

ASSOCIATION BETWEEN URINARY 3, 5, 6-TRICHLORO-2-PYRIDINOL, A METABOLITE OF CHLORPYRIFOS AND CHLORPYRIFOS-METHYL, AND SERUM THYROID HORMONES IN NHANES 1999-2002

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Background and Aims: Thyroid hormones (TH) are vital to a host of human physiological functions in both children and adults. Exposures to chemicals, including chlorpyrifos, have been found to modify thyroid signaling at environmentally relevant levels in animal studies. The aim of this study was to examine circulating TH levels in relation to urinary concentrations of 3, 5, 6-trichloro-2-pyridinol (TCPY), a metabolite of the organophosphorus insecticides chlorpyrifos and chlorpyrifos-methyl, using data from individuals 12 years and older from the U.S. National Health and Nutrition Examination Surveys (NHANES).

Methods: NHANES datasets from 1999-2000 and 2001-2002 were combined, and individuals with thyroid disease were excluded (N=4304). Multivariable linear regression models for relationships between log-transformed urinary TCPY and total serum T₄ or log (TSH) were constructed and adjusted for urinary creatinine, age, BMI, race, serum cotinine, income, and thyroid altering medications. Models were stratified by sex and a categorical age variable (<18, 18-40, 40-60, and >60 years).

Results: In male participants, an interquartile range (IQR) increase in urinary TCPY was associated with statistically significant decreases in serum T₄ of 3.7% (95% CI 0.77%-6.8%) among those <18 years of age, and 3.3% (0.03%-6.8%) in the 18-40 year age group, relative to median T₄ levels. An IQR increase in TCPY was also associated with decreases in TSH of 9% (1%-17%) among men 18-40 years old and 21% (12%-29%) among men >60 years old. Conversely, urinary TCPY was positively associated with TSH in females >60 years of age.

Conclusion: These results, from a representative sample of the U.S. population, support the limited human and animal data that have reported a relationship between chlorpyrifos, chlorpyrifos-methyl, or TCPY exposure and altered thyroid hormones. Further research to confirm these findings, elucidate mechanisms of action, and explore the clinical and public health significance of such alterations in thyroid hormones is needed.

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