PRENATAL ORGANOPHOPHOSPHATE AND CHILD NEURODEVELOPMENT: RESULTS FROM THE MOUNT SINAI CHILDREN'S ENVIRONMENTAL HEALTH AND DISEASE PREVENTION RESEARCH CENTER

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Background & Aims: Prenatal exposure to organophosphate pesticides has been shown to negatively impact child neurobehavioral development. Paraoxonase 1 (PON1) is a key enzyme in the metabolism of organophosphates. We undertook an investigation of the relationship between biomarkers of organophosphate exposure, PON1, and cognitive development at ages 12 and 24 months, and 6 to 9 years.
Methods: The Mount Sinai Children's Environmental Health Study enrolled a multiethnic prenatal population in New York City between 1998 and 2002 (n= 404). Third trimester maternal urines were collected and analyzed for organophosphate metabolites (n = 360). Prenatal maternal blood was analyzed for PON1 activity and genotype. Children returned for neurodevelopment Bayley Scales of Infant Development assessments at ages 12 (n = 200) and 24 months (n = 276), and for psychometric intelligence tests between 6 and 9 (n = 169) years.
Results: Prenatal total dialkylphosphate metabolite level was associated with a decrement in mental development at 12 months among blacks and Hispanics (log10 • DAP Beta = -3.29, 95% CI -5.88, -0.70). Effects were enhanced among children of mothers who carried the PON1 Q192R QQ genotype which imparts slow catalytic activity for the chlorpyrifos oxon (interaction p-value < 0.01; QQ log10 • DAP Beta = -4.71, 95% CI -7.59, -1.83). In later childhood, increasing prenatal total dialkyl- and dimethylphosphate metabolites were associated with decrements in perceptual reasoning in the maternal PON1 Q192R QQ genotype and followed monotonically decreasing trend with increasing prenatal exposure (interaction p-value = 0.09; QQ log10 • DAP Beta = -7.52, 95% CI -14.53, -0.51).
Conclusion: Prenatal exposure to organophosphates negatively impacts cognitive development, which was apparent at assessments as early as 12 months and continued through early childhood. A critical affected domain is perceptual reasoning. PON1 status is an important mediating factor in identifying populations most susceptible to these deleterious effects.