

**Effects of Birth Order and Nursing Methods on Concentration of  
PCDDs, PCDFs and Coplanar PCBs in the  
Blood of Japanese Young Women**

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**Objectives**

Human breast milk has been contaminated with extremely toxic organochlorine compounds such as polychlorinated dibenzo-*p*-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) and coplanar polychlorinated biphenyls (Co-PCBs)<sup>1,2)</sup>. The most efficient excretion for these chemicals from human body is considered to occur through breast milk and their daily intakes in breast-fed babies of healthy Japanese mothers have been estimated to be about 100 to 200 pg/kg/day as 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) equivalent values (TEQs)<sup>3)</sup>, which are about 100 to 200 times greater than the acceptable daily intake (ADI) value of 1 pg/kg/day<sup>4)</sup>. Like this, breast-fed babies are taking relatively a large amount of these toxic chemicals via breast milk. However, concentrations of the three compounds in primiparous milk were about two times higher than those in multiparous one<sup>5)</sup>. It indicates the possibility that the first children will ingest much larger amount of PCDDs, PCDFs and Co-PCBs through breast milk than the second or later children. Therefore, the first question, which we would

like to make clear in this study, is whether the concentrations of the three chemicals in Japanese young women will be different in their birth order or not.

Concentrations of PCDDs in cow's milk, which is the raw material of artificial milk, were about several ten times lower than those in breast milk in Japan<sup>5)</sup> and the ingestion of the chemicals from bottle-feeding is expected to be much lower than that from breast-feeding. Accordingly, the second question, which we would like to elucidate in this study, is whether difference in nursing methods, namely, breast and formula feeding has still produced an effect on the concentrations of these chemicals in Japanese young women.

### Approach and Methods

Sixty to 80 ml of peripheral blood samples were individually obtained from 50 unmarried healthy Japanese women (mean age : ca 20 years old and range : 18 ~ 29 years old). Concentrations of PCDDs, PCDFs and Co-PCBs in the blood were determined by ordinary gas chromatography/mass spectrometry (GC-MS) method<sup>3)</sup>. The information concerning their birth order and nursing methods was given by an interview to each woman when they visited our laboratory for the blood-collecting. If they did not have accurate information about these matters, we asked them to get those from their mothers.

Chemicals and statistical analysis were previously mentioned in detail<sup>3,4,6)</sup>.

### Results and Discussion

1) Correlation between birth order and concentrations of PCDDs, PCDFs and Co-PCBs in the blood

Results are indicated in Fig. 1. Respective concentrations of PCDDs, PCDFs and Co-PCBs in the blood of firstborn women were higher than those of the other women and the total concentration of the three chemicals of firstborn women was significantly greater than that of the other women. This result

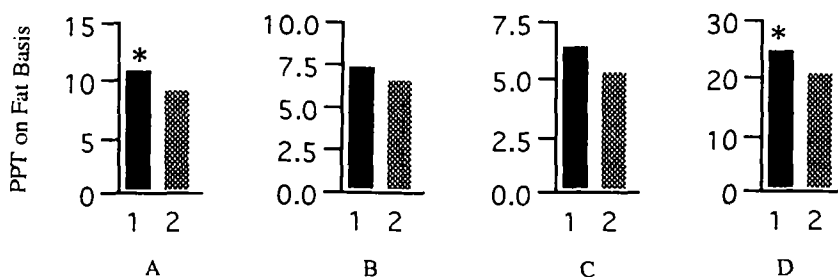


Fig. 1. Correlation between birth order and concentrations of PCDDs, PCDFs and Co-PCBs of the blood in Japanese young women.

1: Firstborn women, 2: Other women

A: PCDDs, B: PCDFs, C: Co-PCBs, D: PCDDs+PCDFs+Co-PCBs

\* :  $p=0.05$

may support the idea that firstborn children ingested larger amount of these chemicals through breast milk than the other children, and such a kind of effect on their concentrations seemed to remain in Japanese young women even a long time after their periods of nursing.

## 2) Correlation between nursing methods and concentrations of PCDDs, PCDFs and Co-PCBs in the blood

Respective concentrations of PCDDs, PCDFs and Co-PCBs in the blood were compared according to nursing methods, namely, breast feeding, mixed (breast plus formula) feeding and formula feeding, and we observed that their concentrations were consistently, but not significantly the highest in the blood of young women nursed with mixed feeding. As shown in Fig. 2, total concentrations of PCDDs, PCDFs and Co-PCBs were also the greatest in the women of the mixed-fed group, but the difference in concentration was not significant.

Contrary to our expectation, breast or formula feeding seems not to have any influence on concentrations of the three chemicals in the blood of Japanese young women aged around 20 years, probably because about 20 years have passed since nursing was finished.

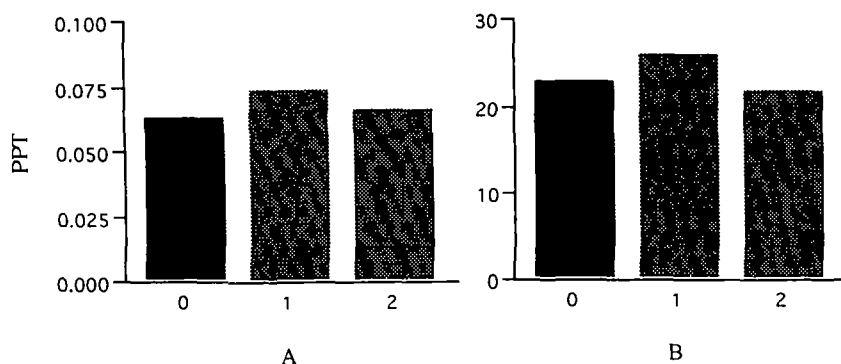


Fig. 2. Correlation between nursing methods and total concentrations of PCDDs, PCDFs and Co-PCBs of the blood on whole weight (A) and fat weight (B) basis in Japanese young women.

0: Breast feeding, 1: Mixed (breast plus formula) feeding, 2: Formula feeding

## 3) Correlation between birth order and concentrations of PCDDs, PCDFs and Co-PCBs in the same nursing method

As indicated in Fig. 1, concentrations of these compounds in the blood of firstborn women were higher than those of the other women, but nursing methods showed no effect on their concentration in

this study. Therefore, we examined their concentrations according to birth order in the respective nursing methods. In general, respective concentrations of PCDDs, PCDFs and Co-PCBs in the blood showed a tendency to be higher in firstborn women than in the other women in the same nursing group. Consequently, as indicated in Fig. 3, their total concentrations were also greater in firstborn women than in the other women in every nursing group.

At the present time, we do not have any idea to explain this observation and in order to elucidate the question, we have to continue studying this subject from every point of view and more in detail.

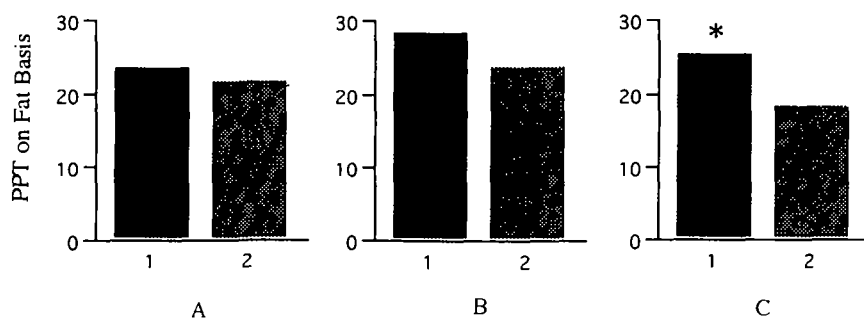


Fig. 3. Correlation between birth order and total concentrations of PCDDs, PCDFs and Co-PCBs in the respective nursing methods.

1: Firstborn women, 2: Other women

A: Breast feeding, B: Mixed (breast plus formula) feeding, C: Formula feeding

\* :  $p < 0.05$

## Conclusions

- 1) Concentrations of PCDDs, PCDFs and Co-PCBs in the blood of firstborn women were higher than those of the other women.
- 2) Nursing methods, namely, breast feeding, mixed (breast plus formula) feeding and formula feeding, did not show any significant effect on the concentrations of the three chemicals, probably because about 20 years have passed since nursing was over.
- 3) However, concentrations of these chemicals in the blood were greater in firstborn women than the other women in every nursing group. Presently, we do not know the reason for this observation.

## References

- 1) Masuda Y (1987): Polychlorinated dibenzo-*p*-dioxins and related compound pollution in human tissues. *Toxicol. Forum* 10: 131-135 (in Japanese)

- 2) Matsueda T, Iida T, Hirakawa H, Fukamachi K, Tokiwa H and Nagayama J (1992) : Comparison of concentration of PCDDs, PCDFs and coplanar PCBs in breast milk of Yusho patients and normal controls. *Organohalo. Comp.* 9 : 143-146
- 3) Matsueda T, Iida T, Hirakawa H, Fukamachi K, Tokiwa H and Nagayama J (1993) : Toxic evaluation of PCDDs, PCDFs and coplanar PCBs in breast-fed babies of Yusho and healthy mothers. *Chemosphere* 27 : 187-194
- 4) Nagayama J, Nagayama M and Masuda Y (1993) : Frequency of micronuclei induced in cultured lymphocytes by highly toxic organochlorine congeners. *Fukuoka Acta Med.* 84 : 189-194
- 5) Ogaki J, Takayama K, Miyata H and Kashimoto T (1987) : Levels of PCDDs and PCDFs in human tissues and various foodstuffs in Japan. *Chemosphere* 16 : 2047-2056
- 6) Nagayama J, Nagayama M, Iida T, Hirakawa H, Matsueda T and Masuda Y (1994) : Effects of highly toxic organochlorine compounds retained in human body on induction of sister chromatid exchanges in cultured human lymphocytes. *Chemosphere* 29 : 2349-2354

