Temporal trend of organochlorine compounds in human milk from the Irkutsk Region, Russia.

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Introduction

The first determinations of PCDDs/Fs, PCBs and organochlorine pesticides in human milk samples from the Irkutsk Region (Irkutsk, Kachug and Baikal'sk) were carried out in 1988-1989[1]. PCDD/F TEQ levels in the samples were found to be slightly lower than in West Germany and USA, while organochlorine pesticides levels were higher in samples from the Irkutsk Region than in western countries [1]. In 1997-1998 analyses of both PCBs and PCDDs/Fs in human tissue from inhabitants of Irkutsk and nearby industrial towns indicated that levels were comparable to those in western Europe, that they were highest in Usol'e-Sibirskoe (where a chemical plant with production of organochlorine compounds is located), and that PCBs made significant contributions to the dioxin-like toxicity equivalents [2,3].

The aim of the work presented here was to assess a potential temporal trend of the compounds measured in human milk for the last 15 years in the Irkutsk Region.

Material and Methods

Sample collection. In 1998-2003 35 human milk samples were collected in Irkutsk, Kachug and Baikal'sk of the Irkutsk Region. The locations of the studied areas are shown in Figure 1. Irkutsk is the biggest centre of the region with 588 000 inhabitants, but it has no major chemical industry. Baikal'sk is a chemical industrial town (pulp and paper mill) with 15 700 inhabitants. Baikal'sk located on the southern shore of Lake Baikal. Kachug is a small district center with 7,700 inhabitants. It is located on the shore of the Lena River.

Most of the milk samples were collected from primiparous (first child) mothers within two weeks – two months after delivery. In some cases the samples could not be collected until several months after delivery. All women had lived more than 5 years in these towns/village. All primipara mothers sampled until two months after delivery were exclusively breastfeeding. In cases of older children, additional food was included in the diet of the children. Each mother completed a questionnaire about anthropometric indices, lifestyle, possible occupational exposure to dioxin-like compounds, current and past places of residence, and food intake patterns. Milk samples (100-200 ml) were collected by manual expression using pre-washed hands into chemically clean glass bottles after the babies had been fed. The collected milk was frozen, transported to the laboratory in the Institute of Geochemistry in Irkutsk and stored at –18°C until analysis.

Sample analysis. Two pooled samples from Kachug and Irkutsk collected in 2001-2003 were analysed at the ERGO laboratory in Hamburg for PCDDs/Fs and dioxin-like and indicator PCBs. The pool samples from Kachug and Irkutsk consist of 15 and 10 individual samples, respectively. One milk sample from Irkutsk collected in 1997 was analysed at the Laboratory of the University of Bayreuthfor PCDD/Fs and dioxin-like PCBs. Indicator PCBs in other milk samples and organochlorine pesticides in all 34 individual samples were determinated at the laboratory of the Institute of Geochemistry in Irkutsk. Published methods were used by all laboratories [2,4,5]. The toxicity equivalents (TEQ) were calculated using the WHO TEFs from 1998. Data on PCDD/Fs obtained in the end of 1980s by Schecter et al.[1] were recalculated according to WHO TEFs from 1998 to be comparable with the new results.

Figure 1. Sites of human milk sampling in the Irkutsk Region.

Results and Discussion

The results are presented in Table 1 and Figure 2. The temporal trends of some organochlorine compounds in human milk are different in the investigated settlements of the Irkutsk Region. The organochlorine pesticides levels and the ratio of DDT to DDE decreased in milk from all towns. The present levels of *p.p'*-DDE, *p.p'*-DDT, a-HCH and g-HCH are 10-40, 6-9, 1-4, and 2-9 percent, respectively, of levels at the end of 1980s. Indicator PCBs levels decreased in milk from Irkutsk by 2.5-3 times for the investigated period of time. However, there was little decrease in PCB levels in Kachug and Baikal'sk. PCB180 levels even increased a little. PCDD and PCDF TEQ decreased by a factor of 3 in Irkutsk and 1.7 in Kachug.

No decrease of PCB levels was observed in Kachug and Baikal'sk. This may suggest that the PCB contamination of the Irkutsk region, and in particular of the fish which are responsible for most of the human exposure, did not decrease greatly during this period. This stands in contrast to observed decreases in environmental and human levels of PCB in other areas of the world including the Russian Arctic [6,7,8]. The decrease observed in women from Irkutsk may well reflect changes in the food supply during this period. It is probable that locally produced food, especially fish in the food supply in the Irkutsk, was replaced by other foods including fish that come from outside of the region and that are presumably less contaminated.

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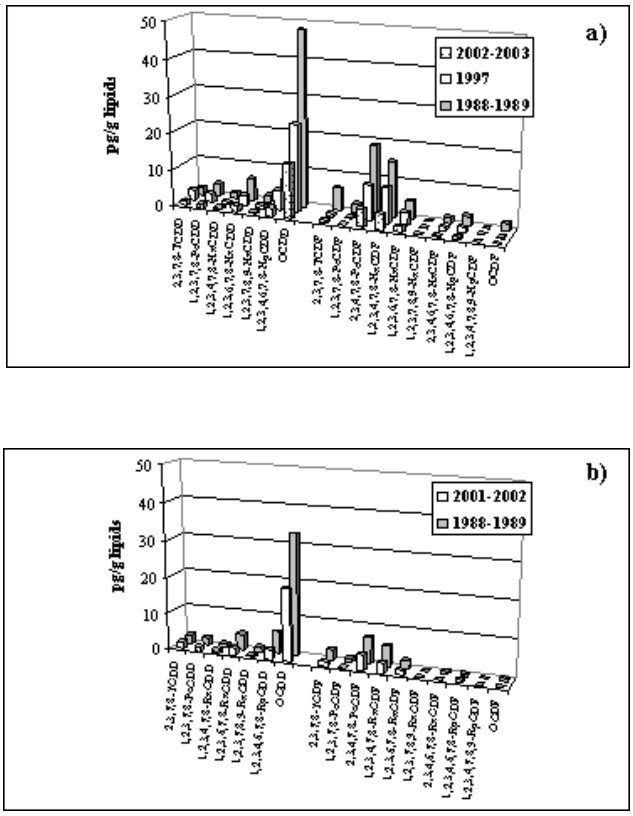

Figure 2. The PCDD/F congener pattern in human milk from Irkutsk (a) and Kachug (b) in 1988-1989, 1997, and 2003.

Table 1. Comparison of current levels of organochlorine compounds in human milk with data from the end of the 1980s [1]. (pgTEQ-WHO/g lipids for PCDD and PCDF and ng/g lipids for other compounds, n.d. – do data, * - PCB-101 coeluated together with PCB-90)

	Irkutsk			**Kachug**			**Baikal'sk**		
	1988-1989	**1998**	**2002-2003**	**1988-1989**	**1998**	**2001-2002**	**1988-1989**	**1998**	**2001-2002**
PCDD, pg WHO-TEQ/g lipids	6.5	5.7	2.5	5.4	n.d.	3.4	n.d.	n.d.	n.d.
PCDF, pg WHO-TEQ/g lipids	12.4	6.5	3.2	4.9	n.d.	2.8	n.d.	n.d.	n.d.
PCB28, ng/g lipids	20	n.d.	2.6	7.0	n.d.	2,0	15	n.d.	n.d.
PCB52, ng/g lipids	< 2.0	0.72	0.54	< 2.0	n.d.	0,35	< 2	1.8	n.d.
PCB101, ng/g lipids	< 2.0	1.5*	1.1	< 2.0	n.d.	1,1	< 2	4.3*	n.d.
PCB138, ng/g lipids	96	70	33	48	n.d.	34	85	71	n.d.
PCB153, ng/g lipids	83	66	32	50	n.d.	39	74	73	n.d.
PCB180, ng/g lipids	21	22	8.7	13	n.d.	14	23	34	n.d.
p,p'-DDE, ng/g	2290	424	252	1336	n.d.	496	980	447	n.d.

lipids									
p,p'-DDT, ng/g lipids	596	40	35	516	n.d.	45	281	22	n.d.
DDT/DDE	0.26	0.09	0.13	0.39		0.09	0.29	0.05	
a-HCH, ng/g lipids	245	6.9	1.6	192	n.d.	5.1	77	3.1	n.d.
g-HCH, ng/g lipids	14	0.6	0.3	14	n.d.	0.6	5	0.44	n.d.