Human exposure to plasticizer chemicals – correlation between indirect and biomonitoring exposure estimates in a Norwegian human cohort

Georgios Giovanoulis1 2 *, Andreia Alves3 4, Thuy Bui1 2, Anna Palm Cousins1, Adrian Covaci4, Stefan Voorspoels3, Jörgen Magnér1 2, Cynthia A. de Wit2

1 IVL Swedish Environmental Research Institute, SE-100 31, Stockholm, Sweden
2 Department of Environmental Science and Analytical Chemistry (ACES), Stockholm University, SE-106 91, Stockholm, Sweden
3 VITO NV Flemish Institute for Technological Research, Boeretang 200, 2400 Mol, Belgium
4 Toxicological Center, Department of Pharmaceutical Sciences, University of Antwerp, Universiteitsplein 1, B-2610, Wilrijk, Belgium
*georgios.giovanoulis@ivl.se

Introduction

Plasticizers used as additives in numerous consumer products have a continuous release into the environment (pseudo-persistent), leading to consecutive human exposure which might cause adverse health effects (e.g. endocrine disruption, Bui et al. 2016, Womuth et al. 2006). Indoor air quality and house dust may have significant impact on human health because people spend most of their time indoors, where the concentrations of plasticizers are comparatively high.

Inhalation and dermal exposure through air, transdermal exposure through dust adhered to the skin, oral exposure through diet and unintended dust ingestion (hand to mouth contact) have been considered as major exposure pathways (Koch et al. 2013a; Latini 2005; Witaszek and Angerer, 2008). On the other hand, daily intake of plasticizers can also be determined through analysis of urinary metabolites. The human biomonitoring approach allows the detection of plasticizers in specific populations, by taking into account all possible routes of exposure and all relevant sources (Alves et al. 2014, Angerer et al. 2007).

Materials & Methods

Air sampling with personal and stationary pumps, and Solid Phase Extraction (SPE) with ENV+ cartridges. Handwipe samples were collected by using glass wool. Indoor dust from floor and elevated surfaces was extracted with Microwave Assisted Extraction, and cleaned up with SPE NH2. All samples were analyzed with GC-MS/MS.

Homogenized food samples from a 24h duplicate diet were extracted with modified QuEChERS, and analyzed with Q Exactive Hybrid Quadrupole-Orbitrap Mass Spectrometer.

Results & Discussion

Table 1. Multivariate linear regression mixed models of phthalate ester and DINCH urinary metabolites by lifestyle characteristics.

Conclusion

• Total daily intake based on inhalation, dust ingestion and dermal exposure indicates low exposure to the selected PEs.
• Diet is the most important exposure pathway.
• The cumulative risk assessment for combined plasticizer exposure, expressed as HQs and HI, was below established risk limits, even considering the worst case scenario (i.e. maximum values).

Pharmacokinetic modelling

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