The associations between blood and urinary concentrations of heavy metal metabolites, obesity, and type 2 diabetes

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Both heavy metal exposure and obesity are associated with a higher risk of cardiometabolic health effects. Blood and urinary biomarkers of heavy metal exposure data from the National Health and Examination Survey (NHANES Continuous 1999-2016) were used. The objective of the study was to determine if high concentrations of heavy metals in blood or urine was associated with obesity and whether high concentrations of heavy metal biomarkers influence the relationship between obesity and type 2 diabetes. A high concentration of barium in urine was associated with 20% higher odds of obesity ($P \leq 0.05$). Conversely, a high urine concentration of cadmium, lead, and antimony were all associated with 30-40% lower odds of having obesity ($P \leq 0.05$). Independent of obesity, a high urinary uranium concentration was associated with a 12% higher risk of type 2 diabetes. Urinary lead and cadmium were not associated with the risk of type 2 diabetes. On the contrary, having a high blood lead or cadmium concentration were associated with a 23% and 13% lower risk of type 2 diabetes, respectively, independent of obesity ($p<0.05$). All other metals were not independently associated with type 2 diabetes risk ($P>0.05$). For most heavy metals, being categorized as high concentration was associated with lower odds of obesity. Generally, being categorized as high concentration was not associated with type 2 diabetes. There may be potential health effects for those who are under the Environmental Protection Agency reference dose guidelines for heavy metals.