

PFOS induces behavioral alterations, including spontaneous hyperactivity that is corrected by dexamfetamine in zebrafish larvae

Abstract

Perfluorooctane sulfonate (PFOS) is a widely spread environmental contaminant. It accumulates in the brain and has potential neurotoxic effects. The exposure to PFOS has been associated with higher impulsivity and increased ADHD prevalence. We investigated the effects of developmental exposure to PFOS in zebrafish larvae, focusing on the modulation of activity by the dopaminergic system. We exposed zebrafish embryos to 0.1 or 1 mg/L PFOS (0.186 or 1.858 μ M, respectively) and assessed swimming activity at 6 dpf. We analyzed the structure of spontaneous activity, the hyperactivity and the habituation during a brief dark period (visual motor response), and the vibrational startle response. The findings in zebrafish larvae were compared with historical data from 3 months old male mice exposed to 0.3 or 3 mg/kg/day PFOS throughout gestation. Finally, we investigated the effects of dexamfetamine on the alterations in spontaneous activity and startle response in zebrafish larvae. We found that zebrafish larvae exposed to 0.1 mg/L PFOS habituate faster than controls during a dark pulse, while the larvae exposed to 1 mg/L PFOS display a disorganized pattern of spontaneous activity and persistent hyperactivity. Similarly, mice exposed to 0.3 mg/kg/day PFOS habituated faster than controls to a new environment, while mice exposed to 3 mg/kg/day PFOS displayed more intense and disorganized spontaneous activity. Dexamfetamine partly corrected the hyperactive phenotype in zebrafish larvae. In conclusion, developmental exposure to PFOS in zebrafish induces spontaneous hyperactivity mediated by a dopaminergic deficit, which can be partially reversed by dexamfetamine in zebrafish larvae.

Keyword: Perfluorooctane sulfonate; PFOS; Behavioral alterations; Spontaneous hyperactivity; Zebrafish larvae