Human biomonitoring surveys on adult populations exposed to contaminated soils (Pb, Cd, As) , focus on health risks due to urban food production.

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Urban food production is increasingly promoted for its positive outcomes on the sustainable and resilient development of cities, on human health and on household purchasing power. However, urban soils may not always meet quality standards for health and food production. In pan-European countries, Pb and Zn smelting activities have been going on for almost a century near or within urban areas, and have permanently contaminated soils with toxic trace metal(oid)s such as Cd, Pb and As. Even after several decades of decline and regulations, chronic exposure to these soils contaminants remains widespread in cities with past metallurgical industry. Urban gardeners, intensively exposed via unintentional ingestion of soil/dust particles and consumption of (contaminated) vegetables grown on these soils, constitute a sub-population at risk with respect to health effects from heavy metal co-exposure.

Following environmental investigations and health risk assessments, three human biomonitoring surveys have been performed on adult populations of (i) gardeners/beneficiaries from a 6 ha community garden (n=88 in summer 2018 and n=55 in winter 2018) and (ii) non-gardeners (reference population, n=100 sampled in summer 2019) both located/living in the “Bressoux” area from Liège city (BE). This neighbourhood shows a widespread soils contamination in heavy metals (i.e. median Pb, Cd and As concentrations of 530; 4.5; and 40 mg/kg, respectively). The community garden therein is one of biggest (up to 230 allotments) and one of the most contaminated in Wallonia, with nearly 30% of vegetables above EU quality standards for Cd and Pb. As a whole, about 240 blood and 240 urine samples were measured for Pb, Cd, As biomarkers to determine if gardening on these soils and/or consuming vegetables products gave rise to higher internal exposures and potential health risks compared to (1) the general population and to (2) non-gardeners living on similar soils. The study allowed the investigation of seasonal change (summer vs. winter) in biomarker levels and contributed to tune the adequacy of precautionary and management measures in this peculiar situation.

Results show that urinary Cd (CdU), urinary speciated (Asi+MMA+DMA) As (AsU) and blood Pb (PbB) concentrations for gardeners were above reference values for the general population and higher than those measured for the reference population of non-gardeners. Differences in PbB, CdU and AsU concentrations were statistically meaningful between the two populations and showed a pronounced change with a decrease in winter for Cd and As. Urinary Cd concentrations for gardeners was 4 times the median value for the Belgian population and showed the strongest difference, with 55% above 1µg/L for gardeners against 8% for non-gardeners. Median AsU for gardeners was 2 times the median from ENNS survey (France). Median PbB for gardeners was above but close to the reference value from the ENNS survey that can be attributed to an upperbound estimate of current PbB median values for a general population. As, Cd, Pb biomarker levels of exposure in the reference population were close or typical of the general population. These differences are explained by a more intense exposure to contaminated soils for gardeners (consistent with a winter-summer difference in exposure for this population) compared to a more passive exposure for the reference population. However, discrepancies in socioeconomic and population factors between gardeners and non-gardeners could also partially contribute to the observed differences.

Contaminated urban soils, once they are devoted to vegetable gardens, may cause individuals to have internal exposures above those of residents living on the same soils but exposed less intensively.