Human biomonitoring of dioxins in breastmilk and research.

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Introduction:

In 1977-1990 it was realized that incinerators spread highly toxic polychlorinated-dibenzo-dioxins and furans into the environment, polluting humans and nursing children via breast milk. In 1987 a cohort study was initiated in the Amsterdam/Zaandam region of the Netherlands to study possible effects of these chemicals on reproduction.

Effects on thyroid hormone metabolism, liver, haematology and immunology, retinol binding protein (a decrease) and Calcium excretion (increase) were found in neonates. Follow-up was performed at the age of 2½ years and 8-12 years. Persistent effects were seen. Effects on haematological and immunologic parameters into preschool age, and negative effects on lung function and negative effects on brain development - both behavioural and cognitive - at the age of 8-12 years, were associated with perinatal exposure. (1) The cohort was studied again recently during puberty (14 -19 years).

Subjects and Methods:

A total of 33 subjects (19 girls and 14 boys) of the original 60 infants, agreed to take part in the follow-up study, including blood withdrawal. The Tanner score was used to assess the pubertal development. Body Mass Index (BMI) was determined. The perinatal PCDD/F exposure measured in breastmilk shortly after birth, was known for all subjects.

Laboratory analyses

Fasting glucose, insulin, total cholesterol and lipid spectrum (HDL, LDL, triglycerides), leptin, white and red blood cell count and blood differentiation and current PCDD/F, dioxinlike (dl -) PCB and PBDE serum concentrations were measured. The current PCDD/F levels were related to the perinatal levels of the individuals.

Results:

A delay in breast development in girls in relation to higher prenatal dioxin exposure was found. (2) A sharp decrease in the levels of dioxins was seen. (table). The PBDE analyses showed an outlier in the samples (n=18): one subject, a girl contained large amounts of PBDE-28, 85, 99, 100, 153 and 154. The mean concentration of the sum PBDEs (28, 47, 85, 99, 100, 153, 154, 183) was 14.0 (4.9-73.6) ng/g lipid including the outlier and 8.7 ng/g lipids excluding the outlier. Exclusion of the outlier revealed a positive association between free T4 (FT4)

and PBDE 99 (Spearman's correlation coefficient: P= 0.048). T3 levels were positively associated with dl-PCB's and PBDE 99 (Spearman's correlation coefficient: P= respectively 0.047 and 0.003, see figure). The outlier had a relatively high FT4 and a relatively lower T3. A trend was seen with the sum of the PBDE's and FT4: P= 0.057. This is in agreement with Turyk's findings in Canadian fisherman. (3) Our findings of endocrine disruption in thyroid hormone metabolism by PBDE's could be explained by an increased resistance in (peripheral) tissues. Other data are currently being evaluated.

Reference List

(1) Leijs MM., Koppe JG, Olie K, Nicolopoulou-Stamati P, ten Tusscher GW. Organohalogen Compounds 2006;68:794-7.

(2) Leijs MM, Koppe JG, Olie K, de Voogt P, Vulsma T, van Aalderen WMC et al. Organohalogen Compounds 2006;68:968-71.

(3) Turyk M, Persky V, Imm P, Knobeloch L, Chatterton Jr R., Yu-cai Lu et al. BFR-congress Amsterdam . 2007.
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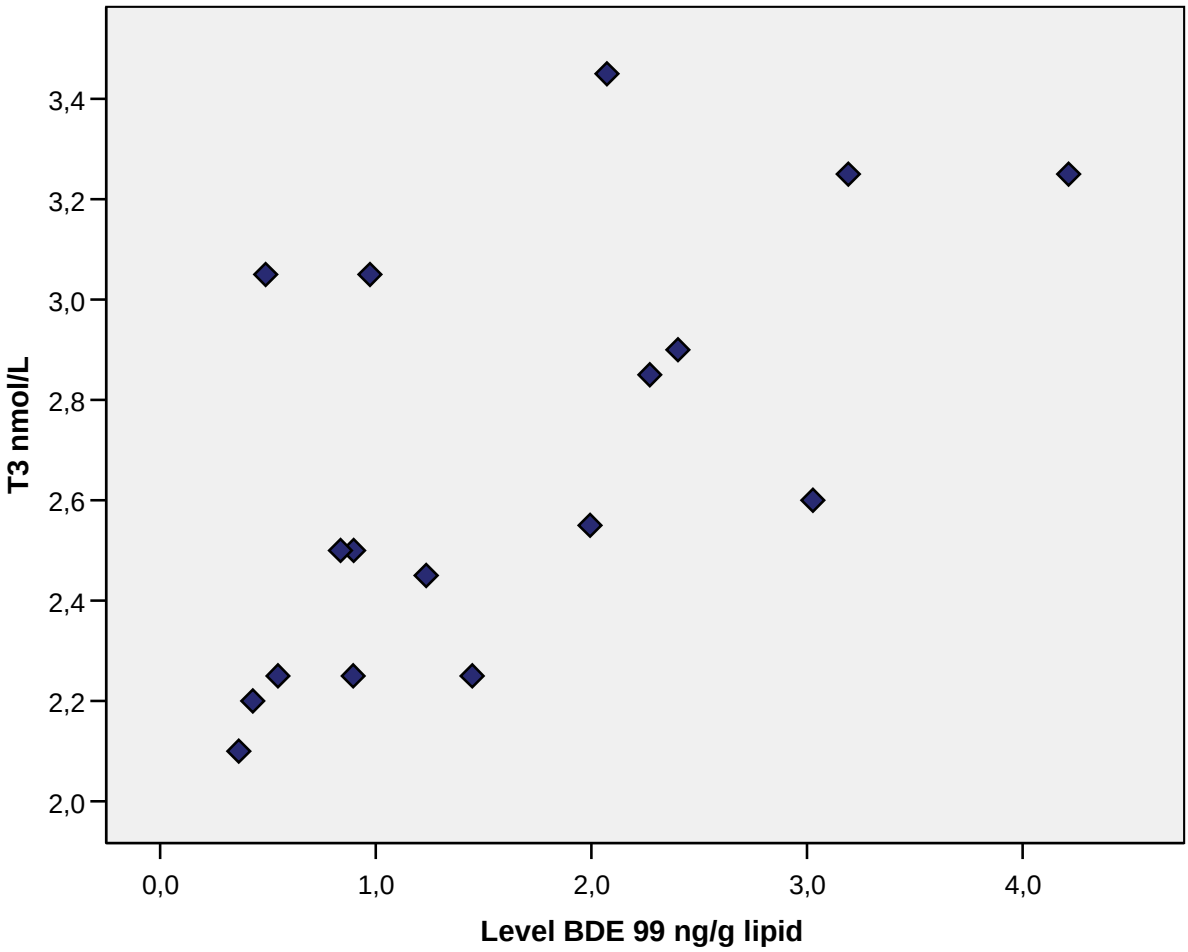

Mean age, perinatal PCDD/F (dioxin) exposure and current PCDD/F (dioxin)and dl-PCB exposure.

	Median(cohort: n=33)	Mean (cohort: n=33)	Median (girls: n=19)	Median (boys: n=14)	Range	Percentile 95%
Age (years)	14.3	15.0	14.3	14.3	14.0-18.7	18.5
Prenatal dioxin exposure (ng/kg lipid) ITEQ	29.8	32.6	29.2	28.6	9.05-88.8	74.8
Lactational dioxin exposure (ng) ITEQ	45.9	66.9	45.9	42.0	4.34-279	239.1
Current serum dioxin WHO-TEQ (ng/kg lipid)	1.6	2.2	1.1	2.3	0.4-6.1	6.1
Current serum dl-PCBs (WHO-TEQ) (ng/kg lipid)	1.8	2.2	1.7	1.5	0.04-7.8	7.3

Serum levels of PBDEs (ng/g lipid) in 18 adolescents.

Subject N=18	SUM PBDEs	BDE 28	BDE 47	BDE 85	BDE 99	BDE 100	BDE 153	BDE 154	BDE 183
no17 outlier	73.66	1.73	3.82	25.86	14.99	15.00	9.09	2.21	0.96
Mean	14.04	0.20	2.29	2.49	2.35	2.09	2.72	0.55	1.36
Mean excluding outlier	8.74	0.11	2.16	1.10	1.66	1.32	0.48	0.48	1.43