BREAST MILK CONTAMINATION BY PCBs AND PCDDs/PCDFs IN ARCTIC QUÉBEC: PRELIMINARY RESULTS ON THE IMMUNE STATUS OF INUIT INFANTS.

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In 1989 we reported that mean PCB concentration in Inuit breast milk was 5 times higher than that of the general population of the Province of Québec (Canada)[1]. This high body burden was mainly due to the consumption of sea mammals which accumulate organochlorine compounds coming from long range atmospheric transport. After considering 1) this unexpected high exposure and the traditional long duration of breast-feeding (1 to 2 years) resulting in a relative high cumulative dose of contaminants and 2) the high incidence rate of various infectious diseases during the first year of life in Arctic Québec, a cohort study was started. In 1989, between July 1989 and July 1990, 230 births occurred in this remote population of 6500 people scattered in 14 settlements. Among them, 213 volunteered to participate in the study and 118 did breast-fed their babies. 107 milk samples were collected and analyzed by HRGC using an electron capture detector for 10 PCB congeners (IUPAC No 28, 52, 101, 118, 138, 153, 170, 180, 183 and 187) and for 8 chlorinated pesticides (heptachlor expoxide, α and δ chlordane, hexachlorobenzene, endrin, dieldrin, DDE and mirex). 2,3,7,8 chloro-substituted congeners of PCDDs-PCDFs and non-ortho coplanar PCBs (IUPAC No 77, 126 and 169) were also determined by HRMS and the results have been presented previously[2]. All breast-fed and bottle-fed babies were examined by a nurse at 3, 6 and 12 months. Various clinical signs and symptoms of infectious diseases were systematically reported. In addition, biological parameters (haematology, enzymology and immunology) were determined. We report in this paper preliminary results on the variation of the immune status of babies according to their exposure.

Infectious diseases

At 3, 6 and 12 months, respectively 39.5, 58.4 and 49.2 % of all babies experienced at least one episode of Acute Otitis Media (AOM) during the previous follow-up period. Because AOM was the most incident illness, we focused our preliminary analysis on this disease (Table 1). Cumulative dose for PCBs, coplanar PCBs and PCDD/PCDFs were calculated by multiplying milk levels by the mean daily consumption of milk fat/kg body-weight (4.2 g), by the mean weight of babies during each period and finally by the cumulative days of breast-feeding. These doses were calculated for babies seen at 3, 6 and 12 months. Generally, babies that have experienced one or more episodes of AOM have accumulated higher doses of PCBs than healthy babies, and these differences were statistically significant for PCB 183 at 3 and 6 months, PCB 138 at 6 months and total PCB (Aroclor 1260) at 6 months. Coplanar PCB exposure was between 10 and 60 % higher in AOM babies. For PCDDs and PCDFs the same pattern was observed.

Cell immunity

Among various immunologic parameters tested, we present in Figure 1 the ratios of T-helper lymphocytes (CD4) on T-suppressor lymphocytes (CD8). This ratio of lymphocyte sub-populations was used as biomarker in the few human studies on the immunotoxic potency of various chemical exposures[3].

Although CD4:CD8 ratios decreased in all babies during the first year of life, differences were observed between bottle-fed and breast-fed babies and according to the PCB level in the breast milk (Fig 1). At 3 months no difference were observed between breast-fed and non breast-fed babies. However, at 6 and 12 months, a negative trend was observed: CD4: CD8 ratio decreased with the level of PCB exposure.

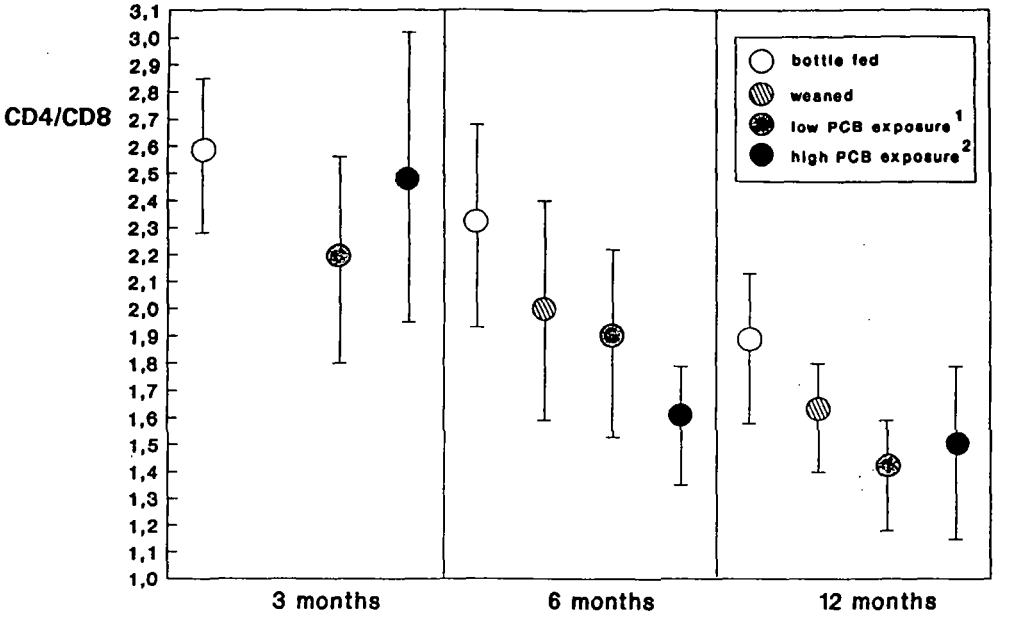
Associations between postnatal exposure to organochlorines and different infectious illness have been rarely reported[4]. Similarly, human studies linking immunologic changes to environmental pollutants exposure are scarce, particularly those involving babies. Immune status of Yu-Cheng children were assessed more than 6 years after the poisoning and the negative results that were reported could be due to the delay between exposure and immunological assessment[5].

The value of immune biomarkers to predict illness is controversial. However recent data indicate that specific deficiencies in the immune system may predispose certain children to develop otitis media and that these deficiencies are due in part to a lack of maturity of the child's developing immune system. Complete statistical analysis are ongoing to better assess the relationship between organochlorine exposure, immune status and illness in this highly exposed population.

Table 1 CUMULATIVE PCB AND PCDD/PCDF EXPOSURE OF INUIT BREAST FED BABIES WITH OR WITHOUT ACUTE OTITIS MEDIA (AOM) EPISODES DURING THE FIRST 3, 6 AND 12 MONTHS OF LIFE

CUMULATIVE DOSE	3 MONTHS			6 MONTHS			12 MONTHS		
PCB (µg) (IUPAC No)	AOM - (n= 48)	AOM + (n= 22)	p	AOM- (n=34)	AOM+ (n= 40)	p	AOM- (n= 28)	AOM+ (n= 34)	p
118	87	160	.11	189	327	.24	515	634	.63
138	380	497	.15	952	1429	.04	2355	3779	.12
153	652	840	.20	1652	2442	.07	4028	6771	.12
170	100	111	.76	262	250	.89	555	731	.49
180	337	367	.67	784	1167	.10	2175	3273	.30
183	32	48	.02	84	123	.03	209	318	.13
187	119	134	.69	266	265	.98	598	701	.64
Aroclor 1260	4762	6190	.15	12095	17353	.05	29705	43850	.15
Coplanar PCBs (ng)									
77	34	51	.03	78	113	.13	220	375	.15
126	283	464	.15	674	1068	.24	1765	3342	.14
169	407	337	.40	894	1231	.30	2016	4024	.08
2,3,7,8 TCDD (ng)	9	10	.74	19	32	.03	60	93	.25
Total TEQs (ng)	79	95	.36	181	267	.17	279	539	.08

Fig.1 CD4/CD8 Ratio at 3, 6 and 12 months of life according to breast-feeding status and PCB contamination milk level



1 < 2.1 mg/Kg (fat basis)

2 ≥ 2.1 mg/kg (fat basis)

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