DETERMINANTS OF PCB CONCENTRATIONS IN SERUM OF PREGNANT WOMEN

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Introduction

Polychlorinated biphenyls (PCBs) are still an environmental problem in Sweden, although the use and production have been banned for decades. Because of this ban the concentrations in food have declined since the 1970s. In fish from some parts of the Baltic Sea, however, this decline appears to have ceased in the 1990s (1). Fish consumption is an important source of PCB exposure in Sweden. The developing fetus and the growing infant is sensitive to PCB exposure, and it is important to keep the body burdens of PCB as low as possible. The high PCB concentrations in fatty Baltic fish have prompted the National Food Administration in Sweden to issue food consumption advisories with the aim to protect girls and women in child-bearing age from accumulating high body burdens of PCB (2). In epidemiological studies of health effects of PCB on infants and children, PCB concentrations in blood serum is often used as a measure of the PCB exposure of the fetus. Here we report some determining factors that influences the serum concentrations of PCB in women during late pregnancy, in order to get a better understanding of the factors affecting the PCB exposure of the fetus.

Table 1. Personal characteristics of the pregnant women.

Variable	N	Median	Range
Age (years)	302	27	17-40
Pre-pregnancy BMI (kg/m^2)	296	22.3	16.6-43.6
Weight gain during pregnancy (% per week)	275	0.61	-0.05-1.42
	Proportions		
Education[a]	302	2:3 % 3:26 %	4:21 % 5:25 % 6:25 %
Place of living	302	East coast:10 %	Other:90 %
Smoking during pregnancy	301	Never:64 %	Former:16 % Smoker:20 %
Alcohol consumption during pregnancy	302	No:82 %	Yes:18 %

[a]2=junior high school education, 3=1-2 years of high school education, 4=3-4 years of high school education, 5=1-3 years of college education, 6=>3 years of college education.

HUMAN EXPOSURE II

Methods and Materials

From January 1996 to March 1999, 302 pregnant women living in Uppsala County, bearing their first child, were recruited in early pregnancy (Table 1). During pregnancy 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 PCB analysis, which was performed as described in Atuma and Aune (3). The determining factor studied in the statistical analysis of the results were age, place of living (along the Baltic coast or elsewhere), body mass index (BMI<30 kg/m^2 or ≥30 kg/m^2), weight gain during pregnancy (<0.8 % per week or ≥0.8 % per week), smoking (never, former, smoker), alcohol consumption during pregnancy (no, yes), and education (junior high school, 1-2 yr high school, 3-4 yr high school, 1-3 yr college, >3 yr college). The associations between the determining factors (independent variables) and serum PCB concentrations (dependent variable) were analysed by multiple regression with all independent variables included in the regression model. In the statistical analysis concentrations of CB 153, Σmono-ortho, Σdi-ortho, and ΣPCB were used as measures of PCB body burden.

Results and Discussion

Di-ortho PCB congeners CB 138, CB 153 and CB 180 gave the largest contribution to the ΣPCB concentration in serum (Table 2). In the multiple regression analysis 'age' (Table 3), 'pre-pregnancy BMI' (Fig. 1) and 'weight gain during pregnancy' (Fig. 1) was significantly associated with concentrations of PCB in serum, except in the case of åmono-ortho PCB and BMI.

Table 2. PCB concentrations in serum in late pregnancy.

Congener	N	Median (ng/g lipid)	Range (ng/g lipid)
CB 105	302	1	1-24
CB 118	302	11	3-93
CB 138	302	29	9-100
CB 153	302	59	17-179
CB 156	302	4	1-27
CB 167	302	4	1-9
CB 180	302	38	10-114
Σmono-ortho	302	18	6-118
Σdi-ortho	302	133	39-526
ΣPCB	302	151	47-618

The independent variables 'place of living', 'education', 'smoking' and 'alcohol consumption during pregnancy' were not significantly associated with the serum PCB concentrations. Our study shows that, among the determining factors studied, age is the strongest determinant of serum PCB concentrations in pregnant women. Moreover, women with a pre-pregnancy BMI of ≥30 kg/m^2 have lower average concentrations of PCB in late pregnancy than women with lower BMI. A high weight gain during pregnancy appears to "dilute" the PCB concentrations in serum, since women with a weight gain of ≥0.8 % per week during pregnancy had lower PCB concentrations than women with lower weight gains.

Table 3. Percentage increase in serum PCB concentrations per year of age.

PCB	Percent change	95% CI	P
CB 153	7.3	6.2-8.4	<0.001
Mono-ortho PCB	7.0	5.5-8.4	<0.001
Di-ortho PCB	6.7	5.6-7.9	<0.001
ΣPCB	6.7	5.6-7.9	<0.001

Results adjusted for 'place of living', 'education', 'pre-pregnancy BMI', 'weight gain during pregnancy', 'smoking during pregnancy', and 'alcohol consumption during pregnancy'

References

1. Bignert A. 2000. Comments concerning the National Swedish Contaminant Monitoring Programme in Marine Biota. www.nrm.se/mg/mcom.
2. Glynn A, Darnerud P-O, Andersson Ö, Atuma S, Johnsson H, Linder C-E & Becker W. 1996. Revised fish consumption advisory regarding PCBs and dioxins. SLV Report 4/96, Swedish National Food Administration, Uppsala, Sweden.
3. Atuma S & Aune M. (1999) Bull. Environ. Contam. Toxicol. 62, 8.

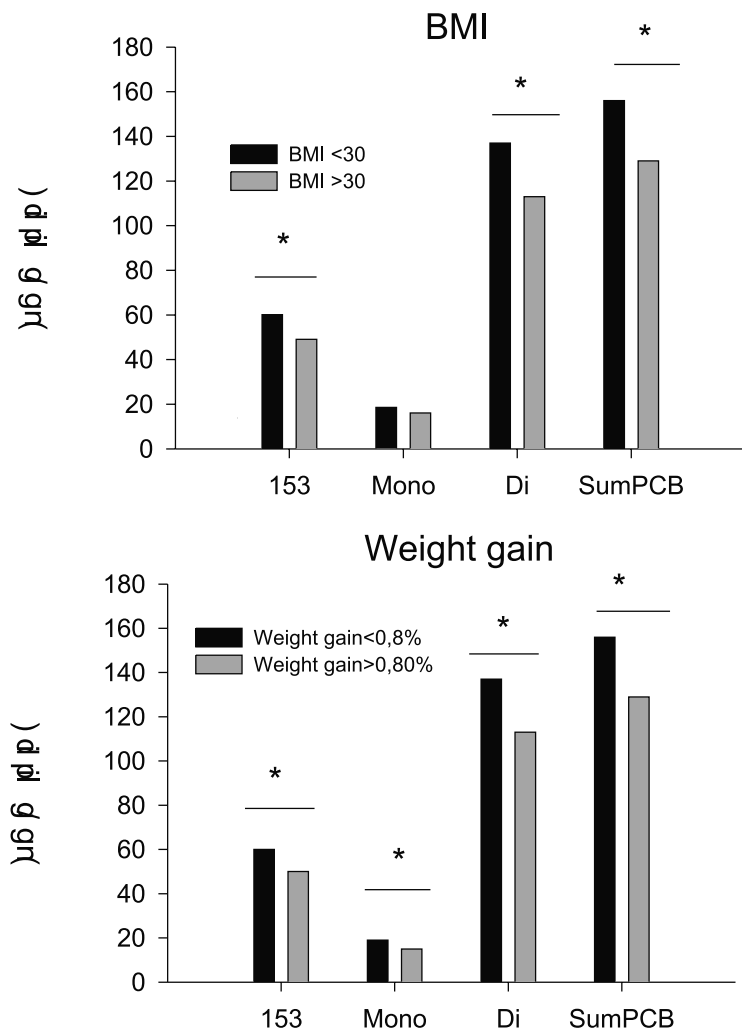Figure 1. Geometric mean of PCB concentrations in serum of pregnant women with a pre-pregnancy BMI of <30 kg/m^2 or $\geq$30 kg/m^2 , and a weight gain of <0.8% per week or $\geq$0.8% per week during pregnancy.
153=CB 153, Mono= mono-ortho PCBs, Di=di-ortho PCBs. The BMI results were adjusted for age, weight gain, place of living, education, smoking and alcohol consumption. Weight gain results were adjusted for age pre-pregnancy BMI, place of living, education, smoking and alcohol consumption. *p<0.05.