PLoS One. 2012;7(4):e31570. Epub 2012 Apr 3.

Gender dimorphism in aspartame-induced impairment of spatial cognition and insulin sensitivity.

Collison KS, Makhoul NJ, Zaidi MZ, Saleh SM, Andres B, Inglis A, Al-Rabiah R, Al-Mohanna FA.

Source : Cell Biology and Diabetes Research Unit, Department of Cell Biology, King Faisal Specialist Hospital and Research Centre, Riyadh, Saudi Arabia. kate@kfshrc.edu.sa

Abstract

Previous studies have linked aspartame consumption to impaired retention of learned behavior in rodents. Prenatal exposure to aspartame has also been shown to impair odor-associative learning in guinea pigs; and recently, aspartame-fed hyperlipidemic zebrafish exhibited weight gain, hyperglycemia and acute swimming defects. We therefore investigated the effects of chronic lifetime exposure to aspartame, commencing in utero, on changes in blood glucose parameters, spatial learning and memory in C57BL/6J mice. Morris Water Maze (MWM) testing was used to assess learning and memory, and a random-fed insulin tolerance test was performed to assess glucose homeostasis. Pearson correlation analysis was used to investigate the associations between body characteristics and MWM performance outcome variables. At 17 weeks of age, male aspartame-fed mice exhibited weight gain, elevated fasting glucose levels and decreased insulin sensitivity compared to controls ($P<0.05$). Females were less affected, but had significantly raised fasting glucose levels. During spatial learning trials in the MWM (acquisition training), the escape latencies of male aspartame-fed mice were consistently higher than controls, indicative of learning impairment. Thigmotactic behavior and time spent floating directionless was increased in aspartame mice, who also spent less time searching in the target quadrant of the maze ($P<0.05$). Spatial learning of female aspartame-fed mice was not significantly different from controls. Reference memory during a probe test was affected in both genders, with the aspartame-fed mice spending significantly less time searching for the former location of the platform. Interestingly, the extent of visceral fat deposition correlated positively with non-spatial search strategies such as floating and thigmotaxis, and negatively with time spent in the target quadrant and swimming across the location of the escape platform. These data suggest that lifetime exposure to aspartame, commencing in utero, may affect spatial cognition and glucose homeostasis in C57BL/6J mice, particularly in males.

PMID: 22509243 [PubMed - indexed for MEDLINE] PMCID: PMC3317920