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Broccoli Extract May Improve Autism Symptoms

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Sulforaphane, a compound found in broccoli sprouts, may improve core symptoms of autism spectrum disorder (ASD), preliminary research suggests.

A small, randomized pilot study of boys and men with ASD showed that 46% of those who received a sulforaphane-rich broccoli sprout extract had significant improvement in social interactions after 18 weeks of treatment, and 42% had improved verbal communication.

Dr Kanwaljit Singh

In addition, more than half of the participants who received the supplement showed a significant decrease in abnormal behaviors. Other improvements were found with regard to irritability, hyperactivity, and repetitive movements — but only temporarily. Most symptoms returned at the same level of severity after treatment was stopped.

"Most of the results were expected, including improved eye contact and communication," lead author Kanwaljit Singh, MD, MPH, from the Department of Pediatrics (Neurology) at the University of Massachusetts Medical School in Worcester, told *Medscape Medical News.*

"But we were pleasantly surprised to see significantly improved scores on the Social Responsiveness Scale [SRS], which was one of our primary outcome measures," he added.

Dr Singh, who at the time of the study was with the Lurie Center for Autism at Massachusetts General Hospital for Children, said that more research in larger populations is definitely needed.

In addition, he pointed out that broccoli sprouts alone do not contain the same high level of sulforaphane found in the supplement that was used. Still, he noted that "it couldn't hurt" to recommend a healthier diet to these patients.

"This isn't a cure for autism. It's one of the first steps that will allow us to look into the biochemical underpinnings in determining autism."

The study was published online October 13 in *Proceedings of the National Academy of Sciences, Early Edition.*

Fever Mechanism

Dr Singh noted that colleague and coinvestigator Andrew W. Zimmerman, MD, had previous experience with children with ASD who came into his clinic with a fever and who were showing decreased hyperactivity, at least temporarily. Dr Zimmerman published a study investigating this phenomenon in 2007, but the mechanism remained unclear.

An isothiocyanate derived from broccoli sprouts, sulforaphane "upregulates expression of the heat-shock response" — much as a fever does. Because of this, the investigators examined whether the compound could also improve symptoms of ASD.

"Dietary sulforaphane, of recognized low toxicity, was selected for its capacity to reverse abnormalities that have been associated with ASD, including oxidative stress and lower antioxidant capacity, depressed glutathione synthesis, reduced mitochondrial function...increased lipid peroxidation, and neuroinflammation," write the researchers.

They enrolled 40 males between the ages of 13 and 27 years (mean age, 17 years) who had moderate to severe ASD. Of these, 26 were randomly assigned to receive 50 to 150 µmol daily of the sulforaphane-rich broccoli sprout extract for 18 weeks, and 14 received matching placebo.

A total of 32 of the participants had a history of behavioral improvements after having had a fever.

The SRS and the Aberrant Behavior Checklist (ABC), which were completed by parents or caregivers, and the Clinical Global Impression Improvement (CGI-I) scale, was was completed by physicians, were used to measure a range of behaviors, including ability to relate to others, sensory communication, and sociability. These measures were administered at baseline, during treatment at the 4-, 10-, and 18-week mark, and at the 4-week posttreatment follow-up.

Results showed that fewer than 3.3% of the placebo group experienced minimal changes by the 18-week assessment.

On the other hand, the participants receiving the supplement showed a 34% reduction in total ABC score, indicating significant improvement ($P < .001$), and a 17% reduction on the SRS ($P = .017$) after 18 weeks.

This group also showed significant improvements on the ABC at the 4-, 10-, and 18-week marks for hyperactivity, irritability, lethargy, and stereotypy; at the same time points, similar improvements were seen in scores on the SRS for awareness, communication, motivation, and mannerisms.

Correcting Cellular Problems?

In addition, significantly more members of the sulforaphane group than of the placebo group showed improved CGI-I scores at 18 weeks for social interaction ($P = .007$), aberrant behavior ($P = .014$), and verbal communication ($P = .015$).

However, all scores returned to pretreatment levels once sulforaphane was discontinued.

Although the active treatment was considered safe and well tolerated, the group receiving sulforaphane gained more weight throughout the study period than the placebo group (4.31 pounds vs 0.31 pounds). Vomiting, increased aggression, headache, and abdominal pain were among the treatment-related conditions reported by both groups.

Two members of the sulforaphane group also had single, unprovoked seizures, but both had a history of seizures.

"Although patients with autism are predisposed to seizures, we cannot rule out the possibility of seizures as an adverse effect of sulforaphane in ASD," write the investigators.

Still, they note that "the substantial improvements of individual ASD patients' trajectories were conspicuous and suggest that further investigation of sulforaphane in ASD is promising."

Dr Singh added that the supplement appears to correct underlying cellular problems in patients with ASD.

Early Days

"At this stage, I can't say that if patients with autism start eating broccoli or broccoli sprouts, they'll notice the same type of changes we found. This is a pilot study and definitely needs to be replicated in larger populations and probably in younger children," he said.

"We aren't at the stage where we'd tell clinicians that they need to prescribe broccoli to their patients. Maybe in the future this could turn out to be another drug that clinicians could prescribe, but more data are needed," said Dr Singh.

Paul Wang, MD, senior vice president and head of medical research at Autism Speaks, noted in a posting on the organization's website that, although this study is too small and preliminary to prove that sulforaphane helps treat autism, "the findings are interesting and important."

"We hope that the authors and other researchers will follow up with larger studies that can address unanswered questions and potential safety issues," added Dr Wang, who was not involved with the research.

Although Johns Hopkins University has filed a US patent application for the product, three inventors/coinvestigators who participated in this study have divested themselves from potential financial benefits. The study authors report no relevant financial relationships.

Proc Natl Acad Sci. Published online October 13, 2014. Abstract

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Cite this article: Broccoli Extract May Improve Autism Symptoms. *Medscape*. Oct 15, 2014.