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Association of exposure to phthalates and environmental phenolics with markers of kidney function: Korean National Environmental Health Survey (KoNEHS) 2015-2017

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Objectives: Increasing number of consumer chemicals have been associated with chronic kidney disease (CKD) in human populations. However, most studies that investigated estimated glomerular filtration rate (eGFR) as an outcome suggested null or protective effects of the chemicals.

Methods: We employed a subset (n=1292) of a nationally representative adult population participating in Korean National Environmental Health Survey (KoNEHS) 2015-2017, and assessed association of major phthalates, bisphenol A (BPA), and parabens with both estimated glomerular filtration rate (eGFR) and albuminuria. In order to address potential reverse causation and collider issues, a covariate-adjusted standardization method was applied in addition to the conventional creatinine-correction for urine dilution.

Results: Regardless of correction method, urinary di-(2-ethylhexyl) phthalate metabolites showed significant positive associations with urinary albumin-creatinine ratio (ACR). Following covariate-adjusted standardization, urinary metabolites of other heavy molecular weight phthalates such as mono-carboxy octyl phthalate and mono-carboxy nonyl phthalate showed significant positive associations with ACR. For eGFR, conventional creatinine-correction resulted in positive associations with most of measured phthalate metabolites. However, following covariate-adjusted standardization, most of positive associations disappeared, and significant negative associations with eGFR were observed for mono-n-butyl phthalate, BPA, and ethyl paraben. Secondary analysis following stratification by CKD status and a principal component analysis generally support the observed associations.

Conclusions: The present study highlights the importance of considering potential reverse causality in association studies for adverse renal outcomes, and provides better understanding on the association of major consumer chemicals with adverse kidney function among humans.