

# CHILDHOOD HEALTH AND DEVELOPMENT IN RELATION TO PERSISTENT ORGANOCHLORINE COMPOUNDS

## EFFECTS OF DIOXINS AND POLYCHLORINATED BIPHENYLS (PCBs) ON THYROID FUNCTION IN INFANTS BORN IN JAPAN - REPORT FROM RESEARCH ON ENVIRONMENTAL HEALTH

Matsuura N, Tada H,<sup>1)</sup> Kondo N,<sup>2)</sup> Nakamura Y,<sup>3)</sup> Masatoshi Morita<sup>4)</sup>

- 1) Department of Pediatrics, Kitasato University School of Medicine, 1-15-1 Kitasato, Sagami-hara, 228-8555, Japan.
- 2) Department of Neonatology, Toho University School of Medicine, Omori-nishi 5-21-16, Ota-ku, Tokyo, 143-8540, Japan
- 3) Department of Pediatrics, Gifu University School of medicine, Tshukasacho, 40, Gifu 500-8705, Japan
- 4) Department of Health Science, Jichi Medical School, 3311-1 Yakushiji, Minamikawachi, Tochigi, 329-0498, Japan
- 5) National Institute for Environmental Studies, regional Environmental Division, 16-2 Onogawa, Tsukuba, Tochigi, 305-0053, Japan

### Introduction

Dioxins(PCDD+PCDF) and PCBs are potentially hazardous compounds and have structural similarity to thyroid hormones. Animal studies have demonstrated that PCDDs, PCDFs and PCBs can alter thyroid hormone homeostasis. Both dioxins and PCBs are highly lipophilic and chemically stable compounds, which contain large amount in human milk samples from highly industrialized, densely populated countries such as Japan and the European countries. Small amounts of dioxins and PCB can reach the fetus by means of transplacental transport, whereas much higher levels reach the breast-fed infants.

Effects of pre- and postnatal exposure to dioxins and PCBs on thyroid function of pregnant women and their infants were reported from European countries, however; there were few reports from Japan. The contents of dioxins and PCBs in human milk and intake of infants from human milk are not studied in large scale in Japan. We would like to report nationwide study from Japan.

### Subjects and Methods

We collected breast milk from 80 mothers (group A) who live in Tokyo, Saitama, Ishikawa Osaka prefecture at 5, 30, 150, 300 postpartum days and measured PCDDs, PCDFs and PCBs. To express the toxic potency in breast milk samples the TEQ (Toxic equivalent, TEQ) approach was used. Mother's age was limited between 25 and 34 years, and all the mothers were primiparous. Intake of dioxins was estimated from two ways. That is, (1) Dioxins concentration in mother's milk x average intake of mother's milk (ml/day) x days until discontinuation of breast feeding, (2) (Dioxins contents of first mother's milk - dioxins contents of last mother's milk) x BMI

At the age of 1 year, blood was taken from 55 among 80 infants of group A for evaluation of thyroid and immune function. Blood was also taken from 30 infants with bottle-feeding at the age of 1 year as a control (group B). Dried blood on filter paper was also taken for thyroid function and thyroid auto-antibodies and was compared with those in newborn period of 5 days. Thyroid and immunologic function together with growth and developmental assessment were performed in each infant at the age of 1 year.

# CHILDHOOD HEALTH AND DEVELOPMENT IN RELATION TO PERSISTENT ORGANOCHLORINE COMPOUNDS

## Results

### 1. Thyroid function in Group A and B

Serum T4, T3 and FT4 levels between groups A were  $10.6 \pm 1.6$  ug/dl,  $1.6 \pm 0.2$  ng/ml,  $1.42 \pm 1.25$  ng/dl, and of Group B were  $11.1 \pm 2.0$  ug/dl,  $1.7 \pm 0.3$  ng/ml,  $1.43 \pm 0.20$  ng/dl respectively and were not significantly different between two groups. TSH levels was  $2.3 \pm 1.0$  uU/ml,  $1.8 \pm 0.8$  uU/ml respectively and were within normal range, however; group A was significantly higher than group B ( $p=0.027$ )( Table 1).

### 2. Thyroid function and intake of dioxins TEQ

There was no correlation between serum level of T3, T4, FT4 and intake of dioxins. There was no correlation between serum level of TSH and intake of dioxins TEQ in group A (Figure 1) ( $r=0.081$ ), however weak positive correlation was observed when both A and B groups were combined ( $r=0.235$ ,  $n=80$ ,  $p<0.05$ ).

### 3. Thyroid auto-antibodies

None of the infants in Group A and B were positive for anti-thyroglobulin and anti-microsomal antibodies.

Table 1. Thyroid function in infant with breast feeding (Group A) and bottle feeding (Group B) at the age of 1 year.

		TSH (uU/ml)	T3 (ng/ml)	T4 (ug/dl)	FT4 (ng/dl)
Breast feeding	Mean	2.3	1.6	10.6	1.42
	S.D.	1.0	0.2	1.6	0.26
	n	55	55	55	55
Bottle feeding	Mean	1.8	1.7	11.1	1.43
	S.D.	0.8	0.3	2.0	0.20
	n	32	32	32	32
p		0.027	0.18	0.271	0.828

# CHILDHOOD HEALTH AND DEVELOPMENT IN RELATION TO PERSISTENT ORGANOCHLORINE COMPOUNDS

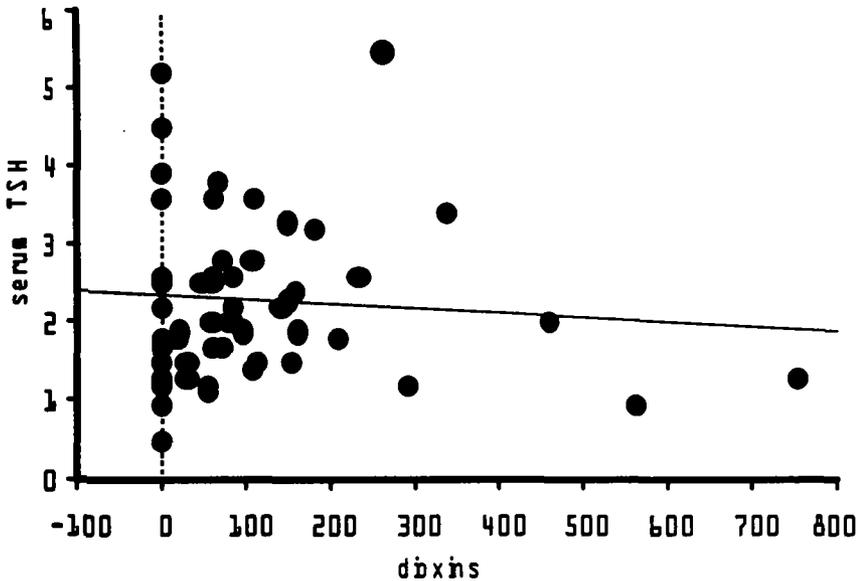


Fig. 1 Correlation between serum TSH level and intake of dioxins TEQ

#### 4. Correlation between thyroid function at 1 years of age and 5 days of newborn infants.

Thyroid function on dried blood on filter paper at 1 year of age and 5 days of age were shown in Table 2. Dried blood on filter paper TSH was all within normal range and there were no significant difference between 5 days and 1 year of age or between Group A and B. There was no significant correlation in dried blood on filter paper TSH levels between at 5 days and at 1 year of age and none of the samples from dried blood on filter paper TSH level was more than 10 uU/ml.

Table 2. Thyroid function on dried blood in filter paper at 1 year of age and newborn infants

		Breast feeding	Bottle feeding
		TSH (uU/ml)	TSH (uU/ml)
5 days of age	Mean	3.4	1.8
	S.D.	1.9	1.2
	n	48	15
1 year of age	Mean	2.7	2.1
	S.D.	1.1	1.0
	n	48	15
	p	0.159	0.551

# CHILDHOOD HEALTH AND DEVELOPMENT IN RELATION TO PERSISTENT ORGANOCHLORINE COMPOUNDS

## Discussion

Although there are significant difference in serum TSH level between breast-feeding and bottle feeding infants, the levels of TSH were within normal range. Serum T3, T4 and FT4 levels are also in normal range and no difference between two groups. It is not clear at present that dioxins intake from mother's milk might effect on serum TSH level in two groups. Correlation between dioxins content in mother's milk and thyroid function in mother as well as their infants was reported from The Netherland, that is, higher dioxins levels in human milk correlated with lower levels of maternal thyroid hormone level, and with higher plasma levels of TSH in the infants in the 2nd week and 3rd month after birth. The mean TSH levels in the high dioxin-exposed breast-fed infants was more than 10uU/ml, level of which was much higher than that of ours in breast-fed infants.

## Conclusion

It is concluded that dioxins intake from breast milk in Japanese infants is not alter thyroid function seriously, however long term effects have to be evaluated.