O02.03.46. Mixed Phthalate Ester and Phosphate Flame Retardant Exposure and Asthma and Allergies in School Children

Atsuko Araki

Atsuko Araki[1], Yu Ait Bamai[1], Michiel Bastiaensen[2], Nele Van den Eede[2], Toshio Kawai[3], Tazuru Tsuboi[3], Sachiko Itoh[1], Chihiro Miyashita[1], Adrian Covaci[2], Reiko Kishi[1]

1. Center for Environmental and Health Sciences, Hokkaido University, Sapporo, Japan.
2. Toxicological Center , University of Antwerp, Antwerpen, Belgium.
3. Japan Industrial Safety and Health Association, Osaka, Japan.

Abstract: Background: Phthalate esters (PEs) and phosphate flame retardants (PFRs) are widely used in interior materials and consumer products. We have reported individual associations between PE and PFR metabolites in urine and children's asthma and allergies, but mixed PEs and PFRs have not yet been studied. Thus, we aimed to find the association between mixed PEs and PFRs and asthma and allergies. Methods: Elementary school children participated in this study. Six PE metabolites were measured using gas chromatography-mass spectrometry (MS); 13 PFR metabolites were measured using liquid chromatography-tandem MS. Wheezing, rhino-conjunctivitis (RC), and eczema were evaluated using International Study of Asthma and Allergies in Childhood questionnaires. Associations between PE and PFR mixtures, and asthma and allergy risk were studied using weighted quantile sum (WQS) regression models adjusted for sex, grade, dampness index, annual house income, parent allergy history, and urine creatinine. Estimated weights of PEs and PFRs as WQS indexes were obtained. The sums of ≥2 metabolites were calculated as parent compound exposure. Results: Wheezing, RC, eczema, and allergies were prevalent in 29, 46, 36, and 72 of 128 children, respectively. The highest correlations were shown with 5-OH-EHDPHP and ΣTPhP (Spearman's ρ=0.525, $p<0.001$), and 5-OH-EHDPHP and ΣTCIPP (ρ=0.451, $p<0.001$). WQS index quartile increases showed higher odds ratios (ORs) of RC (OR=2.83; 95% confidence interval=1.28-6.64), eczema (2.71; 1.19-6.58), and any such allergies (6.25; 2.22-20.68). Top three heavily weighted chemicals were as follows: RC, BDCIPP (w=0.306), ΣTCIPP (0.311), ΣTBOEP (0.203); eczema, 5-HO-EHDPHP (0.287), ΣTBOEP (0.251), BDCIPP (0.168); and any allergies, BDCIPP (0.383), ΣTBOEP (0.207), ΣTCIPP (0.156). Conclusion: We found positive associations between mixed PE and PFR exposure and allergies risk. TCIPP, TBOEP, EHDPHP, and TDCIPP are the main chemicals that affect allergic symptoms in children.