

PCBs and dioxin-like compounds in pooled plasma samples from Inuit adults living in Nunavik (Arctic Québec)

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Introduction

The Inuit population living in Nunavik (Arctic Québec) is exposed to various xenobiotics through their country foods. Results of 105 breast milk analysis conducted in 1989-1990 showed a mean PCB (Aroclor 1260) concentration of 2.9 mg/kg lipids, a level five-fold greater than that measured in breast milk samples of women living in the southern part of the province (0.52 mg/kg lipids)¹. Mean concentrations of chlorinated pesticides or their metabolites (DDE, dieldrin, hexachlorobenzene, mirex) in milk samples from Inuit women were between three to five times greater than those of the reference population². Differences between the two groups were less important for PCDDs and PCDFs levels¹.

The investigation of breast milk levels allows for the quantification of biological exposure to these contaminants in only a limited segment of the population, i.e. women of reproductive age. In the course of the *Santé Québec Health Survey*, we expanded our observations to adults, men and women of all ages, in order to obtain a more complete picture of organochlorine exposure in Arctic Québec. Here we present the results of dioxin-like compound analysis (PCDDs, PCDFs, coplanar PCBs) in 20 pooled plasma samples from this population.

Methods

Potential participants were randomly selected from the adult population (18-74 years) of Nunavik and were asked to visit the local community hospital by the health survey personnel, during Fall 1992. After obtaining information on the purpose of the health survey and signing an informed consent form, 30 ml of blood were obtained by venipuncture from each participant for organochlorine analysis, and information was collected on dietary habits. A total of 499 Inuit participated in this survey (67% of those contacted). Three pooled plasma samples from men aged 20 to 40 years living in Québec City and Montreal were used as controls.

HLV

Blood samples were collected in 10-ml blue-lavender vacutainers (EDTA as the anticoagulant), centrifuged, and the plasma transferred in glass vials pre-washed with hexane. Since dioxin-like compound measurement requires at least 20 ml of plasma, 20 pooled samples containing between 25 and 30 ml were formed from 10 to 55 individual samples. Individual samples were grouped according to age, sex and region of residence (Table 1).

Table 1. Characteristics of the pooled plasma samples from Inuit adults living in Nunavik

HUDSON REGION			
Pooled sample no.	n	sex	age group
1	38	men	18-29
2	29	"	30-39
3	18	"	40-49
4	19	"	50-59
5	10	"	≥ 60
6	55	women	18-29
7	38	"	30-39
8	21	"	40-49
9	18	"	50-59
10	22	"	≥ 60
UNGAVA REGION			
11	26	men	18-29
12	11	"	30-39
13	14	"	40-49
14	10	"	50-59
15	9	"	≥ 60
16	47	women	18-29
17	33	"	30-39
18	22	"	40-49
19	15	"	50-59
20	13	"	≥ 60

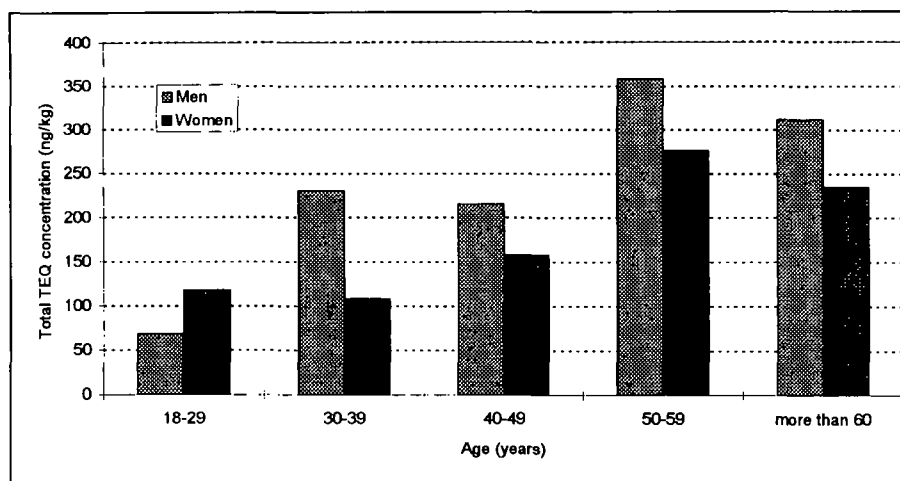


Figure 1: Total TEQ concentration (ng/kg lipids) in pooled plasma samples from Inuit according to age and sex. Each point represents the weighed arithmetic mean of two pooled samples (see Table 1).

Discussion and conclusion

Results reported in the present study clearly show that the adult population of Nunavik carries a much higher burden of PCBs and dioxin-like compounds than southern Québec populations. The control group used to effect comparison is not ideal, since it is composed of three pooled samples formed by individual samples obtained from men aged 20 to 40 years. Comparing this group with Inuit men from Nunavik aged 18-40 years would be more appropriate. The mean concentration for the sum of PCB congener in southern Québec 0.13 mg/kg lipids, compared to 2.2 for Inuit men from the same age group (17-fold greater). For dioxin like compounds, the total TEQ concentration in Nunavik men aged 18-40 years (93 ng/kg lipids) is 3.5 times lower than that of the southern Québec group.

The higher body burden for samples obtained from Inuit living in the Hudson Bay region, when compared to that of the Ungava Bay region was also observed previously in the 1989-1990 breast milk survey³). This may be due to the more traditional diet of Inuit living in the Hudson Bay region compared to those living in the Ungava Bay region. The relationship between age and dioxin-like compound body burden may reflect both the accumulation of these persistent compounds with age, and higher consumption rates of country foods in older people.

Analysis of PCB congeners, chlorinated pesticides and heavy metals in the 499 individual samples from Nunavik are presently being completed. A cord blood surveillance program is also underway in this region and will help assess the prenatal exposure to these compounds. Finally, a large epidemiological study will be initiated to investigate possible adverse neurodevelopmental effects in Nunavik infants.

Acknowledgments

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References

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Table 2: PCBs and PCDDs/PCDFs in 20 pooled plasma samples from Nunavik and 3 pooled plasma samples from southern Québec

HALOGENATED HYDROCARBON	Nunavik (N = 20)				Southern Québec (N = 3)			
	% detected	mean	min	max	% detected	mean	min	max
Major PCBs (mg/kg lipids)								
2,4,4'-TriCB (28)	80	0.04	0.01	0.25	0	< 0.004	< 0.004	< 0.004
2,2',5,5'-TCB (52)	90	0.03	0.01	0.08	0	< 0.004	< 0.004	< 0.004
2,2',4,4'-TCB (47)	75	0.002	0.001	0.004	NA	NA	NA	NA
2,4,4',5-TCB (74)	90	0.08	0.02	0.17	33	0.003	0.001	0.007
2,3',4,4'-TCB (66)	50	0.03	0.02	0.05	0	< 0.004	< 0.004	< 0.004
2,2',4,5,5'-PnCB (101)	100	0.05	0.00	0.13	0	< 0.004	< 0.004	< 0.004
2,2',4,4',5-PnCB (99)	100	0.20	0.02	0.63	NA	NA	NA	NA
2,3,3',4',6-PnCB (110)	100	0.04	0.01	0.07	0	< 0.004	< 0.004	< 0.004
2,3',4,4',5-PnCB (118)	100	0.16	0.03	0.32	100	0.009	0.006	0.011
2,3,4,4',5-PnCB (114)	100	0.05	0.02	0.11	NA	NA	NA	NA
2,2',4,4',5,5'-HxCB (153)	100	1.27	0.24	3.07	100	0.033	0.023	0.048
2,3,3',4,4'-PnCB (105)	100	0.04	0.01	0.08	66	0.003	0.001	0.005
2,2',3,4,4',5-HxCB (138)	100	0.65	0.13	1.63	100	0.029	0.022	0.038
2,2',3,4,4',5,5',6-HpCB (187)	100	0.23	0.04	0.53	100	0.008	0.005	0.011
2,2',3,4,4',5',6-HpPCB (183)	100	0.07	0.01	0.16	100	0.004	0.004	0.004
2,3,3',4,4',5-HxCB (156)	100	0.07	0.01	0.25	100	0.006	0.006	0.006
2,3,3',4,4',5'-HxCB (157)	100	0.018	0.001	0.056	66	0.002	0.001	0.003
2,2',3,4,4',5,5'-HpCB (180)	100	0.68	0.11	2.01	100	0.022	0.018	0.029
2,2',3,3',4,4',5-HpCB (170)	100	0.24	0.03	0.73	100	0.010	0.008	0.014
2,2',3,3',4,4',5,5'-OCB (194)	100	0.11	0.01	0.40	NA	NA	NA	NA
Sum of congeners*	100	4.08	0.81	9.87	100	0.134	0.103	0.184
PCDDs/PCDFs and planar PCBs (ng/kg lipids)								
2378-TCDF	5	5.6	1.5	32.0	0	< 3	< 3	< 3
2378-TCDD	30	8.4	2.5	36.0	0	< 2	< 2	< 2
23478-PnCDF	100	19.8	7.6	36.0	100	9.6	6.7	15.0
12378-PnCDD	55	16.2	4.5	40.0	66	3.4	2.5	4.3
123478/123678-HxCDF	65	14.4	4.0	83.0	100	13.1	8.2	17.0
234678-HxCDF	10	3.7	1.5	17.0	33	2.4	2.0	2.6
123478/123678-HxCDD	100	64.0	32.0	100.0	100	32.3	26.0	37.0
123789-HxCDD	90	20.6	5.0	79.0	66	5.0	3.0	8.0
1234678-HpCDF	100	38.8	22.0	64.0	100	26.3	18.0	39.0
1234678-HpCDD	100	95.6	48.0	181.0	100	62.0	48.0	74.0
OCDD	100	1122.2	531.0	2310.0	100	444.7	332.0	565.0
3,3',4,4'-TCB (77)	0	< 100	< 100	< 100	33	29.3	18.0	50.0
3,3',4,4',5-PCB (126)	100	220.4	51.0	508.0	100	49.3	24.0	77.0
3,3',4,4',5,5'-HCB (169)	100	418.8	85.0	882.0	100	29.0	26.0	32.0
TEQ concentration**,**								
PCDDs/PCDFs	100	39.6	17.1	81.8	100	14.6	11.5	18.9
Planar PCBs***	100	26.3	6.4	58.9	100	5.2	2.7	8.0
Mono- and di-ortho PCBs****	100	118.2	26.7	336.3	100	6.3	5.2	7.8
Total-dioxin-like compounds	100	184.2	55.8	446.7	100	26.1	20.1	31.7

* Non-detected values are given one-half the detection limit

** Calculated using the toxic equivalency factors from the World Health Organization⁴⁾

*** Congeners 77, 126, 169

**** Congeners 105, 114(not in controls), 118, 156, 157, 170, 180.

