

Endocrine Disrupting Chemicals and Thyroid Outcomes

Project Scope

Polybrominated diphenyl ethers (PBDEs) have been recently identified in sport fish from Lake Michigan at among the highest observed levels worldwide, and the levels may be increasing. In the Great Lakes Basin, 7.6 – 9.2 million residents annually consume Great Lakes sport fish. The objective of this study is to characterize exposures to these chemicals from fish consumption and to investigate mechanisms by which PBDEs in Great Lakes fish may act separately or synergistically with polychlorinated biphenyls (PCBs) and/or dichlorodiphenylethylene (DDE) to impair thyroid function in humans.

This ongoing study will examine long-term and recent fish consumption patterns in an existing, well-characterized cohort of 3,695 frequent and infrequent Great Lakes sport fish consumers in Illinois, Indiana, Michigan, Ohio, and Wisconsin.

Dietary exposure to PBDEs may occur in concert with other ubiquitous EDCs such as PCBs or DDE. The effects of these chemicals on thyroid hormone balance and reproductive health will be investigated. Confounding variables which may affect the results of this study will also be identified and characterized.

Phase I of this project consists of the distribution of a questionnaire to collect health and fish consumption data from the cohort population, and will identify individuals eligible for participation in Phase II. The later phase will involve the collection of blood and urine samples. Analysis of Phase II specimens will include the identification of congener-specific serum concentrations of PCBs and PBDEs, as well as DDE levels (unadjusted and lipid adjusted). Cholesterol and triglyceride levels, Hemoglobin A1C (an index of integrated glucose concentration) and thyroglobulin antibodies will also be measured. In addition, a battery of tests related to thyroid function will be administered, and reproductive hormone levels and concentrations of urinary iodine will be measured. Age-adjusted prevalence rates of diabetes and thyroid conditions will be determined in the entire cohort and compared with age-adjusted rates for this population using standard statistical techniques. The incidence of thyroid disease in relation to sport fish consumption and serum concentrations of PBDE, PCB and DDE will be examined.

The impact of possible confounding variables on the association of EDCs and impaired thyroid function will also be determined. Fish consumption habits, other exposures to PBDEs and PCBs, and DDE, pre-existing thyroid disease, medication use, and demographic information will be assessed in the full cohort using the Phase I questionnaire data. Menstrual history and information on other potential confounders will be collected from women of reproductive age at the time of biologic specimen collection.

Grant Title and Principal Investigator

Endocrine Disrupting Chemicals and Thyroid Outcomes
Henry Anderson – Wisconsin Department of Health & Family Services

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Key Findings

- Recruitment and data collection are ongoing in this five year epidemiological study.
- The results of this study will investigate whether exposure to PBDEs, PCBs, and DDE resulting from the consumption of sport fish increases the risk of thyroid impairment and diabetes.
- The results will provide information about the impact of the flame retardant, PBDE, on thyroid function and diabetes.

Project Period: March 2003 to February 2007

Relevance to ORD's Multi-Year Research Plan

This project is expected to contribute directly to Long-Term Goal 1 (LTG-1) of ORD's MYP, by providing a better understanding of the extent of exposure and the impact of EDCs on thyroid function in humans.

- Investigators are in the data collection phase process to determine the degree of human exposure to PBDEs, PCBs and DDE, resulting from consumption of sport fish from Lake Michigan.
- Investigators will attempt to determine concentrations of PBDEs, PCBs and DDE associated with observations of adverse effects on thyroid function.
- Investigators are developing a framework to characterize human exposure to EDCs using urine and blood samples.

Project Results and Implications

This project is ongoing and results are not yet available. The investigators are completing the recruitment of individuals for the Phase II investigation. Following distribution of the Phase I questionnaire, the project has identified over 600 volunteers for participation in Phase II, including charter boat captains and infrequent fish consumers in IL, IN, MI, and OH and WI. The collection of blood and urine samples has begun.

Investigators

Henry Anderson – Wisconsin Department of Health & Family Services

For More Information

NCER Project Abstract and Reports:

http://cfpub2.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.abstractDetail/abstract/6120/report/0