Neurotoxic Effects of Lactational Exposure to Perfluorooctane Sulfonate on Learning and Memory in Adult Male Mouse

Perfluorooctane sulfonate (PFOS) is an organic pollutant that was widely used in industries and consumer products. Because PFOS has been detected in umbilical cord blood, breast milk, and serum because of its stability and bioaccumulative properties, it is suspected to have developmental neurotoxicity in humans and rodents. However, the underlying mechanism remains unclear. Our study aims to examine the effect of early lactational PFOS exposures on learning and memory in male mice and reveal further the underlying mechanisms involved. PFOS solution (0.1, 0.25, and 1 mg/kg) was orally administered to dams from the postpartum days 1 to 14, so that pups would be exposed through breast milk. After the pups were 8–10 weeks postnatal, we performed object location tests, object recognition tests, and pairwise visual discrimination tasks. We also performed mRNA and protein analysis of genes responsible for hippocampal development and function. In both object location and object recognition memory tests, the performance of mice in the 1 mg/kg PFOS-exposed (PF-1) group was significantly lower than those in the control group. Moreover, in the pairwise visual discrimination task, PF-1 group mice learned significantly slower than the control group, although the proportion of correct responses gradually increased in all groups. In vivo microdialysis showed that concentrations of glutamate (Glu) and gamma-aminobutyric acid (GABA) in the dorsal hippocampus were significantly higher in the PF-1 group than in the control group. No notable differences were shown in our mRNA and protein studies. Our study showed that lactational PFOS exposure has a profound, long-lasting toxic effect in the hippocampus and consequently leads to declarative memory deficits. Furthermore, GABA and Glu concentrations were significantly higher in the PF-1 group, indicating that such changes may be partially responsible for the behavioral changes.