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Assessment of Environmental Contaminants of Spices Availed in the City of Coimbatore (Tamilnadu)

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Abstract: - The study was undertaken to investigate the quality of food products such as Spices like Turmeric, Chilly, Pepper, Cardamom, Cumin, and Coriander& Cloves in respect to the heavy metalcontaminants. The spices samples (whole & powder samples) were collected from Coimbatore in tamilnaduand heavy metals (Copper as Cu, Lead asPb, Arsenic as As, Cadmium as Cd & Mercury as Hg)were analyzedusing of Atomic Absorption Spectrometer.Thepresence of Heavy Metalsvariesat different matrix. The mean concentration of food samplesHeavy Metals are found tobe below the permissible limit as per Food Safety Standard Authority of India.The range of heavy metals concentration as Copper -1.5 to 10.85 mg/Kg, Lead - traces was present in turmeric samples range was 0.05 mg/Kg, other heavy metals like arsenic, cadmium & mercury below detectable range in spices samples. Further, the estimated Heavy Metalsdata were subjected forcorrelation analysis toexamine the inter relationship between the investigated spices and the contaminants.

I. INTRODUCTION

Herbs and spices grown in various regions of theworld have been used for several purposes. Uses of these spicesare used for cookingpurposes. Spices and herbs belong to condiments,substances which do not contain nutritive components.Although a few different spices are importance, many more are used as condiments locally,in the regions of their natural occurrence. Someof these are traded in small quantities and used in domestic purpose (Krejpcio, 2006).

Spices are dried parts of plants, regularlywhich are used to enhance color, smell, and agreeableness of sustenance. The greater parts of these are sweet-smelling and impactful. Spices are generally cell strengtheningand antimicrobial activity have been distinguishedto have some medicinal properties. Numerous spices have been found to havehostile to diabetic, mitigating and against easily affected limit. A fewendeavors have been made to focus the macro and the micro supplementcontent in spices and herbs from everywhere throughoutthe world (Nikita Sharma,2014)

Moreover, in the last three decades, mainly because of their medicinal values, the use of spices has increased markedly in most regions of the world. Several researches have shown that heavy metals could be present in spices and the addition of contaminated spices to food may result in accumulation of these metals in human organs. Heavy metals above the permissible levels affect human health, abortion and preterm labor, and mental retardation to children (peter olusakinoladoye 2016). Adults also may experience high blood pressure, fatigue kidney and neurological disorder (Hifsa Mubeen, 2009).

Along with environmental contaminants, the level of nutrients of food material also contributes the risk to the human health, (Allabaksh2014).Heavy Metal content increases in some commodities grown in contaminated soils or atmospheres. These metals have hardly any biological role to play in the human body but on the contrary their toxic effect causes malfunctioning of the body system (Rajesh Kumar Sharma, 2008).

Due to the significant amount of spices consumed, it is important to know the toxic metal contents in these spices. Natural spices (Turmeric, Chilly, Pepper, Cardamom, Cumin, Coriander & Cloves) and processed spices (Turmeric, Chilly, Pepper, Cardamom, Cumin, Coriander & Cloves) are therefore assessed for lead, cadmium, copper and iron contents and possible health risk(s).Evaluation of Effects of The aim of this study was to determine the safetyof the most popular species of herbs used in Polish cuisine,as determined by heavy metals (Copper, Lead, Arsenic, Cadmium & Mercury).

II. MATERIALS AND METHODS

A. Sample Collection

Samples of common spices (Whole & Powdered) were collected from private markets at Coimbatore city and mainly focused on Ukkadam, Gandhipuram, R.S.Puram, Singanallur and Koundampalayamareas . the sample collected includes Turmeric, Chilly, Pepper, Cardamom, Cumin, Coriander & Cloves. & Samples were randomly collected and put into polythene bags. Sample weight at collection was 100- 200 g and information about sample name, weight and date of collection were recorded on each bag. Samples were transferred under suitable conditions for storage until tests were carried out to assess the metal contents.

B. Analytical Procedure

The gross sample was dried in oven, pounded to powder and a representative sample taken. Take 0.5g of Homogenized sample in a MDS Vessel. In that add 5ml of Nitric acid and 4ml of Double distilled WaterAgain add 1ml of Hydrogen peroxide and. Keep it in microwave digestion for 1 hour, finally filter the solution in whatman

42 filter paper and made up to 25ml using double distilled water.

The concentration of Copper, Zinc, Lead, Arsenic, Cadmium & Mercury were determined using of Atomic Absorption Spectrometer (Thermo fisher 3500 series) by following aciddigestion technique. At the respective wavelength and hallow cathode lampwas selected, The metals after calibrating using of standard solution (the calibration curve (plot of concentration against absorbance) gave r^2 value of 0.98 to 0.999 for above mentioned metals) samples were analysed.

$$Metal\ Concentration\ (ppm) = \frac{Concentration\ from\ instrument\ X\ Volume\ of\ Digestion\ sample}{Weight\ of\ sample\ taken\ for\ analysis} mg/kg$$

C. Permissible Limits

Parameters	Spices
Copper as Cu (mg/Kg)	30.0 (Turmeric -5.0)
Lead as Pb(mg/Kg)	2.5
Arsenic as As(mg/Kg)	1.1 (Turmeric -0.1)
Cadmium as Cd (mg/Kg)	1.5 (Turmeric –0.1)
Mercury as Hg (mg/Kg)	1.0

Table 1:- The Standard Limits Given in Food Safety Standard Authority of India.

III. RESULTS AND DISCUSSION

The heavy metals of Copper, Lead, Arsenic, Cadmium & Mercury was performed following samples Turmeric, Chilly, Pepper, Cardamom, Cumin, Coriander & Cloves and results was compared with FSSAI limit.

- *Copper*

The Copper concentrations in whole form average values are 7.8,10.85, 2.75, 2.8, 1.8,1.5, 2.1mg/Kg following sample matrix Pepper, Chilly, Turmeric, Cardamom, Cumin Coriander and cloves respectively. The powdered spices average concentrations of the heavy metals 7.9,10.6, 2.8, 2.7, 1.9, 1.5 and 2.0 mg/Kg in the matrix of Pepper, Chilly, Turmeric, Cardamom, Cumin Coriander and cloves respectively. The food safety and standards authority of IndiaMaximum Permissible Limit of copper is 30 mg/Kg except Turmeric samples, for turmeric sample concentration of copper is 5 mg/Kg. For all analyzed spices samples are below permissible limit of copper as per food safety and standards authority of india. The copper content of whole spices samples are the range of 1.5 mg/Kg ±0.01 to 10.85 mg/Kg ± 0.67 in coriander and chilly samples respectively. The copper content of powdered spices samples are the range of 1.5 mg/Kg ±0.01 to 10.6 mg/Kg ± 0.67 in coriander and chilly samples respectively.The increased concentration of copper damages liver and kidney and can be poisonous (Uriu-Adams, 2005)

- *Lead*

The lead concentrations of whole & powdered spices are not detected. In some cases the lead is present in turmeric samples, the concentration of lead in turmeric samples 0.05 to 0.08 mg/Kg in whole and powdered samples respectively. The food safety and standards authority of indiaMaximum Permissible Limit oflead is 2.5 mg/Kg in all spices samples. For all analyzed spices samples are lessthan permissible limit of Lead as per fssai. The lead content of turmeric samples are the range of 0.05 mg/Kg ±0.004 to 0.1 mg/Kg ± 0.02 in whole and powdered samples respectively. Toxic levels of lead is affecting the nervous, cardiovascular, reproductive, renal and gastrointestinal (Schumann, 1990)

- *Arsenic*

The Arsenic concentrations ofwhole& powdered spicesare not detected. The food safety and standards authority of indiaMaximum Permissible Limit ofArsenic is 1.1 mg/Kg except Turmeric samples, for turmeric sample concentration of Arsenic is 0.1 mg/Kg. For all analyzed spices samples are below permissible limit ofArsenicas per fssai.Capillary damage leads to generalized vasodilation, transudation of plasma, and vasagenice shock. Arsenic's effect on the mucosal vascular supply, not a direct corrosive action, leads to transudation of fluid in the bowel lumen, mucosal vesical formation, and sloughing of tissue fragments (oehme, 1989)

- *Cadmium*

The cadmium concentrations of whole & powdered spices are not detected. The food safety and standards authority of indiaMaximum Permissible Limit ofCadmium is 1.5 mg/Kg except Turmeric samples, for turmeric sample concentration of cadmium is 0.1 mg/Kg. For all analyzed spices samples are below permissible limit of cadmium as per food safety and standards authority of India. Cadmium metals are affected in blood vessels, heart tissue, kidneys, lungs and brain causing heart disease, hypertension, liver damage and suppressing the immune system with other nasty symptoms (Godt, 2006)

- *Mercury*

The Mercury concentrations ofwhole& powdered spicesare not detected. The food safety and standards authority of indiaMaximum Permissible Limit ofMercury is 1.0 mg/Kg. For all analyzed spices samples are below permissible limit ofMercuryas per food safety and standards authority of India.A number of body organ systems are affected by mercury in various forms.Overall, the toxicity of mercury in animals and humans affects the cardiovascular, hematological, pulmonary, renal, immunological, neurological, endocrine, reproductive, and embryonic systems (Walessa Alana, 2018].

Spices – Whole									
S.No	**Parameters (mg/Kg)**	**Pepper**	**Chilly**	**Turmeric**	**Cardamom**	**Cumin**	**Coriander**	**Cloves**	**Detection Limit**
1	Copper as Cu	7.8	10.85	2.75	2.8	1.8	1.5	2.1	0.25
2	Lead as Pb	BDL	BDL	0.05	BDL	BDL	BDL	BDL	0.05
3	Arsenic as As	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.02
4	Cadmium as Cd	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.05
5	Mercury as Hg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.02

Table 2:- The Averaged Concentrations of Food Parameters

Spices – Powder									
S.No	**Parameters (mg/Kg)**	**Pepper**	**Chilly**	**Turmeric**	**Cardamom**	**Cumin**	**Coriander**	**Cloves**	**Detection Limit**
1	Copper as Cu	7.9	10.6	2.8	2.7	1.9	1.5	2.0	0.25
2	Lead as Pb	BDL	BDL	0.08	BDL	BDL	BDL	BDL	0.05
3	Arsenic as As	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.02
4	Cadmium as Cd	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.05
5	Mercury as Hg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.02

Table 3:- The Averaged Concentrations of Food Parameters

❖ *Correlation Study*

S.No	**Parameters (mg/Kg)**	**Pepper**	**Chilly**	**Turmeric**	**Cardamom**	**Cumin**	**Coriander**	**Cloves**
1	Copper as Cu	-0.0171	-0.0249	0.2237	-0.2912	0.335	0.8815	-0.0775

Table 4:- The Correlation Analysis whole vs Powder

A correlation coefficient indicates the strength of relationship between two variables. Correlation coefficients for metals in Whole & Powder spices, see Table 4. According to PeterOlusakin,2016 there's no relationship if it's 0.0; a value of 1.0 indicates absolute dependency and if negative they're said to oppose one another. Correlation coefficients <0.50 are less significant than those >0.50. Table 3 shows insignificant correlations ranging from -0.0775 to 0.8815, implying no relationship, they're from different sources.

IV. CONCLUSION

Heavy metal concentrations in both Whole and Powdered spices were within thefood safety and standards authority of Indiamaximum permissible limits. In conclusion, most spices used in Coimbatore weren't contaminated with heavy metals, no risk from the daily use of the above mentioned spices.

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