EFFECTS OF DIOXINS IN BREAST MILK ON THYROID FUNCTION IN INFANTS BORN IN JAPAN: EFFECTS OF BIRTH ORDER

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Abstruct

Dioxins (PCDD+PCDF+Co-PCB) contents of breast milk was measured in infants of first, second and third children at the age of 30 days and evaluate the effect of dioxins on development, thyroid function and immune function of children at the age of one year. Although dioxins contents in breast milk decreased significantly by birth order in Japan, thyroid function was not changed by birth order. Dioxins contents in breast milk in Japanese postpartum women has been decreasing from early 1970th and will not affect upon thyroid function in infant in Japan.

Introduction

Dioxins (PCDD, PCDF+Co-PCB) are potentially hazardous compounds and have an effect on thyroid function. Our research group on “Effect of dioxins in human milk upon infant development” was organized in 1997 and has been actively practicing until present time. Whether dioxins content in breast milk change in birth order, we collected human milk at 30 postpartum days from the mothers of first, second and third children and measured dioxins content. We compared dioxins content in human milk and thyroid function in each child.

Material and Methods

101 infants each of first and second child and 4 infants of third child were the subjects of this study. We collected breast milk from the mothers at 30 postpartum days and were measured PCDDs, PCDFs and Co-PCB by gas chromatography and mass spectrometry. At the age of one year, physical developments of children were evaluated and blood was taken for evaluation of thyroid and immune functions.

Results and discussion

1. Dioxins content in breast milk and change with birth order

Dioxins contents in breast milk in mothers of first, second and third children were shown in Table 1. PCDDs content were significantly decreased from first children to second and third children.

PCDDs contents of breast milk in first children was correlated significantly with that in second children (r=0.532, p<0.0001) as well as that in first/second child ratio (r=0.278, p<0.005). Total dioxins (PCDDs+PCDFs+Co-PCB) contents of breast milk in first children was correlated significantly with that in second children (r=0.476, p<0.0001) as well as that in first/second child ratio (r=0.327, p<0.001) (Fig.1, 2).

Table 1. Dioxins contents in breast milk in mothers of first, second and third children

	PCDDs	PCDFs	Co-PCBs	Total (pgTEQ/g fat)
First child (n=101)	9.8±3.8	5.8±3.5	6.7±3.9	22.5±9.6
Second child (n=101)	5.7±2.8	3.9±3.6	4.0±2.2	13.6±7.3***
Third child (n=4)	1.9±1.8	1.6±1.4	1.9±0.8	5.4±3.8

*** p<0.001 compared with first child (M±SD)

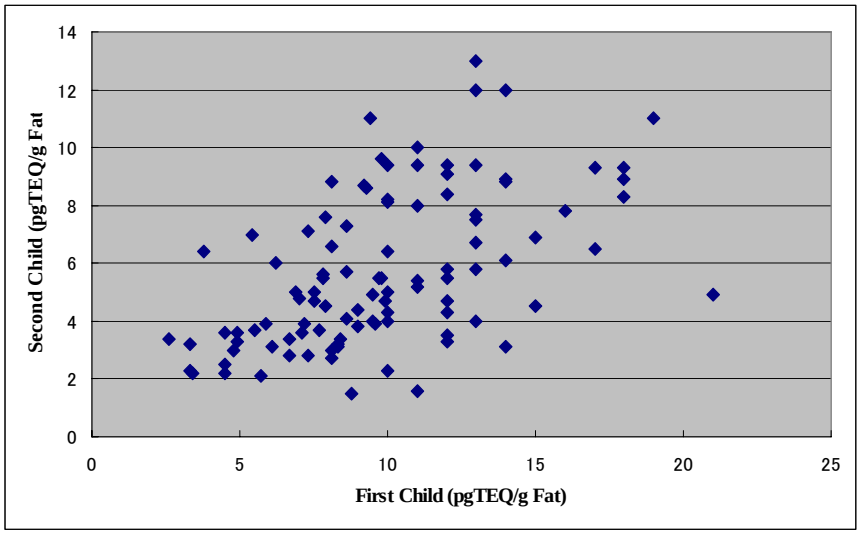

Fig.1. PCDDs contents in breast milk of the mother of first and second children. (r=0.532, p<0.0001)

2. Dioxins contents in breast milk of mothers in four infants of first, second and third children.

Dioxins contents of breast milks from 4 mothers who gave birth first, second and third child are shown in Table 2, Fig. 2. Dioxins contents were significantly decreased with birth order. ANOVA of total dioxins contents of first, second and third children was significant (F=10.4, p<0.005). F value was highest in PCDDs (F=13.6) and lowest in PCDFs (F=3.3). PCDDs were most decreased with birth order and least decreased in PCDFs.

Table 2. Dioxins contents in breast milk of mothers in four infants of first, second and third children.

	PCDDs	PCDFs	Co-PCBs	Total (pgTEQ/g fat)
First child (n=4)	7.7±1.8	3.9±1.5	4.4±1.5	16.3±4.0
Second child (n=4)	3.8±1.2	2.2±1.3	1.8±0.6	7.6±2.6
Third child (n=4)	1.9±1.8	1.6±1.4	1.9±0.8	5.4±3.8

*** p<0.001 compared with first child (M±SD)

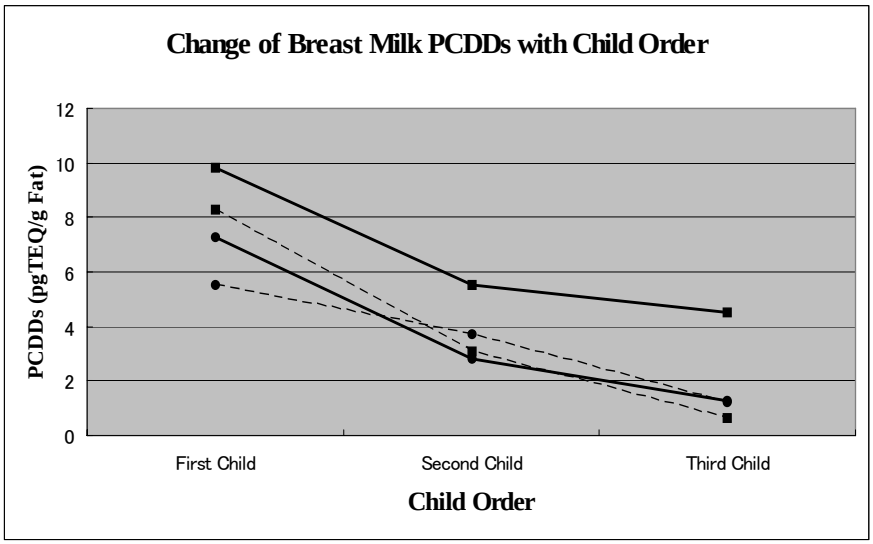

Fig. 2
Change of PCDDs contents in breast milk from mothers who gave birth first, second and third child. ANOVA of PCDDs of first, second and third children was significant ($F=13.6$, $p<0.0001$)

3. Thyroid function in infants with birth order

Among 101 infants each whose dioxins contents of mother's breast milk was measured, 55 infants of first and second children were measured thyroid function at the age of 1 year. Table 3. shows thyroid function of first and second children. Mean serum TSH, FT_4, T_3 and T_4 level between first and second child were not significantly different.

Table 3. Thyroid function of 55 each of first and second children.

	TSH (μU/ml)	FT_4 (ng/dl)	T_3 (ng/ml)	T_4 (μg/dl)
First child (n=55)	2.0±1.3	1.38±0.17	1.63±0.24	10.6±1.8
Second child (n=55)	2.3±1.2	1.41±0.17	1.66±0.23	10.4±1.7
				(M±SD)

4. Dioxins contents of breast milk in mothers and thyroid function of their infants

Dioxins contents of breast milk from the mothers who gave birth first and second children are shows in Fig. 3. Although dioxins contents in breast milk in mother who gave birth
first child was significantly higher than that of second child, TSH levels as well as FT_4, T_3, T_4 levels were not significantly differnt.

5. Correlation of thyroid function between first and second children

Correlation of thyroid function between first and second children was significantly in only serum FT_4 level ($r=0.312$, $p<0.02$).

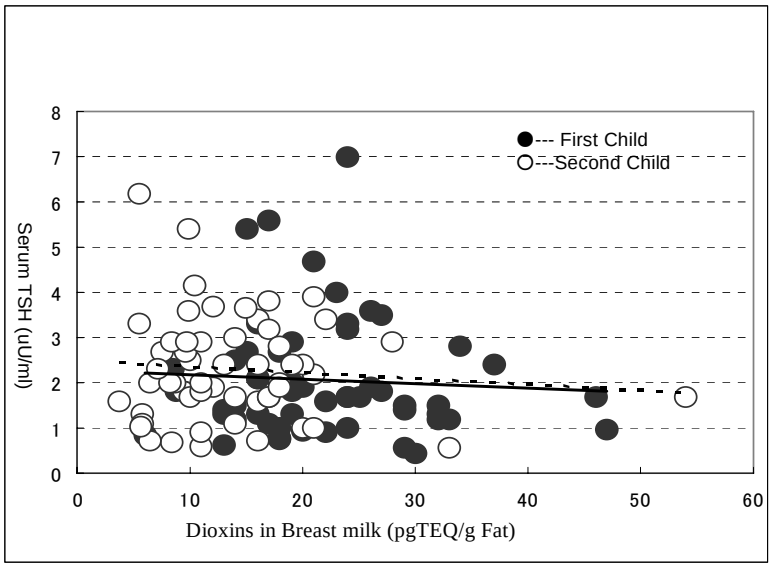

Fig. 4. Dioxins contents of breast milk of mother who gave birth first child (●) and second child (○)and their serum TSH levels at the age of 1 year. Dioxins contents in first infants was significantly higher than that of second infants, TSH level was not significantly different.

The Research group on "Dioxins and PCB in human Milk upon infant development" was organized in 1977 and has been actively practicing until present time and published the results on dioxins in breast milk in general population[1)], on thyroid function[2)] and on immune function[3)]. In this study, we reported the effects of birth order upon dioxins contents in breast milk and effect on thyroid function on offspring. The sample size in this study was 101 infants of first children, 55 of second children and 4 of third children which is a maximum size considering the co-operation of the mothers. Dioxins contents in breast milk decreased significantly by birth order in Japan, however; thyroid function was not changed by birth order, that is, dioxins contents in breast milk will not affect upon thyroid function in infants in Japan.

Acknowledgements

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References

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