

Is There A Link Between Soy Formula and Attention Deficit Disorder?

Scientific Study of Soy Milk Finds Behavior Problems From High Manganese Levels

Irvine, Calif., Oct. 6, 2002 -- Does soy-based infant formula lead to attention deficit hyperactivity disorder (ADHD)? There's much speculation -- but little science -- on this association. Shedding some light on this problem, a UC Irvine-led study discovered that a mineral found in high levels in soy milk appears to be linked to behavioral problems.

The study in rats, one of the first scientific inquiries into soy milk and ADHD, indicates that the mineral manganese may cause behavioral problems if consumed in high doses. The study appears in the August issue of *NeuroToxicology*.

Francis Crinella, professor of pediatrics, and his colleagues at UCI and UC Davis found that giving rats increasing levels of manganese during infancy resulted in behavioral changes at higher doses. The researchers also found that manganese exposure resulted in lowered levels of the neurotransmitter dopamine, which plays a key role in inhibiting behavior seen in cases of ADHD.

"Manganese is a mineral that's essential for life. But past studies on manganese miners have shown that it causes a number of behavioral problems," Crinella said. "Soy milk formula contains about 80 times the levels of manganese found in breast milk, posing the risk that infants could receive too much manganese in the first weeks of life. While we've shown that behavioral problems can result from manganese exposure, we don't know if these problems are permanent, or result in ADHD among humans."

Crinella and his colleagues found that at lower doses, manganese did not result in any significant changes in behavior in the infant rats. However, at the experiment's highest doses of manganese, researchers saw that the rats were much more inconsistent at completing tasks than they were at lower doses.

In addition, the researchers found significant decreases in dopamine with higher doses of manganese. Previous research had shown that dopamine decreases occurred in areas of the brain that are critical for performing problem-solving tasks. These areas of the brain coordinate what is called the brain's "executive function" and are known to be deficient in ADHD.

"While this study shows a definite correlation between high manganese and lower dopamine levels, we still need to see whether high manganese doses result in permanent behavioral problems, including ADHD," Crinella said. "While soy milk by itself is not harmful, manganese can be removed through a laborious and expensive process. Only more scientific research will determine whether or not removing manganese would provide any prevention of ADHD in infants."

Manganese is in the Earth's crust and is found in nearly all cereals and grains, including soy. It is a mineral important for enabling cells to obtain energy. High doses of industrial exposure have been known to produce a syndrome called "manganism," marked by tremors similar to Parkinson's disease and spasmodic, often violent, behavior.

Crinella and his team are now working on simulating human doses of soy milk formula to test whether they have any connection to behavioral problems.

Crinella's colleagues included Trinh Tran, Winyoo Chohanadisai and Bo Lonnerdal of UC Davis, and Louis Le, Michael Parker and Aleksandra Chicz-Demet of UCI.

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