

Geogenic thallium and lead pollution in soils and potential risk of toxicity: A report from Iran

Sir,

Exposure to thallium (Tl: Atomic weight of 204.38 and atomic number of 81) and lead (Pb: 207.21 and 82) are important global health-ill problem in particular in developing world.^[1,2] These elements are derived from two sources anthropogenic or geogenic.^[2] To date, the later has been underestimated in health.

It is shown that geogenic thallium and lead are associated with mineralization of hydrothermal and pyrite mineral, and coal deposits.^[3] Thallium is generally present in very low concentrations in soils generally range from 0.01 to 3 mg/kg.^[4] These concentrations are not properly established; however, most soils contain thallium at concentrations of <1 mg/kg.^[3]

Concentration of Lead in natural soil is varied from 2 to 200 mg/kg (average 10) mg/kg.^[5] We have previously reported anthropogenic thallium and lead exposure and toxicities from Iran due to occupational environments, food sources and even adulterated opioid abuse.^[6,7]

There is geological potential of thallium and lead in Chelpu area. There are many diseases in this area that could be associated with the presence of these two toxic elements. Therefore, we evaluated thallium and lead in soil in Chelpu area that could potentially contribute in toxic exposure. 26 soil samples were collected from Chelpu catchment area, North east Iran. Soil samples were passed through a 120 mesh sieve and crushed. The samples were then analyzed for thallium and lead levels using ICP-ES via Iranian Geological Organization, Tehran.

Mean (SD, min-max) thallium and lead concentrations in soil were 3.64 (0.88, 2.2-5.4) and 12.13 (7.57, 0.6-26.5), respectively, ($n = 26$). These values are comparable with international reports [Table 1].

We found that thallium concentration in Chelpu soil samples was higher than natural soils reported from other geographical regions including International, Chinese and Canadian guidelines.^[3,8,9] Lead concentration in Chelpu soil samples was also higher than natural soils in

Table 1: Thallium and lead concentrations in soil samples of Chelpu in comparison to baseline values of natural soils

Location	Thallium (mg/kg)	Lead (mg/kg)
Soils in Chelpu	3.64 (mean)	12.13 (mean)
Natural soils in the world ^[4,5]	0.01-3 (median=0.2)	10 (mean)
Soils in China ^[8]	0.29-1.2 (median=0.58)	71.4 (mean)
Canadian and Chinese guidelines for agricultural land use ^[3,9]	1	70

world but lower than natural Chinese soils and Canadian guidelines.^[3,5,9] There have been some attempts to establish guidance for preventive measures related to lead pollution and toxicity in Iran. Physicians should be aware of potential consequences related to chronic thallium and lead toxicities in some regions. Sporadic refractory lead toxicities could also be associated with geogenic exposure. Further studies are needed to determine the extent of health impact of geogenic thallium and lead exposures in the area.

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AUTHOR'S CONTRIBUTIONS

MT contributed in the conception of the work, design of the work, analysis and interpretation of data, revising the draft, approval of the final version of the manuscript, and agreed for all aspects of the work. JM contributed in the conception of the work, design of the work, conducting the study, revising the draft, approval of the final version of the manuscript, and agreed for all aspects of the work. RA contributed in the conception of the work, conducting the study, interpretation of the data, revising the draft, approval of the final version of the manuscript, and agreed for all aspects of the work. MHMG contributed in the conception of the work, analysis and interpretation of data, revising the draft, approval of the final version of the manuscript, and agreed for all aspects of the work.

Masumeh Taheri, Jalil Mehrzad¹, Reza Afshari², Mohamad Hosein Mahmudy Gharai

Department of Geology, Ferdowsi University of Mashhad,
¹Department of Pathobiology, Faculty of Veterinary Medicine, Ferdowsi University of Mashhad, and Institute of Biotechnology,
²Medical Toxicology Centre, Mashhad University of Medical Sciences, Mashhad, Iran

Address for correspondence: Prof. Reza Afshari, Medical Toxicology Centre, Imam Reza (p) Hospital, Ibn-e-Sina Street, Mashhad University of Medical Sciences, Mashhad, 9133316791, Iran.
 E-mail: AfshariR@mums.ac.ir

REFERENCES

1. Khazdair MR, Boskabady MH, Afshari R, Dadpour B, Behforouz A, Javidi M, *et al.* Respiratory symptoms and pulmonary function testes in lead exposed workers. *Iran Red Crescent Med J* 2012;14:737-42.
2. Flomenbaum NE, Goldfrank LR, Hoffman RS, Howland MA, Lewin NA, Nelson L. Goldfrank'S Toxicologic Emergencies. 8th ed., Ch. 91, 96. McGraw-Hill Medical; 2006.
3. Xiao T, Guha J, Boyle D, Liu CQ, Chen J. Environmental concerns related to high thallium levels in soils and thallium uptake by plants in southwest Guizhou, China. *Sci Total Environ* 2004;318:223-44.
4. Bowen HJ. *Environmental Chemistry of the Elements*. London: Academic Press; 1979. p. 316.
5. U.S. Environmental Protection Agency Office of Solid Waste and Emergency Response. *Hazardous Waste Land Treatment, SW-874*. National Service Center for Environmental Publications; 1983. p. 273.
6. Mohammadnabizadeh S, Afshari R, Pourkhabbaz A. Metal concentrations in marine fishes collected from Hara biosphere in Iran. *Bull Environ Contam Toxicol* 2013;90:188-93.
7. Afshari R, Mégarbane B, Zavar A. Thallium poisoning: One additional and unexpected risk of heroin abuse. *Clin Toxicol (Phila)* 2012;50:791-2.
8. Qi W, Chen Y, Cao J. Indium and thallium background contents in soils in China. *Int J Environ Stud* 1992;40:311-5.
9. CCME (Canadian Council of Ministers of the Environment): *Canadian Environmental Quality Guidelines*; 1999. Available from: <http://ceqg-rcqe.ccme.ca/en/index.html>.