

Abstract

Human biomonitoring (HBM) is an important tool for monitoring human exposure to chemical pollutants from the environment and their possible adverse effects on the health of the population. HBM is defined as the monitoring and quantification of environmental chemicals, their metabolites or other changes related to exposure in human body fluids and tissues. The monitored biomarkers in this work are cadmium, mercury, cotinine and metabolites of phthalates. While mercury and cadmium are long-term biomarkers in the Czech Republic, cotinine and phthalate metabolites were determined for the first time. The presented work was a part of the pilot international study DEMOCOPHES, which focused on determining the exposure of increasingly susceptible population groups to the mentioned chemical noxas. In this work, the exposure of Czech children and their mothers living in urban and rural environments and the influence of environmental factors, lifestyle and social status on this burden were monitored. Another aim of the work was to compare the results of mercury and cadmium concentrations from the DEMOCOPHES project with the results obtained within the Health Monitoring System in relation to the population of the population in the Liberec Region in the years 1996 - 2016.

The results showed that the levels of Cd in the urine of the Czech population did not exceed the limit value set by the German Commission for Human Biomonitoring (HBM) of 0.5 µg/ l for children and 1 µg/ l for women, except for the borderline increase in the concentration of one boy in Prague (0.59 µg/ l urine). Cadmium concentrations in the Czech population were insignificantly higher in both children (0.109 µg/ l) and mothers (0.270 µg/ l) than the results obtained from the respondents of the participating countries in the DEMOCOPHES project (children - 0.071 µg/ l, mothers - 0.219 µg/ l). The values of cadmium in urine in the monitored Czech population from Liberec (countryside) obtained in the DEMOCOPHES study were comparable with the results obtained from MZSO performed in 2005-2016 in the Czech Republic. The level of mercury in hair of the monitored Czech population was up to 10 times lower than the health limit was defined by the JECFA Committee in 2006 at 2.3 µg / g hair). The levels of the Prague population were higher than in the Liberec population - insignificant in children ($p = 0.078$), significantly in mothers ($p < 0.001$). In comparison with other participating countries, the results of Czech children and their mothers were significantly below the European average. Mercury was also monitored in the Czech population in the years 2005 - 2016, but in other biological material - in urine, so it was not possible to compare the results. Phthalate metabolites were monitored in the Czech population for the first time. So far, only one health-relevant limit has been set for the sum of two metabolites of diethylhexyl phthalate (DEHP), namely 500 µg/ l urine in children and 300 µg/ l in women. This limit was not exceeded in the Czech group, with the exception of the borderline increase (530 µg/ l) in one child from Liberec. In an international comparison, Czech children and their mothers had slightly higher values than the average of most participating countries. Cotinine is a metabolite of nicotine and serves as a biomarker of children's exposure to secondhand smoke. The cut-off value for distinguishing between active and passive smokers is 50 µg/ l of urine. Children who were exposed to second-hand smoke daily had values up to five times higher than children who had never been exposed to tobacco smoke. A significant difference in cotinine content was found in urban and rural mothers, with rural mothers having a higher exposure (5.98 µg/ l urine) than urban mothers (2.16 µg/ l urine). Higher values of cotinine were found in Czech children from rural areas (1,641 µg/ l of urine) than in children in the city (1,536 µg/ l of urine). The level of cotinine in the urine of children decreased with the level of education of mothers. When comparing the results of the analysis of cotinine in the urine of Czech children with the values in children of participating

countries in the DEMOCOPHES study (0.797 $\mu\text{g}/\text{l}$ urine), the Czech Republic is one of the countries with above-average exposure of children to tobacco smoke.