

# HUMAN EXPOSURE II -POSTER

## PCDDs, PCDFs AND Co-PCBs IN HUMAN MILK IN OSAKA CITY, JAPAN

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### Introduction

Polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) and coplanar polychlorinated biphenyls (Co-PCBs), known as "dioxins", are highly fat-soluble and persistent compounds that accumulate especially in tissue lipid. Several congeners of these compounds are highly toxic to human beings, and have caused anxiety about their influence on the human health from exposure to dioxins. In particular, since the concern about the effects of these compounds on the health of breast-fed infants has been risen worldwide, human milk monitoring programmes have been conducted in a number of countries. In Japan, Nakamura *et al* reported observations about the concentrations of dioxins in human milk in some prefectures of Japan in 1998. In order to obtain further information on dioxins in the urban area, we carried out a survey of concentrations of dioxins in human milk in Osaka City and examined the relationships between the TEQ levels of dioxins and the mother's age, the fat content in human milk and duration of residence.

### Materials and Methods

#### Sample

The survey was conducted between June 1999 and January 2000 in all 24 wards of Osaka City. Forty eight human milk samples (about 100ml) were collected from the mothers who were primiparous and were at the 30th day after delivery, living in Osaka City for at least the last 10 years. All the mothers were divided into two groups as follows : one group ranged from 25 to 29 years old, and the other group ranged from 30 to 34 years old, and mothers of each group were selected from all the wards. All samples were frozen and were kept at -20°C until analysis.

#### Analytical Methods

Analytical methods approximately followed, "THE TENTATIVE GUIDELINE OF ANALYTICAL PROCEDURE FOR PCDDs, PCDFs AND Co-PCBs IN FOODS" established by The Ministry of Health and Welfare, in Japanese. The Dioxins analysed were 17 PCDD and PCDF congeners and 12 Co-PCB congeners, setting TEF. Quantification limits were 0.02 pg/g fat for Te-PeCDDs/DFs, 0.05 pg/g fat for Hx-HpCDDs/DFs, 0.1 pg/g fat for OCDD/DF, 0.1 pg/g fat for *non-ortho* Co-PCBs, and 1.0 pg/g fat for *mono-ortho* Co-PCBs.

### Results and Discussion

#### 1. The TEQ levels of dioxins and their distribution

Table 1 shows the I-TEQ levels and the WHO-TEQ levels of the dioxins and Fig.1 shows their

distribution. The arithmetic means of PCDDs+PCDFs, Co-PCBs and PCDDs+PCDFs+Co-PCBs

Table 1. Concentrations of dioxins in human milk in Osaka City (pg TEQ/g fat)

	Arithmetic mean	Standard deviation	Geometric mean	Median	Maximum
PCDDs + PCDFs <sup>a)</sup>	13.9	3.4	13.5	13.1	22.0
Co-PCBs <sup>b)</sup> (12congeners )	9.9	3.6	9.3	9.2	21.3
PCDDs+PCDFs+Co-PCBs	23.7	6.4	23.0	22.7	43.4
PCDDs + PCDFs <sup>b)</sup>	16.5	4.0	16.0	15.3	26.3
Co-PCBs <sup>b)</sup> (12congeners )	9.9	3.6	9.3	9.2	21.3
PCDDs+PCDFs+Co-PCBs	26.3	7.0	25.5	25.3	47.6

a) I-TEQ were calculated using the toxic equivalence factors (TEFs) recommended

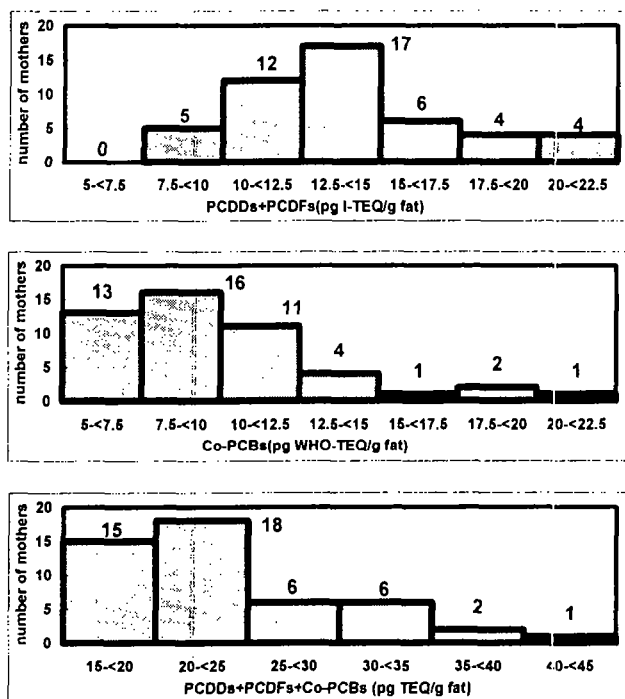


Fig.1. Distribution of dioxins in 48 mothers' human milk in Osaka City

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in human milk in Osaka City was 13.9 pg I-TEQ/g fat, 9.9 pg WHO-TEQ/g fat and 23.7 pg TEQ/g fat. The modes of dioxins were 12.5 – 15.0 pg I-TEQ/g fat for PCDDs+PCDFs, 7.5 – 10.0 pg WHO-TEQ/g fat for Co-PCBs and 20.0 - 25.0pg-I-TEQ/g fat for PCDDs+PCDFs+Co-PCBs.

Nakamura *et al* reported that the arithmetic mean of the dioxins in human milk observed in Japan in 1998 was 12.3 pg I-TEQ/g fat for PCDDs+PCDFs, 10.1 pg WHO-TEQ/g fat for Co-PCBs and 22.4pg-I-TEQ/g fat for PCDDs+PCDFs+Co-PCBs <sup>1)</sup>. This shows that our results were at an average level for the concentrations of the dioxins in human milk in Japan.

The current average TEQ levels of PCDDs+PCDFs which were reported in the advanced nations, were 16.5pg I-TEQ/g fat in France, 12.9 I-TEQ/g fat in Germany , 12pg WHO-TEQ/g fat in Norway, 20pg WHO-TEQ/g fat in Sweden, 22pg WHO-TEQ/g fat in Finland and 35pg WHO-TEQ/g fat in Netherlands <sup>2)-4)</sup>. Our results for the TEQ levels of PCDDs+PCDFs were as high as, or a little lower than those reported from other advanced nations.

### 2. Relationships between the TEQ levels of the dioxins, and duration of residence, the fat content in maternal milk and the mother's age.

The arithmetic mean of duration of residence, the fat content in human milk, and the mother's age, was 25 years (range: 10 – 34 years), 4.1%(range: 2.2 – 7.9%) and 29 years old, respectively. Table 2 shows the correlation coefficients between the TEQ levels of the dioxins and duration of residence, the fat content in human milk and the mother's age. There was no correlation between the TEQ levels of dioxins and the duration of residence or the fat content in human milk.

On the correlation between the mother's age and the TEQ levels of dioxins, the TEQ levels of only Co-PCBs correlated positively with the mother's age and the liner regression coefficient was 0.324 (  $p < 0.05$ ). As the TEQ levels of Co-PCBs increased with an increase of the mother's age, we attempted to examine the correlation between the mother's age and the concentrations of individual Co-PCB congeners. The Co-PCB congeners which correlated positively with the mother's age, were PCB # 156, 157, 114, 189, 167, 169, and 118 (Table 3) . However, the sum of TEQ levels of correlated Co-PCBs congeners contributed only about 38 % of the total TEQ levels of Co-PCBs (Table 3) . Therefore, it is thought that these two factors contributed to the weak correlation between the mother's age and the TEQ levels of Co-PCBs.

Table 2. Relationships between the TEQ <sup>a)</sup> levels and some factors (correlation coefficients)

	Mother's age	Residence years	Fat content in human milk
PCDDs + PCDFs	0.130	0.050	-0.089
Co-PCBs	0.324*	-0.062	-0.002
PCDDs + PCDFs + Co-PCBs	0.248	0.064	-0.048

\* $p < 0.05$

a) TEQ were used I-TEQ for PCDDs/DFs and WHO-TEQ for Co-PCBs.

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Table 3 Correlation coefficients between mother's age and the concentrations of individual Co-PCB congeners and the relative contribution of individual Co-PCBs congeners to the total Co-PCBs-TEQ in human milk

Co-PCBs	correlation coefficients (n=48)	$\frac{\text{Co-PCB-TEQ}}{\text{Total Co-PCBs-TEQ}} \times 100$ (%)
<i>non-ortho-Co-PCBs</i>		
33'44'-TeCB (#77)	0.112	0.0091
344'5-TeCB (#81)	0.237	0.0024
33'44'5-PeCB (#126)	0.165	60
33'44'55'-HxCB (#169)	0.403 <sup>**</sup>	3.5
<i>mono-ortho-Co-PCBs</i>		
233'44'-PeCB (#105)	0.259	2.0
2344'5-PeCB (#114)	0.578 <sup>****</sup>	3.0
23'44'5-PeCB (#118)	0.288 <sup>†</sup>	9.4
2'344'5-PeCB (#123)	0.170	0.17
233'44'5-HxCB (#156)	0.602 <sup>****</sup>	18
233'44'5'-HxCB (#157)	0.588 <sup>****</sup>	3.7
23'44'55'-HxCB (#167)	0.440 <sup>***</sup>	0.10
233'44'55'-HepCB (#189)	0.575 <sup>****</sup>	0.25

p<0.05, †p<0.01, \*\*p<0.002, \*\*\*\*p<0.001

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