Neurodevelopmental Effects of PFAS Exposure through Drinking Water

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OBJECTIVES

Sum concentrations of per- and polyfluoroalkyl substances (PFAS) in Pittsboro, NC drinking water measured over 30 times higher than those in Durham. Previous cohort studies suggest that exposure to these drinking water contaminants may lead to an array of developmental, neurocognitive, and behavioral impacts.

Study Aim: To determine the causative relationship between in utero PFAS mixture exposure and cognitive deficits, emotional dysfunction, and behavioral dysregulation and underlying mechanisms using an animal model.

Hypothesis: In utero exposure to this PFAS mixture will cause cognitive deficits, emotional dysfunction, and behavioral dysregulation in rat offspring by disrupting placental-fetal brain hormonal signaling.

METHODOLOGY

3 cohorts of Sprague-Dawley strain rats are exposed to a PFAS mixture mimicking Pittsboro water and a high dose positive control during mating and through gestation

Pregnancy and birth outcomes are tracked for dams and pups

Offspring undergo a behavioral testing battery

Tissues are collected for pathology, RNA sequencing, serum dose verification, and thyroid hormone measurement

Analysis

Reproductive outcomes: maternal weight gain, gestation length, litter size, pup survival, pup weight, pup anogenital distance, pup reflex development (pictured)

Neurobehavioral outcomes: locomotor activity and habituation (figure 8 maze), anxiety and risk-taking behavior (elevated plus maze), depression and anxiety (novelty-suppressed feeding), non-spatial memory and attention (novel object recognition), depression (forced swim)

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References


Examples of Behavioral Tests: Elevated Plus Maze (left) and Novel Object Recognition (right)

*All figures created with BioRender (https://biorender.com/) unless otherwise cited.