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Research Article

Estimation Herb/Spice/Vegetables Trace Elements: North-West-Regional State(s) of Haryana (India)

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ABSTRACT

A number of elements (bio-active traces from Herbs/Spices/Vegetables) can to improve the taste of foods as well as influence digestion (with metabolism processes and also contains an integer residues of undesirable components (myco-toxins/pesticides/heavy metals/poly-cyclic carbohydrates that can be harmful). The metals (i.e. Fe, Zn, Cu and Mn) contents in (North-West region of Haryana States) mainly trendy spices/vegetables levels were estimated by atomic absorption (AAS; assayed) method. Moreover, the resulted data of metals (Zn and Cu) levels were found with-in limits to be safe (excluding Mn and Fe metals data demonstrated the higher concentration in spices/vegetables can be considered as toxic for human) by comparison with safety standards of National Ministry of Health (NMH).

Key-words: Elements; Bio-active; Metal; Absorption; Limits; Toxic

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Introduction:

The widen contagion with trace metals had raised public as well as scientific interest due to their significant hazardous effects on human health[1]. Due to this, all-over researchers of the world have to study trace metals in air/water and foods with the pollution to avoid harmful effects[2-4] and also determine their human consumption permissibility. Additionally, dried/fresh parts (Rihzomes, Barks, Leaves, Fruits, and Seeds) of spices plants[5] which have been often used to improve color, aroma, palatability and acceptability of food as diet components. Since ancient times, most of these are grown at numbers of regions of the world are fragrant, aromatic and pungent herbs/spices/vegetables and have been used for numerous (like uses for culinary) purposes[6-9]. In addition, spices that may be contaminated with trace and heavy metals to food as a habit resulted; accumulation of these metals in human organs and lead to different health troubles. Spices have been recognized to have some medical properties due to antioxidant and antimicrobial action[10-20]. Also, there are lots of spices have been acknowledged to possess anti-diabetic/hypertensive/ inflammatory potential and chemo-protective action[21- 24]. The micro/trace nutrients/elements metals were those which have atomic (ranging from 63.546 to 200.590 approximately[3]) and specific weight higher than four. During cultivation[25-26], these metals may attain and contaminate (plants, vegetables, fruits and canned foods) through air/water/soil and also during industrial processing & packaging[27]. Thus, there are several studies were done to determine the concentration of heavy metals in spices, dry fruits, and plant nuts[1, 28] and to study their dangerous effects. Subjecting to trace and heavy metals above the permissible affect the human health and may result in illness to human fetus, abortion and preterm labor, and mental retardation to children. Adults also may experience high blood pressure, fatigue and kidney and brain troubles[29].

The key objective of research was an attempt to investigation plus estimation of the elements levels (i.e. copper, iron, manganese and zinc) of traces may be present in North-west regions (Haryana State) locally available spices & vegetables *via* compared with National Ministry of Health (levels/limits; NMH) recommended.

Material and Methods:

The standard copper stock solution (Cu;1000mg/ml), acid solution [12mol/l (6 mol/l concentrate HCl; density 1.19 g/ml) plus nitric acid solution (65% g/ml) & hydrogen peroxide (30%); Merck, Germany] water (Tri-distillated, Purite Neptune Analytical-Purite, England), hydrochloric acid solution and Grower 1% Acid, powder of vitamins with minerals for veterinary use (Farmer, Italy), that contains copper as sulfate and chelate amino-acids forms (0.16% Cu). A flame atomization analyst [Spectrometer 800, Perkin Elmer Co., Bea-consfield, Buck's (UK)] was used for parameters (at $\lambda_{324.7}$) determination and data acquisition using A_{tomic} $A_{bsorption}$ software (*Win-Lab® version* 3.2)

Experimental Procedure

The collected samples (spices/vegetables) from North-west region (Haryana) were recognized and classified according to their general plus scientific name (depicted in Table 2) along with the plant used part.

Analytical Procedure

The powder (about 2.0 g plus grower acid 1%) exactly weighed to place for a thermal treatment in a crucible presence of air/oxygen into adjustable oven (Naber-Therm, GmbH-Germany) i.e. thermo-adjustable calcined process at 4508+208^{0}C). The resulted ash (cold) was moistened with carefully addition of hydrogen peroxide (few drops) and kept on electric mantle until decomposed (H_2O_2). Then, added acid (HCL; 15ml of 6 mol/) solution and evaporated further addition of concentrated nitric acid solution (1ml). Again, acid (HCL; 5ml of 6 mol/l) was added and evaporated continue to dryness. After cooling, solution volume was make-up-to (100ml; volumetric flask) with tri-distilled water. The copper metal concentration is determined by below equation using AAS; atomic absorption spectrophotometer.

Total Metal (μg/g) **= C × F_{dil}/m_o**

Where, C = concentration of standard solution before sample (mg/ml), F_{dil} = dilution factor, m_o = working quantity (g). In case of premixes/nutritive supplements studied by mixture of acid solution (HCL: HNO_3; 20: 1v/v using AAS) for significant results for metal analysis.

Table 1: *List of Herbs/Spices/Vegetables Name's (General plus Scientific with used part)*

Name's		Family	Part Used
General	Scientific		
Pudina / Mint	*Mentha longifolia linn.*	Labiatae	Leaf
Tulsi	*Ocimum sanctum*	Lamiaceae	
Coriander	*Coriandium sativum linn.*	Umbellifeae	Seed
Fenugreek	*Trigonella foenumgraecum linn.*	Legomnoseae	
Black mustard	*Brassica nigra koch.*	Cruciferae	
Red pepper	*Capsicum frutescens linn.*	Solanaceae	Fruit
Fennel	*Foeniculum vulgare mill.*	Umbellifeae	
Carrots	*Daucus carota*	Apiaceae	
Tomatoes	*Solanum lycopersicum*	Solanaceae	
Cabbage	*Brassica oleracea capitata*	Brassicaceae	
Spinach	*Brassica campestris*	Brassicaceae	
Garlic	*Allium sativus linn.*	Liliaceae	Bulb
Onion	*Allium cepa*	Liliaceae	
Potatoes	*Solanum tuberosum*	Solanaceae	Tubers

Preparation and Determination

Before, chemical analysis samples were cleaned-dried at oven (80^0C for 12 hrs) and till grounded in a mill (stainless steel) to obtained fine particles that passed through mesh (0.5 m; kept) for dried analysis. A wet digestion of the dried samples was done [30] using solution of acid (mixture H_2SO_4 plus H_2O_2 30%v/v) for metal determination. A dry-grounded (0.5 g) sample placed in beaker (100 ml) followed added peroxide solution (3.5ml of 30%) and heated (100^0C) then temperature was gradually increased (to 250^0C; 30 min.). After cooled, more solution (1ml of 30 %) was added to the digested mixture for re-heated to repeat the digestion process (more than one time) until to obtain a clear solution. The clear solution was transferred into volumetric flask and make-up the volume (50 ml) with double distilled de-ionized water. The digestion (also standard of each element under investigation) and blank solution (for comparison) was prepared for every metal and estimation performed by atomic absorption (Spectrometer, Perkin-Elmer, Model 2380; a double beam with background correction deuterium and hollow cathode lamp for metal at specific λ). On the basis of human weight and daily intake (mg/kg/day, an average cum assumption that 50kg and 20g/day respectively) measurements against standard solutions were calculated.

Results and Discussion:

The heavy metals the levels result (belong to A group of condiments; Herbs/spices) were determined and compared with established safety standards "*other foods and condiments*" with dry weight (above 50%) content limits (Maximum Permissible Limits National Ministry of Health levels of Mn, Cu, Zn, and Fe limits values are 1, 20, 50 and 100 mg/kg respectively). During metals (Mn, Fe, Zn and Cu) analysis, the trace elements (North-west region spices/vegetables, Haryana) limits were found and expressed in unit of dry weight (d.w.; mg/kg). The metals (Cu) played a role in the oxidative defense system (required for normal iron metabolism) but on the other hand; a severe poisoning[31] due to results of chronic (Cu) toxicity. During estimation, the average content was found to be ranging from 0.69 to 15.8 mg/kg and 3.57 to 76.0 mg/kg for copper and zinc (a co-factor of over two-hundred enzymes involved in metabolic pathways but its high levels in human body can be toxic due to its interference with copper metabolism[32]) respectively. The analyzed zinc content was found relatively

low and confirmed that examined samples (all) have an admissible element quantity in peppermint (d.w; Table 2). Out of all examined samples (different species) found that only mint has excessive amounts of this element (however, essential metal zinc is micronutrient dietary intake should be appropriate) can be dangerous beyond the permissible limits[33-34].
A further significant co-factor is iron (metal content was relatively high which has been confirmed by average ranged from 0.97 to 825 mg/kg found in the analyzed samples) essential for metabolism, DNA synthesis, growth, healing, immune-function, reproduction, enzyme reactions, & preventing anemia. Due to presence in hemoglobin which is an significant factor for athletic performance by acquired and transports oxygen (from the lungs and releases it as blood courses through the tissues) and myoglobin proteins also functions in transport and storage of oxygen in working muscles. The iron metal in cytochromes is play a helping role with cellular energy metabolism and its non-type's (two; heme type found in animal products like meat is easily absorbed whereas non-heme in plants are less absorbed) containing enzymes assist in energy metabolism The large doses of iron non-type can cause constipation/nausea/vomiting/gastrointestinal irritation and overload in individuals (over 65 age individuals have excess iron stores rather than its deficiency) may occur hereditary (heme-type) chromatosis (an excess accumulation) in the liver/tissues (also cause iron oxidative stress) and anemia's.

Table 2: Result of Studied Trace Elements (Dry Weight Basis: mg/kg)

S. No	Name's	Element Dry weight (mg/kg)			
		Zn	Cu	Mn	Fe
1.	CORIANDER	27.0 ±1.42	7.50 ±2.44	21.0 ±1.14	221.50 ± 0.02
2.	FENUGREEK	25.0 ±0.21	3.00±1.10	21.0 ±0.99	183.2 ±0.11
3.	PUDINA/MINT	76.0 ±2.11	8.00±0.43	104 ± 2.01	340.0 ±0.04
4.	RED PEPPER	14.0 ±1.65	5.50 ±1.02	20.4 ±1.05	170.6 ±0.14
5.	FENNEL	26.5 ±0.13	6.50 ±0.87	48.0 ±0.48	197.1 ±1.09
6.	BLACK MUSTARD	42.5 ±3.22	5.50 ±2.03	32.7±0.11	184.0 ±1.22
7.	GARLIC	14.5 ±0.33	2.50 ±1.52	2.85 ±0.24	134.1 ±0.13
8.	ONION	30.0 ±0.22	6.50 ±0.68	23.5 ±1.32	267.7 ±0.24
9.	TULSA	42.2 ±1.20	15.8 ±0.40	92.4 ±1.30	825.0 ±12.0
10.	CARROTS	3.57 ±0.21	4.73 ±0.21	11.8 ±4.35	325.0 ±0.45
11.	TOMATOES	8.32±0.35	2.24 ±0.05	15.73 ±3.15	1.480 ±0.60
12.	CABBAGE	37.9 ±1.23	5.51 ±1.40	30.27 ±4.2	152.0 ±0.70
13	SPINACH	17.1 ±1.79	5.62 ±0.31	93.42 ±0.11	171.0 ± 3.08
14.	POTATOES	7.42 ±0.41	0.69 ±0.11	—	0.970 ± 0.14

One of the considerable trace elements (Mn only necessary for humans to survive but also its high concentrations toxic to human body) is Manganese; when peoples were not live up-to the daily recommended allowances and vice-versa (uptake is too high) then their health will decrease and occur problems. The analyzed samples have relatively high (range 2.85 to 104.0 mg/kg; its poisoning can also caused diseases like lung embolism, bronchitis and parkinson) content of manganese (significant effects occurred in the respiratory tract and brains with hallucinations, forget-fulness & nerve damage symptoms) but was not found in regional potatoes (Haryana State).

Conclusions:

The investigation results were indicated that all seasoning spices/vegetables as well as herbs used for food as well as meals may contain zinc (exclude mint which has high) and copper content under permissible limits (appropriate safety standards). Additionally, the contents of metals (toxic; Mn and Fe) were found at relatively at higher-level (due to presence of both metals in soil-water (underneath contamination), therefore they should be under continuous monitoring (like other food products).

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