

PRENATAL AND POSTNATAL PCB AND DIOXIN EXPOSURE AND COGNITIVE ABILITIES IN THE DUTCH COHORT AT SCHOOL AGE

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Introduction

In the Netherlands a prospective study has been started in 1989 to investigate the effects of background Polychlorinated Biphenyl (PCB) and dioxin exposure on the development of healthy term born babies.

The cohort consists of 209 children that were breast-fed and 209 children that were formula-fed during infancy. Prenatal PCB exposure and PCB and dioxin exposure through lactation were measured.

Previous results in the Dutch cohort showed that prenatal PCB exposure was related to lower birth weight(1), lower growth rate until 3 months of age(1), lower psychomotor scores at 7 months of age(2), a poorer neurological condition at birth(3) and at 18 months(4). At pre-school age the mean score on the Kaufmann Assessment Battery for Children of the highest prenatally exposed children (PCB_{maternal} >3.0 µg/l) was four points lower than the mean score of the lowest exposed group (PCB_{maternal} < 1.5 µg/l)(5). Postnatal PCB and dioxin exposure through lactation was related to lower psychomotor development at 7 months(2). At 3 ½ years of age no adverse effects of postnatal exposure on cognitive abilities could be found.

Prenatal effects of background PCB exposure on cognitive abilities are reported until 11 years of age in the Michigan cohort(6). The most highly prenatally exposed children scored significantly lower on the Wechsler Intelligence Scale for Children. In contrast to these findings however, no developmental effects were found in the North Carolina cohort in children aged 3 to 5 years (7).

We therefore have examined whether the adverse effects of prenatal PCB exposure on general cognitive abilities in the Dutch cohort persist at school age. Moreover we are interested in possible effects on specific aspects of cognitive functioning to reveal possible mechanisms by which neurodevelopmental deficits may occur.

Material and Methods

Subjects

418 Healthy mother infant pairs recruited between June 1990 and February 1992 were invited to participate in the follow-up study at 6 years of age. 207 pairs were living in Rotterdam, a highly industrialised area in the Netherlands and 211 pairs in Groningen, a semi-urban area in the north. 209 children were breast-fed and 209 were formula-fed during infancy.

Exposure variables

Prenatal PCB exposure was estimated from the sum of four PCB congeners, International Union for Pure and Applied Chemistry (IUPAC) numbers 118,138,153,180 in maternal plasma and cord plasma by gas chromatography with electron capture detection.

Lactational exposure was assessed from breast milk PCB and dioxin concentrations, multiplied by the number of weeks of breast-feeding.

At 3 1/2 years of age PCB concentration was estimated from the sum of the four congeners in plasma samples of the 3 1/2 year old children.

Cognitive assessment

At 6 years of age cognitive abilities were measured with the Dutch version of the McCarthy Scales of Development. This test assesses 5 aspects of cognitive functioning; verbal, spatial-perceptual, quantitative, memory and motor abilities. The general cognitive index is the sum of the scores on the verbal, spatial-perceptual, and quantitative scale.

Data analysis

The effects of prenatal and postnatal PCB exposure will be studied with multiple linear regression analysis, adjusting for covariables.

Table 1 Characteristics of study population

	Total cohort (N=375)	Breast-fed group (N=196)	Formula-fed group (N=179)
Age yr (sd)	6,72 (0,32)	6,66 (0,34)	6,78 (0,29)
Sex (m/f) ①	192/183	106/90	86/93
Center R/Gr ②	189/186	99/97	90/89
ΣPCBmaternal (N=373) ③	2,04 (0,59-0,35)	2,22 (0,73-7,35)	1,84 (0,59-5,08)
ΣPCBcord (N=339) ③	0,38 (0,08-2,08)	0,42 (0,08-2,08)	0,35 (0,08-1,98)
ΣPCB42months (N=279) ③	0,40 (0,07-5,90)	0,80 (0,23-5,90)	0,20 (0,07-1,49)
ΣPCBmilk (N=180) ③		402,38 (153,35-1226,38)	

① male/female

② Study Center Rotterdam/Groningen

③ Median and range Sum PCB 118, 138, 153, 180

Results and Discussion

The follow-up at school age has just been completed. From the total cohort (N=418) 375 children were willing to participate at school age.

Preliminary results will be discussed in the presentation. We will analyse the effects of prenatal and postnatal PCB exposure on general cognitive functioning measured with the McCarthy Scales of Development and additionally on more specific aspects of cognitive functioning measured by its subscales: verbal, spatial-perceptual, quantitative, memory and motor abilities.

Acknowledgements

This study is part of an international research project entitled: 'Early PCB exposure and neurodevelopmental deficit: Application and validation of indicators for the early detection of deficit', which is funded by the European Community (contract no. EV5V-CT92-0207).

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