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TEMPORARY TREND OF SERUM LEVELS OF DIOXIN-LIKE SUBSTANCES IN ADULTS LIVING IN A HIGHLY POLLUTED REGION

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Introduction

Polychlorinated dibenzo-p-dioxins (PCDDs), dibenzofurans (PCDFs), and biphenyls (PCBs) are classes of toxic organochlorine compounds which are ubiquitous in the environment. They are metabolically very stable and are eliminated from the body very slowly. The human exposure is mostly through dietary uptake, however some population groups may have
environmental exposures due to past or current industrial activity. The data on kinetics of serum dioxin-like compounds (DLCs) in environmentally exposed humans are important for population risk assessment.

The optimal information on behavior of these substances in the body can be obtained by repeated measurement of body burden, reflected by serum or body fat concentration, at intervals separated by an enough long time period with regard to extremely slow elimination rate of these substances. Data of that kind were published1-5 and it follows from them that a gradual homogeneous exposure pattern to DLCs for most subjects can be expected. For our exposure scenario we have, however, observed in adolescents frequent reuptakes expressed as increasing serum levels over 4 years6. The aim of this study was to assess whether a similar exposure pattern can be expected also in adults.

Material and methods

In year 2000 dioxins, furans, DL-PCBs and NDL-PCBs were determined in serum by HR-MS chromatography of 90 adults (57 males, mean age 46±11.4 years and 33 females, mean age 49±10.9years) living in a highly PCB and dioxin-like by-products polluted area in eastern Slovakia. The subjects were re-examined in 2012.

Results and discussion

The trends of the serum concentration of dioxin agents are shown in Figure and in the Table 1 (A-D). From the Figure it follows that living in eastern Slovakia is linked with a risk to be exposed to DLCs that in a significant part of population is obviously increasing with time.

It can be seen that most of our volunteering subjects experienced a decrease of their body burden of DLCs. The percentage of subjects showing a decrease was somewhat over 50% for most of the congeners, however extremely fast and slow elimination rates can also be observed. The most important conclusion from these data is that within 12 years, in spite of the production ban of PCBs, the serum levels of all DLC congeners evaluated, in a significant percentage of subjects increased. It means that permanent residence in polluted area is accompanied by massive reuptakes of DLCs.

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Figure. Logarithm of serum concentrations of DLCs measured in year 2000 and 2012. Each measurement pair is connected by a line.

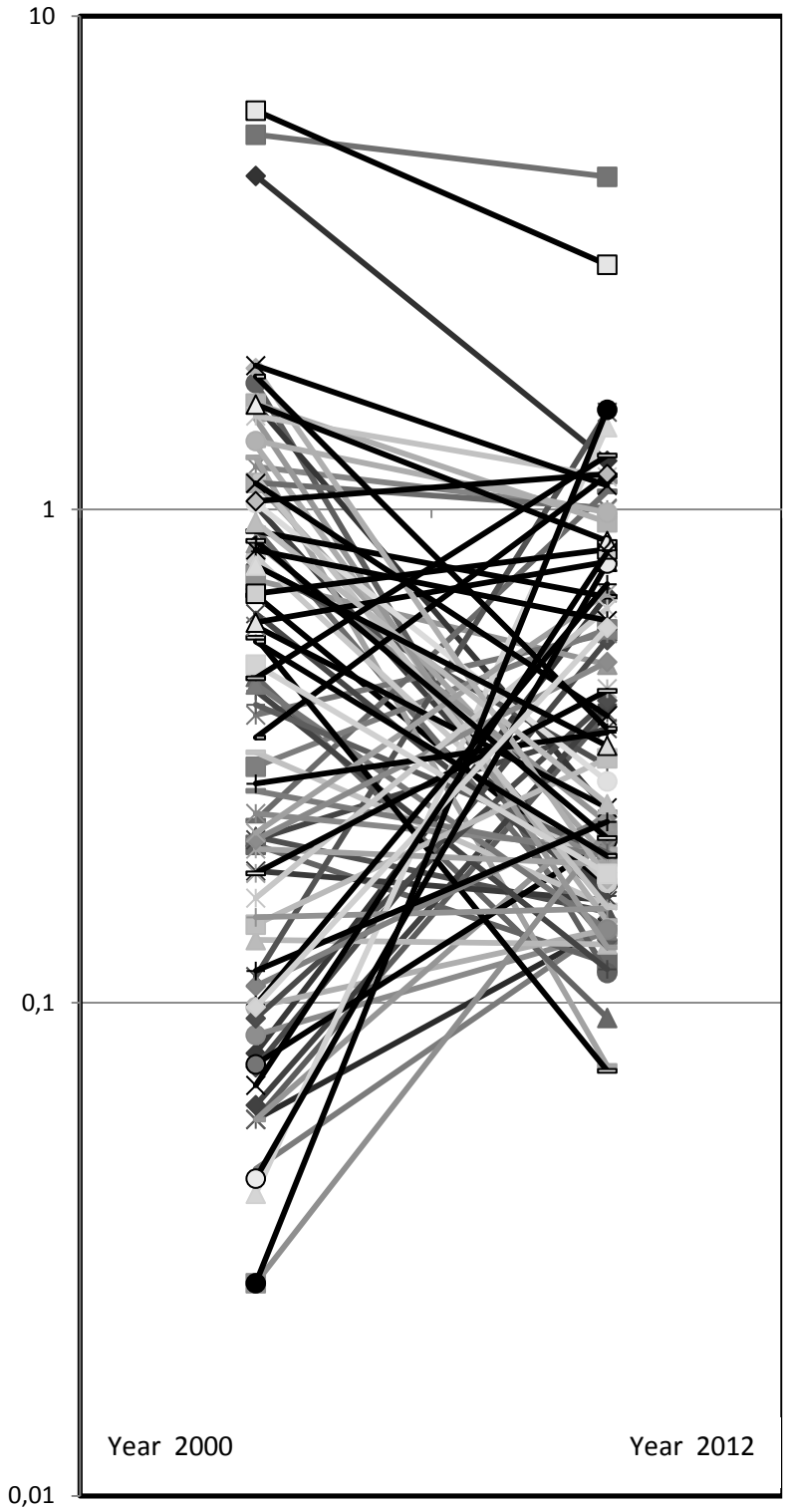

Table 1 (A-D): Median serum concentrations in pg/g lipid in year 2000 and 2012 and ratio of subjects with serum concentration decrease to increase and % of decreases for groups of DL-compounds.

A - Group of compounds	Compounds		Year 2000	Year 2012
PCDD	2,3,7,8-TCDD	Medians	0.442	0.302
		% change	50/37 (57%);p=0.024	
	1,2,3,7,8-PeCDD	Medians	0.935	1.088
		% change	45/42 (52%); p=0.862	
	1,2,3,4,7,8-HxCDD	Medians	1.740	0.943
		% change	61/26 (70%); p<0.001	
	1,2,3,6,7,8-HxCDD	Medians	6.121	4.645
		% change	69/18 (79%); p<0.001	
	1,2,3,7,8,9-HxCDD	Medians	1.592	0.729
		% change	66/21 (76%); p<0.001	
	1,2,3,4,6,7,8-HpCDD	Medians	12.999	6.306
		% change	69/18 (79%); p<0.001	
	1,2,3,4,5,6,7,8-OCDD	Medians	101.48	49.19
		% change	70/17 (80%); p<0.001	

B - Group of compounds	Compounds		Year 2000	Year 2012
NDL-PCB	PCB -105	Medians	11.829	10.309
		% change	44/36 (55%); p=0.169	
	PCB -114	Medians	3.715	3.842
		% change	49/33 (60%); p=0.232	
	PCB -118	Medians	68.444	59.798
		% change	49/35 (58%); p=0.168	
	PCB -123	Medians	1.240	0.666
		% change	47/32 (59%); p=0.611	
	PCB -156	Medians	38.740	49.095
		% change	50/35 (59%); p=0.089	
	PCB -157	Medians	4.503	1.686
		% change	44/13 (94%); p<0.001	
	PCB -167	Medians	19.169	14.909
		% change	50/35 (59%); p=0.126	
	PCB -189	Medians	8.693	11.708
		% change	51/33 (61%); p=0.190	

C - Group of compounds	Compounds		Year 2000	Year 2012
DL-PCB	PCB -81	Medians	8.117	2.95
		% change	53/20 (73%); p<0.001	
	PCB-126	Medians	135.268	62.094
		% change	75/12 (86%); p<0.001	
	PCB-169	Medians	104.940	71.113
		% change	66/21 (76%); p<0.001	

D - Group of compounds	Compounds		Year 2000	Year 2012
PCDF	2,3,7,8-TCDF	Medians	0.393	0.196
		% change	49/38 (56%); p=0.188	
	1,2,3,7,8-PeCDF	Medians	0.399	0.675
		% change	30/57 (34%); p=0.039	
	2,3,4,7,8- PeCDF	Medians	17.15	11.633
		% change	73/14 (84%); p<0.001	
	1,2,3,4,7,8-HxCDF	Medians	5.555	3.819
		% change	75/14 (86%); p<0.001	
	1,2,3,6,7,8,-HxCDF	Medians	5.061	3.571
		% change	67/20 (77%); p<0.001	
	1,2,3,7,8,9-HxCDF	Medians	0.530	0.389
		% change	58/29 (67%); p<0.001	
	2,3,4,6,7,8- HxCDF	Medians	0.923	0.495
		% change	39/48 (45%); p=0.933	
	1,2,3,4,6,7,8-HpCDF	Medians	2.695	1.690
		% change	65/22 (75%), p<0.001	
	1,2,3,4,7,8,9-HpCDF	Medians	0.112	0.342
		% change	16/71 (18%); p<0.001	
	OCDF	Medians	0.219	0.552
		% change	25/62 (29%); p=0.005	