PERSISTENT ORGANIC POLLUTANTS LEVELS IN HUMAN MILK AND FOOD

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The main reason for analysing toxic compounds from surroundings (including food) is the will to determine how dangerous they are to people and the living environment

Concentrations of Persistent Organic Pollutants (POPs) in humans are not as well researched as far as number of other organism. Breast milk is interesting for two reasons. Results can be used to describe the mother`s exposure, and to assess the risk to the infant as a consumer.

The POPs content of mother`s milk, collected from mothers in the Tallinn region, has been studied by Roots (1986, 1996) in 1984. A comparison of the results of this study with those obtained in Estonia between 1971 – 1974 has indicated that DDT concentrations in breast milk are 5 – 20 times lower than those between 1971 – 1974 (Table 1)

Table 1. Concentrations of persistent organic pollutants in Estonian human milk (*Uibo,et al., 1975; **Roots, 1986,1996)

Year	mg/kg wet weight				DDEx100 / sDDT %
	DDT	DDE	sDDT	PCB	
1971*	0,026	0.099	0,125		79
	0.004-0,050	0,021-0,230			
1974*	0,021	0,063	0,084		75
	0,002-0,080	0,008-0,180			
1984**			0,006	0,012	95
			0,003-0,011	0,006-0,017	

During the years 1974 – 1984, decomposition of DDT into its main metabolite DDE was increased in the breast milk from 79% to 95%.

The mean concentrations of total DDT and polychlorinated biphenyls (PCB) in human milk in Estonia in 1984 were relatively low compared with those in other countries .

It was found that an average daily intake of total DDT and PCB by children in the Estonia didn`t exceed the ADI (acceptable daily intake) value of 0,005 mg/kg proposed by the WHO for DDT and for PCB concentration 0,07 mg/kg, which caused " Yusho " disease in Japan in 1968 and in Taivan in 1979.

The dietary intake of DDT in 1969 was 36 mikrogr/day (Lutsoja, et. al.,1969). Six years after the total ban of DDT in Estonia in 1968, the content of its metabolite DDE in human milk rose up to 75 – 79%. The amounts of DDT and DDE consumed by newborn children on the first week after birth were 5,6 mikrogram of DDT and 15,9 mikrogram of DDE per day. During the period of II – IV weeks after birth, the amounts were respectively 11,2 mikrogram of DDT and 35,4 mikrogram of DDE per day (Uibo, et. al., 1975).

In the early eighties those were 0,5 – 1,5 mikrogr/day (DDT) and 1,1 – 3,0 mikrogr/day (PCB) respectively.

PCDDs and PCDFs have been found in human milk samples in all over the world (Holoubek, et al., 2001). It has been suggested that one of the largest sources of PCDDs and PCDFs in the environment is waste incineration. Other sources are : automobiles, copper smelters, scrap reclamation in the iron and steel industry.

Analysis of fish and dairy products indicates that the major exposure is via food (Mussalo, Lindström, 1995; Roots, 1986; 1996, 1999).

The dioxin concentrations in spring 2002 , expressed as the TEQ value, in 6 pools of herring muscle along the Estonian coast vary between 0.6 and 1.9 pgTEQ/g wet weight and in 2 pools of herring muscle out of Estonian coast (in the Eastern part of the Baltic Proper) vary between 0.9 and 2.6 pgTEQ/g wet weight (Otsa,E., Roots, O. & Simm. M.2002). PCDD/PCDF analysis made in the National Research Centre for Environment and Health, Institute of Ecological Chemistry in Germany (Accreditation Certificate No. DAC-P-0141-01-00).

In the studies (Weiss, et al., 2001) authors explosed the use of butter as a sampling matrix to reflect the regional and global scale distribution of chlororganic compounds in food. One butter sample cannot be said to be representative for butter concentrations from the country.

Four butter samples from Estonia were collected, during the period November, 2001. All samples were kept in freezer at –20 C, until investigated. The samples consisted of 200 gram and the butter was bought in ordinary stores (table 2).

Concentrations in butter reflected differences in the propensity of PCB congeners to undergo long range atmospheric transport from global source regions to Estonian West-Estonian Archipelago Biophere Reserve (Agrell, et al., 2001).

Table 2. Polychlorinated biphenyls and chlororganic pesticides (ng/g l.w.) concentrations in Estonian butter.

Compounds	Regions and number of samples			
	Western part of Estonia		Northern part of Estonia	
	1	2	1	2
	Chlororganic pesticides			
alpha-HCH	0.9	1.2	1.1	0.8
gamma-HCH	0.9	2.3	0.8	1.6
HCB	5.2	5.0	4.7	3.7
p,p`DDE	3.4	3.2	3.4	2.5
p,p`DDD	0.4	0.2	0.2	0.8
p,p`DDT	4.3	2.6	1.7	1.7
sumDDT	8.5	6.4	5.7	5.4
	Polychlorinated biphenyls			
IUPAC 28	2.56	2.33	2.11	0.71
IUPAC 52	0.64	0.67	0.48	0.29
IUPAC 101	0.99	0.63	0.97	0.37
IUPAC 118	1.32	1.10	0.79	0.42
IUPAC 138	0.21	1.37	0.52	0.19
IUPAC 153	2.20	1.64	0.42	2.90
IUPAC 180	0.85	0.67	0.20	0.27
SumPCB-7 isomers	8.77	8.41	5.49	5.15

The sources of PCDDs and PCDFs vary in different countries (Holoubek, et al.,2000). For example, in Estonia there are power plants which use oil shale as a fuel (Inventory..,2002). It is mained in Northeastern Estonia. Industry in Narva and Kohtla - Järve as well as oil shale mines in the vicinity generates a lot of waste. In Finland, three municipal waste incineration centres have been in operation, but presently only one of them is in use. There are about twenty municipal waste incineration centres in use in Sweden, and in Norway municipal waste incineration centres are located in three places Estonia has no such centres (Mussalo, Lindström, 1995).

The data given in Table 3 indicate that the levels of PCDDs and PCDFs in human milk are similar in Estonia, Finland, Sweden and Norway. Results also show that the same isomers are found in the same proportions. Similarly, the average concentrations of PCBs in human milk in these countries have been reported to be at the same level .

Table 3. Levels of International Toxic Equivivalents (TEQ) in human milk in 1986 –1991 (pg/g on a fat weight basis) (Mussalo-Lindström, 1995)

	Country			
Compound	Estonia	Finland	Sweden	Norway
	1991	1986-87	1987	1987
I – TEQ	13,5 – 21,4	16,0 – 17,9	20,8 – 23,8	14,9 – 20,4

Exposure of the average population in the East Baltic region (Estonia, Latvia, Lithuania and St. Petersburg region of Russia) and current pesticide use is very low to chlorinated compounds seems lower than in most of western Europe,The low exposure of the general population is indicated by low concentrations of polychlorinated dibenzo-p-dioxins, dibenzofurans and biphenyls in milk fat (Table 4). Thus the overall risk caused by pesticide residues and persistent organic compounds in the Baltic countries and northwestern Russia is low, but local sites of concern exist (Tuomisto and Hagmar, 1999).

Table 4.Polychlorinated dibenzo-p-dioxins/dibenzofurans (PCDD/F) and the marker polychlorinated biphenyl (PCB) (sum of IUPAC 28, 52, 101, 138, 153 and 180) concentrations in human milk in 1993 (WHO, 1996; Tuomisto and Hagmar, 1999)

Country	PCDD/F (pg TEQ/g fat)		Marker PCB (ng/g fat)	
	Urban area	Rural area	Urban area	Rural area
Austria	10,7	10,9	381	303
Belgium	26,6	20,8	261	276
Canada	13,4	10,8	137	86
Croatia	13,5	8,4	220	218
Czech Republic	18,4	12,1	1069	532
Denmark	15,2	-	209	-
Finland	21,5	12,0	189	134
Germany	16,5	-	375	-
Hungary	8,5	7,8	61	45
Lithuania	13,3	14,4	322	287

The Netherlands	22,4	-	253	-
Norway	10,1	9,3	273	265
Pakistan	3,9	-	19	-
Russia	15,2	5,9	197	102
Slovakia	15,1	12,6	1015	489
Spain	25,5	19,4	452	461
Ukraine	13,3	-	191	-
United Kingdom	17,9	15,2	130	131
St. Petersburg Region of Russia*	16,4	-	190	-
Estonia*	14,4	12,4	103	136

- Unpublished data analyzed simultaneously with WHO study (courtesy of Professor Terttu Vartiainen)

Estonia: Tallinn (Urban area) and Rakvere (Rural area).

Conclusion

Exposure of the average population in the East Baltic region (Estonia, Latvia and Lithuania) and current pesticide use is very low to chlorinated compounds seems lower than in most of western Europe. But local sites of concern exist (Agrell, et al., 2001).

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