Associations between dietary habits and body burden of PCBs in pregnant women from Sweden

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Introduction

The use and production of polychlorinated biphenyls (PCBs) have been banned for many years in Sweden. Nevertheless the human population is still exposed to these compounds in food. The human foetus is sensitive to PCBs, which readily pass the placenta from the mother. In risk assessment it is therefore important to determine the body burden of the lipid-soluble compounds in pregnant women, and to study determining factors for the body burden. The aim of our study was to determine the associations between food habits of Swedish women the year they became pregnant and body burdens of PCBs during pregnancy. Moreover, associations between body burdens and food habits during the teen-age years were also studied, because the body burden of PCBs during pregnancy is the result of bioaccumulation for many years. Finally, we analysed associations between body burdens of PCBs during pregnancy and early exposures of the women during their infancy, due to breast-feeding.

Table 1. Personal characteristics of the pregnant women.

Variable	N	Median (range)	Median (range)
Age (years)	323	28 (18-41)	
Pre-pregnancy BMI (kg/m^2)	315	22.2 (16.6-43.6)	
Weight gain during pregnancy (% per week)	294	0.62 (-0.06-1.42)	
Breast fed (months)	170	3 (0-18)	
Food consumption (g/day)		**Year of preg.**	**7th grade**
Meat and meat products	249	101 (0-314)	107 (0-262)
Dairy products (milk fat)	249	23 (4-89)	28 (0-114)
Vegetable fat	249	12 (0-64)	
Egg	249	7 (0-50)	14 (0-50)
Fish (total)	249	21 (0-151)	27 (0-207)
Fatty fish from the Baltic Sea[a]	249	0 (0-20)	1 (0-36)
Other fatty fish	249	2 (0-31)	3 (0-35)
Lean fish	249	16 (0-110)	20 (0-160)

[a]Baltic herring and salmon (not farmed)

[b]Farmed salmon and rainbow trout, other herring, mackerell, eel and whitefish

[c]Cod-like fish species, flatfish, pike, perch, pikeperch, burbot, caviar, fish sticks, canned fish (except herring)

Materials and Methods

From January 1996 to March 1999, 323 pregnant women living in Uppsala County, bearing their first child, were recruited in early pregnancy (Table 1). The women were interviewed twice (early and late pregnancy) about personal characteristics, life style, medical history etc. During gestational week 30-34, a blood sample was taken for analysis of PCBs.[1] The women also answered a detailed food frequency questionnaire covering the year they became pregnant and the year they attended 7th grade in school (teen-age years). In this questionnaire we also asked the women to give information about if they had breastfed during infancy. If the answer was yes, the women were asked to give information about how many months they had received breast milk. The associations between food consumption variables (independent variables) and serum PCB concentrations (dependent variable) were analysed by multiple regression with independent variables such as age, pre-pregnancy BMI, weight change during pregnancy and year of sampling included in the regression model. The statistical analysis covered the congeners CB 118, CB 138, CB 153, CB 156 and CB 180.

Table 2. Concentrations of PCBs in serum in late pregnancy.

Congener	N	Median (ng/g lipid)	Range (ng/g lipid)
CB 118	323	11	3-93
CB 138	323	29	6-100
CB 153	323	59	14-179
CB 156	323	4	1-27
CB 180	323	38	8-139

Results and Discussion

The regression analysis showed no consistent associations between serum levels of PCBs and consumption of meat and meat products, dairy products, vegetable fat, eggs and lean fish (results not shown). A statistically significant higher serum level of CB 118 and CB 153 was found in women reporting the highest consumption of herring and salmon from the Baltic Sea the year of pregnancy compared to women reporting no consumption at all (Table 3). Moreover, a positive association was found between consumption of other fatty fish and serum levels of CB 118. For the other PCB congeners we found no significant association with consumption of fatty fish.

When food consumption during the teen-age years was studied, we still found no consistent associations between serum PCB levels and consumption of meat and meat products, dairy products, vegetable fat, eggs and lean fish (results not shown). For CB 118, CB 153, CB 156 and CB 180, however, we found the highest serum levels among women reporting the highest consumption of fatty fish from the Baltic Sea (Table 4).

The results indicate that fatty fish, especially fatty fish from the PCB-contaminated Baltic Sea,[2] have been a source of PCB exposure among women in child-bearing age from the general population in Sweden. Moreover, the consumption during the teen-age years seemed to have given a more significant contribution to the body burden during pregnancy than the consumption during the year of pregnancy. This is not surprising since the levels of PCB in fish from the Baltic Sea were considerably higher in the 1970s and early 1980s,[3] when the women were teenagers, than during the late 1990s when they became pregnant.

Table 3. Adjusted geometric mean (SD) of PCBs in pregnant women with different levels of fish consumption the year they got pregnant

Consumption	CB 118	CB 153
Fish total (g/d)		
0-8.0	10.6 (10.1-11.1)	
8.1-21.4	11.5 (11.0-12.0)	
21.5-32.2	11.5 (11.0-12.0)	
32.3-106.9	12.1 (11.6-12.7)*	
Baltic fatty fish (g/d)		
Never	11.3 (10.9-11.6)	62.4 (60.9-64.0)
0.1-1.8	10.4 (9.9-11.0)	54.4 (52.1-56.8)*

1.9-20.5 13.1 (12.5-13.8)* 68.4 (65.6-71.4)*

Other fatty fish (g/d)

0-0.9 10.1 (9.6-10.6)
1.0-2.4 11.8 (11.2-12.4)*
2.5-6.9 11.8 (11.3-12.4)*
7.0-30.0 12.1 (11.6-12.7)*

Dependent variable ln-transformed. Independent variables in the model: age, year of sampling, BMI (not CB 118) and weight change during pregnancy. ($p<0,05$, N=226).

Surprisingly, we found a positive association between serum levels of CB 156 and CB 180 during pregnancy and the number of months the women breastfed during their infancy. For CB 156 the adjusted mean level increased 2.3% (SD: 1.1%; $p<0.05$) for each month of breast feeding. The corresponding increase for CB 180 was 1.4% (SD: 0.7; $p<0.05$). This shows that PCB exposure during the earliest period of life still can be traced in the body during pregnancy more than two decades later.

There are many uncertainties in the estimates of food consumtion and the number of months of breastfeeding. Nevertheless, we found that early exposures to PCB during infancy and the teen-age period still influence the body burden of PCBs in pregnant women at the age of 18-41 years.

Table 4. Adjusted geometric mean (SD) of PCBs in pregnant women with different levels of fish consumption the year they attended 7th grade in school

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Consumption CB 118 CB 153 CB 156 CB 180

Fish total (g/d)

0-16.6 10.4 (9.9-10.9) 3.7 (3.5-4.0)
16.7-26.2 11.4 (10.8-11.9) 4.1 (3.8-4.3)
26.3-40.1 11.5 (11.0-12.0) 4.4 (4.2-4.7)*
40.2-297.1 12.4 (11.8-12.9)* 4.4 (4.2-4.7)*

Baltic fatty fish (g/d)

Never 10.6 (10.2-11.0) 58.1 (56.2-60.0) 3.8 (3.6-4.0) 38.0 (36.9-39.0)
0.1-2.5 11.2 (10.7-11.7) 62.1 (60.0-64.4) 4.1 (3.9-4.4) 39.8 (38.6-41.1)
2.6-36.3 12.7 (12.2-13.2)* 65.4 (63.2-67.6)* 4.7 (4.5-5.0)* 41.2 (39.9-42.5)*

Other fatty fish (g/d)

0-0.9 10.5 (10.0-11.1)
1.0-2.6 11.4 (10.9-11.9)
2.5-4.9 11.4 (10.9-12.0)
5.0-35.4 12.3 (11.7-12.9)*

Dependent variable ln-transformed. Independent variables in the model: age, year of sampling, BMI (not CB 118) and weight change during pregnancy. ($p<0,05$, N=226).

References

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