Abstract

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Human biomonitoring study with residents in Afghanistan reveals high PAH, but low PFC exposure

Issue: Human biomonitoring for exposure assessment of environmental pollutants to the general population has been conducted in industrial nations for many years. During a health project, we were given the opportunity for the first time to study the internal exposure of residents from Afghanistan to environmental pollutants. Well known and emerging substances (polycyclic aromatic hydrocarbons, PAH; perfluorinated compounds, PFC) in the focus of environmental medicine were chosen.

Method: A total of 55 residents from Kabul and rural areas participated in this study. The PFC study comprised of 12 children (age 2.5-9 years) and 43 adults (men and women; age 20-65 years) whilst for the PAH study 13 children (age 2-9 years) and 42 adults (men and women; age 20-65 years) were selected. Important influencing variables were recorded via a questionnaire and in addition to that cotinine levels were measured in urine for assessing exposure to tobacco smoke. The most important representatives of PFC namely perfluorooctane sulphonate (PFOS), perfluorooctanoic acid (PFOA) and perfluorohexane sulfonate (PFHxS) were measured in serum and drinking water via HPLC/MS/MS detection. The PAH metabolites 1-hydroxypyrene (1-OH-P) as well as hydroxyphenanthrenes (Σ-OH-Phen) were determined in urine samples via HPLC/FD.

Results: PFOS was found in all serum samples (median; range: 1.2 µg/l (0.21-11.8 µg/l)) whilst PFOA and PFHxS were below the limit of quantification. In the drinking water no PFC was detected. The median (range) values of PAH metabolites are: 1-OH-P 1646ng/l (71-16222 ng/l) and the sum of 1-, 2- and 9-, 3-, 4-OH-Phen 3602 ng/l (116-19670 ng/l).

Discussion: This study underlines that the PFC contamination is very low in developing countries. The highlighted results in this study are the lowest ever recorded PFC-human biomonitoring results. In contrast, the results for PAH reveal a strikingly high exposure. This can be particularly observed in children and women from rural areas. For instance, children show a ten times higher concentration of PAH metabolites in their urine than children from Germany and the USA. The main reason for the indoor PAH contamination is not the exposure to tobacco smoke as reported in most studies, but the pollution of indoor air. The main source may be the combustion of traditional biofuels in rudimentary ovens in closed rooms with poor ventilation. So far, a similar observation has only been reported worldwide from China. This study stresses the importance of interior PAH pollution with the known significant health risks (i.e. respiratory diseases, lung cancer) via indoor smoke exposure in developing countries. In contrast, for PFC it is unlikely that residents from Afghanistan are at health risk.