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Author	Rabiner, David
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Summary	Children with developmental coordination disorder (DCD) were treated with dietary supplements with omega-3 fatty acids. The dietary supplementation did not effect motor skills, but improvements in reading, spelling, and behavior were seen in the treatment group.
Keyword	Complementary Alternative Interventions

This research review originally appeared in Attention Research Update, an online newsletter that helps parents, professionals, and educators stay informed about new research on ADHD. The newsletter is written by Dr. David Rabiner, a Duke University psychologist and former member of CHADD's Professional Advisory Board. To learn more about Attention Research Update, and to sign up for a free subscription, please visit www.helpforadd.com.

Fatty acid supplementation helps children's academics and behavior

Although medication treatment is helpful for an estimated 70 to 90% of children with ADHD, the development of effective alternative treatments is important for several reasons. First, even for children who respond well to medication, there often remain residual difficulties that need to be addressed. Second, some children experience intolerable side effects that preclude the ongoing use of meds. Finally, most studies documenting the beneficial effects of stimulant medication treatment are relatively short-term, and data showing that stimulant medication improves the long-term prognosis for children with ADHD is still scarce.

Dietary supplementation of long-chain fatty acids as an intervention for ADHD has generated considerable interest in recent years. Certain highly unsaturated fatty acids (HUFAs) are known to play an important role in many aspects of physical health, and may also play a role in a wide range of neuro-developmental and psychiatric conditions. For example, children with ADHD have been shown in several studies to have low blood levels of HUFAs. Because HUFAs are important for healthy brain development and functioning, some researchers have suggested that increasing HUFA levels via dietary supplements could enhance brain functioning and reduce ADHD symptoms.

In a prior issue of Attention Research Update - www.helpforadd.com/2002/june.htm - I reviewed 2 studies examining the impact of fatty acid supplementation on ADHD symptoms. In the first study, 63 children who were being treated effectively with stimulant medication were randomly assigned to receive Docasahexaenoic acid (DHA, a type of long-chain fatty acid) or a placebo over a 4-month period. Computerized tests of attention and parents' ratings of children's ADHD symptoms did not differ for treatment vs. placebo groups at 4 months; the authors interpreted this as evidence against the benefit of fatty acid supplementation for children with ADHD.

A problem with this conclusion, however, is that participants remained on medication during the trial. Because these children were all positive medication responders, their symptoms would already have been substantially reduced, thus making it difficult to demonstrate additional benefits of an additional intervention. In children with ADHD who were not being treated with meds, however, DHA supplementation might provide benefits that could not be detected here.

In the second study previously reviewed, 41 8-12 year-old children with developmental dyslexia were randomly assigned to receive either HUFA supplementation, containing both omega 3 and omega 6 fatty acids, or an identical-looking placebo. None had been formally diagnosed with ADHD, although all had above-average scores for high levels of ADHD based on parent responses to the Conners Rating Scale. After 12 weeks, children receiving active treatment had significantly lower ratings for inattention and global ADHD symptoms than children who had received the placebo. Average scores for treated children now fell

towards the upper end of the "normal" range while average scores for children in the placebo group remained elevated. The degree to which the results would generalize to children carrying a formal diagnosis of ADHD was not clear.

At the time, my overall conclusion on the effects of fatty acid supplementation on children's ADHD symptoms was the following:

"At this point in our knowledge, it seems premature to conclude either that fatty acid supplementation has no benefits for children with ADHD, or that such benefits are clearly established. Hopefully, research will soon be available that will permit a more definitive evaluation."

A study published in the May 2005 issue of *Pediatrics* (Richardson, A.J., et al. The Oxford-Durham Study: A randomized, controlled trial of dietary supplementation with fatty acids in children with developmental coordination disorder, Pediatrics, 115, 1360-1366) provides important new data on this interesting issue. This study was conducted in England, and involved 117 5-12 year old children - about one-third were girls - diagnosed with Developmental Coordination Disorder (DCD). Many of these children had elevated levels of ADHD symptoms, although they were not formally diagnosed with ADHD as part of the study.

DCD involves specific impairments of motor coordination that interferes significantly with a child's academic achievement and/or activities of daily living. DCD is believed to affect approximately 5% of children, and frequently overlaps with ADHD dyslexia. Manifestations of the disorder in school-age children frequently include difficulties with the motor aspects of handwriting, playing ball, assembling puzzles, etc. In the school setting, children with DCD frequently struggle with written language and/or problems with organizational skills and attention. Thus, although this is a different disorder from ADHD, children with DCD experience many similar problems in school.

Participants were randomly assigned to receive dietary fatty acid supplementation treatment or a placebo. The initial assignment to treatment vs. placebo lasted for 3 months. At the end of 3 months, those in the treatment group continued to receive fatty acid supplementation for 3 additional months while children who had been receiving placebo were switched to active treatment as well.

Active treatment was a supplement containing 80% fish oil and 20% evening primrose oil in gelatin capsules. The daily dose of 6 capsules (2 capsules in the early morning, at lunch, and in the late afternoon provided both omega-3 fatty acids (Dose received: 558 mg of eicosapentaenoic acid and 174 mg of docosahexaenoic acid) , omega-6 fatty acids (Dose received: 60 mg of y-linoleic acid), plus vitamin E (Dose received: 9.6 mg). *Note: Although this information reflects the doses used in the study, the authors specifically comment that the optical dosage and combination of fatty acids remains unknown and that additional studies are required to determined this.* Placebo treatment consisted of olive oil capsules that were carefully matched to the active treatment in both appearance and flavor. Capsules were administered by teachers during the week and by parents on the weekend.

MEASURES

Several different measures were collected at baseline, 3 months, and 6 months to determine whether fatty acid supplementation improved children's functioning. First, teachers completed the Conners Rating Scale, a widely used behavior rating scale to assist in the assessment of ADHD and other behavioral/emotional problems in children. Children's reading and spelling achievement was assessed using a standardized measure of academic achievement. This measure of reading achievement focused on the ability to read single words and did not examine reading comprehension. Finally, motor functioning was assessed with the Movement Assessment Battery for Children.

RESULTS

The authors first compared children in the treatment and placebo groups after 3 months to determine whether fatty acid supplementation was associated with improvements in motor and academic functioning and with reductions in ADHD symptoms. Results of these analyses indicated the following:

- There was little change in children's motor skills and no indication that treated children showed greater improvement than children receiving placebo.

- Before treatment, average reading and spelling achievement scores were about 1 year below age level for children in both groups. After 3 months, children receiving fatty acid supplementation gained an

average of 9.5 months in reading and 6.6 months in spelling. Children receiving placebo, in contrast, gained only 3.3 months in reading and 1.2 months in spelling. Thus, compared to the placebo group, gains made by treated children were highly significant.

- At baseline, the average score on the ADHD scale of the Conners was elevated in both groups. Scores for treated children showed a significant decline while scores for placebo children were essentially unchanged. Within the treated group, 16 children initially had scores on the ADHD scale in the clinically elevated range; after 3 months, 7 no longer fell in this range. Among children in the placebo group, only 1 of 16 children showed this same improvement.

Recall that after 3 months, children in the placebo group began receiving fatty acid supplementation and treated children continued receiving the supplement. Assessments of motor functioning, academic achievement, and ADHD symptoms were examined again 3 months later. Here is a summary of what was found:

- As before, gains in motor functioning were modest.

- Children who began receiving treatment showed an average gain of 13.5 months in reading and 6.2 months in spelling. Children who continued on active treatment continued to make substantial gains as well: 10.9 months in reading and 5.3 months in spelling.

- ADHD symptoms declined significant in children who began receiving supplementation. Scores continued to decline among children continuing on active treatment.

SUMMARY AND IMPLICATIONS

The results of this double-blind, placebo controlled study are exciting: among 117 children with developmental coordination disorders, dietary supplementation of omega-3 and omega-6 fatty acids was associated with substantial gains in reading and spelling as well as significant reductions in ADHD symptoms. Although these children were not diagnosed with ADHD, many had elevated levels of ADHD symptoms, and may have qualified for an ADHD diagnosis had they been formally evaluated.

The gains in children's reading and spelling achievement were particularly noteworthy: children who received 6 months of treatment showed an average gain of over 20 months and a spelling gain of about 12 months. Thus, despite not receiving any specific academic intervention during this time, they went from being about a year below age level to essentially catching up with their peers.

Although this is a very important finding, as with all exciting new findings, replicating this result in a second study would be very important to do. In addition, because the measure of reading achievement focused on single-word reading, the extent to which comparable gains may have occurred in children's reading comprehension is unknown. This would be an important issue to examine in subsequent research. The authors also note that additional studies are needed to establish the optimal composition of fatty acid treatments - they used a 4:1 ratio of omega 3 to omega 6 fatty acids - as well as the optimal dosage.

It is important to emphasize that this was a carefully conducted and well-controlled study, in which neither participants, teachers, parents, or those administering the achievement tests were unaware of when children were receiving active supplementation and when they were receiving placebo. Because of these controls, the benefits reported can confidently be attributed to the effects of the fatty acid supplementation. As the authors note, however, the study was not designed on the possible mechanisms by which these effects were obtained (e.g., what specific changes in brain functioning were induced by the supplements that resulted in children's gains).

It is also important to emphasize that although many children in this sample of children with DCD showed elevated levels of ADHD symptoms, and that ADHD symptoms improved with treatment, participants in this study did not carry an ADHD diagnosis. Thus, the extent to which children with ADHD would benefit from this treatment approach is unclear, and, as noted above, a prior study of fatty acid supplementation in children with ADHD failed to find such benefits. In this study, however, children were already being managed effectively on medication, making additional gains hard to document, and only a single fatty acid was supplemented rather than both omega-3 and omega-6 fatty acids as was done here.

Given the extremely positive results of the current investigation, it would appear that new research on the

impact of fatty acid supplementation on the behavior and academic functioning in children with ADHD would be extremely important to carry out. To my knowledge, the gains in academic achievement that were demonstrated here have not been reported in any prior study of ADHD interventions, and are truly exciting. Learning whether children with ADHD, many of whom struggle academically, would also benefit from fatty acid supplementation should thus be a high research priority.