

Fluoride consumption linked to diabetes using mathematical models

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Credit: George Hodan/public domain

Water fluoridation prevents dental cavities, which are a costly public health concern. But despite the benefits supplemental water fluoridation remains a controversial subject. Some indicate it may cause long term

health problems, but studies reporting side effects have been minimal or inconclusive. The long-term effects of ingested fluoride remain unclear.

A recent study published in the *Journal of Water and Health* examined links between [water fluoridation](#) and [diabetes](#). Type 2 diabetes is a growing epidemic in the United States. Incidence rates have nearly quadrupled in the past 32 years and show no signs of stopping. According to the study, fluoridation with [sodium fluoride](#) could be a contributing factor to diabetes rates in the United States, as the chemical is a known preservative of blood glucose.

The sole author of the paper, Kyle Fluegge, PhD, performed the study as a post-doctoral fellow in the Department of Epidemiology and Biostatistics at Case Western Reserve University School of Medicine. Fluegge now serves as health economist in the Division of Disease Control for the New York City Department of Health and Mental Hygiene and co-director of the Institute of Health and Environmental Research in Cleveland, Ohio.

In the study, Fluegge used mathematical models to analyze publicly available data on [fluoride](#) water levels and diabetes incidence and prevalence rates across 22 states. He also included adjustments for obesity and physical inactivity collected from national telephone surveys to help rule out confounding factors. Two sets of regression analyses suggested that supplemental water fluoridation was significantly associated with increases in diabetes between 2005 and 2010.

"The models look at the outcomes of [diabetes] incidence and prevalence being predicted by both natural and added fluoride," said Fluegge.

Fluegge reported that a one milligram increase in average county fluoride levels predicted a 0.17% increase in age-adjusted diabetes

prevalence. Digging deeper revealed differences between the types of fluoride additives used by each region. The additives linked to diabetes in the analyses included sodium fluoride and sodium fluorosilicate. Fluorosilicic acid seemed to have an opposing effect and was associated with decreases in diabetes incidence and prevalence. Counties that relied on naturally occurring fluoride in their water and did not supplement with fluoride additives also had lower diabetes rates.

The positive association between fluoridation and diabetes was discovered when Fluegge adjusted fluoride exposure levels to account for estimated per capita tap water consumption.

"The models present an interesting conclusion that the association of water fluoridation to diabetes outcomes depends on the adjusted per capita consumption of tap water," explained Fluegge. "Only using the concentration [of added fluoride] does not produce a similarly robust, consistent association." For this reason, Fluegge adjusted his calculations to incorporate tap water consumption, instead of sticking to calculations that rely on "parts per million" measurements of fluoride in the water.

Fluegge used several estimations in his study, including calculations of county-level water fluoride levels; per capita county [tap water](#) consumption; and county measures of poverty, obesity and physical inactivity. Although he doesn't suggest the study should trigger policy changes, he does indicate it should serve as a call for additional research on the important association between fluoridation and diabetes.

"This is an ecological study. This means it is not appropriate to apply these findings directly to individuals," explained Fluegge. "These are population-level associations being made in the context of an exploratory inquiry. And water is not the only direct source of fluoride; there are many other food sources produced with fluoridated water."

In addition to being found in food like processed beverages or produce exposed to specific pesticides, fluoride is found naturally in water in the form of calcium fluoride. Supplemental fluoride was first added to community water supplies in the 1940s.

Said Fluegge, "The models indicate that natural environmental fluoride has a protective effect from diabetes. Unfortunately, natural fluoride is not universally present in the [water](#) supply."

Residents can learn more about fluoride levels in their communities through the Centers for Disease Control My Water's Fluoride database.

More information: K. Fluegge, Community water fluoridation predicts increase in age-adjusted incidence and prevalence of diabetes in 22 states from 2005 and 2010, *Journal of Water and Health* (2016).

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