Soy-Based Formulas May Be Linked to ADHD

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Sources: Francis M. Crinella, Ph.D., clinical professor, pediatrics, University of California, Irvine; Aleksandra Chicz-DeMet, Ph.D., associate adjunct professor, psychiatry, University of California, Irvine; Mary Beth Arensberg, Ph.D., director, public affairs, Ross Products division, Abbott Laboratories

(HealthScoutNews) -- California researchers have discovered a possible link between high levels of manganese, a mineral found in soy-based infant formulas, and the development of attention deficit hyperactivity disorder later in life.

Soy formulas can contain as much as 80 times the amount of manganese present in human breast milk. The popular formula Isomil, for instance, contains 25 micrograms of manganese in every five-ounce bottle.

The University of California-Irvine researchers found that supplementing the diet of rat pups with 250 micrograms to 500 micrograms of manganese per day -- the equivalent of 10 to 20 five-ounce bottles of Isomil -- resulted in developmental deficits and lowered dopamine levels in the same areas of the brain believed associated with attention deficits and hyperactivity.

"The problem with soy is that it is a bio-accumulator of metals. That means soybeans tend to soak up manganese from the earth," says Francis M. Crinella, a clinical professor of pediatrics at UC-Irvine and lead author of the study, published in the current issue of the journal NeuroToxicology.

Crinella also cites four studies dating as far back to 1977 in which testing done on the hair of children with various learning or behavior problems have shown elevated levels of manganese. Although definitive evidence linking soy formula use in infancy with the development of attention deficit hyperactivity disorder (ADHD) has yet to surface, two new studies -- one involving humans and the other involving primates -- are currently in the works at UC-Irvine and the University of California-Davis.

There are some experts, among them infant formula manufacturers, who disagree with the scientists' evidence so far, however. "There is no known incidence of manganese deficiency or toxicity in infants," says Mary Beth Arensberg, director of public affairs for the Ross Products division of Abbott Laboratories, which makes Isomil. She points out that her company's product meets all U.S. Food and Drug Administration guidelines for infant formula that presently require a minimum manganese level, but not a maximum.

"Humans normally eliminate excess manganese in the liver, so soy infant formula is typically a problem only when the infant has liver problems," she says.

However, the California scientists say their evidence seems to suggest otherwise. According to the study, the gastrointestinal tracts of infants from birth to 12 months old are not sufficiently developed to absorb and excrete excess manganese. That's the development period during which Crinella and his colleagues hypothesize the damage to a rapidly developing infant brain may occur. "In later childhood there is a very efficient manganese excretion system through bile," he explains. "Manganese ingestion doesn't seem to make any difference once an infant has reached one year of age." And, he notes, since adults typically have a fully developed mineral excretion system, the researchers do not believe mothers' breast milk is a likely source of high levels of manganese.

Bottle-fed infants also often show iron anemia, according to Crinella, which can amplify the affects of manganese toxicity. "The most impaired rats were those that were also anemic," he says. Isomil, it should be noted, is fortified with iron. "This study lends support to previous studies that also found neurotoxic affects of manganese on the dopamanergic areas of the brain," says Aleksandra Chicz-DeMet, an associate adjunct professor of psychiatry at UC-Irvine, and a co-author of the article. "What our research adds to the knowledge of manganese's effects is that we have also looked at rat behavior and found that the rats with behavior disruptions had lower dopamine levels in their brains."

Dopamine levels can't be measured in the brains of humans, which explains why studies on the neurotransmitter had to begin with laboratory rats, but will next involve primates, Chicz-DeMet says. "If we see similar findings in primates, it will give our findings more support," she says.

The corresponding human study at UC-Irvine will follow premature infants, who for a variety of reasons often cannot be fed breast milk. Ross Products also makes the popular cow's milk-based formula Similac, which has 10 micrograms of manganese per five-ounce bottle, less than the soy-based Isomil, but still significantly higher than levels found in breast milk. "The levels of manganese in these products reflect natural levels of manganese," asserts Ross Products' Arensberg. "Manganese is a necessary mineral for skeletal growth and an essential trace mineral required by law to be in infant formulas. Although levels in cow's milk and soy milk are higher than levels in human milk, they are still within the ranges recommended by nutrition experts."