Commentary: Halogenated organic compounds and child’s growth: a growing public health problem

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Halogenated organic compounds (HOCs) such as polychlorinated biphenyls (PCBs) and dichlorodiphenyl dichloroethylene (DDE) may interfere with normal hormonal function and, thereby, affect growth and maturation. Thus, these toxicants were termed ‘endocrine disruptors’.1–6 Two outcomes, easily observed and frequently linked to HOCs, are birth size and post-natal height and growth. Both outcomes can indicate adverse intrauterine and post-natal development and are associated with several adult diseases.7,8 A number of studies have reported that DDE and PCBs are associated with reduced birth sizes9,10 and with children’s height and growth (Table 1). Surprisingly, for clearly defined birth size measures, it has not yet been determined whether DDE, PCBs, or other HOCs are responsible for the effects. In addition, new endocrine disruptors are emerging. Furthermore, among the various PCB congeners, it is not clear which of these or which group (e.g. ortho vs non-ortho substituted PCBs, Table 1) is the culprit. There may be evidence for most HOCs, but the mechanisms are still unknown.

In contrast to birth size, childhood height and growth exhibit more complexity (Table 1): height is based on one measurement, growth on at least two height determinations. Based on the presented studies, the critical time window of exposure may either be prenatal, post-natal, or both. Some investigations were based on exposure measurements of only one HOC and did not control for others. Height measurements were taken only in infancy, before or after puberty, or span childhood and adolescence. Since HOCs may exert sexually dimorphic effects in children, some analytical approaches include a stratification by sex. The study by Nuria Ribas-Fitó et al, in this issue, is, to date, the largest and most comprehensive assessing the effects of multiple prenatal exposures (PCBs and DDE) on height and growth while stratifying by sex and race.11 The authors presented evidence that prenatal DDE exposure may reduce prepubertal height. One surprising finding is that African American children seem to be more susceptible. This in turn raises suspicions that genetic polymorphisms of some unknown mechanisms may explain existing contradictory findings.

Given that HOCs are ubiquitous, biomagnified in the food chain, and bring to bear a variety of adverse effects,12–14 the gap in our knowledge is alarming. In addition, newly emerging toxicants exhibiting potentially endocrine disrupting effects are being produced in large amounts (e.g. phthalates, polybrominated diphenyl ethers). There are several possible explanations and approaches to better characterize HOCs and, consequently, protect public health from current and future risks.

Disquieting explanations include epigenetic effects and inheritance:15 Given a unique composition of DNA, gene activity may vary. A change in gene activity (expressed or silenced) may occur through modifications of either the structure of the double strand helix (by methylation) or of histones (by acetylation, methylation, or phosphorylation). Alterations in gene activity could be modulated by HOCs.16–18 If such epigenetic modifications occur during early fetal life, they may be retained through cell division19 and, thereby, passed on to future generations.15,20,21 Hence, reduced height in a girl may be due to exposure to HOC in her grandmother. The study setting reported by Nuria Ribas-Fitó et al. would facilitate such an investigation.

On the other hand the puzzle of contradictory findings seems to be a result of lack of collaboration in a world of belligerent competition for funding. For instance, three of the nine reports in Table 128,30,11 all having contradictory findings, originated from the same Collaborative Perinatal Project in the US. Hence, for the sake of the common good we need to convene, sort out problems, rerun analyses, and develop scientific, sound strategies to better protect the vulnerable public.

References


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DDE, dichlorodiphenyl dichloroethylene; PCDD, polychlorinated dibenzo-dioxins; PCDF, polychlorinated dibenzo-furans; PBBs, polybrominated biphenyls; PCBs, polychlorinated biphenyls; ↓, decrease; ↑, increase; – no effect; <>, not measured/does not apply.