vegetables are also part of daily diets in many households forming an important source.

Studies on the uptake of heavy metals by plants have shown that heavy metals can be transported passively from roots to shoots through the Xylem vessels. Vegetables takes up metals by absorbing them from contaminated soils as well as from deposits on different parts of the vegetables exposed to the air from from

determine the concentrations of heavy metals in leafy vegetables of local market of kotni village New Raipur.

MATERIAL AND METHODS:

The all chemicals which are used in the analysis of elements were chemicals of analytical grade procured from E marks,Germany, Qualigens , Mumbai India and Loba Cheme of high purity and distilled deionized water were used in all the solution preparation. All glass wares and plastic containers used were washed with detergent solution followed by (20% v/v) nitric acid and then rinsed with tap water and finally with distilled deionized water. Also standard solutions of the metals salts and other reagents were prepared

Table 1: Specification of Leafy vegetable:

S.N.	Common Name	Vernacular Name	Botanical Name	Family	Habit	Ethnobotanically important plant part
1	Palak Bhaji	Spinach	SpinaceaoLeracea L	Chenopodiacea	Cultivated	Leaves
2	Lal Bhaji	Red Spinach	Amaranthus tricolor L	Amaranthaceae	Cultivated	Leaves and stem
3	Mooli Bhaji	Raddish	Raphanussativus L	Brassicaceae	Cultivated	Leaves

Study Area:

The study area covered in this research was local market of Kotni village of New Raipur district in the state of Chhattisgarh, India. Kotni is a village in Arang Tehsil in Raipur District of Chhattisgarh state, India. It is located 25 km towards East from districts quarters Raipur.17KM from Arang.26KM from state capital Raipur. Total population of Kotni village is 1561 and number of houses are 290.

Sample and Sampling:

We have selected three different sample of leafy vegetables namely, Mooli Bhaji (RaphaninSativa L), Spinach (Amaranths tricolor L). The vegetable samples were collected from m Kotni village in the month of June 2017..The details of these vegetables are given in the table1.

Sample treatment:

Samples of edible portions of vegetables (1kg each) at a height above 10cm from the soil surface were collected. The samples were collected once in a month and were kept in pre-distilled water rinsed polythene bags and pined up to avoid excess deposition . Then the samples were brought back to laboratory,chopped into small pieces and oven dried at 80^{o} C till the constant weight was achieved. To assess the effect of washing on the removal of heavy Metals from the vegetable surfaces, samples of vegetables were collected from selected sampling locations. The sample of each sampling location was separately divided into two groups. First group was kept as such for oven drying, whereas other group was washed with clean tap water according to the normal household technique. After draining the excess water samples were chopped into small pieces and oven dried at 80^{o} C till the constant weight was achieved. The dry vegetable samples were

Powdered with a stainless steel blender and passed through a 2mm size sieve. The samples were then kept at room temperature for further analysis.

Sample digestion:

1gm vegetable samples were digested after adding 20 ml conc HNO_3, 2ml $HCLO_4$ and HCL, left for 10 minutes and digest at 70 – 80 C on hot plate.

on hot plate. The solution was allowed to evaporate to dryness until all the tissue had been digested and raised the temperature 105 C to reduce the volume to 0.5 – 1.0 ml and add 10 ml of distilled water, boil the residue. The mixture was cooled and filtered through a Whatman no.541 filter paper into a 100 ml volumetric flask and made up to mark with distilled deionized water.

Sample analysis:

A serial dilution method was used to prepare the working standards and the concentrations the metal in each sample digest were determined

Using Digital spectrophotometer by preparing standard curve. Cu and Fe and Zinc were determined spectrophotometric ally by 1,10 phenonthroline method, Neocuproine method and dithlazone method at 510 nm, 457 nm and 620 nm respectively.

Daily intake of heavy metals form Vegetables:

The daily intake of heavy metals through the consumption of vegetables tested was calculated according to the equation.

Daily intake of metals (DIM) = DVC * VMC

DVC = daily vegetable consumption; VMC = mean vegetable metal concentrations (mg/day, fresh weight). Where daily vegetable consumption was taken as 98 g of vegetable per person per day as set by the FAO/WHO (1999), for heavy metal intake based on body weight for an average adult (60 kg body weight).

RESULT AND DISCUSSON:

The experimental results of the metal contents obtained from each leafy vegetable from the kotni market site are listed in Table1 and graphical representation are shown in Fig 2. The Fe concentrations in different leafy vegetables like Mooli bhaji, Palak bhaji and lal Bhaji were calculated 6.23 mg/kg, 22,14 mg/kg and 18.36 mg/kg respectively.

The concentration of Cu in Mooli Bhaji, Palak Bhaji and Lal Bhaji were calculated 0.21 mg/kg, 0.64 mg/kg and 0.72 mg /kg respectively.

The concentration of Zn was estimated 1.52 mg/kg 6.3 mg/kg and 5.18 mg/kg in Mooli Bhaji,PalakBhaji and LalaBhaji respectively.

Table 2: Concentration of Fe & Zn in leafy Vegetables (mg/kg)

S.N.	Same / Metal Conc	Mooli Bhaji	PalakBaji	Lal Bhaji	FAO/WHO safe limit
1	Fe	6.23	21.01	18.36	425
2	Cu	0.25	0.64	0.86	40
3	Zn	1.69	6.3	5.90	99.4

Table 3: Daily intake of Heavy metal (DIM) through consumption of vegetables

S.N.	Heavy Metal	Mean Metal Conc (mg/kg)	Daily intake (µg/day)	FAO/WHO limit or PTDI Limit
1	Fe	15.20	1489.27	48 mg
2	Cu	0.58	57.20	3 mg
3	Zn	4.63	454.09	60 mg

Fe has several functions in the body. It saves as a carrier of oxygen by hemoglobin from the lungs to the tissues, as a transport medium for electrons within cells, and as integrated part of important enzyme systems in various tissues. Fe is essential for the synthesis of chlorophyll and activates a number of respiratory enzymes in plants.The highest amount of Fe is found in Palak Bhaji 21.01 mg/kg and the lowest amount of Fe was found in Mooli Bhaji 6.23 mg/kg. The Fe concentrations of were found among the vegetables in the order of Palak Bhaji > Lal Bhaji > Mooli Bhaji. The Fe contents of these plants are lower than the FAO/WHO (2001) safe limit of

425.00 mg/kg.These vegetables could be good supplement for Fe.

Cu is an essential metal for plant growth and activation of many enzymes, however most plants contain the amount of copper which is inadequate for normal growth that is usually ensured through artificial or organic fertilizer. The highest concentration of Cu, 0.86 mg/kg in Lal Bhaji and the lest concentration of Cu, 0.25 mg/kg were recorded in the Mooli Bhaji. The Concentrations of were found among the vegetables in the order of Lal Bhaji > Palak Bhaji > Mooli Bhaji.

The contents of Cu recorded in this study are lower than the permissible level by FAO/WHO in the leafy vegetable.

Zn is the least toxic and an essential element in human diet. It is distributed widely in plant and animal tissues and occurs in all living cells. It which results in retarded growth and delayed sexual maturation.

functions as a cofactor and is a constituent of many enzymes.

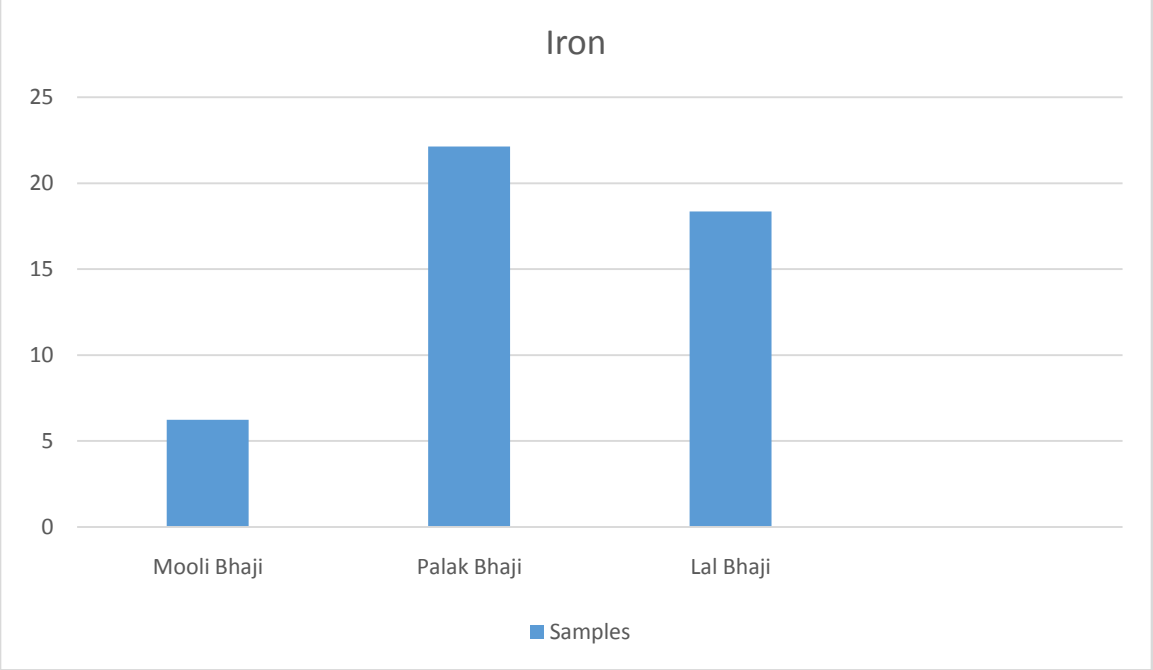
The recommended dietary allowance for Zn is 15 /mg/day for men and 12 mg/day for women by Agency for Toxic substances and Disease Registry.

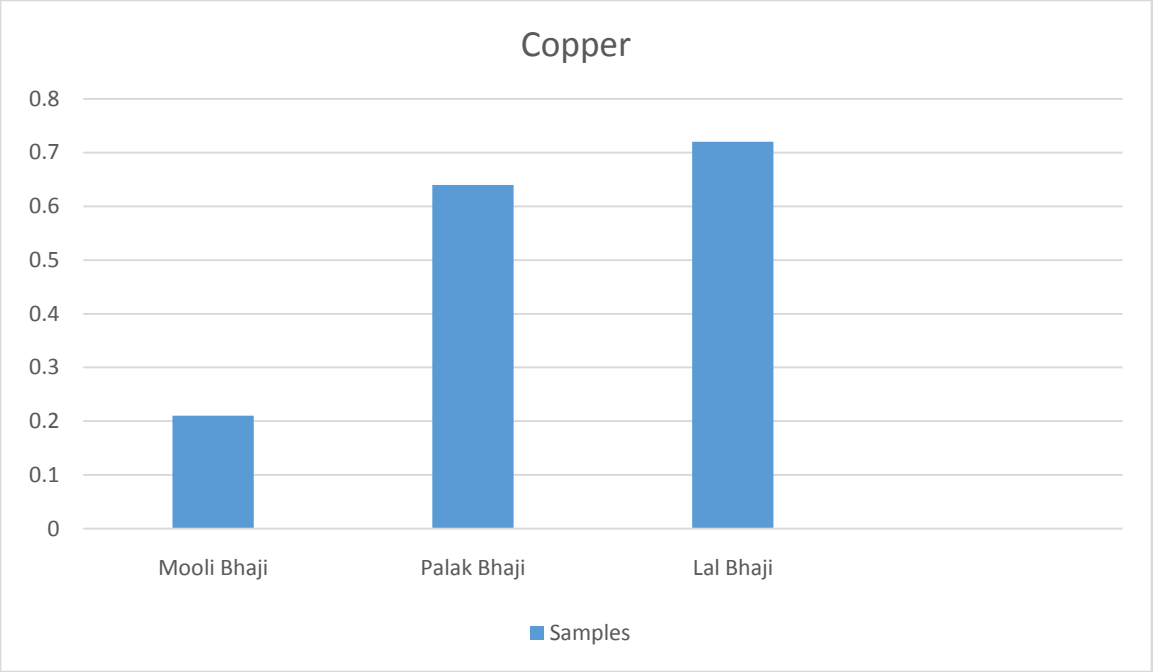
The highest amount of Zn was found in Palak Bhaji 6.3 mg/kg and the lowest amount of Zn was found in KarmotaBhaji 1.52 mg/kg.

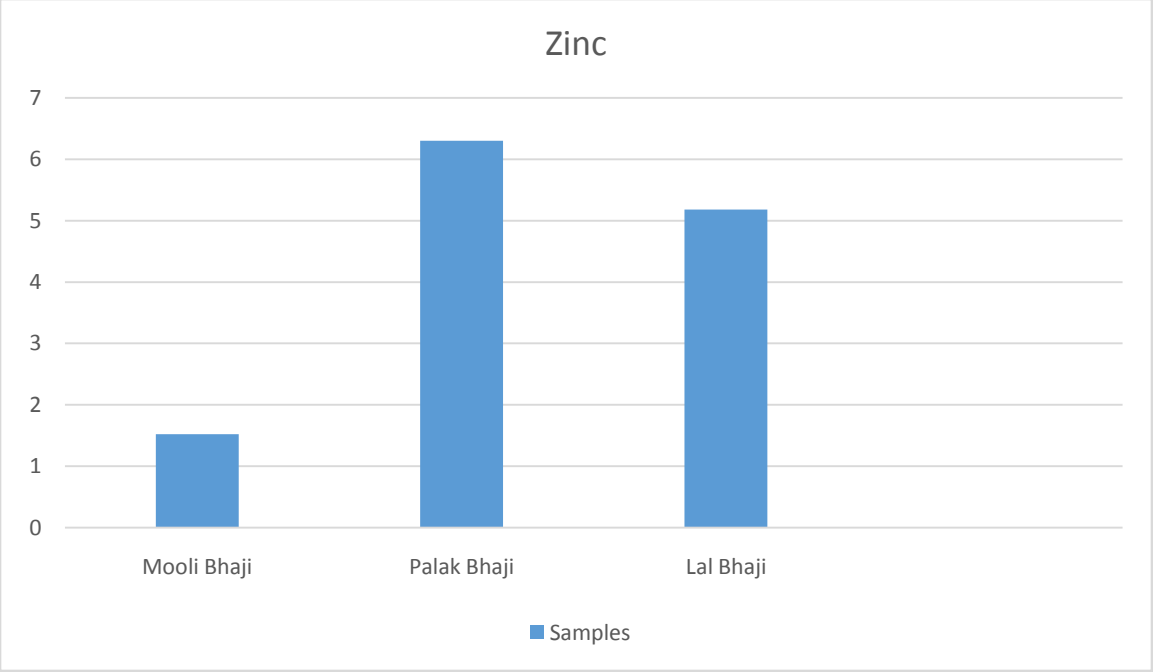
The concentrations of Zn is found in the order of Palak Bhaji > Lal Bhaji > Mooli Bhaji.

The contents of Zn in all the plants examined are generally lower than the permissible levels by the FAO/WHO (2001) in leafy vegetables as shown in table 2.

Regular consumption of these vegetables may assist in preventing he adverse effect of zinc deficiency







The exposure of consumers and the related health risks are usually expressed in terms of the provisional tolerable daily intake.

The FAO/WHO (1999) have set a limit for the heavy metal intake based on the body weight for an average adult,namely, 60 kg body weight.

The average diet per person per day of vegetables is 98 g. If the mean levels of Fe (15.58 mg/kg, Cu (0.52 mg/kg) and Zn (4.33 mg/kg) found here are consumed daily, the contribution of heavy metal intake for an average human being from the vegetable diets were calculated and presented as shown in Table 3. The estimated daily intakes for

heavy metals are reported by the FAO/WHO, which had set a PTDI limit for heavy metal intake based on body weight for an average adult (60 kg body weight) for heavy metals as shown in table 3.

CONCLUSION:

Fe, Cu and Zn are chief dietary mineral supplements which have special role in important metabolic function in human and animal. The required concentration of Fe in diet for human body is 17 mg, Cu 2-3 mg and Zn 3-4 mg in a standard body weight.

Levels of the metals are found to be within the safe limits prescribed by the FAO/WHO. This is an important result as human health is directly affected by consumption of vegetables as diet.

The monitoring of heavy metals in vegetables needs to be continued; because these are the main sources of food for human and animals which are considered as bio indicators of environmental pollutions.

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