

**ESTIMATION OF DIETARY INTAKE OF POLYCHLORINATED  
DIBENZO-p-DIOXINS, POLYCHLORINATED DIBENZOFURANS, AND  
COPLANAR POLYCHLORINATED BIPHENYLS IN JAPANESE  
INFANTS**

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***Introduction***

Nationwide monitoring of polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) and coplanar polychlorinated biphenyls (Co-PCBs) in breast milk has been conducted since 1998 in Japan. We previously demonstrated that PCDDs+PCDFs+Co-PCBs levels in breast milk of Japanese women were slightly lower than those in European countries<sup>1</sup>. The amount of these chemicals by breast-feeding on Japanese infants, however, was assumed as large as that in other industrial countries<sup>2,3</sup>. To estimate dietary intake of PCDDs, PCDFs, and Co-PCBs in infants, we measured infant intake of breast milk and observed trends of these compounds in Japanese mothers' milk.

***Materials and Methods***

Breast milk of women who had a first delivery was collected at 30 days after the delivery from 1998 through 2001. We collected breast milk of women who had a second delivery among participants of

our research after the first delivery from 1999. Seven isomers of PCDDs, 10 ones of PCDFs and 12 ones of Co-PCBs per gram fat of milk were measured using 50ml samples of breast milk, and toxic equivalences (TEQs) were calculated using 2,3,7,8-TCDD toxic equivalent factors (TEFs) reported by WHO in 1998. First, we observed the trends of PCDDs, PCDFs and Co-PCBs levels in breast milk from 1998 through 2001. We compared the means of these compounds in breast milk among women who had the first and the second delivery using the one-way analysis of variance. The statistical significance was considered to exist when a probability was less than 0.05.

Second, we measured daily intake of milk on 192 normal breast-feeding infants at one month after birth in 1998. Fat content of breast milk was reported previously<sup>4</sup>. We calculated the means of daily intake of PCDDs+PCDFs+Co-PCBs of one-month-old infants (pg TEQ/ kg/ day) and estimated 95% confidence intervals of these means. Based on the assumption that fat in breast milk after the second delivery is the same contents as that after the first delivery, we also calculated daily intake of these compounds in infants after the second delivery.

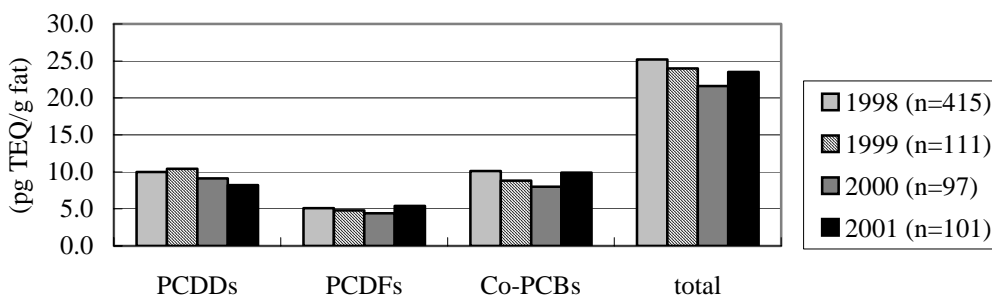
### **Results and Discussion**

The total levels of PCDDs, PCDFs and Co-PCBs in breast milk of women who had the first delivery were 25.2 pg TEQ/g fat in 1998 and 23.5 pg TEQ/g fat in 2001. The trends of these compounds for four years were shown in Figure 1. The means of PCDDs, PCDFs, Co-PCBs and total levels of these compounds for four years differed significantly, but the decrease in levels of them were not demonstrated except PCDDs. The trends of these compounds in breast milk of women who had the second delivery were shown in Figure 2. The total levels of them in 1999 and 2001 were 14.9 and 19.1 pg TEQ/g fat, respectively. Except for PCDDs, the means of PCDFs, Co-PCBs, and total of them looked like increasing during the three years. However, there was not statistical significance among the three groups because the sample size was small. The level of PCDDs+PCDFs+Co-PCBs in breast milk of women after the second delivery was 81% of that of women after the first delivery in 2001.

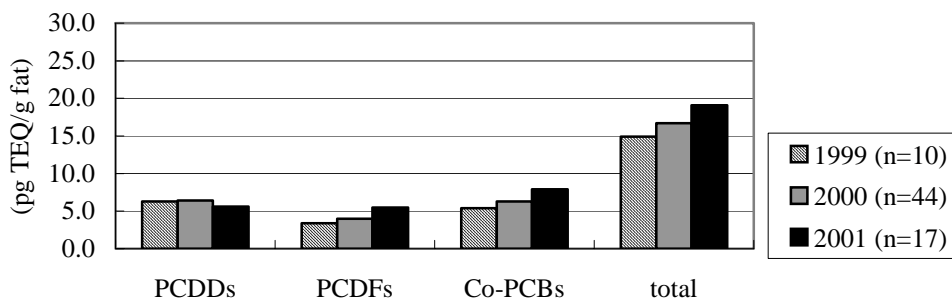
Daily infant intake of breast milk was estimated to be 886.3g at 30 days after birth. For the mean of fat content of breast milk at the same day was 3.8%, infant intake of fat in milk was 33.7 g per day. The mean of body weight of Japanese infants at one month old was 4.8 kg. Therefore, the daily

infant intake of PCDDs+PCDFs+Co-PCBs in breast milk of women after the first delivery was estimated 177 pg TEQ/ kg/ day (95% confidence interval; 171, 183) in 1998. The range of infant intake of these compounds after the first delivery was between 152 and 177 pg TEQ/ kg/ day (Table 1). The minimum level of them during four years was 38 times as high as the WHO tolerable daily intake. Similarly, the range of infant intake after the second delivery was between 105 and 134 pg TEQ/ kg/ day. The value of 105 pg TEQ/ kg/ day was 25 times higher than the tolerable daily intake. These values were higher than those reported previously <sup>2,3</sup> because intake of breast milk per body weight was the maximum at 30 days old. The intake of it was decreasing until one year old so that the mean of intake of PCDDs+PCDFs+Co-PCBs for one year after birth was 93pg TEQ/ kg/ day, which was 23 times as the tolerable daily intake.

**Figure 1. Trend of means of PCDDs, PCDFs, Co-PCBs in breast milk of Japanese women at 30 days after the first delivery**



**Figure 2. Trend of means of PCDDs, PCDFs, Co-PCBs in breast milk of Japanese women at 30 days after the second delivery**



**Table 1: Estimation of infant intake of PCDDs+PCDFs+Co-PCBs at one month old  
(pg TEQ/ kg/ day)**

Years	After the first delivery		After the second delivery	
	Mean	95% confidence interval	Mean	95% confidence interval
1998*	177	171, 183		
1999	169	159, 178	105	84, 126
2000	152	142, 161	117	103, 132
2001	165	154, 176	134	81, 187

\*: No mothers who had the second delivery in 1998.

### Conclusions

Estimated infant intake of PCDDs, PCDFs and Co-PCBs at 30 days after birth was 25 times higher than the WHO tolerable daily intake not only after the first delivery but also after the second delivery. To evaluate daily infant intake of these compounds, it is important that we continue to monitor the levels of these compounds in breast milk in Japan.

### Acknowledgements

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