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Scientist Shows Link Between Diet and Onset of Mental Illness

Changes in diet have been linked to a reduction of abnormal behaviors in mentally ill people or animals, but a Purdue University study shows that diet might also trigger the onset of mental illness in the first place.

Joseph Garner, an associate professor of animal sciences, fed mice a diet high in sugar and tryptophan that was expected to reduce abnormal hair-pulling. Instead, mice that were already ill worsened their hair-pulling behaviors or started a new self-injurious scratching behavior, and the seemingly healthy mice developed the same abnormal behaviors.

"This strain of mouse is predisposed to being either a scratcher or a hair-puller. Giving them this diet brought out those predispositions," said Garner, whose results were published in the December issue of the journal *Nutritional Neuroscience*. "They're like genetically at-risk people."

Garner studies trichotillomania, an impulse-control disorder in which people pull out their hair. The disorder, which disproportionately occurs in women, is thought to affect between 2 and 4 percent of the population.

Mice that barber, or pull their hair out, have been shown to have low levels of serotonin activity in the brain. That neurotransmitter is known to affect mood and impulses. Garner hypothesized that increasing serotonin activity in the brain might cure or reduce barbering and possibly trichotillomania.

Serotonin is manufactured in the brain from the amino acid tryptophan, which is consumed in diets. The problem is that tryptophan often doesn't make it across the barrier between blood and the brain because other amino acids can get through more easily and essentially block the door for tryptophan.

Garner modified a mouse diet to increase simple carbohydrates, or sugars, and tryptophan. The sugars trigger a release of insulin, which causes muscles to absorb those other amino acids and gives tryptophan a chance to make it to the brain.

Using eight times as much sugar and four times as much tryptophan, Garner observed a doubling of serotonin activity in the brain. But the mice that barbered did not get better.

"We put them on this diet, and it made them much, much worse," Garner said.

A second experiment divided the mice into three groups:

those that were seemingly normal, others that had some hair loss due to barbering and a group that had severe hair loss. All the mice soon got worse, with conditions escalating over time.

"Three-quarters of the mice that were ostensibly healthy developed one of the behaviors after 12 weeks on the new diet," Garner said.

Some of the mice developed ulcerated dermatitis, a fatal skin condition thought to be caused by an unidentified pathogen or allergen. Garner saw that the only mice that contracted the condition were the scratchers.

"What if ulcerated dermatitis, like skin-picking, another common behavioral disorder, is not really a skin disease at all?" Garner said. "We now have evidence that it may be a behavioral disorder instead."

When taken off the new diet, the negative behaviors stopped developing in the mice. When control mice were switched to the new diet, they started scratching and barbering.

Garner's study raises questions of how diet might be affecting other behavioral or mental illnesses such as autism, Tourette syndrome, trichotillomania and skin-picking. He said that before now, a link between diet and the onset of mental disorders hadn't been shown.

"What if the increase of simple sugars in the American diet is contributing to the increase of these diseases?" Garner said. "Because we fed the mice more tryptophan than in the typical human diet, this experiment doesn't show that, but it certainly makes it a possibility."

Garner next wants to refine the experiments to better imitate human dietary habits, including the amount of tryptophan people consume. Internal Purdue funding paid for his work.

Journal Reference: 1. Brett D. Dufour, Olayiwola Adeola, Heng-Wei Cheng, Shawn S. Donkin, Jon D. Klein, Edmond A. Pajor, Joseph P. Garner. Nutritional up-regulation of serotonin paradoxically induces compulsive behavior. *Nutritional Neuroscience*, 2010; 13 (6): 256 DOI: 10.1179/147683010X12611460764688