Medical Xpress

Is there a link between childhood obesity and ADHD, learning disabilities?

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A University of Illinois study has established a possible link between high-fat diets and such childhood brain-based conditions as attention deficit hyperactivity disorder (ADHD) and memory-dependent learning disabilities.

"We found that a high-fat diet rapidly affected dopamine metabolism in the brains of juvenile mice, triggering anxious behaviors and learning deficiencies. Interestingly, when methylphenidate (Ritalin) was administered, the learning and memory problems went away," said Gregory Freund, a professor in the U of I College of Medicine and a member of the university's Division of Nutritional Sciences.

The research was published in Psychoneuroendocrinology and is available pre-publication online.

Freund said that altered dopamine signaling in the brain is common to both ADHD and the overweight or obese state. "And an increase in the number of dopamine metabolites is associated with anxiety behaviors in children," he added.

Intrigued by the recent upsurge in both child obesity and adverse childhood psychological conditions, including impulsivity, depression, and ADHD, Freund's team examined the short-term effects of a high-fat (60% calories from fat) versus a low-fat (10% calories from fat) diet on the behavior of two groups of four-week-old mice. A typical Western diet contains from 35 to 45 percent fat, he said.

"After only one week of the high-fat diet, even before we were able to see any weight gain, the behavior of the mice in the first group began to change," he said.

Evidence of anxiety included increased burrowing and wheel running as well a reluctance to explore open spaces. The mice also developed learning and memory deficits, including decreased ability to negotiate a maze and impaired object recognition.

Switching mice from a high-fat to a low-fat diet restored memory in one week, he noted.

In mice that continued on the high-fat diet, impaired object recognition remained three weeks after the onset of symptoms. But Freund knows from other studies that brain biochemistry normalizes after 10 weeks as the body appears to compensate for the diet. At that point, brain dopamine has returned to normal, and mice have become obese and developed diabetes.

"Although the mice grow out of these anxious behaviors and learning deficiencies, the study suggests to me that a high-fat diet could trigger anxiety and memory disorders in a child who is genetically or environmentally susceptible to them," he said.

Because the animals adapt to the high-fat fare, the scientists also hypothesized that abruptly removing fat from the diet might negatively affect anxiety, learning, and memory.

The researchers had expected that the high-fat diet would stimulate inflammation, which is associated with obesity, but they saw no evidence of an inflammatory response in the brain after one or three weeks on the high-fat regimen.

Instead, they saw evidence that a high-fat diet initiates chemical responses that are similar to the ones seen in addiction, with dopamine, the chemical important to the addict's pleasurable experiences, increasing in the brain.

More information: dx.doi.org/10.1016/j.psyneuen.2013.01.004

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