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Quantitative analysis of heavy metals from vegetable of Amba Nalain Amravati District

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ABSTRACT

For development of human life metals are essential. Contaminated vegetables may produce health defect on human being by intaking of heavy metal. This study investigated the level of four different heavy metals which are toxicmetals (Cu,Cd,Pb,Cr) were determined in different vegetable from Amba Nala of Amravati District.Heavy metalswere extracted from vegetables using dry ashing method.AAS (Thermo Scientific Pvt.Ltd.,India,Model No.AA-303) as used toevaluate the level of these metals in the vegetables. Concentration of lead and cadmium in all the vegetables tested even after exceed washing. Heavy metal content was found highest in unwashed sample than washed sample and washed sample than boiled sample.Overall, this study indicates that vegetables are contaminated by toxic heavy metals present in sewage water.

Keywords: Heavy metal, Cauliflower, Brinjal, Spinach, Red spinach.

INTRODUCTION

Vegetables constitute an important part of the human diet since they contain carbohydrates, proteins, vitamins, minerals as well as trace elements. Accumulation of heavy metals by vegetables may depend on plant species as well as concentration of heavy metal. These heavy metals are not abundant in soil, but they may be an accumulated through disposal of sewadge water. Disposal of sewadge water is a great problem. These sewage effluents are considered not only a rich source of organic matter and other nutrients but also they elevate the level of heavy metals like Cu, Pb, Cr and Cd in receiving vegetable of soils [1]. Elevated concentration of heavy metal can affect human being. Heavy metals are not easily biodegradable and consequently can be accumulated in human vital organs leading to unwanted side effect [2, 3]. This situation causes varying degree of illness based on acute and chronic exposures.

Among the heavy metals when Cu exceed its safe value concentration cause hepatic and kidney damage, hemolytic anemia and methanoglobinemia [4].The acceptable for human consumption of copper is 10 ppm.Cadmium exerts effects on human health when it present at higher concentration and causes severe diseases such as tubular growth, excessive salivation, gastrointestinal irritation, cancer, kidney damage, diarrhea and vomiting [5].Lead is sequestered in the bones and teeth ,affect nervous bone, liver, weakness in the wrist and figure, pancreases, and gum and also causes blood diseases [5].

Chromium plays an important physiological role in all animals including human beings. Chromium is present in many pharmaceutical samples and in airborne particulates, causing environmental pollution. Cr(III) is an essential component having an important role in the glucose, lipid and protein metabolism, while Cr(VI) has a definitely adverse impact on living organisms. Cr(VI) can easily penetrate the cell wall and exert its noxious influence in the cell itself, being also a source of various cancer diseases [6,7].As well as Chromium (VI) causes kidney and liver damage , stomach upset and ulcers, skin rashes, lung cancer, weakened immune systems, alteration of genetic material and respiratory problems[8].

These metals are dangerous because they tend to bioaccumulation in the food chain and they are harmful to humans and animals. Knowledge of metal-plant interactions is important for the safety of the environment and for reducing the risks associated with the introduction of trace metals into the food chain. Consequently the metal can inactivate many important enzymes resulting in inhibition of photosynthesis, respiratory rate and other metabolic processes in plants [9].Low level chronic exposure causes adverse effect on human health.

The present work has been undertaken to obtained information of the levels of heavy metals (copper, cadmium, lead and chromium) in selected fruits and vegetables.

MATERIALS AND METHODS

Distilled water was used throughout the study. Allglassware and plastic containers used were washedwith detergent solution followed by 20% (v/v) nitricacid and then rinsed with tap water and finally withdistilled water. In the present study analyzed vegetables are Cauliflower, Brinjal, Spinach, Red Spinach.

SAMPLING: 300 g of edible portion of different vegetables get collected and washed with distilled water to remove dust particles.They were separated in three parts (100g each). Then these three parts were chopped into small pieces using a knife and kept in air-dried condition for approximately 70 hours. Dried samples of different parts of vegetables were grind into a fine powder and powders were used for heavy metal analysis. Heavy metals in vegetable samples were extracted by acid digestion. Powdered samples (15 g each) were accurately weighed and placed in a silica crucible and fewdrops of concentrated nitric acid were added. Dryashing processwas carried out in a muffle furnace (Swastik Scientific Co.Mumbai, P.14, Se.No 1021) by stepwise increase of the temperature up to 550°C andthen left to ash at this temperature for 6 h [10]. The ash was kept in desiccators and thenrinsed with 3N hydrochloric acid. Filtered the ash suspension in a 50 ml volumetric flaskwith the help of Whatman paper No 1 and madea volume by adding 3N hydrochloricacid up to the mark.

Analysis:
Concentrations of heavy metals in the acidic solution were estimated using AtomicAbsorption spectrophotometer(Thermo Scientific Pvt. Ltd., India, Model No.AA-303).

RESULTS AND DISCUSSION

Metallic elements are ubiquitous in the environment.Some trace heavy metals are significant in nutrition,either for their essential nature or their toxicity. The aim of this study was tomonitor the presence of heavy metals in vegetables collected from Amba Nala of Amravati District. Sources of contamination affecting predominately vegetable samples are due to various inputs, such as fertilizers, pesticides, sewage sludge.

Heavy metals analysis revealed that the sample were contain Cu,Cd,Pb and Cr.The Results are tabulated in table 1, table 2, table 3.Washed sample of cauliflower contain Cd which was slightly greater (0.358mg/kg)than permissible recommended value(0.2mg/kg). Cd and Pb content of all samples were found above safe permissible levels recommended by WHO/FAO.But exception was found in boiled sample of Cauliflower and Brinjle that contain Cd(0.15 and0.088mg/kg)below the permissible level. Permissible level recommended by WHO/FAO are 40, 0.3, 0.2, 2.3 mg/kg respectively [11].Among the four different vegetable unwashed and washedsample of spinach contain highest level of cu(29.27and 21.34mg/kg). Cu containing unwashed,washed and boiled sample did not exceed safe value. Cr content in unwashed Brinjal was found to more than safe value(3.765mg/kg). Pb content of all the vegetables remains higher than the recommended value(0.3mg/kg).

Heavymetal content was found highest in unwashed samples followed by washed and boiled samples(table 1, table 2, table 3). From observation it shows that occurrence of heavy metal is minimum in boiled sample (table 3).

Table 1: Concentration of heavy metal in unwashed samples

Vegetables	Heavy metal content (mg/kg)			
	Cu	Cd	Pb	Cr
Cauliflower	13.03	0.653	9.01	0.530
Brinjal	24.14	0.28	7.73	3.765
Spinach	29.27	1.923	11.70	2.71
Red Spinach	10.78	0.884	7.022	0.358

Table 2: Concentration of heavy metal in washed samples

Vegetables	Heavy metal content (mg/kg)			
	Cu	Cd	Pb	Cr
Cauliflower	11.41	0.358	6.87	0.242
Brinjal	18.37	0.251	5.529	0.61
Spinach	21.34	1.48	6.313	0.391
Red Spinach	8.882	0.713	5.32	0.136

Table 3: Concentration of heavy metal in boiled samples

Vegetables	Heavy metal content (mg/kg)			
	Cu	Cd	Pb	Cr
Cauliflower	8.965	0.15	2.66	-
Brinjal	14.821	0.088	3.02	-
Spinach	13.89	1.21	3.33	-
Red Spinach	6.552	0.540	2.23	-

Table 4:% of heavy metal in Cauliflower

Heavy Metal	Unwashed Sample	Washed Sample	Boiled Sample
Cu	86.86	76.06	59.76
Cd	4.35	2.38	1
Pb	60.06	45.8	17.73
Cr	3.53	1.613	0

From above readings of concentration we have calculated percent calculation which can be plotted as follow:

Figure 1: % of heavy metal in Cauliflower

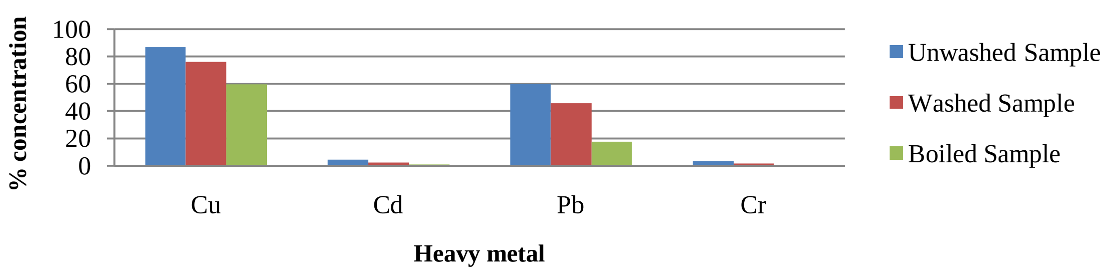


Table 5: % of heavy metal in Brinjal

Heavy Metal	Unwashed Sample	Washed Sample	Boiled Sample
Cu	160.93	122.46	98.8
Cd	1.86	1.67	0.58
Pb	51.53	36.86	20.13
Cr	25.1	4.06	0

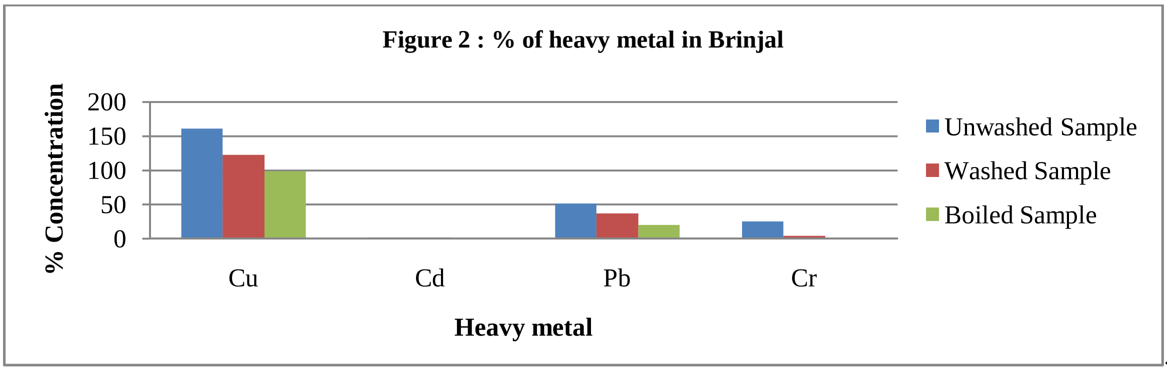


Table 6 : % of heavy metal in Spinach

Heavy Metal	Unwashed Sample	Washed Sample	Boiled Sample
Cu	195.13	142.26	92.6
Cd	12.82	9.866	8.066
Pb	78	42.08	22.2
Cr	18.066	2.606	0

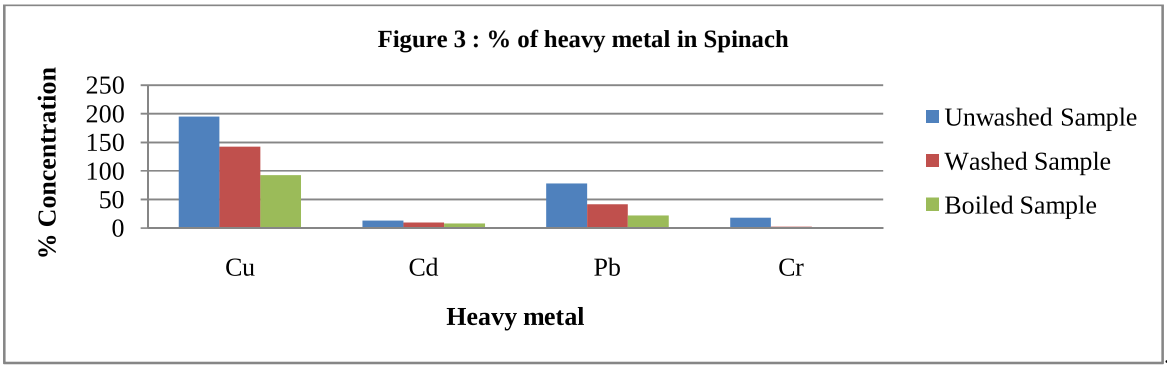
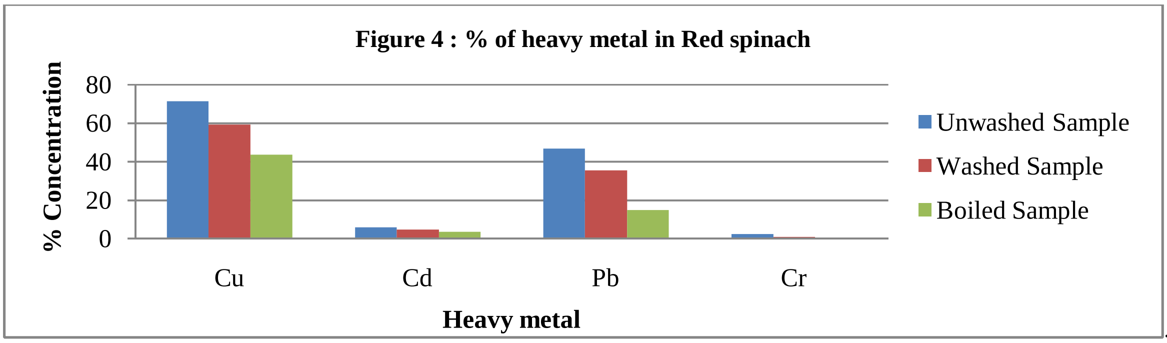


Table 7 : % of heavy metal in Red spinach

Heavy Metal	Unwashed Sample	Washed Sample	Boiled Sample
Cu	71.4	59.21	43.68
Cd	5.893	4.753	3.6
Pb	46.81	35.46	14.86
Cr	2.386	0.906	0



Chromium, copper, essential with known biochemical functions while lead, cadmium is non-essential with toxic effects. Result revealed that concentration of heavy metal elevated due to the treatment of sewage sludge on vegetable and also shows that occurrence of heavy metal greater in unwashed than washed sample and washed than boiled sample.

CONCLUSION

From the given result it clear that Cu,Cd, Pband Cr are present in the sample.These metals showstoxic potential which injures to human health like metal poisoning incidences of Cd poisoning in Japan and Cu poisoning in Holland had made attention of scientist and common people towards the harmful effects of metals [12].

Hence it is essential to monitoring of heavy metals in vegetables in order to prevent excessive build-up of these metals in the human food chain and avoid consumption of contaminated vegetable food stuff.

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