

Weight, size, head circumference and TSH of Inuit newborn prenatally exposed to high levels of organochlorines.

Dewailly, E^{AB}, Bruneau, S.^A, Laliberté, C.^A, Bélanger, D.^A, Gingras, S.^A, Ayotte, P.^A and Nantel, A.^B.

^A Environmental Health Service, Community Health Department, 2050, St-Cyrille Blvd, Ste-Foy (Québec) G1V 2K8 Canada.

^B Québec Toxicology Center, 2705, Laurier Blvd, Ste-Foy (Québec) G1V 4G2 Canada.

The Kativik region is located north of the 55° parallel, in the Province of Québec. 6500 Inuit are scattered along a 2000 km seashore line. Because fish and sea mammals are major components of their traditional diet, these population are exposed to unusually high quantities of bioaccumulating contaminants such as heavy metals and organochlorines.

In 1988, we found very high levels of PCBs and DDE in the milk of 24 Inuit women of Hudson Bay. Levels of PCBs in the Inuit breast milk were 5 times higher than those of 48 caucasian women living in the southern part of the province¹.

In view of these data, we conducted a one year follow-up study of all babies (breast-fed and bottlefed) born between July 1989 and July 1990. The follow-up period ended in July 1991. One objective of this study was to evaluate exposure of breast-fed babies to various organochlorine compounds (OCs). Because levels of contaminants in milk lipids is similar to that in blood lipids for both mother and foetus, we used breast milk levels as an indirect indicator of foetal exposure. Secondly we wanted to identify the main factors associated with organochlorine exposure and finally we assessed the health risk for babies exposed prenatally and postnatally (breast-feeding) to these high levels of contaminants.

PCBs (including coplanar congeners) and PCDDs/PCDFs concentrations measured in the 109 breast milk samples confirm the particular high exposure of these babies. We present in this paper the preliminary results of the cohort study with special focus on health status at birth, especially variables that have been linked to *in utero* exposure in previous studies: size, weight, head circumference and TSH blood levels². However, these findings are still controversial^{3,4}.

Methods

Between mid-July 1989 and mid-July 1990, 224 births occurred in the Kativik region (birth rate of 35/1000 persons). Among the 125 babies who were breast-fed (56 %), we were able to estimate prenatal exposure using mother milk analyses for 109 of them. 10 PCB congeners (IUPAC No 28, 52, 101, 118, 138, 153, 170, 180, 183 and 187), 8 chlorinated pesticides (heptachlor epoxide, α and δ chlordane, endrin, hexachlorobenzene (HCB),

dieldrin, DDE and mirex) were measured by gas chromatography with electron capture detection. Additional analyses (coplanar PCBs, PCDDs and PCDFs) were performed by mass spectrometry on 40 milk samples. Because some chlorinated pesticides and PCB congeners were rarely detected and because PCDDs/PCDFs and coplanar PCBs were only analyzed on 40 milk samples, statistical analyses were limited to contaminants detected in the 109 milk samples: PCB congeners IUPAC No 138, 153, 180, 183 and HCB, dieldrin, DDE and mirex.

At birth, size, weight and head circumference were routinely measured by a nurse or a midwife. Data on TSH levels were obtained through the provincial screening program. Data on size, head circumference and TSH were obtained for 92 and weight for 94 newborns.

Statistical analyses included correlation analyses, covariance analyses and multiple regression in order to control for confounding factors (age and weight of mother at delivery and length of pregnancy). All these analyses were performed using SAS package.

Results

Pearson correlation coefficient between weight, size, head circumference, TSH levels and organochlorine exposure did not show statistically significant associations. However these crude analyses showed that size was slightly negatively correlated with DDE ($p = 0.09$), HCB ($p = 0.11$) and total PCB expressed in Aroclor 1260 ($p = 0.11$). No association was observed with weight, head circumference and TSH levels.

These crude statistical analyses did not take into account the known influence of maternal characteristics such as age, length of pregnancy, cumulative duration of previous breast-feeding and weight at delivery. We studied correlation between these factors and the newborn variables under study.

Birthweight was highly correlated with both the length of pregnancy ($r = 0.40$, $p < 0.001$) and the weight of the mother ($r = 0.30$, $p < 0.001$). Newborn size was only linked to the length of pregnancy ($r = 0.25$, $p = 0.02$).

We used a multiple regression model to adjust the crude association between newborn size and organochlorine contaminants for the length of pregnancy. Under these conditions the majority of PCB congeners and chlorinated pesticides were highly negatively associated with newborn size. PCB 138, 153, 180 and 183 were statistically linked to newborn size with p values of 0.01, 0.02, 0.03 and 0.04, respectively. HCB, dieldrin, DDE and mirex were also strongly associated ($p = 0.02$, 0.07, < 0.01 and 0.05, respectively) to this parameter. R square (percentage of variance of newborn size explained by levels of contaminants) ranged between 7 and 12 %.

Because covariance analyses showed that the newborn sex variable interacted with this relationship, we have conducted separate analyses for males and females. The multiple regression model revealed a difference between males and females concerning the associations between contaminants levels and the newborn size. For the females, no association was observed between the contaminant levels and size, when incorporating the length of pregnancy in the regression model (p ranging between 0.25 and 0.28, R^2 : 6.0-6.5 %). However, among the males, these associations were highly significant ($p < 0.01$ with R^2 ranging from 22 to 26 %).

Discussion

In this study, we observed a negative and statistically significant association between the size of newborns and OCs exposure which could be affected by uncontrolled factors. The indirect estimation of fetal exposure to contaminants using mother milk levels is less precise than a direct cord blood measurement, even though levels were adjusted on a lipid basis. Finally it is well known that weight and size of newborn could be also affected by alcohol and tobacco consumption. Nearly all mothers were smokers and alcohol consumption was impossible to measure in this culturally different population. While it is possible that our result could have been affected by these potentially confounding factors, it is unlikely that these factors are associated to organochlorine exposure of mothers.

The fact that newborn males and females could be affected differently by prenatal OCs exposure has been previously reported.^{5,6} Differences in body weight and height were only observed for females. However, in our study, males seem to be more affected by prenatal exposure. Additional analyses are underway to elucidate this unexpected finding.

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