



THYROID FUNCTION TESTS

Early-life exposure to flame retardants is associated with lower FT₄ but higher FT₃ during later life

BACKGROUND

Many things that we use in daily modern life such as plastics, personal care products, electronic waste, pesticides and flame retardants are known to contain chemicals that interfere with the normal functioning of the glands of the endocrine system. These chemicals are called endocrine-disrupting compounds (EDCs). Exposure to such chemicals has been associated with the development of cancer, hormone dysfunction and reproductive problems. Children are believed to be particularly susceptible, even if the exposure has happened before birth. Many of the studies that have been done to investigate these effects do not have a clear dose-response relationship between higher EDC exposure and health problems and different studies have inconsistent results.

A particular type of these EDCs, polybrominated biphenyls (PBB) are flame retardants used commonly in electrical appliances and textiles. Once they enter the human body, they attach to fat and remain detectable for many years. In pregnant women, EDCs are also able to pass through the placenta and are found in breast milk.

In 1973, millions of Michigan residents were exposed to PBB when it was accidentally added to livestock feed. During the 10 month period before this was discovered, people were exposed by eating contaminated meat and dairy. In the aftermath, people who were believed to have had the highest exposure because they lived in or obtained their food from the affected farms were recruited to investigate the long term health effects of PBB exposure. These participants, their children and other members of the community have been followed for the past 40 years as part of the Michigan PBB Registry and have had their levels of PBB regularly assessed. The levels of other similar substances, known as PCBs were also assessed, as the participants were continuously exposed to from typical environmental sources. This study examined the effect that this exposure had on thyroid hormone levels in children.

THE FULL ARTICLE TITLE

Curtis SW et al 2019 Thyroid hormone levels associate with exposure to polychlorinated biphenyls and polybrominated biphenyls in adults exposed as children. *Environ Health* **18**:75. PMID: 31443693.

SUMMARY OF THE STUDY

For this study, 717 participants in the Michigan PBB Registry provided serum samples between 2004 and 2015. In these samples, 4 types of PBB and 4 types of PCBs were measured. Participants who were known to take thyroid medications were excluded. To evaluate outcomes, serum TSH, free T₄, T₄ and free T₃ were measured.

The study population was 61.6% female, average age of exposure was 14 years, 446 were exposed before puberty and 269 after completion of puberty. The participants were found to have PCBs levels similar to those found in representative samples of the United States. However, 92% of participants had higher PBB levels when comparing to the rest of the U.S population. Older participants had higher levels of PBB and PCB; men had higher levels of both than women.

A higher PBB concentration was associated with a lower free T₄ and a higher free T₃ and this association was observed mainly in participants who were exposed before completion of puberty. A higher PCB concentration was associated with a higher free T₄. There was no association of either chemical with TSH, total T₄ or total T₃.

WHAT ARE THE IMPLICATIONS OF THIS STUDY?

The conclusion of this study is that exposure to PBBs during early life is associated with lower free T₄ and higher free T₃ concentrations during later life. Although the associations between thyroid hormone levels and PBB in this study are not consistent with actual clinical thyroid disease (the majority of the samples were within usual ranges for





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population), variation in thyroid hormone levels within their normal ranges can still impact health. Therefore, people with higher exposure to PBBs may be at greater risk for metabolic and reproductive problems even if their hormone levels are still within the usual population

range. This is especially true about the people exposed as children. Further study of this population is needed to determine the health implications of this exposure.

— Jessie Block-Galarza, MD

ATA THYROID BROCHURE LINKS

Thyroid Function Tests: <https://www.thyroid.org/thyroid-function-tests/>

ABBREVIATIONS & DEFINITIONS

Thyroxine (T4): the major hormone produced by the thyroid gland.

Triiodothyronine (T3): the active thyroid hormone, usually produced from thyroxine.

TSH: thyroid stimulating hormone — produced by the pituitary gland that regulates thyroid function; also the best screening test to determine if the thyroid is functioning normally

Endocrine disruptors (EDCs): chemical pollutants in the environment that can affect the action of endocrine glands. Examples include bisphenol A (BPA), polychlorinated biphenols (PCBs), perfluoroalkyl substances (PFAs), polybrominated biphenyls (PBB) and organochlorines (OCs).