Exposure Sources of Environmental Chemicals and Their Effect on Adolescent Health

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[Abstract]

Key Words: Environmental chemicals, Environmental Epidemiology, Mixture exposure, Pubertal onset, Adolescent, Exposure sources, Birth cohort, Reproductive hormones, Exposure model

Plastic and consumer products contain additives, which become hazardous environmental chemicals once released into the environment. Concerns regarding the exposure to these chemicals have increased due to their endocrine disrupting properties. We examined the exposure levels of environmental chemicals (phthalates, phosphate flame retardants (PFR), bisphenols, and per- and polyfluorinated alkyl substances (PFAS)) for children at pre-pubertal age (n=427) and their association with pubertal onset and reproductive hormones. The contents of these chemicals in the consumer products and estimated exposure levels of these chemicals among the adolescent population were examined. We found that almost all children were exposed to one or more phthalates, PFR, and bisphenols. Polyvinyl chloride flooring materials and heating of plastic food containers using a microwave may increase exposure levels. These chemicals could delay onset of puberty and increase or decrease reproductive hormones when exposed to children at prenatal to pre-pubertal ages, suggesting the alteration of hormone levels. Electronic devices, cloths, cooking ware, food containers, stationary, indoor materials, and personal care products contained traditionally used plasticizers and PFR; whereas many substitutes were used for bisphenols and PFAS. Detection frequency of PFAS in tap water collected in Hokkaido area was relatively low. DEHP, TBOEP, BPA were detected from house dust, suggesting that household dust could be a major exposure source. PFASs were relatively low in household dust, however, there were households with significantly high levels of PFOS and PFNA. Information on the usage of consumer products and urine samples were collected (n=273) via face-to face health checkups. The exposure estimates were made by integrating the usage and market survey with children and assessing the metabolites of the exposed substances in the urine samples. The exposure estimates were relatively high for DEHP, TPhP, BPA, and PFHxA, which aligned with the metabolites of DEHP and TPhP detected in the children's urine. One of the organofluorine compounds, PFHxA, are rarely detected in blood, but was detected in urine, confirming exposure to the compound. Therefore, the exposure levels must be lowered to avoid human health effects.

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