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The association between blood heavy metals and chronic kidney function among Korean healthy women: Impact of (pre)hypertension

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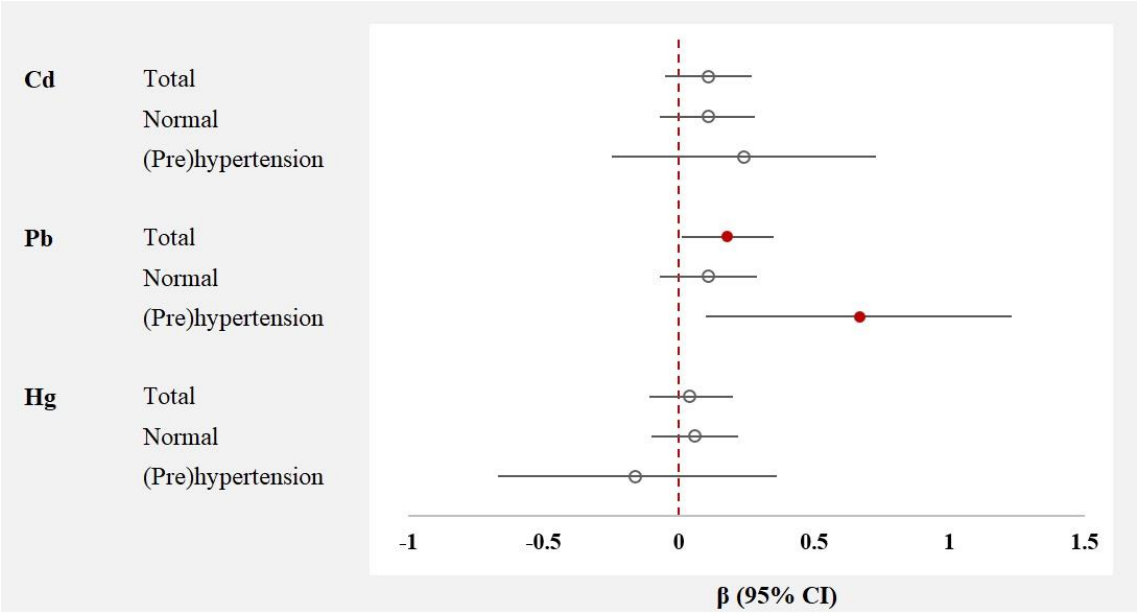
Objectives: The objective of this study was to find the association of major metals in blood with the albumin-to-creatinine ratio (ACR) as a marker of kidney function in Korean healthy women, and examined (pre)hypertension as an effect modifier.

Methods: A total of 447 healthy adult women of 20-49 years old were recruited from hospitals in Seoul, Gyeonggi, Incheon, and Jeju at 2015-2016. Cadmium (Cd), lead (Pb), and mercury (Hg) were measured from whole blood. The association between blood heavy metal levels and ACR was evaluated in multivariable linear regression models. For secondary analysis, we considered two urinary chemicals that were reported for possible chemical determinant for ACR in the same population. To evaluate effect modification, the model was stratified by (pre)hypertension status. Statistical analyses were conducted using SAS 9.4.

Results: Approximately 8.7% of the participants showed ACR greater than 30 mg/g, i.e., micro/macro-albuminuria, and 27.7% showed ACR in the range of 9.71-30 mg/g. Only blood Pb showed a significant association with ACR. The positive association between blood Pb and ACR still showed after adjusting monobutylphthalate and benzophenone-1 which were identified as chemical determinants for increased ACR from the sample women (Kang et al., 2019). The association between blood Pb and ACR was stronger in (pre)hypertension group. The association between Pb and ACR was greater in the lower 50% group of Cd exposure.

Conclusions: In healthy adult females, a significant association of Pb exposure with CKD was observed. The association between Pb and CKD was much stronger in (pre)hypertension group. These observations suggest that those with (pre)hypertension are the sensitive population for Pb exposure. While the effects of Cd exposure on ACR were not evident, potential interaction between Cd and Pb on ACR was suggested. The observations highlight the importance of environmental metals and hypertension in association with kidney function marker.

Figure 1. Associations between blood heavy metal concentrations (μg/L; μg/dL for Pb) and urinary albumin-to-creatinine ratio (ACR) (mg/g) by (pre)hypertension status in Korean women (n =447). Adjusted for age, region, education, parity, urinary cotinine, and alcohol consumption. A solid circle means for the statistical significance ($p < 0.05$), while an open circle stands not statistically signi


Cd
Total
Normal
(Pre)hypertension
Pb
Total
Normal
(Pre)hypertension
Hg
Total
Normal
(Pre)hypertension
-1
-0.5
0
0.5
1
1.5
β (95% CI)