

Levels of phthalate metabolites in children's urine, 2016

The monitoring of the urinary content of selected phthalate metabolites extends the international project Democophes aimed at mothers and their children aged 6-11 years [1].

In 2016, the monitoring was carried out in five localities – Prague, Liberec, Ostrava, Žďár nad Sázavou, and Kutná Hora. The target population were children aged five and nine years. The study cohort consisted of 419 children (162 five-year-olds and 257 nine-year-olds). The samples collected were 400 urine specimens. Analyses were performed in the laboratory of the National Institute of Public Health in Prague using high performance liquid chromatography (HPLC) along with tandem mass spectrometry (MS/MS).

The following urinary phthalate metabolites were monitored: mono(2-ethylhexyl) phthalate (MEHP); mono(2-ethyl-5-hydroxy-hexyl) phthalate (5OH-MEHP); mono(2-ethyl-5-oxo-hexyl) phthalate (5-oxo-MEHP); mono-benzyl phthalate (MBzP); mono-isobutyl phthalate (MiBP); and mono-n-butyl phthalate (MnBP).

Of the phthalate metabolites analysed, the prevailing compounds were MnBP, MiBP, and the sum 5-OH MEHP and 5-oxo MEHP. Only a minor part of MEHP is present in urine due to its rapid biotransformation to secondary metabolites.

The health safety limit (HBM I) set by the German Biomonitoring Commission for the sum of two major secondary metabolites of bis (2-ethylhexyl) phthalate DEPH, 5-OH-MEHP and 5-oxo-MEHP, is 500 μ g/l of urine in children. This limit was not exceeded in any child monitored in 2016, and the median urinary concentration was 33.8 μ g/l (34.2 μ g/g creatinine).

Prior to statistical analysis, the data were standardized to the creatinine content. All metabolites monitored showed statistically significant (p<0.05) decline of concentrations in children with increasing age, except MEHP, the median of which was slightly lower in younger children. The levels of phthalate metabolites also varied with area of residence (p<0.05).

	MEHP	5-OH- MEHP	5-oxo- MEHP	MBzP	MiBP	MnBP			
Number of children	378								
	μg/l urine								
Geomean	2.31	20.5	12.8	3.65	43.5	62.4			
Median	2.38	21.2	13.5	3.2	38.7	61.4			
25 th Percentile	1.00	12.1	7.61	0.95	23.1	37.7			
75 th Percentile	3.81	34.7	19.7	6.87	72.3	103			
95 th Percentile	7.38	66.7	41.3	37.1	237	235			
Minimum	1.00	2.99	1,00	0.95	4.31	7.8			
Maximum	16.7	245	99.8	265	843	523			

Tab. 1 Levels of urinary phthalate metabolites in children, 2016



	μg/g creatinine								
Geomean	2.35	20.8	13.0	3.71	44.2	63.4			
Median	2.38	20.4	12.6	3.24	38.9	61.9			
25 th Percentile	1.57	13.4	8.82	1.75	24.1	40.6			
75 th Percentile	3.50	31.3	19.9	6.36	69.5	95.0			
95 th Percentile	6.19	54.7	37.6	36.1	231	200			
Minimum	0.516	4.18	1.29	0.509	8.96	11.5			
Maximum	21.9	158	74.5	253	691	745			

When the place of residence was located near a local source of pollution, higher levels of phthalate metabolites were detected in children; however, statistically significant differences (p<0.05) were only observed for MiBP and MnBP. A significant effect on the urinary levels of MiBP and MnBP (p<0.05) was also caused by frequent contact with plastic products, such as soft rubber toys, plastic figurines, inflatable pool toys/fins, etc. Based on parental data on the family's financial situation, children from families with a satisfactory financial situation had lower levels of urinary phthalate metabolites in comparison with children from families with an unsatisfactory financial situation, but a significant link was only shown for MnBP.

A significant factor (p<0.05) influencing the levels of selected urinary metabolites (MEHP, 5-OH MEHP, 5-oxo MEHP, and MBzP) was also the maternal education level, with the children of mothers with tertiary education showing lower levels of the above mentioned urinary metabolites than children of mothers with lower education levels. The child's gender or other parameters contained in the questionnaire (recent household renovation, consumption of selected foods, or body weight) had no significant effect on phthalate exposure.

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