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EXPOSURE TO POLYCHLORINATED BIPHENYLS (PCBS) AND NEUROBEHAVIORAL DEVELOPMENT OF CHILDREN

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Abstract

Polychlorinated biphenyls (PCBs) are synthetic organic chemicals classified as persistent organic pollutants (POPs). PCBs are carcinogenic, act as endocrine disruptors and were previously associated with several negative health outcomes (e.g. cancer, hearing impairment, lower birth weight, etc.).

The aim of this study was to analyse the association between exposure to PCBs and neurobehavioral development of children.

Our study population consisted of a cohort of children from contaminated Michalovce region. Concentrations of PCB congeners were analysed in samples of cord blood and blood of children at 6 years using high-resolution gas chromatography. Besides the chemical analysis of PCB congeners, total blood lipid levels were determined to calculate PCBs in the serum per gram of lipids for each PCB congener. PCB concentrations below the limit of detection (LOD) were imputed separately for each congener as LOD/2 or LOD/√2 according to the percentage of values below the LOD. In addition to individual congeners, PCBs were also used in the statistical analysis as a group of dioxin-like (DL) PCBs: congeners 105, 114, 118, 123, 156, 157, 167, and 189 and a group of non-dioxin-like (NDL) PCBs: congeners 138, 153, 170 and 180. At the same age, the Wechsler Preschool & Primary Scale of Intelligence, 3rd Edition (WPPSI-III) psychological test was used to assess the cognitive development of children (n=177). Raw scores in each subtest were converted to scale scores and subsequently the verbal IQ (VIQ), performance IQ (PIQ), full-scale IQ (FSIQ) and processing speed quotient (PSQ) were calculated. Associations between the sum of DL and sum of NDL PCB congeners and VIQ, PIQ, and FSIQ were analysed using multiple linear regression. The final models for prenatal PCB exposure and cognitive outcomes were adjusted for maternal education (low, medium, high), ethnicity (majority vs. Romani), HOME score (quality of child´s home environment), maternal age (years), and parity (primipara vs. multipara). The final models for postnatal PCB exposure were adjusted for maternal education, ethnicity, and HOME scores.

The highest median cord blood concentration was observed for congener 153 (145,21 ng/g lipids). Median cord blood concentration of NDL PCBs was higher than DL PCBs (383,59 and 18,19 ng/g lipids, respectively) and concentrations in cord blood were higher compared to concentrations in blood at 6 years (NDL=121,36 and DL=13,66 ng/g lipids). Prenatal exposure to DL PCBs was significantly associated with lower VIQ (p=0.032), PIQ (p=0.013), and FSIQ (p=0.007). Postnatal exposure to DL PCBs was also associated with lower VIQ (p=0.014) and FSIQ (p=0.016) but not with PIQ. Postnatal exposure to NDL PCBs was associated with significantly lower FSIQ (p=0.029) and VIQ (p=0.012), however, no significant association was observed for prenatal exposure to NDL PCBs.

Conclusion: Our results suggested that both, prenatal and postnatal exposure to PCBs, may influence neurobehavioral development of young children, even when the PCB concentrations are decreasing over time.

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