The influence of maternal dietary exposure to dioxins and PCBs during pregnancy on ADHD symptoms and cognitive functions in Norwegian preschool children.


Abstract

BACKGROUND:
Polychlorinated dibenzo-p-dioxins/dibenzofurans (dioxins) and polychlorinated biphenyls (PCBs) are persistent organic pollutants (POPs) with potentially adverse impact on child neurodevelopment. Whether the potential detrimental effects of dioxins and PCBs on neurodevelopment are of specific or unspecific character is not clear.

OBJECTIVES:
The purpose of the current study was to examine the influence of maternal dietary exposure to dioxins and PCBs on ADHD symptoms and cognitive functioning in preschoolers. We aimed to investigate a range of functions, in particular IQ, expressive language, and executive functions.

MATERIAL AND METHODS:
This study includes n=1024 children enrolled in a longitudinal prospective study of ADHD (the ADHD Study), with participants recruited from The Norwegian Mother and Child Cohort Study (MoBa). Boys and girls aged 3.5 years participated in extensive clinical assessments using well-validated tools; The Preschool Age Psychiatric Assessment interview (PAPA), Stanford-Binet 5th revision (SB-5), Child Development Inventory (CDI), and Behavior Rating Inventory of Executive Function, Preschool version (BRIEF-P). Maternal dietary exposure to dioxins and PCBs was estimated based on a validated food frequency questionnaire (FFQ) answered mid-pregnancy and a database of dioxin and PCB concentrations in Norwegian foods. Exposure to dioxins and dioxin-like PCBs (dl-compounds) was expressed in total toxic equivalents (TEQ), and PCB-153 was used as marker for non-dioxin-like PCBs (ndl-PCBs). Generalized linear and additive models adjusted for confounders were used to examine exposure-outcome associations.

RESULTS:
Exposure to PCB-153 or dl-compound was not significantly associated with any of the outcome measures when analyses were performed for boys and girls together. After stratifying by sex, adjusted analyses indicated a small inverse association with language in girls. An increase in the exposure variables of 1 SD was associated with a reduction in language score of -0.2 [CI -0.4, -0.1] for PCB-153 and -0.2 [CI -0.5, -0.1] for dl-compounds in girls. For boys, exposure to PCB-153 or dl-compounds was not associated with language skills. The difference between sex-specific associations was not statistically significant (p-value=0.13). No sex-specific effects were observed for ADHD-symptoms, IQ scores, or executive functions.

CONCLUSIONS:
We found no indications that variation in current low-level exposure to PCB-153 or dl-compounds in Norway is associated with variation ADHD-symptoms, verbal/non-verbal IQ, or executive functions including working memory in preschoolers. However, our findings indicated that maternal dietary exposure to PCB-153 or dl-compounds during pregnancy was significantly associated with poorer expressive language skills in preschool girls, although the sex-specific associations were not significantly different.