

Study shows innovative application of ultrasound for detection of altered bone quality in a fluoride-exposed population

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An [NIEHS-funded study](#) has found that chronic exposure to fluoride lowers bone quality, as measured using an innovative application of the ultrasonic scans of cortical bones in subjects exposed to fluoride.

The study, published in Bone Reports, was led by [Dr. Tewodros Godebo](#), assistant professor of environmental health sciences at Tulane University School of Public Health and Tropical Medicine.

The study was conducted in a large population cohort that collected 871 distinct speed of sound (SOS) measurements from 341 subjects, aged 10-70 years old and living in the Rift Valley of Ethiopia.

This is the first study to quantitatively determine bone quality in a population exposed to fluoride. Bone quality describes aspects of bone composition and structure that contribute to bone strength. This study integrated a wide set of bone properties including bone density, mineralization, collagen formation, and microarchitecture of the skeleton that are reflected in the ultrasound measurement as SOS.

The study revealed differences in bone quality that were associated with the level of fluoride exposure from drinking water. The fluoride in the study ranged from the typical low levels of 0.7 mg/L (ppm) found in the U.S. and many other developed countries (where fluoride is added to water supplies to prevent or reduce tooth decay), to levels of 15.5ppm, ten times higher than the maximum 1.5ppm limit in

drinking water set by the World Health Organization. Many of the elevated fluoride communities in this study were associated with significantly reduced bone quality as compared to the low-level fluoride communities. Specifically, the research found negative associations between fluoride exposure and bone quality as measured using SOS.

"Our findings demonstrate that we now can quantitatively determine fluoride-induced deterioration of bone quality in humans using ultrasound equipment in field and rural settings," Dr. Godebo said. "This study shows that using the ultrasound technique appears potentially useful for more widespread assessment of bone quality issues linked to environmental contaminants that harm bones."

"The portable and low-cost ultrasound technique has distinct advantages over traditional x-ray technology, which is costly, difficult to use in remote areas, and exposes patients to radioactive harms," said [Dr. Marc Jeuland](#), a research collaborator from Duke University.

The new method should be tested in other locations and for accuracy in diagnosis of various bone-related disorders to assess the feasibility of its more extensive diagnostic use, Godebo said.