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Metal(loid) Loadings in Kindergarten Dust: An Exposure Assessment in Estarreja, Portugal

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- Young children frequently engage in hand-to-mouth activities, which makes them more likely than adults to ingest significant amounts of indoor dust. Given that preschoolers are particularly vulnerable to potentially toxic elements (PTEs) through ingestion, it is crucial to characterize their exposure within kindergarten environments. Although dust metal concentrations and dust metal loadings (expressed in units of μg g^{-1} and μg m^{-2}, respectively) are different measures of indoor metal (and metalloids) levels, both metrics are important as they provide complementary information, allowing for a better understanding of indoor exposure to these potentially toxic elements (PTE). Loading is, however, considered to be a suitable measure of potential exposure. Dust metal loading, dust metal concentration, and total dust loading are measures positively correlated with each other, and one dust metal loading value can be associated with a range of dust metal concentrations due to the variability of total dust loadings across different indoor environments.
- A study was conducted in five kindergartens in the industrial city of Estarreja to address this potential hazard. Indoor dust samples were collected from a known surface area in each kindergarten to report on dust metal(loid) concentrations and loadings. Total concentrations of chromium (Cr), cobalt (Co), nickel (Ni), cadmium (Cd), arsenic (As), and lead (Pb)

were determined using Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) in the <63 μm and <250 μm particle size fractions of the indoor dust.

- Non-parametric analysis (Spearman's rank-order correlation) revealed high and significant (p<0.001) positive correlations between dust loading and dust elemental loading. Strong correlations were also observed between elemental loadings and elemental concentrations, but the relationship was significant only for Ni and Pb (p<0.05). Notably, the strong correlation (r_s= 0.73) between Pb concentration and dust Pb loading suggests that dust loading, which ranged from 54.6 to 978.7 mg m^{-2} in the coarse fraction and 5.0 to 161.2 mg m^{-2} in the finer particle size fraction, has a strong influence on dust Pb loading.
- The results indicate that dust mass has a negligible impact on the dust elemental loading for elements such as Cd, Co, Cr, and As.

Keywords: particle size, data analysis, industrial setting, exterior dust, garden soil