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Multivariate analysis of the first blood-metal assessment in Afghan school children

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After decades of war, climate change, gender inequality, adverse economic outcome, the Afghan population is facing many environmental threats: nutritional issues, unsafe drinking water, substandard sanitation, improper waste management, poor air quality, uncontrolled use of toxic substances in agriculture, transport and soil pollution [1,2]. And yet, there is no data available to assess the spread of contaminants in the Afghan population. Our study provides the first blood-metal levels of 246 school children aged 6-15 years old living in Afghanistan (Jalalabab city). A questionnaire addressed environmental factor exposure and demographic data. We explored these original results using univariate and multivariate analyses including socio-economic position and anthropometric data.

The median value of trace elements in blood (ug/dl) were: Cu 84.4 [90th percentile/10th percentile ratio(Q90/Q10): 1.5], Zn 2991 [Q90/10: 2.7], Mg 3910[Q90/10: 1.4], Fe 43769 [Q90/10: 1.3] and, for potentially toxic elements, Mn 7.91[Q90/10: 2.8], V 0.51 [Q90/10: 3.5], Cd 0.03 [Q90/10: 3.2], As 0.26 [Q90/10: 2.2], Ti 3.35 [Q90/10: 2.1], U 0.02 [Q90/10: 3.3], Pb 6.72 [Q90/10: 2.1], Sr 10,37 [Q90/10: 2.1], Tl 0.02 [Q90/10: 3.2], Th 0.02 [Q90/10: 4.4], and Mo 0.29 [Q90/10: 2.7]. Pb, As, V, Mn and Cd were above toxic baselines defined by the Center of Disease Control and Prevention (USA) and Western European biomonitoring surveys. Several contaminations correlated with each other’s and relied to the demographic, socio-economic and anthropometric status. Four potential sources of contamination by non-essential metals have thus emerged: fertilizers, ammunition, brickworks, coal combustion and road traffic.

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This research was conducted in accordance with the Declaration of Helsinki and approved by the Ministry of Public Health review board in Afghanistan (IRB approval A.070049). Informed consent forms were filled by the children and their parents on the request of the Education Directorate Board of Nangarhar province.

[1] UNDP, 2025 HDT report, NY USA, https://data.undp.org/countries-and-territories/AFG.

[2] World Bank. The Human Capital Index 2020 Update: Human Capital in the Time of COVID-19; The World Bank: Washington, DC, USA, 2020.