



Volume 6, No. 2

May, 2006

## COMPLEMENTARY THERAPIES FOR ATTENTION DEFICIT HYPERACTIVITY DISORDER (ADHD)\*

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### Abstract

ADHD can be a debilitating problem to children and adults. Untreated, it can predispose to school dropouts and accidental injuries. While the most common approach to treating ADHD has been the prescription of stimulant medications, recent reports of deaths associated with these medications is a strong caution in their use on the one hand, and on the other hand a stimulus to explore the safer complementary/alternative medicine (CAM) approaches. A variety of CAM modalities can help children and adults with ADHD, including dietary measures, neurobiofeedback, cranial osteopathy, Brain Gym, and more.

### Overview

ADHD is a common problem, estimated to affect 3 to 9 percent of children (Spencer, 2002), with rates of persistence from childhood into adulthood ranging from 8% to 85% and an estimated prevalence of 4% in adults (Wiess, 2003). The ranges of prevalence and persistence rates reflect differing criteria used for defining ADHD, with higher rates found when more recent criteria are used (Spencer, 2002; Spencer, et al., 2002). ADHD may present with any or all of the following symptoms: hyperactivity, distractibility, impulsivity, short attention span, forgetfulness, procrastination, poor consequential thinking, low frustration tolerance, mood lability, temper outbursts, preference for high levels of stimulation. Boys are far more likely to manifest these symptoms than girls in earlier childhood, particularly when hyperactivity is present, and it is usually schools and family who request treatment. Girls are far more likely to have the attentional problems without the hyperactivity, which accounts for the identification of ADHD more frequently in older girls and women – often by their own complaints that they have difficulty concentrating or remembering rather than by the complaints of family or schools.

*Joe was referred for psychiatric evaluation at age 8. He had been getting poor grades in first grade in most subjects, but was failing all academic subjects in second grade and his behaviors had become a serious problem. He was restless, unable to sit still in his seat, frequently dropped things, called out without raising his hand, and had a quick temper. His mother complained that he was always losing books and assignments, and took two hours or more to complete homework that his teacher said should only take half an hour. At home he was impulsive, unable to sit through a meal or a TV show, and a serious liability when taken to a mall – where he would often disappear if not held by the hand.*

*His psychiatric evaluation revealed a cheerful but very restless child, who could not remain in his seat more than half a minute without a reminder. He appeared to have difficulty understanding questions, many of which had to be repeated several times. Mother reported that he had always been a very active child, even in infancy, and that sugar made his behaviors markedly worse.*

*I diagnosed that Joe had ADHD. Mother was not open to exploring dietary approaches to dealing with his problems, but agreed to give him Ritalin. On 5 mg three times daily there was no change. On 10 mg he was so quiet, his mother was scared, saying, "He looked like a zombie!" We had mother cut a 5 mg tablet in half so that he could have a dose of 7.5 mg. Both his teacher and mother were astounded at how differently he behaved while on the medication. He was able to sit still, listened and absorbed instructions much better, and completed his homework in only 45 minutes – without his mother having to stand over him constantly to get him to focus on his work.*

There is a strong current of criticism in the CAM community about the possibility that ADHD may be over-diagnosed. This possibility is supported by reviews that show that the rates of ADHD diagnosis may vary by 20:1 between different cities and between 4:1 between various states (Goldman et al., 1998; LeFever, et al. 1999). Similarly, there are strong suspicions that stimulant medications may be over-prescribed. Under 50 percent of the children who received stimulants met the currently accepted criteria for ADHD (Greenhill et al. 1999; Jensen et al., 1999; Wolraich et al., 1996). The contrary view is also expressed: ADHD may be under-diagnosed by teachers and physicians who are not trained to recognize these problems. It may also be that milder cases of ADHD, demonstrating only part of the symptom spectrum, respond well to the medications.

What is clear is that untreated ADHD predisposes people to impaired school performance, school dropouts and failure. Teacher school surveys found that 8-11 percent of students demonstrate sufficient impairments from ADHD symptoms to require further diagnostic investigation (Gaub and Carlson, 1997). Children with ADHD demonstrate a range of learning difficulties and behavioral problems, including distractibility, Inconsistent behavior, forgetfulness, lags in self-control and age appropriate self-care, disturbed sleep patterns, higher risks of accidental injuries, and high rates of high school drop-outs (Barkley, 1998). In addition, secondary problems of poor self-image and low self-esteem lead children to seek peer support from children with similar problems, which often ends in antisocial attitudes and behaviors.

Adults with ADHD are predisposed to difficulties with employment, driving, and relationships. ADHD is also associated with high comorbidity with other psychiatric disorders, such as anxiety, antisocial behavior, conduct, depression and bipolar disorder, and substance abuse (Adler, 2002; Barkley, 2002; Wender, 2001; Wiess, 2002). Parents of children with ADHD have a higher likelihood of also having ADHD than the general population.

### **Differential diagnosis and problems commonly associated comorbid with ADHD**

Many childhood psychological and behavioral problems can include symptoms similar or identical to ADHD (Pearl, et al., 2001).

*Oppositional Defiant Disorder (ODD)* is diagnosed in approximately 50% of children with ADHD (Spencer et al, 1999). ODD manifests as arguing constantly over anything and everything; extreme stubbornness; insistence on getting one's own way or no way; and serious temper outbursts. The ADHD may be overlooked because of the severity of the anger and temper problems associated with the ODD. The ODD may respond well to treatment of the ADHD, as children become less impulsive and better organized, have improved self-image and self-control.

*Depression* is often expressed in children as hyperactivity, irritability, anger and temper outbursts, difficulty sleeping, distractibility and forgetfulness. These symptoms are easily mistaken for ADHD. A help in differentiating between the two is the frequent history of onset of ADHD symptoms in early childhood, while depression often manifests in children who were previously free of such symptoms.

*Bipolar (Manic Depressive) Disorder* may manifest in children as hyperactivity, impulsivity, irritability, and temper outbursts. What often distinguishes bipolar disorder is severe difficulty sleeping, even to the point of staying up most or all of the night, and rapid mood swings for no external reason.

*Post Traumatic Stress Disorder (PTSD)* may likewise manifest as short attention span, irritability, temper outbursts and difficulty sleeping. The onset of symptoms following a trauma in a child previously free of symptoms, the presence of nightmares, fears related to the trauma, and re-enactments of the trauma suggest PTSD. Again, treatment of comorbid ADHD may be enormously helpful to children experiencing PTSD.

*Sleep disruption and sleep disorders* may cause children to be hyperactive and inattentive, disrupting their learning abilities and making them more irritable (O'Brien, Ivanenko, et al. 2003). Successful treatment of the sleep disorders can improve these symptoms. Attention to sleep disturbance may be promising as well for children with ADHD as they often have poor sleep patterns. A study explored the use of an extract of Mexican valerian (*Valeriana edulis*) in five boys who had 'intellectual deficits, and disordered sleep. Several of these boys also had ADHD. In a self-controlled study, 500 mg dried valerian root over a two week period improved their sleep, and was particularly beneficial to those who had hyperactivity (Francis and Dempster, 2002).

*Pervasive developmental delay (PDD) and Autistic spectrum disorders* may include irregular hyperactivity (Goldstein S; Schwebach, 2004). ADHD may be present in addition to the PDD and autism, in which case the hyperactivity is constant.

*Hearing difficulties* may appear as inattention and may be mistaken therefore for ADHD (McFarland; Cacace, 2003).

*Emotional stress* can worsen symptoms of ADHD. Anxiety, depression and post-traumatic stress disorders will often produce difficulties in concentration even for people who do not have ADHD and will impair their memory. My personal experience in this regard was when I had a marked difficulty concentrating when I was living in Israel during the Yom Kippur war – to the extent that I could not recall what I had just read in the newspaper. This was highly unusual for me, and an alert to how anxious I was under the stress of planes flying low overhead at all hours of the day and listening anxiously to the news reports from the battlefields. If this is the case with people who do not usually have attention problems, we would expect the same effects of stress and anxiety to be markedly amplified in people with ADHD.

### **Medications to control ADHD symptoms**

The most commonly recommended treatments for ADHD have been the stimulant medications Ritalin, Adderall and Dexedrine. These are rapidly effective, starting within about 30 minutes of taking the medicine, and lasting 4 to 12 hours, depending on the preparations prescribed. These are among the most commonly prescribed drugs for childhood problems. Recently, modafinil/Provigil, another stimulant has also been reported to help.

About 30 percent of children do not respond to stimulants or have serious difficulties tolerating the side effects (Barklay, 1990). These can include sleep onset delays, appetite suppression, rebound effects (marked worsening of symptoms when medication effects wear off), development of tics (minor motor movements of facial and other muscles) or a tendency to pick at the skin and fingernails (sometimes to the point of bleeding), and occasionally a marked worsening of ADHD and comorbid symptoms (especially anger and rage with oppositional defiant disorders).

Atomoxetine/Strattera is a non-stimulant that has been found to help with ADHD symptoms. The advantage of this medication is that its effects are continuous, 24/7, though morning and afternoon doses may sometimes be needed in order to maintain maximal round-the-clock effect. The disadvantages are that effects usually take 2 to 6 weeks to manifest, are far weaker than those of stimulants, and side effects are much more likely, including stomach upset and severe rage responses.

Secondary line medications can sometimes be helpful, but in a much lower percent of children. These include antidepressants such as imipramine/Tofranil, desipramine/ Norpramin and bupropion/Wellbutrin, and cardiac medications such as clonidine/Catapres and guanfacine/Tenex. The latter are particularly helpful in softening or eliminating rebound effects of medications.

### **Serious problems with stimulant medication and growing incidence of ADHD**

Recent alerts warn of fatalities with stimulant treatment for ADHD (Bridges 2006). These include Ritalin, Adderall and their long-acting forms, some of which bear other names, such as Concerta and Metadate. This has come as a surprise to many of us who prescribe stimulants, because until now these have been considered among the safest of medications – as far as serious, damaging side effects are concerned. In retrospect, this should not have been such a surprise when one considers that there are over 100,000 deaths annually in the US alone from medications properly prescribed, and another 100,000 deaths annually from medical errors, including medication errors (Lazarou et al 1998).

This is of serious concern because ADHD appears to be a growing problem. It is suspected that ADHD may be due to any of a combination of factors that could include early brain trauma (as in the mechanics of the birth process or due to oxygen starvation during the birth process); nutritional factors (such as deficits in essential fatty acids, vitamins and/or supplements); allergies (including food intolerances to milk and wheat); toxin loads in the diet (such as sugar, food coloring and hormones); toxic factors in the environment (such as residues of pesticides or fertilizers); and other environmental factors such as electromagnetic pollution and geopathic stress, but these have not been firmly established and are generally discounted by the medical community.

Dietary toxins are clearly implicated. At least half of the parents in my clinical practice (that has focused largely on children) report that their children who have ADHD have much more difficulty if they eat anything with sugar in it. Oddly, numbers of studies that examined this factor came up with no correlation between sugar ingestion and worsening of ADHD symptoms. One study reported that high sugar ingestion combined with high carbohydrate produced more hyperactivity (Wender and Solanto, 1991). The second most common items are food coloring (particularly red dye) and caffeine. Bateman and colleagues (2004) demonstrated that artificial food colorings (20 mg daily) and sodium benzoate (45 mg daily) produced a worsening in ADHD symptoms, and that the symptoms improved when the food additives were discontinued. The medical community has been slow to acknowledge dietary contributors to ADHD symptoms.

*Food allergies* to wheat, milk and other ingredients have been widely suspected of contributing to ADHD. A seven to fourteen day is recommended by Schmidt and colleagues (1997). They recommend an “oligoantigenic [elimination] diet consisting of 2 meats (lamb, turkey), 2 carbohydrates (rice, potatoes) 2 vegetables (any cabbage, carrots), and 2 fruits (apple, banana)... 24% of the subjects demonstrated an improvement” by adhering to these measures.

### **Behavioral issues and therapies**

Research has correlated high exposure to TV in early years with development of ADHD (Christakis, Zimmerman, et al, 2004). It is postulated that the rapid shifts in stimuli in the TV programs and

commercials may habituate the brains of these children to a short attention span. It is difficult to know, however, where the causality lies in this correlation. Children with ADHD usually have very short attention spans, making them difficult for their families to manage. For reasons that are not entirely clear, these children are able to sit for long hours watching TV shows or playing video games. It may be that because of this, parents use the TV as a baby sitter – making the ADHD the cause of higher TV watching rather than vice-versa.

It is clinically apparent that when there is stress in the home or in their school or other environments, children with ADHD have a distinct worsening of their symptoms. Therapy for parents of these children may help the children.

Behavioral management techniques that are taught and administered by professionals for mild ADHD are usually the treatment of choice in the USA. With recommendations for combining prescription drugs, nutraceutical therapy, cognitive reprogramming, parenting and educational strategies, biofeedback, self-hypnosis, and more, these provide a comprehensive treatment program that can lead to a fully functional and normal life (Bussing & Zima, 2002).

Parents and teachers who can maintain firm behavioral limits can help children with ADHD to accept and internalize expectations for socially acceptable behaviors and self-control. Parents who themselves have ADHD may have great difficulties in being firm and consistent. Teachers who are firm may be able to handle children who have even serious ADHD symptoms in their classrooms. Those who are not firm may be unable to establish behavioral controls, in which case the child with ADHD may become unmanageable in class.

### **Complementary/ Alternative Medicine (CAM) treatments for ADHD<sup>1</sup>**

While precise medical and psychiatric diagnoses are essential in medical treatment, and may be important as well in CAM treatments, it is far more important in CAM therapies to treat the individual who has the symptoms rather than the symptoms the individual has.

*Cranial osteopathy* can address congenital skull and brain injuries. This is a form of healing in which the bones of the skull and bioenergy rhythms of the brain may be adjusted. Successes have been reported in treating ADHD, as well as with childhood developmental problems such as cerebral palsy. A series of treatments over several weeks or months, sometimes longer, may be needed (Lee, 2002).

*Biofeedback* can help and sometimes cures ADHD, based on observed problems with the brain activities of people with ADHD (Moss 2002). The EEGs of people with ADHD have a predominance of slow, theta waves in the frontal brain regions and less than normal faster, beta wave activity (Lubar and Lubar, 1999; Nash, 2000). The predominant slow wave activity increases when people are challenged with a cognitive task like doing math problems. SPECT scans show less blood flow in frontal areas, indicating that these areas are not at optimal function. PET scans demonstrate lowered metabolic in these same areas. Frontal brain areas are important in planning and organizing activity such as planning and organizing behaviors, inhibiting maladaptive behaviors, and activating well-organized clusters of behaviors (Barklay, 1997). ADHD children or adults are handicapped in maintaining focus, planning, organizing, and executing appropriate behaviors and in restraining inadvisable and impulsive actions. When faced with academic tasks that should elicit increased focusing activity, the person with ADHD often becomes less focused.

General biofeedback which is aimed at calming and can contribute a little to reducing the hyperactivity of ADHD. People with ADHD are trained to decrease forehead muscle tension. This, in turn, decreases restless behavior. Similarly, Keith Lowenstein points out that poor heart rate variability (HRV) has been correlated with limited abilities to sustain attention (Suess et al., 1994), increased sympathetic nervous system tone (initiating fight or flight responses), increased cardiac reactivity, lessened resiliency in dealing with acute and chronic stress, elevated risks of anxiety and mood disorders, and higher risks

of immune system problems (Malik, 1996; Stys & Stys, 1998). Lower HRV in children is associated with temperament and behavioral problems (Calkins, 1997; Mezzacappa et al., 1997; Pine et al., 1998; Porges et al., 1996). Self-regulatory techniques that improve HRV have demonstrated measurable and effective benefits in treating stress-related physical and psychological disorders (\*heartmath. While these self-regulatory approaches are of limited benefits in controlling the core ADHD symptoms, they are extremely helpful in dealing with general stress and anxieties that can worsen ADHD problems. They are also excellent in building self-confidence and self-esteem, so they are generally recommended as part of more specific EEG neurofeedback treatment plans.

EEG neurofeedback addresses abnormal brain wave activity that has been identified in ADHD. A baseline quantitative EEG (QEEG) can map out the electrical activity from a variety of sites on the head. This documents which areas show abnormal activity levels and provides a focus for effective neurofeedback training. High costs and limited availability limit the use of the QEEG. Most treatment begins with placement of sensors at standard sites on the midline of the person's skull. An initial baseline is recorded and the person engages in neurofeedback training which normally requires between 25 and 50 sessions. The EEG readings are converted to auditory signals such as simple variable tones and music, and visual displays are also used to guide people to increase the amounts of faster, beta brainwave activity and to suppress their slower, theta wave activity.

The widely utilized Lubar protocol includes academic tasks (reading, math and homework) in the neurofeedback training sessions. These encourage people to generalize the enhanced attention achieved from the feedback sessions to academic learning activities when feedback is not available. Lubar and others report substantial normalization of brain electrical activity, increasing the beta wave activity and reducing theta wave activity. At the same time, they find improved on-task behavior, performance in school, and scores on psychometric testing, reflected on behavioral checklists, achievement tests and IQ scores. A study by Cartozzo and colleagues found that 30 sessions of EEG biofeedback led to a significant reduction in theta (4-7 Hz) amplitude, and increased attention span (Cartozzo, Jacobs & Gevitz, 1995). Rossiter and LaVaque, 1995) also found improvements in attentiveness and impulse control with neurofeedback.

Young (2004) found that the annual cost of EEG biofeedback treatment for an ADHD child ranges from \$1,800 to \$4,000 (US Dollars) depending on the provider's charges for his/her services, including direct and indirect costs Young, G (2004). A course of EEG Treatment costs from \$1800 to \$4000.

*Brain Gym* and related exercises that harmonize right and left sided mind-body functions (Dennison and Dennison, 1992) can reduce and sometimes cure symptoms of ADHD.

*Self-healing* can be enormously helpful in a variety of ways. Methods for self healing that may be helpful include:

WHEE – Wholistic Hybrid derived from EMDR (Shapiro) and EFT (Craig) – can reduce anxieties, stress and frustration responses; calm angers; release emotional residues from new and old traumas; transform self-critical and self-limiting beliefs; improve self-image; install positive beliefs; and enhance self-image. WHEE can also be helpful to parents and other family members who become frustrated or angry with the person who has ADHD.

Meditation (Arenander and Sheppard, 2000), breathing, muscle relaxation and any other forms of relaxation that are comfortable to a person can be calming and can reduce stress responses. These work on the body to reduce physical tensions and stress responses, and are also calming for emotional tensions. Jim Brooks (2002), within his ayurvedic practice, finds that Transcendental Meditation can reduce and sometimes eliminate children's need for stimulant medications to control ADHD symptoms.

Keith Lowenstein notes that there is a growing body of research that self-regulatory practices such as meditation can help children with behavioral problems (Platania-Solazzo et al., 1992; Tellis et al., 1997). Genetically vulnerable children and adults who suffer chronic or early exposures to stress and

trauma are liable to develop alterations in functions, structures, chemistry, and genetic development in their nervous systems (Anisman et al., 1998). Self-regulating exercises offer many benefits to help children with such problems to improve control over their excessive reactivity, anxieties, fears and angers. A modest investment in teaching children self-regulatory techniques as part of their school curriculum would earn them lifelong benefits in dealing with problems associated with emotional traumas.

Heart-centered focus can be calming. If we stop running programs in our heads, particularly when these are related to stress, anxiety, fear and pain, then we stop vicious circles of stress and anxiety such as: External or internal stress → physical tension, anxiety → worry → internal stress → physical tension, anxiety.

For so long as the mind remains in the head, where thoughts jostle one another, it has no time to concentrate on one thing. But when attention descends into the heart, it attracts all the powers of the soul and body into one point there. This concentration of all human life in one place is immediately reflected in the heart by a special sensation that is the beginning of future warmth. This sensation, faint at the beginning, becomes gradually stronger, firmer, deeper. At first only tepid, it grows into warm feeling and concentrates the attention upon itself. And so it comes about that whereas in the initial stages the attention, by its own vigor, gives birth to warmth in the heart. This warmth then holds the attention without special effort. From this, the two go on supporting one another, and must remain inseparable; because dispersion of attention cools the warmth, and diminishing warmth weakens attention.

Theophan the Recluse  
Russian Orthodox saint (1815-1894)

*Homeopathy* has helped many people with irritability, anxiety and anger problems. In a ten-day treatment with a combination of homeopathic remedies (Stramonium, Cina and *Hyoscyamus niger*) compared with a placebo, 57 percent of those receiving homeopathic remedies showed significantly fewer behavior problems (Lamont, 1997).

*Aromatherapy* can be calming for various forms of anxiety, ADHD, depression and more. Essential oils are used in evaporators or combined with massage oils (d'Angelo). Particularly helpful in ADHD have been the following oils: Basil (*Ocimum basilicum*), Clary sage (*Salvia sclarea*), Lavender (*Lavandula angustifolia*), Lemon (*Citrus lemon*), Melissa (*Melissa officinalis*), Orange (*Citrus aurantium*), Sandalwood (*Santalum album*), Sweet marjoram (*Origanum majorana*), and Vetiver (*Vetiveria zizanioides*). While there is no direct research on aromatherapy for ADHD, children who have developmental disorders showed greater relaxation with inhaled aromatherapy (Sheppard-Hanger & Stokes, 2000).

While self-healing methods can reduce the severity of problems associated with ADHD, I have not seen them control or eliminate the symptoms of ADHD.

*Diet and supplements* can help ADHD and other psychological and behavioral problems. This is a very complex issue, but the bottom line is that avoiding foods that contribute to ADHD and eating a healthy diet (with avoidance of toxins and inclusion of the right fatty acids) can often help children with ADHD.

Avoiding sugar and red dye, if they increase a child's ADHD symptoms, is an obvious intervention. Sugar is so commonly present in our diets that we may easily overlook items such as breakfast cereals, ketchup and party treats at school or birthday celebrations. I am truly puzzled why several controlled studies found no correlations between ingestion of sugar and ADHD.

Red dye is obviously a common ingredient of candies, water ices and the like, and almost always found in hot dogs and bologna (to keep the meat looking pink rather than turning gray), and often added to fruit juices (even yellow ones) and party snacks (such as nacho chips).

Harding and colleagues (2003) published a controlled study on the use of a complex combination of nutrients and supplements for ADHD, with significant positive results. This study is difficult to evaluate because it used about 30 ingredients (See Table 1), so that it is difficult to know whether only this combination is effective, or whether one or more of the ingredients is the potent, effective factor. These authors are not alone, however in recommending combinations of interventions (Brue and Oakland, 2002).

**Table 1. Supplements used in the alternative treatment group**

Gastrointestinal and Immune Support (Risk Factor #1)	
(1)	Lactobacillus acidophilus and bifidus
(2)	Lactoferrin (5 mg)
(3)	Silymarin (5 mg)
Sulfur-Containing Supplements and Glycine (Risk Factor #2)	
(1)	Taurine (275-425 mg)
(2)	Glycine (700-1830 mg)
(3)	Methionine (25-75 mg)
(4)	N-acetylcysteine (NAC) (0-10 mg)
(5)	L-cysteine (0-25 mg)
(6)	Glutathione (20 mg)
(7)	Alpha Lipoic acid (5 mg)
(8)	Garlic extract (200 mg)
Amino Acids (risk Factors #3 and #6)	
(1)	Tyrosine (900-1800 mg)
(2)	Histidine (25-75 mg)
(3)	Glutamine (600-1400 mg)
(4)	Alpha Ketoglutarate (AKG) (25-75 mg)
(5)	L-carnitine (30 mg)
Minerals (Risk Factor #4)	
(1)	Magnesium (as magnesium glycinate) (220-480 mg)
(2)	Calcium (as calcium ascorbate) (110-170 mg)
(3)	Potassium (as glycerol phosphate) (46-70 mg)
(4)	Chromium (as nicotinate) (140-200 mcg)
(5)	Selenium (as methionate) (26-32 mcg)
(6)	Zinc (as monomethionate) (9-15 mg)
(7)	Manganese (as arginate) (2.5-4 mg)
(8)	Boron (as citrate) (1200-1800 mcg)
(9)	Copper (as tyrosinate) (1.2-2.4 mg)
(10)	Silica (4 mg)
(11)	Molybdenum (as chelate) (5-40 mcg)
(12)	Vanadium (chelate) (2-20 mcg)
(13)	Iron (as glycinate) (1-2 mg)

A combination of 200 mg American ginseng (*Panax quinquefolium*) and 50 mg *Ginkgo biloba* in a proprietary herbal formula (AD-FX) was administered to children 3 to 17 years old. These children were already being treated with medications for their ADHD. The herbs were given twice daily. After four weeks, 74 percent of the children demonstrated improvements (Lyon, Cline, et al. 2001).

Magnesium deficiency can produce irritability, shorter attention span, and mental confusion. Low blood magnesium levels are often found in children with ADHD symptoms (Kozielec and Starobrat-Hermelin, 1997). In a study of 50 children who had ADHD and documented magnesium deficiency, 200



mg per day of magnesium supplements of magnesium over six months improved their behaviors more than standard therapy alone (Starobrat-Hermelin and Kozielc, 1997). Magnesium is found in legumes, seeds, nuts, whole grains, green leafy vegetables, and tofu. In addition, Shannon recommends magnesium citrate, with an equal amount of calcium citrate 200 mg per day for children 5 to 11, 300 to 400 mg per day for older children (White, 2004).

Zinc contributes to regulation of fatty acids and neurotransmitters (such as dopamine) which are vital to brain functions. Levels of this mineral seem to be low in children with ADHD (Bekaroglu, Aslan, Gedik, 1996; Toren, Eldar, Sela, 1996). Low levels of zinc can reduce the clinical response to stimulant medication (Arnold, Pinkham, Votolaton, 2000). A high dose of 150 mg/day (about 45 mg elemental zinc) supplementation has been shown to have a therapeutic effect (Blici, Yildirim, et al. 2004; Akhondzadeh, Mohammadi, Khademi, 2004). The recommended daily allowance of zinc is 10 mg for children aged 1 to 10, and 15 mg for kids over 11. Food sources include meat, fish, shellfish, poultry, dairy products, whole grains, legumes, and nuts. High doses of zinc as recommended above can cause nausea, vomiting, copper-deficiency anemia, and depressed immune function.

Low levels of iron in the blood (serum ferritin) have been correlated with general ADHD symptoms and with more severe ADHD symptoms and greater cognitive deficits (Konofal E/ Lecendreu M/ Arnulf I, et al. 2004). Iron supplementation has been recommended but this has not yet been studied as a therapeutic supplement for ADHD.

Janet Settle (2002) is one of many in this field who suggest that preventive measures should include focus on dietary fat, which would be especially important during pregnancy and throughout childhood for prevention and treatment of ADHD. The brain is 60 percent fat. Our brain function reflects the types of fat incorporated into our brain cells, which in turn is largely influenced by our dietary intake of fat. There are healthy and unhealthy dietary fats. Even healthy fats can be harmful if we do not balance them with necessary amounts of other healthy fats. The body cannot manufacture the essential fatty acids (EFAs) which are required for our survival. We must acquire these through our diet. There are two types of EFAs: omega-6 and omega-3. While both are essential, ratios of the omega-6 to omega-3 is critical. Optimally, we need a 1:1 ratio of omega-6 to omega-3 dietary fatty acids for optimal health. In a typical American diet there is often a 20:1 ratio. This means that American diets include 20 times the optimal, healthy amount of omega-6 fatty acids and too little of the omega-3 fatty acids.

In the U.S. diet, the most common fat is linoleic acid (LA), which is a short-chain omega-6 fatty acid that is found in seeds, grains, and oils (e.g. corn, soybean, sunflower, and safflower oil). Our bodies build LA into the arachidonic acid (AA), which is a long-chained omega-6 fatty acid important to the brain. These are the oils that are in excess in American diets.

Omega-3 fatty acids are produced primarily by ocean plants (algae). The short-chain building block for omega-3, alpha-linolenic acid (ALA), is available in substantial amounts in walnuts and in the oils of flaxseed, black currant, and canola. ALA is a building block for eicopentainoic acid (EPA) and docosahexainoic acid (DHA), both of which are long-chain omega-3 fatty acids. EPA and DHA can be found in cold-water fish such as salmon. The brain incorporates DHA, as does human breast milk.

While we are just at the start of understanding impacts of EFA intake on health, a review of research indicates that omega-3 deficiency can contribute to development of psychiatric disorders including ADHD, dyslexia, depression, postpartum psychiatric problems, bipolar disorder, schizophrenia and dementia (Mischoulon, 2000).

Animal studies show that the fatty acid composition in the brain cell membranes is influenced by diet (Bourre et al., 1993). A diet deficient in omega-3 oil leads to abnormal animal behavior such as lowered stress tolerance, increased anxiety, impaired learning capacity, poor visual development, and greater vulnerability to toxins (e.g. alcohol). Changes in membrane fatty acid can also alter serotonin metabolism, which is important in the development of depression.

Experts are speculating that early DHA deficiency may lead to lifelong vulnerability to ADHD, depression, and various other mental disorders. The ever-increasing deficiency of omega-3 fatty acid in US diets may account for the markedly increasing prevalence of ADHD (Stordy and Nicholl, 2000). Mothers of dyslexic children had deficiencies of omega-3 fatty acid in pregnancy, compared with mothers of children who had no dyslexia (Stordy and Nicholl, 2000). Children with low omega-3 fatty acid levels are more likely to have behavioral and learning problems (Stevens et al., 1996). With omega-3 supplements, two studies showed improvements in infants' cognitive and development (Birch et al., 2000; Willats et al., 1998). Lower membrane DHA, EPA, and AA were found in children with ADHD compared to matched controls, even when they had normal intake of the short-chain building blocks, which suggests that in addition to dietary deficiencies there may also be metabolic processing abnormalities (Burgess et al., 2000).

Improvements have been reported in children with ADHD using combined supplements of fish oil and omega-6, although not in all areas of problems (Burgess et al., 2000). One study found no benefit in ADHD supplementation with DHA alone from microalgae (Voight, 1999).

In another study of essential fatty acids, "significant reductions in inattentive and hyperactive behaviors were noted on the Revised Behavior Problem Checklist completed by parents, but no significant improvements were noted on the teachers' measures" (Aman, Mitchell, Turbott, 1987).

*Spiritual healing* has been reported anecdotally to help ADHD, but has not been researched until recently. In this issue of *IJHC*, Allan Sweeney and Mark Gobel report on two children who were helped significantly with spiritual healing and a variety of other bioenergy interventions.

## In summary

ADHD can be a serious and debilitating problem in children who are untreated. Treatments with stimulants carry significant risks, including rare fatalities. A variety of CAM therapies can benefit these children. The difficulties in identifying causes of ADHD may be that there are multiple factors contributing to its manifestation. This may explain why single-modality interventions have had limited success. With multiple simultaneous interventions it may be possible to reduce enough of the contributions of several contributing factors so that clinical efficacy can be established.

\* I am grateful to Scott Shannon, MD, for his editorial review of this article and suggestions for references on dietary supplements that can help in ADHD, referenced in White, 2004.

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Note:

1. Much of this discussion on complementary therapies for ADHD is taken from the outstanding summary of CAM for mental health by Scott Shannon, 2002.

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