Fetal growth and exposure to PCB and DDE

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OBJECTIVE

To study the effects of *in uteto* exposure to PCB and DDE on fetal growth measured as birth weight, gestational age and risk of preterm birth

METHODS

Pregnant women were approached in Greenland, Poland and Ukraine and asked to donate a blood sample and fill in a standard questionnaire translated to the native languages.

After the women had given birth, informations on birth outcomes were obtained from the medical records at the centres where the women had given birth (Table 1).

The present study was restricted to women who gave birth to a singleton live-born child.

We measured PCB as 2,2',4,4',5,5'-hexachlorobiphenyl (CB-153), and p,p'-DDE in the maternal blood samples collected during pregnancy using on-column degradation of the lipids and analysis by gas chromotography mass spectromety.

Table 1 Analyzed sample size, levels of pregnancy outcomes and of exposure chemicals

	Greenland		Poland		Ukraine	
	N / Mean	*% / SD*	*N / Mean*	*% / SD*	*N / Mean*	*% / SD*
Mothers interviewed	598		472		640	
Blood samples	575	96.2%	261	55.3%	616	96.3%
Life births analyzed	521	87.1%	198	41.9%	579	90.5%
Preterm births (<37 weeks)	27	5.2%	12	6.1%	12	2.1%
Birth weight (g)	3591	605	3506	471	3275	440
Gestational age (weeks)	39.6	1.8	39.3	1.5	39.1	1.2
CB-153 female (ng/g lipid)	174.7	218.1	11.8	9.2	31.8	28.7
p,p'-DDE female (ng/g lipid)	441.2	460.8	427.7	270.8	769.3	520.9

Table 2 Characteristics of the study cohorts – potential confounding factors

		Greenland		Poland		Ukraine	
		Mean/N	*SD/%*	*Mean/N*	*SD/%*	*Mean/N*	*SD/%*
	Age	26.8	6.1	28.8	3.3	25.0	4.8
	BMI kg/m2	24.5	4.6	21.7	3.2	21.7	3.2
Education	left before 15 or 15-17	216	41.5 %	0	0.0 %	156	26.9 %
	left at age 18	43	8.3 %	44	22.2 %	145	25.0 %
	continued above age 18	201	38.6 %	150*	75.8 %	212	36.6 %
	missing	61	11.7 %	4	2.0 %	66	11.4 %
Marital status	married	106	20.3 %	160	80.8 %	324	56.0 %
	living as married	309	59.3 %	32	16.2 %	199	34.4 %
	living alone	53	10.2 %	6	3.0 %	51	8.8 %
	missing	53	10.2 %	0	0.0 %	5	0.9 %
Smoking	never smoker	62	11.9 %	129	65.2 %	368	63.6 %
	smoker	397	76.2 %	37	18.7 %	133	23.0 %
	ex-smoker	62	11.9 %	32	16.2 %	78	13.5 %
ETS	no	140	26.9 %	71	35.9 %	112	19.3 %
	yes	371	71.2 %	126	63.6 %	459	79.3 %
	missing	10	1.9 %	1	0.5 %	8	1.4 %
Alcohol drinks	less than 14/week	493	94.6 %	197	99.5 %	578	99.8 %
	14 and more/week	28	5.4 %	1	0.5 %	1	0.2 %
Occupational exposure	no	513	98.5 %	172	86.9 %	499	86.2 %
	yes	8	1.5 %	26	13.1 %	80	13.8 %
Parity	1	61	11.7 %	148	74.7 %	321	55.4 %
	2	77	14.8 %	34	17.2 %	127	21.9 %
	3+	378	72.6 %	9	4.5 %	108	18.7 %
	missing	5	1.0 %	7	3.5 %	23	4.0 %
Newborn sex	Boy	282	54.1 %	96	48.5 %	301	52.0 %
	Girl	239	45.9 %	102	51.5 %	278	48.0 %

RESULTS

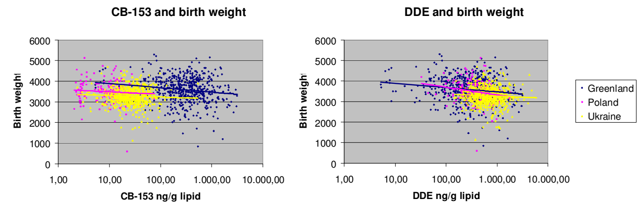

Figure 1 Birth weight in relation to CB-153 and p,p'-DDE exposure in the three populations

Table 3 Regression coefficients (per log unit increase in exposure) and odds ratios (per interquartile distance change) of multivariate linear and logistic regression models of maternal serum CB-153 and DDE and birth weight, gestational age and premature birth

	Birth weight (g)			Gestational age (weeks)			Premature birth	
	regression coefficient	*standard error*	*p-value*	*regression coefficient*	*standard error*	*p-value*	*OR*	*95% C.I.*
CB-153								
Greenland	-82.2	28.2	<0.01	-0.29	0.11	0.01	1.35	0.79 - 2.30
Poland	-53.2	43.6	0.22	-0.08	0.20	0.69	1.30	0.34 - 4.88
Ukraine	-13.4	20.8	0.52	-0.09	0.07	0.18	1.64	0.62 - 4.34
DDE								
Greenland	-52.5	25.2	0.04	-0.28	0.10	<0.01	1.19	0.71 - 1.99
Poland	-87.2	39.5	0.03	-0.52	0.15	<0.01	4.49	0.88 - 22.76
Ukraine	-18.3	22.5	0.42	-0.12	0.07	0.09	1.71	0.67 - 4.37

All regression models were adjusted for the potential confounders in Table 2, if forward inclusion of these covariates changed the regression coefficients by more than 10%. Birth weight was additionally adjusted for gestational age.

The birth weight decreased with increasing exposure to CB-153 or DDE (Figure 1). After adjustment, the most pronounced effects of CB-153 on birth weight and gestational age was found in Greenland (82 g decrease in birth weight and 0,3 week decrease in gestational age per log unit increase in CB-153). Notably, Greenland is also the population with the highest CB-153 exposure. In Poland and Ukraine, non-significant negative associations with birth weight and gestational age were found indicating minor effects at the CB-153 exposure levels found in these countries (Table 3).

DDE was negatively associated to birth weight and gestational age in Greenland and Poland and tends to be associated to gestational age in Ukraine, indicating potential adverse effects of DDE exposure on *in utero* child growth at DDE levels presently observed in European populations (Table 3).

Although the odds ratios for premature birth (<37 weeks of gestation) were elevated at both exposures and in all populations, none of these associations were statistically significant. Due to limited power (only 51 children in total being born preterm) we are not able to exclude that the risk of prematurity may also be elevated.

Conclusion

Results from the present study indicate that PCB and DDE may negatively affect fetal growth. However, inter country differences indicate that these compounds can only explain part of the occurrence of reduced fetal growth.

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