Editorial

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Contamination of River Churni with Heavy Metal and Cardiovascular Risk Assessment by Urinary Level of Microparticles Analysis

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ABSTRACT

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Editorial

Water is the most precious natural resource that holds our life and expands it. It is essential for our existence and replication. From the time immemorial, all the civilization grown in the bank of rivers to facilitate their growth and development. Rivers are the natural sources of water through which we survived from the beginning of life processes. Expansion of civilization, indiscriminate urbanization and industrialization without proper planning polluted the water bodies indiscriminately throughout the country and West Bengal at the top of the list of this unprecedented work. As a result, rivers have become highly polluted and deteriorated due to discharge of untreated industrial effluents which contains considerable levels of heavy metals river waters (Venugopal [1]). This makes it very much essential to have a regular check on the quality of water bodies. The maintenance of healthy ecosystem depends upon quality of water in the various water bodies in the region and the biological diversity of the aquatic life (fish, other organisms etc.) in the river waters.

Heavy metal concentration and other impurities in the river waters also affect plant life which consumes such untreated waters. Small fish which eats these plants are also affected due to bioaccumulation. When humans eat the fish, small animals or plants which are affected, the adverse effect moves up the food chain through biomagnifications and it is called food chain contamination. This food chain contamination is our major concern, because it causes lateral entry of heavy metals to the topmost consumers of the food pyramids and cumulative exposure through chronic accumulation causes serious health hazards which should be carefully addressed. Only regular check-up and survey is not the solution to mitigate the problem. It should be addressed by careful supervision of health workers, scientists, stake holders and locals to overcome the problem. Churni is such a river in Nadia district of West Bengal, India which was dug during the 17th century of Maharajah Krishna Chandra, the King of Nadia as a moat against the Bargees of Maharashtra.

Only 80 years ago, in the 1930's, it was the major trade route inside undivided Bengal. Now, the river has lost its navigability. The river is subjected to different anthropogenic activities throughout its course. The upper stretches receive discharges of sugar mill effluents from the Darshana sugar mill factory (situated in Bangladesh) and the lower stretch in India is subjected to water obstruction by bamboo-made barrages at several places. Retting of jute in the river

water has caused a rise in the riverbed and enhanced the problem of silting and aggravated the problem of flood. Weed infestation is an emergent problem of the river. Encroachment along the riverbank has narrowed the river. Unscientific agricultural practices along the riverbank is also adding to the problem. The catchment area of this river includes a medium populated Ranaghat municipality (Chatterjee M [2]). The opposite bank of this river comprises village residential areas and unorganized small-scale industries, basically cotton industries, which release their untreated effluents and sewage into the river.

Ranaghat & Santipur Municipality is highly populated urban area with several industries fascinating the polulation residing here. All The industrial effluents are discharged in this water body continuously polluting the aquatic system which causes elimination of several fish species and accumulation of heavy metals in the body of aquatic animals including fish. People of these area using this water for irrigation. Consumption of fishes also causes bioaccumulation of these heavy metals into human bodies and cumulative exposure causes myriad health hazards. As the banks of river Churni is mainly infested by textile miles, the effluents of those factory, rich in cadmium (Cd), chromium (Cr) and lead (Pb) deposited in Churni and pollute the water body. The effects of cumulative exposure and bioaccumulation of these heavy metals have been studied on local population (n=150) with age, sex and socio economic matched normal unexposed population (n=135) residing far apart from the bank of river Churni but in the same district. Association of cardiovascular risk factors with chronic heavy metal exposure through food chain contamination was assessed by cross sectional study to evaluate the role of microvascular endothelial microparticles (EMP) and platelets microparticles (PMP). Our findings propose that higher urinary Pb, Cd, Cr level with higher higher EMP/ PMP level is positively associated with vascular endothelial dysfunction and obviously cardiovascular disease progression. Therefore, endothelial or platelet microparticle can be designated as a biomarker for early or late cardiovascular disease associated with heavy metal exposure.

Method

Morning void urine samples were collected from every participant in sterile container and analysed by AAS at Kalyani University for the concentration of Pb, Cd and Cr. Blood samples collected from every participant were analysed by flowcytometer using citrated serum by a pairs of monoclonal antibodies for the concentration of microparticles.

Result

All the data obtained are statistically analysed by Maan Whitney U test and Kruskal Walis Test (Tables 1 & 2).

Table 1.

	Exposed			Unexposed		
Metals	**Cd**	**Cr**	**Pb**	**Cd**	**Cr**	**Pb**
Age yrs	29± 05	30±04	35±07	40± 6	37±5	35 ±6
Sex						
Male	102	100	94,	100	90	90
Female	48	50	50	35	45	45
Smoking habit						
Smoker	78	78	78	65	65	65
Ex-smoker	30	30	30	30	30	30
Nonsmoker	42	42	42	40	40	40
Occupation						
Farmer	54	52	48	50	50	50
Teacher	10	10	8	20	20	20
Small trader	16	16	16	15	15	15
Daily labourer	30	30	30	50	50	50
Alcohol consumption						
Never	60	58	75	100	90	90
current	90	92	85	35	45	45
BMI						
<25	75	70	64	40	35	45
>25	75	80	80	95	100	90

Table 2.

Urinary Metal	Exposed (ng/ml) Mean±SD	Unexposed (ng/ml) Mean ± SD	Pvalue Kruskal Walis Test	Microparticles		
				CD 14	CD62	CD62E
Cd	88.44 ± 6.81	12.53 ± 0.32	0.001	223 ±37	312 ± 76	347 ± 79
Cr	32.71 ± 0.35	1.34 ± 0.21	0.001	129 ±61	244 ±87	232 ±76
Pb	19.93 ± 2.01	5.08 ± 0.43	0.001	323 ±97	286 ±101	144 ±46

Discussion

Are transmitted to secondary and tertiary consumers and create serious Heavy metals like Cr, cd, Pb are hardly retained in water. The dissolved oxygenated metalloids are acquired by aquatic phyto and zooplankton and then through food chain passes to aquatic animals for deposition. Mostly in fishes the heavy metals are deposited in gills, liver, gut and muscle (Sanyal [3]). From primary consumers the heavy metalsthreat to human. Heavy metal contamination through food source therefore a burning issue as

the people are receiving local fish contaminated with Cr, Cd and Pb in the bank of river Churni. Though the river Churni and its bank is only populated by cottage industries like textile industries, its effluents are rich in heavy metals, creating serous heath threat to the local people. People residing in this area receiving chronic exposure of those heavy metals have myriad clinical problems including hyperlipidemia and hypertension. The microvascular complications and risk of development of cardiovascular diseases are therefore studied in a cross section of population exposed chronically to those heavy metals by food chain contamination.

Statistically significant level of EMP/PMP. EMPs are submicron vesicle like structures responsible for endothelial dysfunction. It is released via cell activation during apoptosis (Lee, et al. [4]). Similarly, plasma endothelial-derived microparticles level were proposed as a balance marker among cell stimulation, proliferation, apoptosis processes, and death [30]. Specifically, platelet derived microparticles stimulated adherence of platelets and endothelial cells to stenotic sites, induced plaque clotting inside lesions, and were strongly linked to inflammatory responses, lipid deposition, and atherosclerosis progression (Burnier, et al. 2009). It is reported earlier that, high level of PMPs are associated with several cardiovascular and cerebrovascular diseases, such as ischemic heart disease, heart failure with and without acute decompensation, hypertension, tachyarrhythmias, thromboembolism events, and subclinical atherosclerosis (Koga, et al. [5,6]). From, all of the above references and our present findings it is indicated that urinary and blood EMP, PMP may contribute as a diagnostic and prognostic marker for the development of microvascular complications and cardiovascular or cerebrovascular diseases in persons chronically exposed to heavy metals like Cr, Cd, Pb.

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