

Comparison of concentrations of PCDDs, PCDFs, PCBs and other Organohalogen Compounds in Human milk of Primiparas and Multiparas

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Introduction

PCDDs, PCDFs and Co-PCBs accumulate in the human body because of their highly lipophilic properties. Many workers reported that the concentrations of PCDDs, PCDFs and Co-PCBs in human breast milk because of their potential health damage to the nursing baby¹⁾⁵⁾. Previously, we examined the concentrations of PCDDs/DFs in breast milk of Yusho patients in comparison with the normal control values²⁾. Here we present data on the concentrations of PCDDs/DFs and Co-PCBs as well as other organohalogen compounds (OHC) in human breast milk. we examined the variations of PCDDs/DFs and other organohalogen compounds levels in breast milk obtained from two different groups of primiparas and multiparas.

Methods

Human breast milk samples (7 samples of primiparas and 8 samples of multiparas) were collected in Fukuoka, Japan, between August, 1994 and September, 1994.

The ages ranged from 22 -40 years old and the average age was 30 years. Before the sample treatment, ten kinds of ¹³C-label PCDDs/DFs and three kinds of ¹³C-labeled coplanar PCBs were added as internal standards for checking recoveries of PCDDs/DFs and Co-PCBs throughout the analytical procedure. Details of sample treatment such as extraction, and purification method used in this study, have been reported elsewhere³⁾.

The PCDDs/DFs and Co-PCBs were analyzed by the HRGC/HRMS technique using a Finnigan MAT-95 mass spectrometer (Finnigan MAT-95, Germany) directly interfaced with a Varian Model 3400 gas chromatograph . All target compounds were measured with an SP-2331 capillary column (0.32mmX60m; film thickness, 0.25mm). The mass resolution (5 % valley) was 7000 to 8000. Other organohalogen compounds (PCBs and pesticides) were analyzed by ECD gas chromatography.

Results and discussion

Table 1 summarizes the mean concentrations of PCDDs/DFs and Co-PCBs obtained from primiparas and multiparas and Table 2 summarizes the analytical data of other organohalogen compounds in the same samples. The 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (2,3,7,8-TCDD) toxic equivalent (TEQ) values of PCDDs and PCDFs were calculated using I-TEF and those of the Co-PCBs were calculated using the data reported by WHO⁴). The mean total concentrations of PCDDs/DFs and Co-PCBs as 2,3,7,8-TCDD TEQ values in the breast milk obtained from primiparas and multiparas were 34.6 and 30.7 pg/g fat, respectively. The levels of each congener were similar to those previously reported from other industrial countries⁵). The levels of 2,3,7,8-TCDD, 1,2,3,7,8-PeCDD, 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 2,3,4,7,8-PeCDF and 1,2,3,6,7,8-HxCDF in breast milk of the primiparas were 1.3 to 1.8 times higher than those of the multiparas, the difference being significant.

The concentrations of dioxin-like chemicals in the breast milk of primiparas are generally greater than those of multiparas and our present results also seem to support this idea. Fig. 2 shows the analytical results for PCBs and organohalogen pesticides. Contrary to our expectation, concentrations of PCBs, *p,p'*-DDT, *p,p'*-DDD and dieldrin in the breast milk of primiparas were similar to or less than those of multiparas. However, concentrations of other pesticides such as HCB, β -HCH and heptachlor-epoxide were markedly higher in primiparas than in multiparas.

Conclusions

The levels of PCDDs, PCDFs, coplanar PCBs, PCBs and other organohalogen compounds have been measured in human breast milk. The mean concentrations of PCDDs, PCDFs and coplanar PCBs in human breast milk was 9.0, 6.2 and 15.6 pg Toxic Equivalents (TEQs)/g on a fat basis, respectively.

Significant differences between the breast milk obtained from primiparas and multiparas were observed in the concentration of some isomers of PCDDs/DFs. The present findings suggest that the concentrations of dioxin-like chemicals are higher in the breast milk of primipara than in that of multipara.

References

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Table 1 Concentration of PCDDs, PCDFs and Co-PCBs in human milk on a fat basis (pg/g)

Congener	Total(n=15)		Primipara(n=7)		Multipara(n=8)		Ratio
	Mean	SD	Mean	SD	Mean	SD	Pri/Multi
2,3,7,8-TCDD	1.6	0.6	2.0	0.4	1.2	0.3	1.7 ***
1,2,3,7,8-PeCDD	6.8	2.9	8.9	1.7	5.0	2.6	1.8 **
1,2,3,4,7,8-HxCDD	3.6	3.1	4.7	4.3	2.6	1.1	1.8
1,2,3,6,7,8-HxCDD	25.2	9.8	32.3	8.1	18.9	6.4	1.7 **
1,2,3,7,8,9-HxCDD	5.1	2.6	6.9	2.7	3.6	1.2	1.9 **
1,2,3,4,6,7,8-HpCDD	30.6	15.0	29.8	15.4	31.3	15.6	0.9
OCDD	185.1	104.9	174.2	137.0	194.6	75.5	0.9
2,3,7,8-TCDF	2.1	0.6	2.3	0.8	2.0	0.5	1.1
1,2,3,7,8-PeCDF	0.6	0.5	0.6	0.5	0.6	0.5	1.1
2,3,4,7,8-PeCDF	9.5	3.0	11.4	1.3	7.8	3.0	1.5 *
1,2,3,4,7,8-HxCDF	3.7	1.1	4.3	0.5	3.3	1.2	1.3
1,2,3,6,7,8-HxCDF	3.9	1.1	4.5	0.5	3.2	1.3	1.4 *
1,2,3,7,8,9-HxCDF	1.7	0.6	1.9	0.8	1.6	0.4	1.2
2,3,4,6,7,8-HxCDF	1.7	1.0	2.0	1.3	1.5	0.7	1.3
1,2,3,4,6,7,8-HpCDF	2.0	0.5	2.0	0.7	2.1	0.5	1.0
1,2,3,4,7,8,9-HpCDF	0.5	0.7	0.2	0.2	0.7	0.9	0.3
OCDF	2.8	1.2	2.7	1.3	3.0	1.3	0.9
3,3',4,4'-TeCB	12.2	6.9	10.4	6.4	13.7	7.3	0.8
3,3',4,4',5-PeCB	151.3	78.9	134.5	70.7	165.9	87.4	0.8
3,3',4,4',5,5'-HxCB	54.7	27.0	60.0	33.4	50.1	21.1	1.2
Total PCDD	257.9	109.9	258.7	144.7	257.2	78.9	1.0
Total PCDF	24.0	5.6	27.0	4.2	21.5	5.7	1.3 *
Total PCDD/PCDF	281.9	112.3	285.7	145.8	278.7	83.5	1.0
Total Coplanar PCB	218.2	97.9	204.9	94.3	229.8	105.9	0.9
TEQ(International)	30.8	9.2	32.6	9.6	28.9	8.9	1.1
Fat(%)	4.0	1.5	4.6	1.8	3.5	0.9	1.3
Age	29.9	4.6	27.4	3.8	32.1	4.2	0.9

***:p<0.01 **:p<0.1 *:p<0.5

Table 2 Concentration of PCBs and other organohalogen compounds in human milk on a fat basis (ng/g)

Congener	Total(n=15)		Primipara(n=7)		Multipara(n=8)		Ratio
	Mean	SD	Mean	SD	Mean	SD	Pri/Multi
PCB(ppb)	300.6	110.5	299.4	51.2	301.7	148.8	1.0
HCB	30.2	10.0	35.1	7.1	25.9	10.5	1.4
β-HCH	1309.9	917.0	1656.1	887.3	1007.0	884.5	1.6
p,p'-DDT	87.1	42.7	88.7	23.9	85.8	56.1	1.0
p,p'-DDE	851.1	393.9	949.9	213.0	764.6	503.1	1.2
p,p'-DDD	4.9	7.4	3.0	3.9	6.5	9.4	0.5
o,p'-DDT	6.8	12.3	8.3	16.5	5.5	7.9	1.5
Heptachlor-Epoxyde	8.7	10.1	11.7	11.5	6.0	8.6	2.0
Dieldrin	19.6	6.6	20.6	6.7	18.8	6.8	1.1

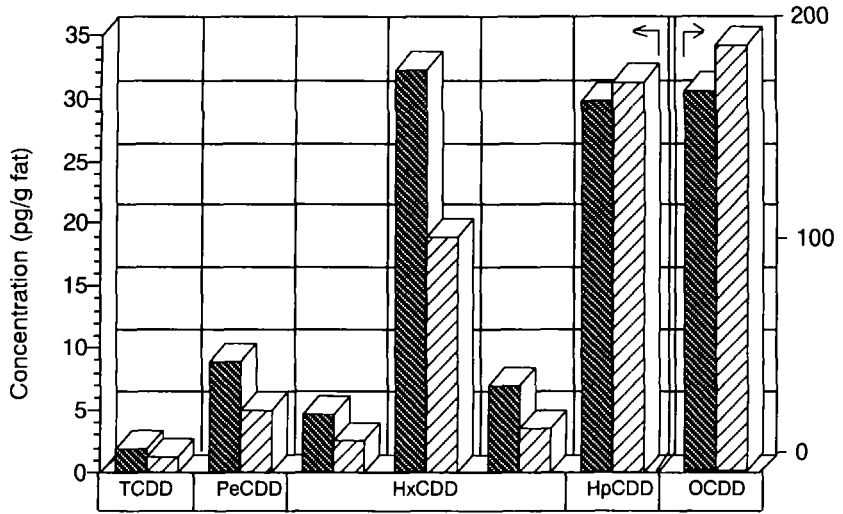


Fig.1 Congener pattern of PCDDs in breast milk

■ Primiparas ▨ Multiparas

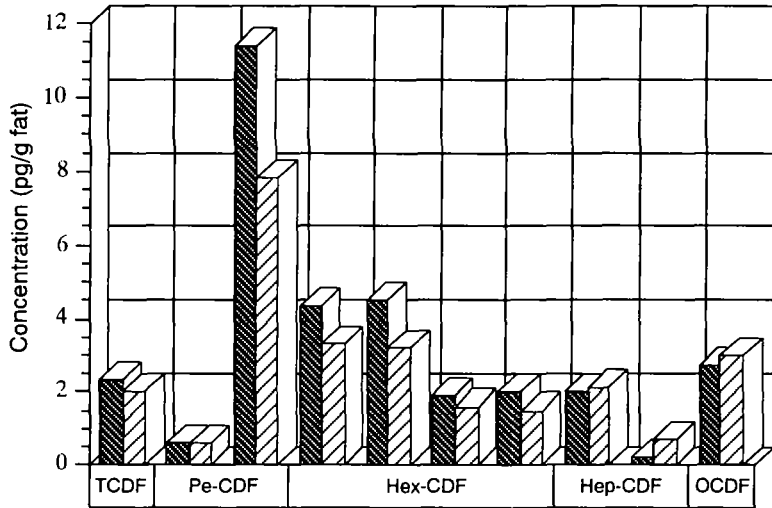


Fig.2 Congener pattern of PCDFs in breast milk

■ Primiparas ▨ Multiparas