

Research points to omega-3 as a nutritional intervention for childhood behavioral problems

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Credit: Robert Kraft/public domain

At the forefront of a field known as "neurocriminology," Adrian Raine of the University of Pennsylvania has long studied the interplay between biology and environment when it comes to antisocial and criminal

behavior. With strong physiological evidence that disruption to the emotion-regulating parts of the brain can manifest in violent outbursts, impulsive decision-making and other behavioral traits associated with crime, much of Raine's research involves looking at biological interventions that can potentially ward off these behavioral outcomes.

A new study by Raine now suggests that omega-3, a fatty acid commonly found in [fish oil](#), may have long-term neurodevelopmental effects that ultimately reduce antisocial and aggressive [behavior](#) problems in [children](#).

He is a Penn Integrates Knowledge Professor with appointments in the School of Arts & Sciences and the Perelman School of Medicine.

Along with Raine, the study featured Jill Portnoy a graduate student in the Department of Criminology, and Jianghong Liu, an associate professor in the Penn School of Nursing. They collaborated with Tashneem Mahomed of Mauritius' Joint Child Health Project and Joseph Hibbeln of the National Institute on Alcohol Abuse and Alcoholism.

It was published in the *Journal of Child Psychology and Psychiatry*.

Beginning 43 years ago, when Raine was a graduate student, he, his advisor and colleagues conducted a longitudinal study of children in the small island nation of Mauritius. The researchers tracked the development of children who had participated in an enrichment program as 3-year-olds and also the development of children who had not participated. This enrichment program had additional cognitive stimulation, physical exercise and nutritional enrichment. At 11 years, the participants showed a marked improvement in brain function as measured by EEG, as compared to the non participants. At 23, they showed a 34 percent reduction in [criminal behavior](#).

Raine and his colleagues were interested in teasing apart the mechanisms behind this improvement. Other studies suggested the nutritional component was worth a closer look.

"We saw children who had poor nutritional status at age 3 were more antisocial and aggressive at 8, 11 and 17," Raine said. "That made us look back at the intervention and see what stood out about the nutritional component. Part of the enrichment was that the children receiving an extra two and a half portions of fish a week."

Other research at the time was beginning to show that omega-3 is critical to brain development and function.

"Omega-3 regulates neurotransmitters, enhances the life of a neuron and increases dendritic branching, but our bodies do not produce it. We can only get it from the environment," Raine said.

Research on the neuroanatomy of violent criminals suggested this might be a place to intervene. Other brain-imaging researchers have shown that omega-3 supplementation increases the function of the dorsolateral prefrontal cortex, a region Raine found to have higher rates of damage or dysfunction in criminal offenders.

Raine's new study featured a randomized controlled trial where children would receive regular omega-3 supplements in the form of a juice drink. One hundred children, aged 8 to 16, would each receive a drink containing a gram of omega-3 once a day for six months, matched with 100 children who received the same drink without the supplement. The children and parents in both groups took a series of personality assessments and questionnaires at the start.

After six months, the researchers administered a simple blood test to see if the children in the experimental group had higher levels of omega-3

than those in the controls. They also had both parents and children take the personality assessments. Six months after that, the researchers had parents and children take the assessment again to see if there were any lasting effects from the supplements.

The assessments had parents rate their children on "externalizing" aggressive and [antisocial behavior](#), such as getting into fights or lying, as well as "internalizing" behavior, such as depression, anxiety and withdrawal. Children were also asked to rate themselves on these traits.

While the children's self-reports remained flat for both groups, the average rate of antisocial and aggressive behavior as described by the parents dropped in both groups by the six-month point. Critically, however, those rates returned to the baseline for the control group but remained lowered in the experimental group, at the 12-month point.

"Compared to the baseline at zero months," Raine said, "both groups show improvement in both the externalizing and internalizing behavior problems after six months. That's the placebo effect.

"But what was particularly interesting was what was happening at 12 months. The control group returned to the baseline while the omega-3 group continued to go down. In the end, we saw a 42 percent reduction in scores on externalizing behavior and 62 percent reduction in internalizing behavior."

At both the six- and 12-month check-ins, parents also answered questionnaires about their own [behavioral traits](#). Surprisingly, parents also showed an improvement in their antisocial and [aggressive behavior](#). This could be explained by the parents taking some of their child's supplement, or simply because of a positive response to their child's own behavioral improvement.

The researchers caution that this is still preliminary work in uncovering the role nutrition plays in the link between brain development and antisocial behavior. The changes seen in the one-year period of the experiment may not last, and the results may not be generalizable outside the unique context of Mauritius.

Beyond these caveats, however, there is reason to further examine omega-3's role as a potential early intervention for antisocial behavior.

"As a protective factor for reducing behavior problems in children," Liu said, "nutrition is a promising option; it is relatively inexpensive and can be easy to manage."

Follow-up studies will include longer-term surveillance of children's behavioral traits and will investigate why their self-reports did not match the parental reports.

More information: "Reduction in behavior problems with omega-3 supplementation in children aged 8–16 years: a randomized, double-blind, placebo-controlled, stratified, parallel-group trial." *Journal of Child Psychology and Psychiatry*, 56: 509–520. doi: 10.1111/jcpp.12314

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