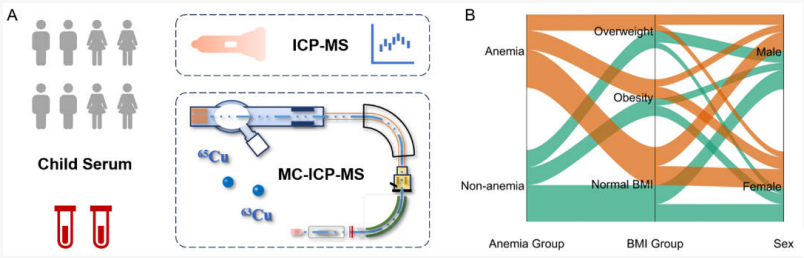
Copper isotope ratios and metallomic profiling in serum: new clues for child health



The design of the experimental workflow (a) and cohort grouping information (b).

GA, UNITED STATES, July 20, 2026 /EINPresswire.com/ -- The study investigated serum concentrations of multiple elements and copper isotopic fractionation in healthy, anemic, and overweight or obese children, to give metallome profiles and evaluate the feasibility of these elements and $\delta^{65}Cu$ as a potential indicator with metallome comprehensively for early subclinical status. This study addresses two of the most prevalent and impactful pediatric health concerns globally, anemia and childhood overweight/obesity, through an innovative multi-elemental and isotopic lens.

The rising incidence of anemia and overweight has been identified as a serious public health problem worldwide, especially among children and adolescents. While the individual health impacts of anemia and obesity are well-documented, the underlying metabolic dysregulations, particularly concerning trace element homeostasis, are not fully understood, especially in the crucial early or subclinical stages. Traditional diagnostic markers often lack the sensitivity to detect these subtle shifts.

In a study published in the KeAi journal Environmental Chemistry and Ecotoxicology, a group of researchers from China pioneers an approach by integrating the analysis of 13 essential and non-essential trace elements with the novel application of copper stable isotope ratios ($\delta^{65}Cu$) in pediatric serum.

"We demonstrate the potential of $\delta^{65}Cu$ as a sensitive isotopic biomarker for early anemia detection in a pediatric cohort for the first time," explains co-corresponding Qian Liu, a professor in environmental analytical chemistry at Research Center for Eco-Environmental Sciences of Chinese Academy of Sciences. "While traditional hematological parameters and absolute element concentrations showed limited discriminatory power, $\delta^{65}Cu$ values exhibited marginal significance between anemic and non-anemic children, suggesting it may capture subtle metabolic alterations preceding overt clinical symptoms."

The team also uncovered distinct and previously unreported serum metallomic patterns linked to body mass index (BMI) — most notably a strong, graded positive association between serum lead (Pb) levels and increasing BMI.

“This finding critically links environmental toxicant exposure to pediatric obesity risk,"says Liu. "Further, serum metal levels show compensatory mechanisms in mild childhood anemia.”

Meanwhile, cobalt was identified as a potential dual biomarker for anemia and overweight children. The researchers advocated that new biomonitoring strategies should integrate multi-element and isotopic data.

"By linking detailed metallomics with isotopic analysis, we uncover new associations between trace element dysregulation, environmental exposure, and common childhood health conditions," adds Liu. "We believe these findings offer substantial translational potential for improving early diagnosis, understanding pathophysiology, and guiding targeted public health actions."

References
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