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## **The Concentrations and TEQ Levels of PCDFs and PCDDs in The Breast Milk of Korean**

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### Introduction

In the last years concern about possible adverse health effects in breast-fed infants arose because of relatively high polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDDs/PCDFs) concentrations in mother's milk<sup>1)</sup>. However, in Korea, partitioning between mother's blood, milk, adipos tissues and placenta dioxin levels as well as tissue levels in the fetus and new born has not been fully characterized. This paper reports dioxin levels in 20 first breast milks and 66 breast milks of Korean mothers.

### Materials and Methods

**Sample:** The samples measured in this study have been collected and treated by medical doctor at hospital in Seoul National University. After collection, the first breast milk samples were frozen and kept at  $-20^{\circ}\text{C}$  until analysis.

**Analytical Method:** The milk samples 10 ml were transferred to separatering funnel and spiked with fifteen carbon-13 labeled isotope compounds (Cambridge Isotope Laboratories, Woburn, MA, USA). In this funnel Sodium Oxalate 1 g, formic acid 10 ml, NaCl 2 g and ethanol 25 ml are added and shaken for 20 min. 50 ml n-hexane, as extracting solvent, was added and shaken for 30min. The extraction was done 3 times. Extracts were concentrated to about 10 ml and passed through the activated florisil column and sep-pak cartridge for solid phase extraction (Waters, Milford, MA), with more two times of n-hexane 10 ml. Eluent concentrated to about 20ml by nitrogen stream and washed with conc. sulfuric acid, 5% NaCl and 20% KOH. Washed extracts passed through anhydrous  $\text{Na}_2\text{SO}_4$  and concentrated to 10 ml for solid phase clean-up; silica, alumina and carbon column by USEPA 1613 method. Eluent to be spiked recovery standards 20  $\mu\text{l}$  was concentrated to 20  $\mu\text{l}$ . 2  $\mu\text{l}$  was injected to HRGC/HRMS.

**GC/MS analysis;** Determination were performed with HP 5890 series II gas chromatograph and Finnigan MAT 95S mass spectrometer at resolution 10,000 using Ultra 2 capillary column (Hewlett Pacard).

## Results and Discussions

The mean concentrations of PCDFs in the first breast milks were determined 0~4.696 pg/g and the mean TEQ levels were 0~0.059 pgTEQ/g (Table 1). Total concentrations and TEQ levels of PCDFs were showed 7.019 pg/g and 0.177 pgTEQ/g, respectively. The mean concentrations of PCDDs in the first breast milks were determined 0~8.389 pg/g and the mean TEQ levels were 0~0.330 pgTEQ/g (Table 2). Total concentrations and TEQ levels of PCDFs were showed 14.224 pg/g and 0.693 pgTEQ/g, respectively. Figure 1 show the TEQ levels of PCDFs/PCDDs in the first breast milks of Korean by bar graph. Figure 2 show the distribution of TEQ levels of PCDFs/PCDDs in the first breast milks by spot graph. 2,3,7,8-TCDD did not detect in Seoul and Chunbuk area. In Seoul, the total TEQ level was 12.349 pg TEQ/g lipid and range was 0.033~5.785 pgTEQ/g lipid. In Chunbuk, the total TEQ level was 8.194 pg TEQ/g lipid and range was 0.008~2.394 pgTEQ/g lipid (Table 3). Figure 3 is the bar graph of the variation of total pgTEQ/g lipid, duration, primipara, mutipara and area.

## References

1. Neubert, D., *Xenobiotica*, 18 (1988) 45-58.

Table 1. The Concentrations and TEQ Values of PCDFs in Breast Milk

Compound	concentration (pg/ml)			pgTEQ/ml		
	mean	SD	min-max	mean	SD	min-max
2,3,7,8-TCDF	0.383	0.393	0.000-1.211	0.038	0.039	0.000-0.121
1,2,3,7,8-PeCDF	0.886	1.301	0.000-4.616	0.044	0.065	0.000-0.231
2,3,4,7,8-PeCDF	0.020	0.051	0.000-0.158	0.010	0.025	0.000-0.079
1,2,3,4,7,8-HxCDF	0.093	0.334	0.000-1.204	0.009	0.033	0.000-0.120
1,2,3,6,7,8-HxCDF	0.589	0.897	0.000-2.513	0.059	0.090	0.000-0.251
1,2,3,7,8,9-HxCDF	0.046	0.115	0.000-0.343	0.005	0.011	0.000-0.034
2,3,4,6,7,8-HxCDF	0.040	0.144	0.000-0.518	0.004	0.014	0.000-0.052
1,2,3,4,6,7,8-HpCDF	0.266	0.959	0.000-3.459	0.003	0.010	0.000-0.035
1,2,3,4,7,8,9-HpCDF	0.000	0.000	0.000-0.000	0.000	0.000	0.000-0.000
OCDF	4.696	8.930	0.000-28.736	0.005	0.009	0.000-0.029
Total PCDFs	7.019	13.124		0.177	0.296	

Table 2. The Concentrations and TEQ Values of PCDDs in Breast Milk

Compound	concentration (pg/ml)			pgTEQ/ml		
	mean	SD	min-max	mean	SD	min-max
2,3,7,8-TCDD	0.231	0.395	0.000-1.379	0.231	0.395	0.000-1.379
1,2,3,7,8-PeCDD	0.660	1.008	0.000-3.500	0.330	0.504	0.000-1.750
1,2,3,4,7,8-HxCDD	0.000	0.000	0.000-0.000	0.000	0.000	0.000-0.000
1,2,3,6,7,8-HxCDD	0.824	0.916	0.000-3.191	0.082	0.092	0.000-0.319
1,2,3,7,8,9-HxCDD	0.005	0.020	0.000-0.071	0.001	0.002	0.000-0.007
1,2,3,4,6,7,8-HpCDD	4.115	8.323	0.000-29.322	0.041	0.083	0.000-0.293
OCDD	8.389	8.994	0.000-27.557	0.008	0.009	0.000-0.028
Total PCDDs	14.224	19.656		0.693	1.085	

Figure 1. The Total TEQ Values of PCDFs and PCDDs in Breast Milk

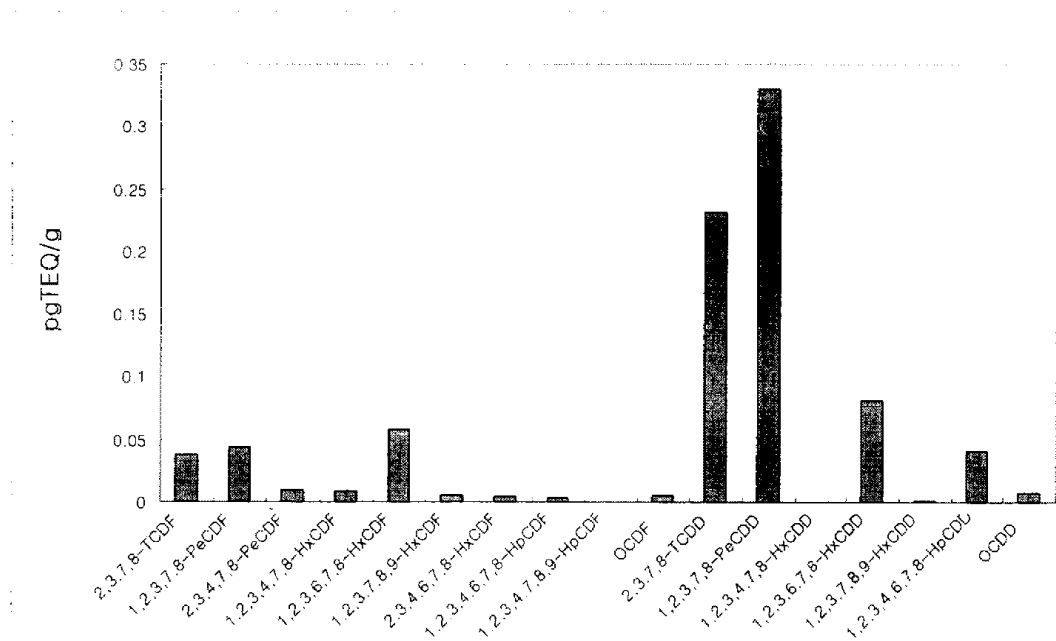


Figure 2. The Distribution of TEQ Values of PCDFs and PCDDs in Breast Milk

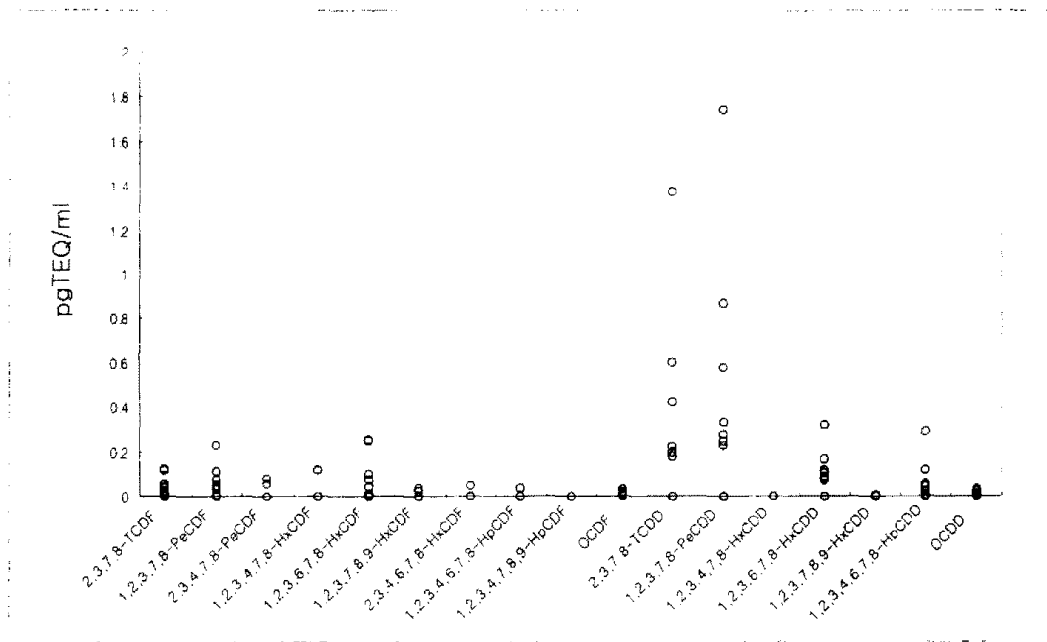


Table 3. Dioxin Concentrations of Human Milk Sampled on the 5th day after delivery in Korean Women

Unit : pgTEQ/g lipid

PCDDs/PCDFs		Seoul	Chunbuk	Total
Number of donors	I-TEF	31	35	66
2,3,7,8-TCDF	0.1	0.604	0.165	0.371
2,3,7,8-TCDD	1	ND	ND	ND
1,2,3,7,8-PeCDF	0.05	0.154	0.038	0.092
2,3,4,7,8-PeCDF	0.5	0.65	2.994	1.893
1,2,3,7,8-PeCDD	0.5	5.785	0.883	3.185
1,2,3,4,7,8-HxCDF	0.1	0.569	0.45	0.506
1,2,3,6,7,8-HxCDF	0.1	0.624	0.365	0.487
1,2,3,7,8,9-HxCDF	0.1	0.314	0.451	0.387
2,3,4,6,7,8-HxCDF	0.1	0.272	0.014	0.135
1,2,3,4,7,8-HxCDD	0.1	0.064	0.219	0.146
1,2,3,6,7,8-HxCDD	0.1	1.186	1.36	1.278
1,2,3,7,8,9-HxCDD	0.1	0.123	0.203	0.165
1,2,3,4,6,7,8-HpCDF	0.01	1.082	0.141	0.583
1,2,3,4,7,8,9-HpCDF	0.01	0.174	0.035	0.1
1,2,3,4,6,7,8-HpCDD	0.01	0.56	0.601	0.582
OCDF	0.001	0.033	0.008	0.02
OCDD	0.001	0.191	0.183	0.187
Total		12.349	8.194	10.146

ND means not detected

TR means trace which too small to quantitate

Figure 1. The Total TEQ Values of PCDFs and PCDDs in Breast Milk

