Biomarkers of Organophosphate Pesticides and Attention-Deficit/Hyperactivity Disorder in Children: A Case-Control Study

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Journal of Environmental & Analytical Toxicology, 2017
DOI: 10.4172/2161-0525.1000460

Abstract

Children are frequently exposed to significant hazard for organophosphate poisoning (OP) in their environment; since the brain is growing during this period and it is extra liable to neurotoxicants. The aim of this work was to determine the relationship between urinary concentrations of dialkylphosphates (DAP) metabolites, which are biomarkers of OP pesticide exposure, and attention-deficit/hyperactivity disorder (ADHD) in Egyptian children ages seven to twelve years. A case-control study was conducted at Alzhraa University hospital. We recruited 40 children diagnosed as ADHD according to “the diagnostic and statistical manual of mental disorder (DSM-5) criteria” by psychiatrist. Control group of 40 healthy children who did not have any psychiatric or neurologic disorders, age and sex matched. Exposure was determined by analyzing six urinary metabolites of DAP. We investigated the association between ADHD subtypes, coincidence of epilepsy and OP exposure. Significant increase in urinary level of all DAP metabolites for children with ADHD in comparison to control group except Diethyl-dithio-phosphate. ADHD children with epilepsy had statistically significant elevated level of urinary Dimethyl-dithio-phosph ate, Diethyl- phosphate and Dimethyl-phosphate metabolites in comparison to those without epilepsy. By logistic regression analysis, Children with high level of urinary Dimethyldithio-phosphate (OR=2.29), Diethyl-phosphate (OR=2.40), Dimethyl-phosphate (OR =2.02), and Dimethyl-thiophosphate (OR=1.82) have two fold increased risk of developing ADHD than those having lower concentration of these metabolites. Our findings back up the theory that existing environmental concentration of organophosphate pesticide exposure may lead to the development of ADHD and increase the risk of epilepsy in ADHD children.