A DIFFERENT PERSPECTIVE ON ORAL BIOACCESSIBILITY OF Cu, Zn AND Cr IN LISBON AND NORTHAMPTON URBAN SOILS

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The most common potential harmful elements (PHE) for human health are As, Cd, Cr, Cu, Pb and Zn. Incidental soil ingestion by children is an important exposure pathway for assessing public health risks associated with exposure to PHE contaminated soils. Children spend more time playing outdoors and through their hand-to-mouth actions are particularly vulnerable to the risk posed by PHE. However, some of these PHEs are essential for the metabolism of living organisms, children included. Elements such as Cr, Cu, and Zn are required by organisms at low levels but become toxic at some higher levels of exposure. This study compares the quality of urban soils from two cities (Lisbon and Northampton) in terms of their content in essential elements to human health. The methodology used is based on the results of oral bioaccessibility testing, which was carried out using the UBM Barge method. Bioaccessibility estimates are in the range of 31-246 mg/kg for Zn, 0.33-2.43 mg/kg for Cr and 2.7-51.7 for Cu in the soils of Lisbon and 6.1-95.4 mg/kg for Zn, 0.33-65.1 mg/kg for Cr and 3.6-36.5 for Cu in the soils of Northampton. Soil ingestion studies have been performed for exposure and risk assessment purposes and the US EPA has recommended values of 0.2 g/day and suggests that a reasonable ingestion rate for children with pica is 10 g/day. Considering the maximum bioaccessibility estimate (more critical due to eventual toxicity) and the Recommended Daily Intake (RDI) for children aged from 1-8 years old, the results show that: for Zn, a child needs to ingest about 49 g/day of Lisbon soil and 125 g/day of Northampton soil to reach the necessary RDI requirements; for Cu, the amount of soil needed is 9 g/day for Lisbon and 12 g/day for Northampton to fulfil the dietary Cu requirements; for Cr, a child needs to ingest about 6 g/day of Lisbon soil and 0.23 g/day of Northampton soil to reach the RDI. This is a very straightforward and broad-brush approach and it doesn't take into account factors such as: soil is only one source of these elements in a child's diet; the finest soil fractions are suspended and easily inhaled; absorption of elements from soil is modified by the presence of food in the gastrointestinal tract. However, it allows for comparison of the soil composition and quality in terms of essential element concentration. Bioaccessible Cr in Northampton soil raises some concern since a soil ingestion of 0.9 g/day would reach the toxicity level for young children.

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