Treatment Options for Attention Deficit Hyperactivity Disorder: A Review of Past and Present Practices

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Abstract
Among disorders affecting children with special needs, attention deficit hyperactivity disorder (ADHD) is a highly controversial disorder, both in its diagnosis and its treatment. The definition of ADHD has changed over the years, but the core symptoms of this neurobehavioral syndrome continue to be defined by specific behavioral characteristics, which include persistent difficulties in inattentiveness, hyperactivity and impulsivity. However, it is defined in the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) published by the American Psychiatric Association as a disorder in its own right. ADHD is characterized by over activity, impulsiveness and an inability to sustain attention. Low self-esteem, under-achievement and difficulties in socializing are also often experienced. It is difficult to diagnose, as there is no specific test or marker, and its identification usually relies on a checklist of typical behaviors. The prevalence of ADHD is fairly consistent across diverse geographic, racial, and socioeconomic populations. It is estimated that ADHD affects up to 8% of school aged children. ADHD is most common in childhood or adolescence, but it can persist into adulthood, resulting in on-going problems of under-achievement and social difficulties. The etiology of ADHD is most likely a complex interplay of factors, which include neurobiologic, genetic, environmental and central nervous system (CNS) insults. The most widely used treatment is medication followed by psychological therapies and of recent nutritional/dietary interventions. This paper intends to discuss what ADHD is, its major symptoms, causes and the available medical, psychological, nutritional as well as educational options for treating/managing/remediating children with ADHD.

Keywords: Special Needs Education, Nutritional therapy, Learning Disabilities, Attention Deficit Hyperactivity Disorder.

Introduction
Attention deficit hyperactivity disorder (ADHD) is not new as it was first described almost 100 years ago. Today, ADHD is referred to as a slight but demonstrable difference in normal brain function that causes a clever child to underachieve academically and to behave poorly. This cluster of behaviors was once called hyperactivity, then attention deficit disorder, and now attention deficit hyperactivity disorder. Despite better knowledge of ADHD, many
children remain undiagnosed. Bewildered parents watch as their children underachieve at school and create immense tension in the home. Professionals are often equally unaware, some continuing to believe ADHD to be a superficial non-condition or a poor excuse for incompetent parenting.

As ADHD is caused by a subtle difference in the normal brain, the seeds of ADHD are present at birth. The extent of the difficulty depends on the severity of the child’s problem and how well their behaviour and education are managed. This inborn predisposition cannot be changed but home and school environment can be modified to help these children behave and achieve to their maximum potential, (Green & Chee, 1997).

According to Holford & Burne, (2006) it seems incredible that an estimated 1 in 10 children in the United States is affected by attention deficit hyperactivity disorder, or ADHD. Children with this condition just cannot sit still, have a short attention span and volatile moods, get into fights and disrupt their classes. They have a hard time in school and at home, performing badly, getting into trouble and often being shunted from school to school. Untreated, a hyperactive six-year-old might grow up to become a delinquent teenager, getting prone to drug abuse and alcohol. When misunderstood, ADHD might look like something to be blamed on poor parenting or schooling. When studied deeply, a plethora of other potential causative factors emerges: heredity, smoking, alcohol or drug use during mothers’ pregnancy, oxygen deprivation at birth, prenatal trauma, allergies, nutritional deficiencies and environmental pollution.

Causes of ADHD

**Heredity/genes:** Most children with ADHD seem to have a close relative with a similar problem. Often the father of the child had found his early school years difficult or has underfunctioned academically for his abilities. Some of these adults have done well in life but are still restless, inattentive and get easily irritated. There is good research evidence to prove this genetic influence. Identical twins are created sharing the same genetic material. If one twin shows ADHD symptoms, research shows an almost 90 per cent chance the other will also have this problem. The risk between siblings is somewhere between 30 per cent and 40 per cent. These are high figures when compared with a rate of ADHD in the general population which is somewhere between 2 per cent and 7 per cent. There is no doubt that genes play an important part in the inheritance of both ADHD and specific learning disabilities, but why one child in a family inherits and another does not remains a mystery, (Green & Chee, 1997).

**Food additives:** Controversy over the effect of diet on the symptoms of ADHD has been raging for nearly thirty years. This has mostly centered on the effect that food additives may have in young children. The focus on food additives is largely as a result of the work of allergist Benjamin Feingold in the 70s. The Feingold diet, which eliminates artificial colourings, flavourings and salicylates (a natural chemical found in some foods), is still recommended and widely implemented by parents and parent support groups, who often report excellent benefits from it or similar types if dietary restriction. However, it has been generally dismissed by most professional medical bodies as ineffective due to a lack of clinical evidence, (Jacobson & Schardt, 1999).

**Neurotransmitter Deficiency:** The brain, and the rest of the nervous system, is partially constructed from billions of nerve cells, called neurons. Communication between these neurons allows the brain to “work”. That is the communication taking the form of electrical or chemical signals between brain cells, using a complex and unique process to facilitate the
passing of information throughout the nervous system. The chemicals that carry the signals are called neurotransmitters. When the neurotransmitter chemical is released, it stimulates the target cell, which then continue the signaling process. Its job done, the neurotransmitter is either absorbed by the releasing cell or destroyed by an enzyme. Neurotransmitters perform specific roles in the functioning of the nervous system including mood, sleep, motor function and pain relief (Thibodeau & Patton, 2004).

**Nutrient deficiencies:** Brain cells and neurotransmitters are all created from nutrients, and nutrients continue to influence both their growth and their activity. According to Bennett, (2006), many ADHD people lack all or most of these important vitamins and nutrients in their diet. They are:

- ‘B’ Vitamins found in tomatoes, peas, lettuce, beans, milk, mackerel, pumpkin, brewer’s yeast, groundnuts, liver, potatoes, cauliflower, bananas, onions, seeds and nuts, eggs, sardines etc.
- Tyrosine found in tuna, milk produce, chicken, eggs, nuts and seeds.
- Zinc found in lamb meat, liver, seafood, poultry, fish, ginger, green peas, whole wheat grain, oats, peanuts, egg yolks etc.
- Calcium found in brewer’s yeast, cabbage, pumpkin seeds, milk, yoghurt, nuts, pulses, cooked dried beans, almonds and cheese.
- Magnesium found in cashew nuts, green peas, dark green leafy vegetables, whole grain foods, milk, groundnuts, cooked beans, brewer’s yeast, garlic etc.
- Omega-3 fatty acids in seeds and nuts, seed oils and oily fish example mackerel, tuna, salmon, sardines.

**Signs of ADHD in children**

Green & Chee (1997) outlined some frequent findings with ADHD children as follows:

- Many became toddler tornadoes the moment they got up on their toes.
- Most are busy preschoolers, a few were extremely volatile and roughed up other children.
- For many, the first school report used the words ‘disruptive’ and ‘distractible’.
- There is a dramatic difference between the academic achievement in a one-on-one situation versus unsupervised study.
- Most are restless, and as you talk to them they fidget and their eyes flit.
- At home most ADHD children are insatiable, go on and on and generate immense tension.
- Their behavior in a group is often embarrassing and when playing with one other child they are overpowering and bossy.
- Their impulsivity makes them both verbally and physically accident prone.
- As you talk to the parents you quickly sense their frustration, stress and confusion. (This is different to the feeling you get from the parents of a defiant, poorly managed child.)
- In the surgery young, impulsive, overactive children are easy to diagnose. The moment they walk in the door, the doctor will, by reflex, reach out to protect their property.
- In the surgery older children present less dramatically. Most, but not all, squirm, fidget and fiddle. Their talk often gets sidetracked or they become lost in mid-
sentence. Asking questions often gets the answer, “Good”. Their eyes and minds are all over the place.

- An estimated 90 per cent of ADHD children can be identified by a properly taken medical history. Sometimes diagnoses are made by listening carefully to the parents. Doctors believe what parents tell them.

**Types of treatment/management/remediation procedures**

**Medical treatment:** For decades, medications have been used to treat the symptoms of ADHD. The medications that seem to be the most effective are a class of drugs known as stimulants. Following is a list by NIMH (2003) of the stimulants, their trade (or brand) names and their generic names. “Approved age” means that the drug has been tested and found safe and effective in children of that age.

<table>
<thead>
<tr>
<th>Trade Name</th>
<th>Generic Name</th>
<th>Approved Age</th>
</tr>
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<tbody>
<tr>
<td>Adderall</td>
<td>Amphetamine</td>
<td>3 and older</td>
</tr>
<tr>
<td>Concerta</td>
<td>Methylphenidate</td>
<td>6 and older (long acting)</td>
</tr>
<tr>
<td>Cylert</td>
<td>Pemoline</td>
<td>6 and older</td>
</tr>
<tr>
<td>Dexedrine</td>
<td>Dextroamphetamine</td>
<td>3 and older</td>
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<tr>
<td>Dextrostat</td>
<td>Dextroamphetamine</td>
<td>3 and older</td>
</tr>
<tr>
<td>Focalin</td>
<td>Dextroamphetamine</td>
<td>3 and older</td>
</tr>
<tr>
<td>MetadateER</td>
<td>Methylphenidate</td>
<td>6 and older (extended release)</td>
</tr>
<tr>
<td>MetadateCD</td>
<td>Methylphenidate</td>
<td>6 and older (extended release)</td>
</tr>
<tr>
<td>Ritalin</td>
<td>Methylphenidate</td>
<td>6 and older</td>
</tr>
<tr>
<td>Ritalin SR</td>
<td>Methylphenidate</td>
<td>6 and older (extended release)</td>
</tr>
<tr>
<td>Ritalin LA</td>
<td>methylphenidate</td>
<td>6 and older (long acting)</td>
</tr>
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**Dietary/Nutritional interventions:** There is one substance that has been shown in some scientific studies to be beneficial in treating ADHD that is L-Tyrosine. This is an amino acid (a protein) that the body uses to synthesize dopamine and norepinephrine, the two neurotransmitters believed to be involved in ADHD. These neurotransmitters are the targets of the medications used to treat ADHD. Some studies have shown that children with ADHD may have lower levels of this amino acid. By increasing the intake of L-Tyrosine through diet or supplements, it is possible to increase the amount of dopamine and norepinephrine available in the brain. It has been seen in clinical practice that some children and teenagers have benefited from taking one or two L-Tyrosine tablets per day in conjunction with psychological interventions (Nemzer, 1986).
Essential fatty acids play a key role in normal brain function. Since the body cannot synthesize essential fatty acids (EFA), they must be provided in the diet. Many children with ADHD have shown symptoms of essential fatty acid deficiency such as excessive thirst, dry skin, eczema, and asthma. It is also interesting that males, who have a much higher requirement for essential fatty acids than females, are more commonly affected: four out of five children with ADHD are boys. Researchers have theorized that children with ADHD may be deficient in essential fatty acids not just because they have inadequate dietary intake (though this is not uncommon), but rather because their need is higher, they absorb them poorly or they do not convert them well into prostaglandins that help the brain communicate. It is of interest then that essential fatty acids conversion to prostaglandins can be inhibited by most of the foods that cause symptoms in children with ADHD such as wheat, dairy products, and foods containing salicylates. Conversion is also hindered by deficiencies of the various vitamins and minerals needed for the enzymes that power the conversions, including vitamin B3, B6, C, biotin, zinc and magnesium (Colquhon and Bunday, 1981).

In another study using contrast analysis of the plasma polar lipid data, subjects with lower compositions of total omega-3 fatty acids had significantly more behavioural problems, temper tantrums, and learning, health and sleep problems than did those with high proportions of omega-3 fatty acids.

Research at Oxford University has proven the value of these essential fats in a “double-blind” trial involving 41 children aged 8 to 12 years who had ADHD symptoms and specific learning disabilities. Those children receiving extra essential fats in supplements were both behaving and learning better within 12 weeks (Richardson and Puri, 2002).

Another study carried out by the author of this article on grade five pupils in Kano State Nigeria, also found out that hyperactivity in children with ADHD can significantly be reduced with intake of essential fats supplements. This resulted in increased attention and concentration and improved handwriting. The study lasted 12 weeks (Darma, 2010).

B6 and magnesium: Some children may be zinc or magnesium deficient, both of which can produce symptoms associated with ADHD. The symptoms of magnesium deficiency, for example, are excessive fidgeting, anxious restlessness, coordination problems and learning difficulties in spite of having a normal IQ. It is interesting to note that magnesium plays a key role in production of noradrenaline a neurotransmitter that is involved in stimulation/motivation. Other nutrients also involved in the production of noradrenaline include manganese, iron, copper, zinc, vitamin C and B6.

The late Dr. Bernard Rimland assessed the relative effectiveness of different nutrient strategies compared to drugs and found that supplementing B6 and magnesium is 10 times more effective than Ritalin, Holford, (2007). A polish study from 1997 that examined the magnesium status of 116 children with ADHD found that magnesium deficiency occurred far more frequently in them than in healthy children (95 per cent of the children were deficient) and also noted a correlation between levels of magnesium in the body and severity of symptoms. Supplementing magnesium improved their status and significantly reduced their hyperactivity, (Starobrat-Hermelin and Kozielec, 1997).

Vitamin C and B3: in one study by Dr. Abram Hoffer, a pioneer in orthomolecular medicine, large amounts of vitamin C and B3 significantly improved the behavior of 32 out of 33 children with ADHD.
While supplements may be somewhat helpful for some children, they do not supply all of the steps that should be taken to help children and teenagers with ADHD. Psycho educational, behavioural and parent education interventions are essential for a totally successful approach.

Neurotransmitters such as serotonin, which is involved in mood, or adrenalin which gives you motivation, or acetylcholine which is vital for good memory, are made from the amino acids in the protein you eat. However, their production in the brain depends on vitamins and minerals. These micronutrients/trace nutrients help turn glucose into energy, amino acids into neurotransmitters, simple essential fats into more complex fats like GLA (Gamma-Linolenic acid) or DHA (Docosahexaenoicacid) and prostaglandins, and choline and serine into phospholipids. They help build and rebuild the brain and nervous system and keep everything running smoothly. They are our brain’s best friends (Holford, 2004).

Academic interventions: Academic intervention consists of modifications in methods of instruction, materials or the classroom environment (DuPaul & Eckert, 1997). Examples of modifications in instruction might include the teacher’s use of direct instruction, co-operative learning teams (Fowler, 1994) or peer tutoring (Kohler & Strain, 1990). Materials can be enhanced for students through an adjustment in the length of the assignment, the addition of colour cues or the element of novelty, and by providing structure to the task (Fowler, 1994). Lensch (2000) provides an example of a relatively simple intervention where the student with ADHD is allowed to select two seats within the classroom to be used at his discretion throughout the school day.

Okeke, 2001 cited Lerner (1993) who suggests the following as useful tips for teachers in assisting students with ADHD in the classroom:

1. Placement in the classroom: seat the student in an area with minimal extraneous distractions and you can readily ascertain whether the student is attending. This may be at the front of the room, but should be away from doors and windows.
2. Plan varied activities so that student can move: modify classroom routines to enable the student to get up and move around the classroom periodically.
3. Provide as much structure and routine as possible: establish a routine and keep it the same from one day to another.
4. Require a daily assignment notebook: this activity helps the student to organize his or her time, to know what is to be done, and to designate when it has been accomplished. Make sure the student writes down the correct assignment each day.
5. Make sure you have the student’s attention before you teach: an attention signal, such as a hand-sign, a light touch, or eye contact is sometimes helpful. It is important to gain the student’s attention before speaking.
6. Make directions clear and concise: directions should be consistent with daily instructions. Simplify complex directions and avoid multiple commands.
7. Break assignments into workable chunks: children with ADHD should not be expected to work independently for a long period of time. Break bulky tasks into manageable ones.
8. Give extra time as needed: students with attention disorders may work at a slower pace. Give them extra time and do not penalize them if they cannot complete their work within a limited time frame.
9. Provide feedback on completed work as soon as possible: students should know how they are doing and have opportunity to make their corrections. When possible, let them check their own work.
10. Encourage parents to set appropriate study space at home: show parents how to establish routines, with a set time for studying. Ask parents to receive and check completed homework. Request that they also check the organization of the student’s book bag.

11. Make use of learning aids: many students with ADHD enjoy using computers, calculators, tape recorders and other learning aids. These tools help structure learning and maintain interest.

12. Find an area in which the student does well and encourage that interest: every child has strength or special interests in certain activities. Find out these areas and fasten growth in that activity.

13. Provide ample praise and rewards: be sure to acknowledge good or improved behaviour. Inform the students about their progress through praise and rewards.

14. Modify the testing situation: if necessary provide additional time or practice or decrease the work required on the test.

**Psychological Treatment:** Traditional child psychotherapy, such as play therapy or non-directive talking therapy, has not proven to be effective in the treatment of ADHD nor has traditional family therapy. Providing individual psychotherapy for one or both of the parents also does not work. Research has demonstrated that modern psychological treatment methods especially behaviour modification, cognitive behavioural therapy and relaxation training can have a positive effect. In some studies, one or several of these techniques used in combination have proven to be as effective as medication in reducing ADHD symptoms. Apart from psychotherapy, other interventions include behavioural therapy (BT), social skills training, support groups and parenting skills training. Psychotherapy works to help people with ADHD to like and accept themselves despite their disorder. It does not address the symptoms or underlying causes of the disorder. In psychotherapy, patients talk with the therapist about upsetting thoughts and feelings, explore self-defeating patterns of behaviour, and learn alternative ways to handle their emotions. As they talk, the therapist tries to help them understand how they can change or better cope with their disorder.

The potential for adverse drug effects, no matter how small, is one reason why some people invoke the principle of "do no harm" – and urge beginning with behavioral treatments. Proponents also point to multiple studies showing that behavioral treatments are more effective than drugs alone at improving the overall functioning of children with ADHD (Pelham & Fabriano, 2008).

Advocates for "behavioral treatments" are referring to a set of interventions that include teaching parents how to better parent a child with an ADHD diagnosis, teaching teachers how to better teach children with ADHD, and helping children take responsibility for monitoring and managing their own behavior. Parents and teachers post rules, adjust workloads, provide choices, reinforce good behavior, and offer special tutoring (DuPaul & Stoner, 2003).

During the discussion of the costs of behavioral approaches, Pelham argued that behavioral approaches would actually save money in the long run because the changes they bring about are long-lasting. When combined with medication, behavioral treatments can also allow for lower doses of medication to be used, thereby saving on medication costs.

Researchers agreed that failing to respond to ADHD – whichever treatments are offered – also carries costs, to the health care system for associated injuries and medical problems, to
the education system, and to the juvenile justice system (Pelham, Foster & Robb, 2007). Acknowledging the costs of ADHD, however, does not tell us what is the most effective, including most cost-effective, means of treating or otherwise responding to children with an ADHD diagnosis.

Behavioural Therapy (BT) helps people develop more effective ways to work on immediate issues. Rather than helping the child understand his or her feelings and actions, it helps directly in changing their thinking and coping and thus may lead to changes in behaviour. The support might be practical assistance, like help in organizing tasks or school work or dealing with emotionally charged events. Or the support might be in self-monitoring one’s own behaviour and giving self-praise or rewards for acting in a desired way such as controlling anger or thinking before acting (NIMH, 2003).

Behavioural therapies use learning principles to eliminate or reduce unwanted reactions, one’s thoughts and feelings, and bodily sensations and functions. Rather than dealing with unconscious conflicts, this therapeutic approach deals with events of which people are aware or can readily become aware. The therapist teaches the client to replace undesirable responses (groundless fears, for example) in their day-to-day living. Learning-based techniques include the following:

Contingency Management: Here, desirable actions are selectively reinforced (rewarded), and undesirable actions are ignored whenever possible (at times, undesirable actions may be penalized instead of ignored, but this tactic is regarded as a last resort, since it produces distress and tends to yield unpredictable results).

Contingency management (or the use of consequences) may take the form of a token economy in which the student is rewarded for the desired behaviour (positive reinforcement) examples are social praise, hugs and special privileges. Another contingency system, response cost, involves the loss of a token (punishment) if the individual does not display the appropriate behaviour. Time-out is a condition in which the individual is removed from a reinforcing situation to one that is not reinforcing, such as removing the child from the group to sit in the passage or in a quiet chair until he is ready to rejoin the group (Bos& Vaughn, 1998).

A study conducted by Robinson, Newby and Ganzell (1981) using contingency management with a group of hyperactive boys in a third-grade classroom showed positive results. All eighteen participants improved in academic performance. The emphasis of this study was on the accurate completion of reading and vocabulary tasks. However, inappropriate disruptive and hyperactive behaviours were reduced because they were incompatible with the targeted behaviour (i.e academic task completion).

Social skills training can also help children learn new behaviours. In social skills training, the therapist discusses and models appropriate behaviours important in developing and maintaining social relationships, like waiting for a turn, sharing toys, asking for help, or responding to teasing, then gives children a chance to practice. For example, a child might learn to “read” other people’s facial expression and tone of voice in order to respond appropriately. Social skills training help the child to develop better ways to play and work with other children. Support groups help parents connect with other people who have similar problems and concerns with their ADHD children. Members of support groups often meet on a regular basis (such as monthly) to hear lectures from experts on ADHD, share frustrations
and successes, and obtain referrals to qualified specialists and information about what works. There is strength in numbers, and sharing experiences with others who have similar problems help people know that they are not alone.

Parenting skills training offered by therapists or in special classes, gives parents tools and techniques for managing their child’s behaviour. One such technique is the use of token or point systems for immediately rewarding good behaviour or work. Another is the use of “time-out” or isolation to a chair or bedroom when the child becomes too unruly or out of control. During time-outs, the child is removed from the agitating situation and sits alone quietly for a short time to calm down. Parents may also be taught to give the child “quality time” each day, in which they share a pleasurable or relaxing activity. During this time together, the parents look for opportunities to notice and point out what the child does well, and praise his or her strengths and abilities.

Conclusion
In conclusion, ADHD is a neurological disorder which can be detected in children from the age of three and can continue to manifest through adolescence up till adulthood. Common symptoms are inattention, poor concentration, impulsivity, hyperactivity, learning difficulties and difficulty organizing tasks. Causes include heredity, pregnancy and birth problems, food additives, neurotransmitter deficiency, environmental toxins, accidents, nutritional deficiencies, biochemical imbalances etc. Treating or managing children with ADHD therefore, require more than one approach at any given time. The best trio approaches include medical and nutritional treatments to enhance cognitive activity; educational approach to improve academic performance and psychological therapy to improve behavior.

References


