

CB-153 and p,p'-DDE in Inuits and Europeans

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Introduction

Persistent organohalogen pollutants (POPs), such as polychlorinated biphenyls (PCB) and pesticides such as dichlorodiphenyl trichloroethane (DDT) have been detected in human blood, adipose tissue and breast milk worldwide. There are indications that exposure to POPs may be a risk factor for neurological, hormonal and immunological effects in infants and children.¹⁻⁴ Moreover, some POPs can disrupt multiple endocrine pathways and induce a wide range of toxic responses.⁵ A variety of studies have demonstrated their estrogenic, anti-estrogenic, and androgen properties.⁶⁻⁸ There is also concern that POPs may adversely affect male fertility.⁹

The aims with the present study were to describe serum levels of 2,2',4,4',5,5'-hexachlorobiphenyl (CB-153) and p,p'-DDE (the major metabolite of DDT) in a large dataset, comprising 3161 subjects from four countries, and to analyze inter-country variations in exposure levels and biomarker correlations, and to assess the relative impact of different determinants (gender, age, residence area, breast-feeding, smoking, body mass index [BMI], gestational length, and dietary intake of seafood) for the inter-individual variations in serum levels of POPs.

Material and Methods

Serum samples were obtained from 3161 subjects, comprising Greenlandic Inuits (439 men and 572 women), Swedish fishermen and their wives (189 men and 544 women) and subjects from the general populations, Warsaw, Poland (257 men and 261 women) and Kharkiv, Ukraine (287 men and 612 women). CB-153 and p,p'-DDE were extracted from the serum using solid-phase extraction and then analysed by gas chromatography-mass spectrometry.^{10, 11} The concentrations were adjusted for total serum lipid concentrations determined by enzymatic methods and expressed as ng/g lipid.¹²

Information on age, gestational length, height and weight (for calculation of BMI), smoking habits, and intake of seafood was collected. For the fishermen's wives from Sweden information on life-long total length of breast-feeding was obtained and for the other women whether it was the first time they were given birth (primipara). For the populations from Sweden and Greenland we also used information regarding area of living. Information on current smoking was not obtained for the women from Sweden and information on current intake of seafood was not obtained for the Swedish fishermen.

The impact of potential determinants for inter-individual and inter-country variations in CB-153 and p,p'-DDE serum levels were evaluated by multivariate linear regression models. The correlations between serum levels of CB-153 and p,p'-DDE for different populations were evaluated by Spearman's correlation coefficients.

Results and Discussion

In total, the mean serum levels of CB-153 among the 1172 men was 180 ng/g lipid (median: 83; min: 3.3; max: 5500) and the mean serum level for p,p'-DDE was 780 ng/g lipid (median: 570; min: 4.4; max: 13000). The corresponding figures among the 1989 women were for CB-153 serum levels 88 ng/g lipid (median: 50; min: 2.0; max: 2200) and for p,p'-DDE serum levels 480 ng/g lipid (median: 360; min: 5.2; max: 5900). In the Table the levels for the different populations are given.

A noteworthy finding was that while there were high correlations between serum levels of CB-153 and p,p'-DDE in the Inuit and Swedish populations (r_s between 0.76 and 0.93) the correlations were considerably weaker in the populations from Warsaw and Kharkiv (r_s between 0.19 and 0.54), indicating different exposure sources.

The present study confirms that age is an important determinant for the serum levels of POP. Dietary intake of seafood and area of living were also important determinants for POP exposure in the Inuit and Swedish populations, but considerably less so in the populations from Warsaw and Kharkiv. Regarding the other determinants the pattern was very inconsistent, e.g. the effect of BMI on serum levels of p,p'-DDE among the men went in different direction among the Swedish fishermen and the men from Warsaw.

The uniquely large data-set of individual POP biomarkers presented in this paper will be combined with a number of semen function, reproductive hormone and "time to pregnancy" outcome variables collected from the same populations. The results from this project are expected to provide most valuable information that can be used for human risk assessments of POP.

Table. Age and serum levels of CB-153 and p,p'-DDE for the participants. Medians and (within brackets) 5th and 95th percentiles are shown.

Gender	Age	CB-153	p,p'-DDE
Population	(years)	(ng/g lipid)	(ng/g lipid)
<i>Men</i>			
Inuit men	30	200	560
	(21, 44)	(50, 920)	(90, 2200)
Swedish fishermen	48	190	240
	(32, 62)	(62, 640)	(80, 890)
Warsaw	30	17	530
	(25, 37)	(4.3, 38)	(220, 1000)
Kharkiv	25	44	930
	(20, 39)	(5.5, 130)	(390, 2400)
<i>Women</i>			
Inuit women	26	110	300
	(19, 38)	(21, 530)	(49, 1300)
Swedish fishermen's wives	50	84	140
	(37, 57)	(30, 220)	(50, 530)
Warsaw	29	11	380
	(25, 34)	(2.6, 27)	(140, 880)
Kharkiv	24	27	650
	(18, 34)	(8.1, 69)	(270, 1700)

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