

**Brief Report for O.A. No. 685/2023 before Honorable NGT Principal Bench listed on
21.11.2023**

The Study of Heavy Metal Concentrations in Vegetables obtained from Markets of Bengaluru City was conceptualized by EMPRI to estimate the concentration of heavy metals in vegetables. Samples of vegetables were collected randomly in duplicates from five different Retail Markets, Local Markets, Organic Stores, Horticultural Producers' Cooperative Marketing and Processing Society (HOPCOMS). A total of ten vegetables namely Brinjal, Tomato, Capsicum, Bean, Carrot, Green Chilly, Onion, Potato, Spinach and Coriander were collected only once and analysed for eight metals (Iron (Fe), Zinc (Zn), Chromium (Cr), Manganese (Mn), Lead (Pb), Copper (Cu), Nickel (Ni) and Cadmium (Cd)). The study was carried out as part of potential research indicative areas of EMPRI. In this study, the results were compared with the Food and Agricultural Organization /World Health Organisation (FAO/WHO) standards for maximum permissible values of metals in vegetables (Table).

The findings of the report highlighted the presence of heavy metals in vegetables. Among 320 samples analyzed, 200 samples were found to be within the permissible limits pertaining to the concentrations of Fe, Zn, Mn, Cu and Ni. Whereas the concentrations of Cr, Pb and Cd have exceeded the permissible limits of FAO/WHO. The concentrations of lead and cadmium were below detectable limits in vegetables from retail markets and organic stores.

The findings of the study were reported in the media without taking permission from the competent authority, as such reports are subjected for review/validation by subject experts before their disclosure to media. While the project encompassed a preliminary study for indication of heavy metal presence in select vegetable samples involving one time sampling in one season, it is opined that larger sample size covering all seasons with control sample would be statistically significant and also indicate reliability of concentrations of heavy metals. Now the report review/validation is under process by subject experts.

Further, to understand the extent of contamination in vegetables from selected stores/markets of Bengaluru, a more comprehensive and in-depth investigation/study involving its sources, soil, water, agri-inputs and diverse farming practices would be necessary involving the Food Safety Standard Authority of India (FSSAI) at state level.

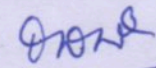
Table. Comparison of the standards and the metal concentrations in the vegetables

	Heavy Metal Concentrations (mg/kg)								Market Type
	Fe	Zn	Cr	Mn	Pb	Cu	Ni	Cd	
Permissible limits FAO/WHO (mg/kg)	425.5	99.4	2.3	500	0.3	73.3	67.9	0.2	
Vegetables									
Spinach	317.536	15.196	266.668	222.932	BDL	12.878	44.856	34.794	Retail markets (Big Bazar BTM Layout, Metro Cash & Carry Kanakapura Road, Vega City mall Bannerghata Road, More Mega Mart Bannerghata Road, Reliance Fresh Jaynagar)
Coriander	302.186	13.09	255.262	224.202	BDL	12.91	43.338	33.584	
Brinjal	72.692	6.44	260.576	127.756	BDL	9.582	36.312	32.364	
Tomato	124.4	13.276	272.112	141.92	BDL	11.862	44.916	39.844	
Capsicum	123.842	15.68	270.652	135.462	BDL	9.236	39.296	35.52	
Potato	157.9	17.796	270.358	138.062	BDL	11.752	54.072	38.706	
Green Chilly	110.266	12.076	276.562	144.252	BDL	10.672	44.74	36.596	
Onion	135.176	8.95	264.278	133.026	BDL	9.906	49.744	37.172	
Carrot	123.042	24.676	270.796	136.412	BDL	10.1	56.62	64.66	
Beans	131.086	13.2825	263.842	152.786	2.44	13.212	53.806	40.33	
Local Market (Malleshwaram, Yeshwantpur, Banashakari, Gandhi Bazar, K.R.Market)									
Spinach	336.136	11.382	198.238	97.626	50.062	9.905	12.83	11.232	Local Market (Malleshwaram, Yeshwantpur, Banashakari, Gandhi Bazar, K.R.Market)
Coriander	197.561	14.43	190.768	79.909	65.21	12.086	16.792	9.576	
Brinjal	112.731	5.862	185.31	48.601	66.742	11.408	13.466	11.844	
Tomato	121.128	4.66	206.106	41.26	73.39	9.026	13.868	12.834	
Capsicum	114.707	12.06	203.156	43.902	76.502	12.6	14.376	12.768	
Potato	167.836	7.156	205.676	45.031	75.686	8.688	13.127	12.182	
Green Chilly	131.381	9.166	221.412	49.502	73.646	14.196	18.046	12.838	
Onion	120.809	6.15	224.746	46.03	83.87	10.69	15.236	14.458	
Carrot	159.667	11.49	222.882	48.668	80.024	10.591	13.007	12.948	
Beans	126.612	9.576	211.222	59.613	85.151	10.253	11.982	14.906	
Organic Stores (Organic world Vsanthnagar, Village Naturals ISRO Layout, Grameena Angadi Rajajinagar, Namdhari's Fresh Indiranagar, Desi organic & natural Vajrahalli)									
Spinach	361.852	77.882	271.658	171.472	BDL	11.464	BDL	BDL	Organic Stores (Organic world Vsanthnagar, Village Naturals ISRO Layout, Grameena Angadi Rajajinagar, Namdhari's Fresh Indiranagar, Desi organic & natural Vajrahalli)
Coriander	386.518	30.232	291.854	108.082	BDL	23.228	BDL	BDL	
Brinjal	123.182	13.638	292.708	72.972	BDL	67.146	BDL	BDL	
Tomato	67.984	8.722	284.286	59.544	BDL	13.004	BDL	BDL	
Capsicum	70.772	15.372	298.756	61.808	BDL	15.83	BDL	BDL	
Potato	166.408	3.562	293.166	65.792	BDL	3.318	BDL	BDL	
Green Chilly	150.914	4.982	292.682	62.532	BDL	6.952	BDL	BDL	
Onion	64.708	3.98	288.088	63.582	BDL	12.562	BDL	BDL	
Carrot	153.066	9.148	294.492	71.628	BDL	5.792	BDL	BDL	
Beans	230.386	60.722	292.176	78.134	BDL	23.542	BDL	BDL	
Hopcoms (Lalbag, Yelahanka, Shanthinagar, Hebbal, Rajarajeshwarinagar)									
Spinach	371.258	115.142	267.912	158.222	9.89	56.292	5	1.016	Hopcoms (Lalbag, Yelahanka, Shanthinagar, Hebbal, Rajarajeshwarinagar)
Coriander	321.934	112.436	274.196	139.532	14.506	9.952	0	0.962	
Brinjal	151.908	65.328	275.624	90	4.946	5.292	0	1.258	
Tomato	67.018	17.9	283.978	85.742	17.316	3.652	0	1.782	
Capsicum	130.252	59.07	275.938	83.682	20.442	8.846	0	0.676	
Potato	219.64	20.27667	284.148	76.078	15.826	4.388	0	0.95	
Green Chilly	129.078	13.09	279.552	84.876	18.132	25.39	0	0.87	
Onion	186.168	12.2075	270.696	74.804	19.12	26.736	1.286	0.176	
Carrot	180.958	18.185	277.752	83.582	20.11	13.986	5.29	1	
Beans	109.222	14.262	270.356	104.762	19.122	20.282	0	0.39	

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* Values per vegetable are average of 10 samples


 Director General
 EMPRI