Association found between the uptake of various elements during pregnancy and autism risk

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According to a study published on June 1 in *Nature Communications,* differences in the uptake of multiple toxic and essential elements over the second and third trimesters and in the early postnatal periods of pregnancy are connected with the risk of developing autism spectrum disorders (ASDs).

Credit: Svetlana Iakusheva/Shutterstock.com

The critical developmental windows for the observed discrepancies varied for each element, suggesting that systemic dysregulation of environmental pollutants and dietary elements may serve an important role in ASD. Using evidence found in baby teeth, the study has identified specific environmental factors that influence risk and pinpointed developmental time periods when elemental dysregulation poses the biggest risk for autism later in life.

ASD occurs in 1 of every 68 children in the USA, as stated by the U.S.

Centers for Disease Control and Prevention. While the genetic factors have been studied intensively, specific environmental factors and the stages of life when such exposures may have the biggest impact on the threat of developing autism are poorly understood.

Previous research has pointed out that fetal and early childhood exposure to toxic metals and deficiencies of nutritional elements are associated with several adverse developmental outcomes such as intellectual disability and language, attentional, and behavioral problems. However, the exact causes are not known.

"We found significant divergences in metal uptake between ASD-affected children and their healthy siblings, but only during discrete developmental periods," said Manish Arora, PhD, BDS, MPH, Director of Exposure Biology at the Senator Frank Lautenberg Environmental Health Sciences Laboratory at Mount Sinai and Vice Chair and Associate Professor in the Department of Environmental Medicine and Public Health at the Icahn School of Medicine at Mount Sinai.

Arora continued:

> *Specifically, the siblings with ASD had higher uptake of the neurotoxin lead, and reduced uptake of the essential elements manganese and zinc, during late pregnancy and the first few months after birth, as evidenced through analysis of their baby teeth. Furthermore, metal levels at three months after birth were shown to be predictive of the severity of ASD eight to ten years later in life."*

Baby teeth were collected from pairs of identical and nonidentical twins, among which at least one was diagnosed for ASD. Researchers from The Seaver Autism Center for Research and Treatment at Mount Sinai used validated tooth-matrix biomarkers and analyzed the baby teeth to determine the effects that the timing, amount, and subsequent absorption of toxins and nutrients have on ASD.

They also analyzed teeth from pairs of normally developing twins, who served as the study control group. During fetal and childhood development, a new tooth layer is formed every week or so. This leaves an imprint of the microchemical composition from each unique layer, which provides a chronological record of the exposure. The team at The Senator Frank R. Lautenberg Environmental Health Sciences Laboratory used lasers and reconstructed these past exposures along incremental markings, similar to using growth rings on a tree to find the growth history of the tree.

"Our data shows a potential pathway for interplay between genes and the environment," says Abraham Reichenberg, PhD, Professor of Psychiatry and Environmental Medicine and Public Health at the Icahn School of Medicine at Mount Sinai. "Our findings underscore the importance of a collaborative effort between geneticists and environmental researchers for future investigations into the relationship between metal exposure and ASD to help us uncover the root causes of autism, and support the development of effective interventions and therapies."

Further studies are required to find whether the discrepancies in the amount of certain metals and nutrients are due to disparity in how much a fetus or child is exposed to them or because of a genetic variation in how a child takes in, processes, and breaks down these metals and nutrients.

Sources:

- https://eurekalert.org/pub_releases/2017-06/tmsh-ets053017.php
- https://www.nature.com/articles/ncomms15493
