

Levels of Polychlorinated Biphenyls in Blood of Breast-fed Children Whose Mothers are Non-occupationally Exposed to PCBs

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The environments is widely contaminated by polychlorinated biphenyls (PCBs). Because of their stable and lipophilic properties, they can accumulate in human tissues and breast milk (ACKER and SCHULTE 1970). There have been few reports on the transfer of PCBs from mother to child.

KODAMA and OTA (1977) demonstrated the presence of PCBs in the blood of breast-fed infants and reported that blood PCB levels of them rose gradually with ingestion of breast milk. We have previously reported similar findings for children whose mothers had been occupationally exposed to PCBs; we found extremely high levels of PCBs in the children's blood and some kinds of clinical signs (HARA *et al.* 1976, KUWABARA *et al.* 1978). In a further survey on these children, we discovered a baby with an unusually high blood PCB level of 115 ppb ($\mu\text{g/kg}$). The baby was 8-month-old and had been fed on mother's milk for approximately 6 months (KUWABARA *et al.* manuscript in preparation).

Here, we report on the blood PCB levels of children whose mothers are non-occupationally exposed, and the relationship between breast feeding and those levels.

MATERIALS AND METHODS

Blood (3-10 ml) was drawn from non-occupationally exposed mothers and their children in Osaka prefecture in 1976. The blood samples were analyzed by essentially the same methods as described before (KUWABARA *et al.* 1978). Recovery rate of PCBs by this procedure was more than 90 %.

RESULTS AND DISCUSSION

PCB level in the blood of mother and child: The results are listed in Table 1. The PCB levels in 9 of the 17 children are higher than those of their mothers. The maximum level is 12.8 ppb and is 6 times higher than that of the child's mother. Four samples were below the 0.2 ppb detection limit. Compared to the levels found for mothers, the levels for children have a wider variation.

TABLE 1

PCB Levels in Blood of Mother and Child

Child				Mother	
No.	Sex	Age year, month	PCB level in blood (ppb)	No.	PCB level in blood (ppb)
C -1	M	4,7	3.3	M -1	2.0
C -2	M	1,2	9.1	M -3	2.2
C -3	M	0,7	ND	M -4	3.0
C -4	F	0,4	ND	M -5	2.4
C -5	M	0,4	0.8	M -6	1.7
C -6	F	0,3	ND	M -7	3.2
C -7	F	0,3	ND	M -8	2.9
C -8	M	1,8	7.3	M -9	2.4
C -9	M	6,2	4.0	M -10	2.1
C -10	F	2,5	12.8	M -11	2.5
C -11	M	3,3	2.8	M -12	2.9
C -12	M	0,1	2.8	M -13	2.6
C -13	F	3,9	8.2	M -14	4.2
C -14	F	0,7	3.4	M -15	2.8
C -15	F	1,4	3.4	M -16	4.6
C -16	F	2,1	3.6	M -17	3.1
C -17	M	4,3	3.5		
Mean $\pm$ S.D.			3.8 $\pm$ 3.6 ppb	2.8 $\pm$ 0.8 ppb	

M designates male and F designates female.

ND: value below the detection limit, 0.2 ppb.

Mean and S.D. of child are evaluated assuming that ND is 0.1 ppb.

Sample No. C-1 and C-2 are brotherly (No. M-1's children).

Fig.1 shows the relation between breast feeding and blood PCB level of the children. It appears that increasing feeding period of the mother's milk tends to increase the level of PCBs in blood of the children. It is especially noteworthy that the levels of 1-month-old and 7-month-old infants fed on mother's milk are much higher than babies of approximately the same age who ingest only artificial milk.

The average PCB concentration in modified milk powder for infants was 1 ppb (Osaka Prefectural Government, 1976) or 3 ppb (Science and Technology Agency, Japan, 1972). We found that the PCB daily intake by meal of non-occupationally exposed adults was about 3 or 20 μ g per person (WATANABE *et al.*

manuscript in preparation), and the average for human milk PCB level was 33 ppb (YAKUSHIJI *et al.* 1977). Compared to the value of artificial milk or diet, the amount of PCBs which infants receive is considerable. Assuming that a baby ingests 1 kg of the breast milk contaminated by 30 ppb PCB, the baby would receive 30 μ g of PCBs each day.

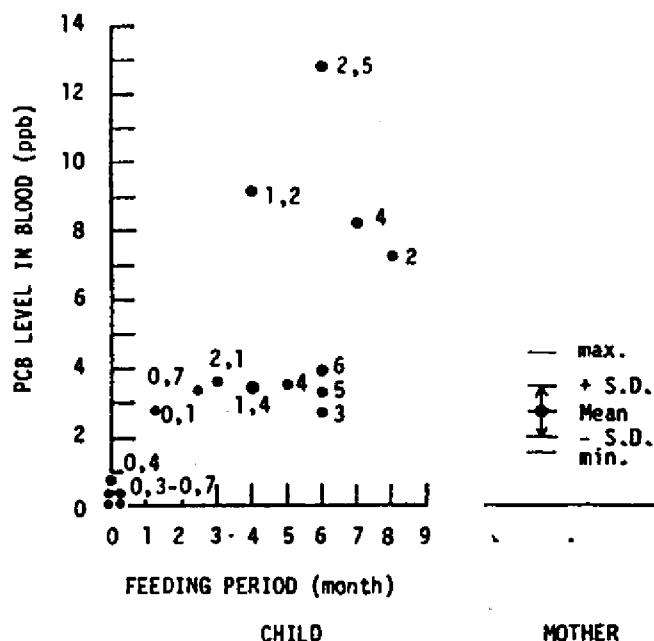


Fig.1. Relation between PCB level in blood of the children and the feeding period of mother's milk. Each number designates the age of a child (years, months). The average level in blood of mothers is also shown.

PCB pattern in the blood of mother and child: In the previous study on the child and mother occupationally exposed to PCBs, we found that the gas chromatographic patterns of blood PCB of the children fed mother's milk for a long time were quite different from those of their mothers. The pattern change of this type is remarkably observed in the blood PCBs of "Yusho" patients who suffered from PCB poisoning in Japan in 1968 (MASUDA *et al.* 1974). These patterns have been discussed in detail in a previous report (KUWABARA *et al.* 1978).

In the current study, there are no clear cases of change in blood PCB patterns between mothers and children as shown in Fig.2. However, regarding this point, more examinations will be performed.

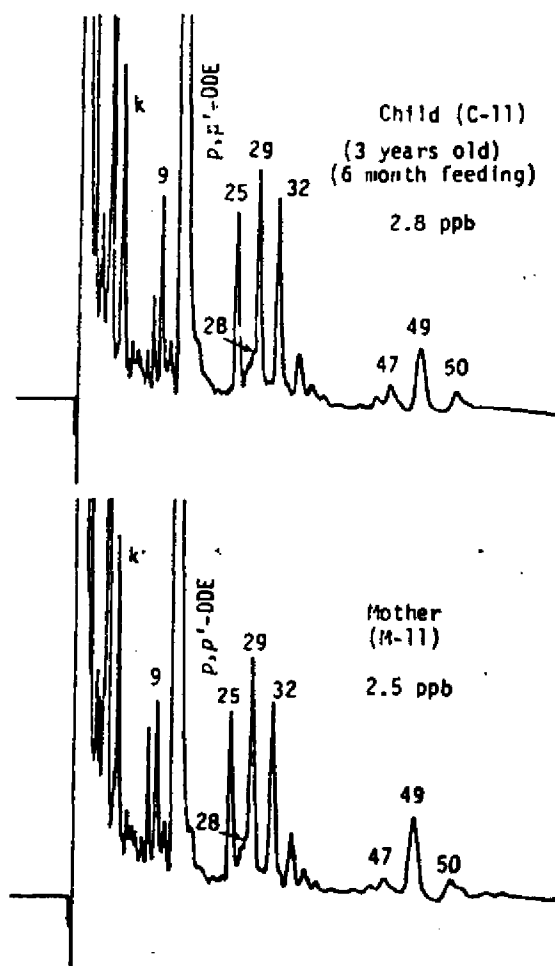


Fig.2. Gas chromatograms of PCBs in blood from a mother and her child on a 2 % Apiezon L column employing an electron capture detector. Peak No. k and 9 are identified as tri- and tetrachlorobiphenyls (YAKUSHIJI *et al.* 1978), and from No. 25 to 50 are identified as penta- to heptachlorobiphenyls, respectively (JENSEN and SUNDSTROM 1974, NAKAMURA and KASHIMOTO 1977).

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