Effects of PCBs and dioxins on the development of young children.

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1. Introduction

Both PCBs and dioxins are lipophilic stable toxic compounds to which human adults are exposed by eating animal fats. They are stored in the human adipose tissue.
During pregnancy small amounts of both compounds pass the placental barrier and the embryo and fetus are exposed during a critical period of organ growth and development. After birth the breast-fed infant is exposed to relatively high levels of these contaminants. The postnatal exposure of formula-fed infants is negligible since animal fat in formula is replaced by lipids of a vegetable origin.
The specific purpose of the study was to examine neurological and psychomotor development of young children in relation to perinatal exposure to PCBs and dioxins.

2. Methods

In this study PCBs have been measured in maternal plasma and umbilical cord plasma as a measure of the intrauterine exposure of the infants. The postnatal exposure to PCBs and dioxins was estimated from the levels in human milk and formula. A prospective longitudinal follow-up study on the neurodevelopment, according to Prechtl and Touwen, was done in a cohort of 418 Dutch Caucasian fullterm

infants in the second week after birth and at 18 months of age. This part of the study was done in co-operation with the Department of Obstetrics and Developmental Neurology of the University of Groningen. Two hundred and nine infants were breast-fed for at least six weeks, the other 209 infants received formula from one batch as a reference.
The Rotterdam subpopulation of 207 infants was also studied for their visual recognition memory at 3 and 7 months of age with The Fagan Test of Infant Intelligence, and for their mental and psychomotor development with the Bayley Scales of Infant Development at 3, 7, and 18 months of age.
In a subgroup of 105 mother-infant pairs, living in the Rotterdam region, influences of PCBs and dioxins on the thyroid hormone status were studied in co-operation with The Department of Toxicology of the Agricultural University Wageningen.

3. Main results

Perinatal exposure to Dutch background levels of PCBs and dioxins gives subtle signs of neurological dysfunctioning in the second week after birth and at 18 months of age. However, there is no relationship with clinically relevant neonatal neurological abnormalities.
The visual recognition memory at 3 months of age was not influenced by perinatal exposure to PCBs or dioxins. However, at 7 months of age breast-fed infants had significantly higher mean scores on the Fagan Test, compared to formula-fed infants. Moreover, the visual recognition memory of the infants was positively correlated with the duration of breast-feeding. There was no deleterious effect of the perinatal exposure on the visual recognition memory of the infants.
At 3 months of age, higher in utero exposure to PCBs was significantly associated with lower psychomotor scores on the Bayley Scales of Infant Development. At 7 months of age, breast-fed infants scored significantly higher on the psychomotor scale at 7 months of age, compared to formula-fed infants. However, the psychomotor score of the 66% highest exposed breast-fed infants (> 756 pg total PCB-dioxin TEQ) was negatively influenced by this postnatal exposure, and comparable to the psychomotor score of the formula-fed infants. It is assumed that breast-feeding itself has a positive effect on the

motor development due to lipophilic substances like hormones and trophic factors, which are absent in formula. However, when the PCB and dioxin load reaches a certain level they might have a deleterious effect on the psychomotor development so that the beneficial effects of human milk are nullified. There was no significant effect of the perinatal exposure to PCBs and dioxins on the mental development at 3 and 7 months of age. At 18 months of age the mental nor the psychomotor score was related to this exposure.
A higher exposure to PCBs and dioxins is significantly correlated with lower plasma levels of maternal TT3 and TT4, and with higher plasma levels of TSH in the infants. There was no significant relationship between the thyroid hormone levels in the infants and their neurodevelopment during the first 18 months of life.

4. Conclusions

All 418 mother-infant pairs in this study had detectable levels of PCBs and dioxins in their body.
Although this study detected no serious, clinical relevant developmental abnormalities, even the Dutch background exposure to relatively low levels of PCBs and dioxins resulted in subtle signs of neurological dysfunctioning, a small delay in psychomotor development, and alterations in the thyroid hormone status.
The mechanisms by which these contaminants interfere are not clear at the moment.
From the results of this study it is not necessary to discourage breastfeeding.

5. References

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