

Changes in blood lipid concentrations of PCDDs, PCDFs and coplanar PCBs in a breast-fed and a formula-fed infant in the second year of life

K. Abraham^A, O. Pöpke^B, M. Ball^B, A. Lis^B, H. Helge^A

^A Virchow Klinikum der HU Berlin, Kinderklinik (KAVH), Heubnerweg 6, D-14059 Berlin, Germany

^B ERGO Forschungsgesellschaft, Albert-Einstein-Ring 7, D-22761 Hamburg, Germany

1. Introduction

Last year (DIOXIN '94), we reported on concentrations of PCDDs, PCDFs and coplanar PCBs in blood lipids of two infants, one breast-fed and the other formula-fed, at 11 months of age¹⁾. Intake and fecal excretion were investigated in these children at one, five and ten months^{2,3)}. After six months of breast-feeding, a two- to three-fold accumulation of the most toxic congeners (compared to the mother) was found in the breast-fed infant. This finding was theoretically expected on the basis of intake and absorption data, body weight and body composition data. In the formula-fed infant which had a much lower intake of PCDDs and PCDFs only four congeners were detectable in blood. Their concentrations were lower than those of the mother.

At the age of 25 months again blood was taken from the same infants to get information about the time course of the concentrations of PCDDs, PCDFs and coplanar PCBs.

2. Experimental conditions

During the second year of life, both infants were healthy and had normal weight gains. Compared to the first blood sampling at the age of 11 months the breast-fed infant's weight increased from 10.4 to 13.6 kg, that of the formula-fed one from 11.2 to 14.9 kg. Whole blood was obtained at the age of 25 months by venipuncture (about 20 ml) before breakfast and collected in heparinised vials which were immediately frozen at -18°C until analysed for PCDDs, PCDFs and coplanar PCBs using the same analytical methods as those used at the age of 11 months¹⁾. 2378-T4CDD toxicity equivalents (TEs) for PCDDs and PCDFs were calculated using I-TEFs⁴⁾. Concentrations below the limit of detection (LD) were taken in consideration as one half of the value defining the limit of detection.

3. Results and discussion

Concentrations of PCDDs, PCDFs and coplanar PCBs in blood (lipid based) of both infants at the ages of 11 and 25 months are listed in Table 1. At first sight unexpectedly, PCDDs and PCDFs increased (+26% for I-TE) in the breast-fed infant despite the weight gain (+30%). When the decreasing relative body fat mass during this period³⁾ is taken into account, however, the weight gain corresponds to an increase of the absolute body fat mass of only about 10%. Using the intake data of PCDDs and PCDFs after weaning at the age of 10 months (0.77 pg 2378-T4CDD/kg/d, 3.6 pg I-TE/kg/d), even theoretically, a slight increase of body burden concentrations can be expected.

Moreover, when fluctuations in the blood lipid concentrations and day-to-day variations of the analytical procedures are considered, the results of the breast-fed infant meet the expectations under the condition that elimination of the compounds during this period of time is negligible. Obviously also in children the half-lives of PCDDs and PCDFs are very long, and a clear decrease of the body burden concentrations can not be expected within a few years. This finding is in agreement with the model of Ayotte et al⁶⁾, but contrary to that of Kreuzer et al^{7,8)}, who predicted a shorter half-life of 2378-T4CDD in infants.

In contrast, lower concentrations of PCB 169, as found at 25 months, may be due to a shorter half-life compared to that of PCDDs and PCDFs. Unfortunately, relatively high values of PCB 126 were also found in the blanks, so that no reliable result could be obtained for this congener.

In the formula-fed infant OCDD was the only PCDD/PCDF congener detected. This was the result of higher limits of detection caused by considerably lower blood lipid concentrations in this infant at 25 months of age. Apparently, body burden concentrations of PCDDs and PCDFs in formula-fed infants increase only slightly due to increasing body weight and relatively low concentrations of these compounds in normal diets.

Table 1 Concentrations of PCDDs, PCDFs and coplanar PCBs in blood (lipid based) of a breast-fed and a formula-fed infant at the age of 11 and 25 months.

Compound (Conc. in pg/g fat)	breast-fed infant		formula-fed infant	
	11	25	11	25
2378-T4CDF	<2.7	<2.5	<3.0	<2.5
2378-T4CDD	3.7	4.1	<1.0	<1.0
12378-P5CDF	<1.2	n.d.(1.4)	<1.2	n.d.(2.5)
23478-P5CDF	23.1	29.7	1.5	<2.5
12378-P5CDD	11.1	15.2	<1.0	n.d.(1.8)
123478-H6CDF	9.8	12.2	<2.2	<2.5
123678-H6CDF	8.1	10.2	<1.0	<2.5
234678-H6CDF	<3.4	<3.0	<2.3	<2.5
123478-H6CDD	7.8	9.1	n.d.(1.1)	n.d.(2.8)
123678-H6CDD	43.0	51.7	2.5	<5.4
123789-H6CDD	7.1	8.1	n.d.(1.2)	<4.5
1234678-H7CDF	13.1	n.a.	<5.8	<6.0
1234678-H7CDD	24.3	29.7	8.8	<10.0
OCDF	<5.0	n.a.	<5.0	n.a.
OCDD	148.7	204.0	79.3	70.0
<i>I-TE (<LD=0.5*LD)</i>	29.2	36.8	2.4	2.3
PCB 77	23 (m)	20 (m)	26 (m)	20 (m)
PCB 126	287	n.a.	24	n.a.
PCB 169	270	183	7	11

n.a. = not analysed

n.d. = not detected (limit of detection)

(m) = maximum value, due to possible contribution of a contaminant

4. References

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