

Perinatal Exposure to Polychlorinated Biphenyls on Lymphocyte Subpopulations and Thyroid Hormone Status in Japanese Breast-Fed Infants

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Introduction

It is well known fact that polychlorinated biphenyls (PCBs) have ubiquitously polluted our environment and foods. Consequently, the human body and breast milk in Japan have been also contaminated with PCBs¹⁾²⁾.

In 15 samples of Japanese breast milk, which were collected in 1990 and 1991, mean levels of PCBs on whole and fat weight bases were about 12 and 300ppb, respectively²⁾. This level was about 10,000 times greater than that of PCDDs, PCDFs and Co-PCBs as 2,3,7,8-TCDD TEQ value²⁾. Therefore, we should give due attention to possible health consequences of PCBs in

breast-fed infants.

In order to clarify the biological and/or biochemical effects of perinatal exposure to PCBs, we investigated the lymphocyte subpopulations and thyroid hormone status in the peripheral blood of 101 breast-fed infants in relation to their contamination levels.

Material and Methods

One hundred and twenty four mothers volunteered to participate in all in this study and they had a normal pregnancy without use of medicines. Breast milk (50~100ml), sampled 2 to 4 months after the childbirth, was used to determine the concentrations of PCBs by ECD gas chromatography method²⁾.

About 1 year after birth, 5 to 10ml of peripheral blood samples were individually obtained from 101 breast-fed infants. These blood samples were used to measure the lymphocyte subpopulations by indirect immunofluorescence using monoclonal mouse anti-human antibodies against CD3, CD4, CD8, CD4 + CD8, CD16, CD20 and HLA-DR, and their relative population densities were calculated³⁾. They were also employed to determine the serum concentrations of T₃, T₄, TSH and TBG by radioimmunoassay methods by using commercially available kits⁴⁾.

In order to get more reliable results, the Spearman rank correlation coefficients were computed instead of the Pearson correlation and their statistical significances were evaluated.

Results

1) Concentrations of PCBs in the breast milk

Respective distributions in concentrations of PCBs on the whole and fat weight bases are

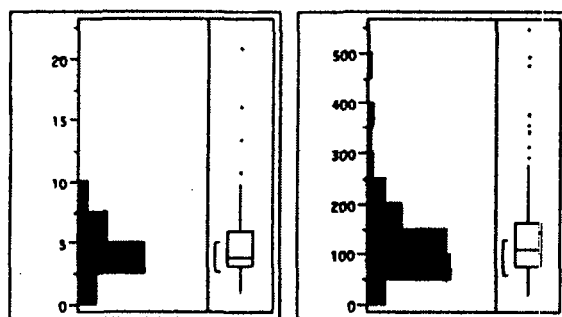


Fig. 1. Distributions in concentrations (ppb) of PCBs on the whole (left) and fat (right) weight bases in the breast milk of 124 mothers

indicated in Fig. 1. Median concentrations on the whole and fat weight bases were 3.84 and 110.4 ppb, respectively. The range of concentration on the whole weight basis was 1.00 to 20.9ppb and that on the fat weight basis 19.8 to 545ppb.

2) Correlation between the concentration of PCBs and peripheral lymphocyte subpopulations in breast-fed infants.

Percentages of lymphocyte subpopulations were examined in the peripheral blood of 93 breast-fed infants⁵⁾, which will be presented in Dioxin '98. The Spearman rank correlation coefficients of concentrations of PCBs with the percentages of lymphocyte subpopulations were calculated and the results are shown in Table 1.

Any of the peripheral lymphocyte subpopulations did not indicate significant correlation ($p < 0.10$) with the concentrations of PCBs on either whole or fat weight bases.

Table 1. Spearman rank correlation of concentrations of PCBs on whole or fat weight basis in the breast milk with percentages of lymphocyte subpopulations in the peripheral blood of breast-fed infants

PCB Conc.	Correlation Coefficient					
	CD3+	CD4+	CD8+	CD16+	CD20+	HLA-DR+
Whole	0.039	0.020	-0.017	-0.093	0.111	0.028
Fat	0.036	-0.055	0.088	-0.114	0.096	-0.004

Table 2. Spearman rank correlation of concentrations of PCBs on the whole or fat weight basis in the breast milk with serum chemical levels related to the thyroid function in the peripheral blood of breast-fed infants

PCB Conc.	Correlation Coefficient			
	T ₃	T ₄	TSH	TBG
Whole	-0.077	0.013	0.006	0.020
Fat	-0.126	-0.199	0.063	-0.083

3) Correlation between the concentrations of PCBs and thyroid hormone status in breast-fed infants

Serum levels of T_3 , T_4 , TSH and TBG were determined in the peripheral blood of 101 breast-fed infants⁶⁾, which will be made known in Dioxin '98. The Spearman rank correlation coefficients of concentrations of PCBs with the serum chemical levels related to thyroid function were calculated and the results are indicated in Table 2.

Any of the serum levels of the thyroid hormones, TSH and TBG did not show significant correlation ($p < 0.10$) with the concentrations of PCBs on either whole or fat weight bases.

Discussion

The presence of PCBs in the breast milk results in daily intakes of about 120 to 2500 ng/kg body weight with the median figure of 460 ng/kg body weight, which is about 30 times larger than those of dieldrin and heptachlor epoxide and also about 3 times less than those of β -HCH and DDT⁷⁾. In our recent investigations^{7) 8)}, perinatal exposure to DDT may cause some effects on both the immune system and the thyroid function in Japanese breast-fed infants.

The daily median intake of PCBs from the breast milk in this study was about 4,000 times greater than that of PCDDs, PCDFs and Co-PCBs in 2,3,7,8-TCDD TEQ value^{5) 6)}. Perinatal exposure to dioxins and the related chemicals seemed to elicit some effects on the thyroid hormone status⁵⁾. We, however, could not find any significant effect of PCBs on either the immune system or the thyroid function in breast-fed Japanese infants.

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