How to Cite:
Shanjuvigasini, F. N. U., Pitchai, S., & Staten, B. H. (2022). Complementary and alternative medicines (CAM) for attention-deficit / hyperactivity disorder (ADHD) in children: A review. *International Journal of Health Sciences*, *6*(S4), 8958–8967. https://doi.org/10.53730/ijhs.v6nS4.10685

Complementary and alternative medicines (CAM) for attention-deficit / hyperactivity disorder (ADHD) in children: A review

F N U Shanjuvigasini
Corresponding Author, PhD Research Scholar, Department of Rehabilitation Science, Holy Cross College (Autonomous), Tiruchirappalli, Affiliated to Bharathidasan University. Special Education Dept. Chair & teacher, Hillcrest High School, Greenville County Schools, USA
Corresponding author email: shanjuvigasini@gmail.com

Dr. Swarnakumari Pitchai
Associate Professor, Department of Rehabilitation Science, Holy Cross College (Autonomous), Tiruchirappalli, Affiliated to Bharathidasan University
Email ID swarnaravichandran@gmail.com

Dr. Bridget Hollis Staten
Professor, Department of Human Services, Rehabilitation Counseling Program Coordinator, South Carolina State University, USA
Email ID drbhstaten@yahoo.com

***Abstract*---**ADHD is one of the most common neurodevelopmental disorders in children that persist into adulthood. Commonly used medications, like stimulants, have serious side effects and short-lived effects, which limit their usage to a small group of children. This predicament leaves room for the exploration of various Complementary Alternative Medicines (CAM) and their efficacy in the place of pharmacological treatment or as an add-on treatment to reduce the dosage of stimulant medication. The absence of side effects draws parents to CAM. Some of the standard CAM therapies discussed in this article are dietary changes, behavioral changes, academic or school-based interventions, homeopathy, Traditional Chinese Medicine, Chinese Herbal Medicine, Cognitive training, Cognitive Behavior Therapy, Neurofeedback, Meditation, and yoga. Though the efficacy of the non-pharmacological treatments is still conflicting, parents continue to try out these Complementary and Alternative Medicines and Therapies and report improvements in ADHD symptoms and behavioral and academic gains.

Manuscript submitted: 27 April 2022, Manuscript revised: 18 June 2022, Accepted for publication: 9 July 2022

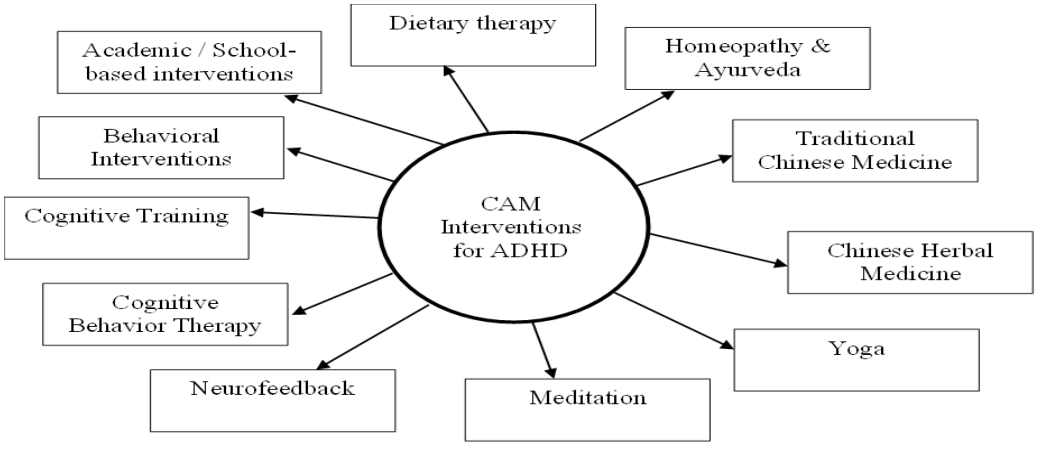
***Keywords*---**ADHD, CAM, yoga, homeopathy, non-pharmacological, interventions.

Introduction

Attention-Deficit Hyperactivity Disorder is one of childhood's most common neurodevelopmental disorders that often persist into adulthood. It is characterized by individuals exhibiting age-inappropriate levels of inattention and or hyperactivity-impulsivity in more than one setting for more than six months, significantly impairing academic behavioral and social functioning (American Psychiatric Association, 2013; Centers for Disease Control and Prevention, 2015). Children with ADHD have trouble paying attention in class, are often overly active, and exhibit impulsive behaviors in the classroom. The overall pooled estimate of the prevalence of ADHD in children aged 18 years and below is 7.2% (Thomas et al., 2015).

Medications commonly used to treat ADHD symptoms include stimulants such as methylphenidate and amphetamine. The frequently used non-stimulants are atomoxetine, tricyclic antidepressants, and alpha agonists. For many decades, doctors were not ready to use stimulants to treat children with ADHD as it stimulates the central nervous system. (Osland et al., 2018). Hence, many parents of young children with developmental disorders like ADHD became interested in Complementary and Alternative Medicine (CAM) interventions to either avoid or decrease the use or dosage of medication (Chan, 2002). Eventually, the use of Complementary and Alternative Medicine (CAM) in pediatrics has become widespread among parents whose children are diagnosed with ADHD. The use of Complementary and Alternative Medicines (CAM) is also increasing in the general population since ADHD has no cure, and many students are not labeled (Sinha & Efron, 2005).Alternative treatments for ADHD (Bhandari, 2021) include eliminating specific food items in diets, supplementing with Omega-3s, parent training, exercise, yoga, meditation, neurofeedback, memory training, and academic and behavioral interventions.

Complementary and Alternative Medicines and therapies for ADHD



In the research article, the following CAM interventions have been described

A. Dietary Therapy
B. Video games for ADHD
C. Behavioral Interventions
D. Academic or school-based interventions
E. Healing with Homeopathy
F. Traditional Chinese Medicine (TCM)
G. Chinese Herbal Medicine (CHM)
H. Cognitive Training
I. Cognitive and Behavioral Therapies (CBT)
J. Neurofeedback
K. Meditation
L. Yoga

Dietary Therapy

Dietary Therapy involves the elimination of specific foods or a few foods approach to managing ADHD symptoms.

i. Impact of sugar and high-fiber diets
There is no conclusive proof that sugar causes ADHD. Research shows that refined sugars, saturated fats, and carbohydrates can affect a child's activity level due to the blood sugar spike. This spike increases the child's activity level due to the adrenaline rush caused by the rising blood sugar (Bhandari, 2021) Additionally, nutritionists advise adding more fiber to a child's diet to help keep blood sugar levels even. High-fiber diets include fruits, whole grains, berries, and oatmeal (Lockett, 2021).

ii. Intake of supplements for ADHD:
Research has shown that children with ADHD have lower levels of omega-3 fatty acids. So, doctors recommend taking Omega-3 supplements. In one study, children with ADHD who were given omega-3 supplements showed a significant improvement in ADHD symptoms comparedmon with children who took a placebo. According to research from the University of Oxford in England, when school children were administered fish oil supplements with Omega-3 essential fatty acids (EFAs) for months, significant improvements were observed in behavior, reading, and spelling (Montgomery, 2021).

iii. Feingold diet and ADHD symptoms:
Ben Feingold, MD, an allergist, created the classic Feingold elimination diet to treat hyperactivity. The Feingold diet requires eliminating certain food items like artificial colors, flavors, and preservatives, from the child's diet to see if it affects their behavior to decrease hyperactivity. Though most scientific studies have disproved this theory, some parents still claim that they notice an improvement in their child's behavior after following the Feingold diet (Feingold, 1985). A point worthy of parental consideration while following elimination diets is ensuring that the children receive a well-balanced and nutritious diet.

Video games for ADHD

The Food and Drug Administration (FDA) has approved a game-based, digital therapeutic video game to improve attention in children with ADHD. Endeavor Rx is a game-based program that creates sensory stimuli and motor challenges that help train the brain and ease the symptoms of ADHD. The program is prescription only and can be downloaded to your mobile device for the child to use. It is a safe add-on treatment option in addition to other medicines or therapies. The game adapts to each child's unique needs and allows parents to track progress (EndeavorRx, 2022).

Behavioral Interventions for kids with ADHD

Behavioral interventions rely on changing behavioral contingencies so that the desired behaviors can be increased and undesirable ones can be decreased (Shrestha et al., 2020).

Procedures for increasing a desirable behavior

Verbal Instruction and Demonstration

Explicit verbal instruction is an efficient way to give instruction, correction, or redirection to a child who doesn't know how to engage in a particular behavior. It was proved that verbal instruction, in combination with demonstration and task repetition, enables quicker acquisition of the skill (Haguenauer et al., 2005).

Modeling

According to Paul (Paul, 2021), Behavior Modeling Training is also an effective strategy that involves the following five steps:

1. describing specific behavioral skills
2. describing models that display the effective use of these behaviors
3. offering opportunities for practice
4. provision of feedback and reinforcement
5. ensuring transfer of learned behaviors and generalizing to the job (Taylor et al., 2005)

Task Analysis

Task analysis is the process in which the task to be learned is broken down into simple and easy-to-follow sequential steps, starting from the first to last or last to first steps, respectively called forward and backward chaining. The study accomplished a large effect size of Hedge's g of 0.811 (Tofel-Grehl & Feldon, 2013).

Motivational Strategies

a) Positive Reinforcement:
   Positive reinforcement increases the rate of occurrence, frequency, intensity, and duration of desirable behaviors (Leijten et al., 2019).

b) Contingency Contracting:
A contingency contract is a written contract between the children and their teacher, defining a specific target behavior and the criteria for reinforcement and punishment. Social contracts are signed between teachers and students to create classroom rules. Social contracts allow students to partner and collaborate with their teachers in framing classroom rules and expectations, increasing student accountability and facilitating better classroom management (Burgess, 2017).

Procedures for decreasing undesirable behaviors

Punishment includes the withdrawal of positive reinforcement as a consequence of undesirable and disruptive behaviors.

Time-outs

Time-outs are a highly effective means of decreasing negative behaviors in children with ADHD. Time-outs are behavior modification techniques, including removing a child from a reinforcing environment due to deviant, disruptive or undesirable behaviors. Hence, behavioral treatment options are found to be highly effective for ADHD. Though isolating individuals for time-outs has been seen as a controversial option (Landau & Macleish, 1988; Malacrida, 2005), due to its exclusionary nature, college students rated them as more acceptable if provided as a secondary option to non-exclusionary time-outs and explained as a contract to students (Corralejo et al., 2018).

Academic or school-based interventions

According to (Mary, 2017), the following academic interventions can be used in combination

- Modify teaching methods to match the learning style of the student. (Dendy, 2006)
- Take into consideration the interests and preferences of the individual student.
- Modify assignments, allowing each student to succeed.
- Use more hands-on activities.
- Give a minimal number of directions at one time.
- Provide a visual model or visual reminder of tasks.
- Break bigger tasks into easily manageable chunks.
- Allow students to use a computer to type or use “speech to text” software.
- Make students have an agenda or planner to record daily classwork and homework.
- Use color-coded folders for organizing assignments for different academic subjects.
- Assign clean-out dates for students to clean their desks, book bags, or folders.
- Tape a calendar or schedule of daily activities and transitions onto their desks.

- User timers to organize time
- Allow chewing gum to help focus better.
- Seat close to the teacher or source of instruction
- Peer tutoring students work in pairs to tutor one another and earn points for both.
- Co-operative learning – Each student is assigned a specific role in structured groups with specific expectations of outcomes
- Learning games – Students play board games to reinforce vocabulary, phonics, grammar notes, and basic math facts games on a computer.

Healing with Homeopathy

Homeopathy aids in the restoration of the overall well-being and emotional well-being of children without side effects. According to (Batra, 2013), Homeopathy is a mind-body holistic medicine that considers each child's unique, distinctive nature and characteristic symptoms and prescribes treatment. It is also clinically effective in treating many emotional and psychological problems like ADHD. 'Ritalin,' the conventional medication used to treat ADHD, is based on homeopathic tenets. Homeopathic remedies, such as "Kali Bromatum" and "Tarentula Hispanica," are clinically helpful for treating restlessness, temper tantrums, attention span challenges, and improving academic performance. Studies published in The British Homeopathic Journal and The European Journal of Pediatrics reported that ADHD children who were given homeopathic treatment showed significantly fewer ADHD symptoms (Batra, 2013).

Traditional Chinese Medicine (TCM)

In TCM theories, ADHD is a condition affecting (Ni et al., 2014) the mind, thought, and emotion. The pathogenesis is caused by the imbalance of Yin-Yang and disfunction of the Zang-fu (Visceral) organs. The affected systems are primarily the heart, liver, spleen, and kidney.

Diagnosis of ADHD through TCM is divided into five primary syndromes (Ni et al., 2014)**:**

1. Heat in the heart and liver, resulting in the predominantly hyperactive and impulsive type of ADHD
2. Internal disturbance of pyro phlegm, resulting in the predominantly hyperactive and impulsive type of ADHD
3. Deficiency of liver-yin and kidney-yin, resulting in the combined type of ADHD
4. Heart spleen deficiency, resulting in the combined type of ADHD
5. Liver depression and Spleen deficiency, resulting in the combined type of ADHD

TCM treatments are based on the following three basic principles

TCM treatments are designed with three basic principles - reinforcing deficiency and reducing excess, regulating the function of Zang-fu organs, and balancing Yin-Yang with individualized treatment adjustments for each unique symptom.

TCM emphasizes the importance of monitoring the dynamic changes of syndromes during treatment, and TCM treatments are customized to respond to individual conditions (Ni et al., 2014).

Chinese Herbal Medicine (CHM)

TCM clinicians prescribe therapies customized for each patient using a well-balanced formula of Chinese herbs. Traditional medicine evaluates the functioning of the medicinal herbs according to the four properties (cold, hot, warm, and cool), five tastes (sweet, sour, bitter, spicy, and salty), channel tropism, and lifting, lowering, floating, and sinking properties. It is utilized in combination with acupuncture, Tui na(Chinese Medical Massage), Tai Chi(Chinese Martial Art), Yaoshan(TCM diet therapy), and other similar treatments. Under the compatibility guideline, medical herbs are prescribed as a well-balanced formula that ensures equilibrium between yin-yang and Zang-fu based on the different effects (Ni et al., 2014). The International society is yet to evaluate the clinical impact of TCM in the treatment of ADHD.

Cognitive Training

Cognitive training improves the functioning of the working memory (Shrestha et al., 2020) and involves computerized training with or without administration by clinicians. Cog Med Working Memory Training (CWMT) is a training program given through computers. It is used to enhance verbal and non-verbal memory. “Brain game Brian” is another computerized training program for 8 to 10-year-old children. This game focuses on improving working memory and increasing cognitive flexibility and inhibition (Evans et al., 2018).

Cognitive and Behavioral Therapies (CBT)

Cognitive and Behavioral Therapies (CBTs) are based on the complex interplay of thoughts, feelings, and behavior in the etiology and treatment of various psychological disorders, including ADHD in childhood and adulthood. The last 15 years have also witnessed an increasing interest in CBT for adult ADHD.

Characteristics of CBT (Knouse, 2014) are

- CBT is scientific and evidence-based
- CBT is a short-term intervention
- CBT takes into consideration the interactions among thoughts, emotions, and behaviors
- CBT facilitates instruction of client-specific skills

Neurofeedback

Neurofeedback is based on a Brain-Computer Interface (BCI) and is implemented through a software system. Through the provided feedback, the participant can learn to self-regulate his brain activity and alter or change the underlying neural mechanisms of cognition and behavior (Enriquez-Geppert et al., 2019).

Three standard neurofeedback training protocols, namely theta/beta (TBR), Sensory Motor Rhythm (SMR), and Slow Critical Potential (SCP), were found to be more effective and specific to children with ADHD (Enriquez-Geppert et al., 2019).

Meditation (Whelan, 2021)

Studies have revealed that people with ADHD can mediate successfully. Meditation is the phenomenon of sitting still and, in most cases focusing on the breath. But meditation trains the brain to focus and be present in the current moment.

Steps for efficient and effective meditation for ADHD

1. Dedicating a specific time of day to meditate
2. Finding a comfortable position to meditate
3. Wearing convenient clothing
4. Switching off the phone
5. Ignoring noise by focusing on the breath
6. Experiencing the breath
7. Allowing the mind to wander
8. Slow and steady completion of the meditation

Yoga

Yoga comprises postures associated with body awareness, breathing, and meditation to calm the mind. The postures/asanas help develop flexibility, strength, and balance while improving the functioning of the endocrine, gastrointestinal and immune systems (Feuerstein, 2003). Pranayama refers to breathing and postures that aid the focus of the mind. Deliberate slowing of breathing led to a calmer mind (Feuerstein, 2003). The benefits of using school-based yoga practice as a potential intervention for students with and without ADHD from preschool to high school have been established in some studies and found inconclusive in other studies (Enriquez-Geppert et al., 2019).School-based yoga interventions have improved academic performance, focus, emotional regulation, and cognitive functioning (Serwacki & Cook-Cottone, 2012).

Conclusion

There are a variety of clinical practice guidelines for the effective management of ADHD. But some of the significant differences among them is the recommendation of the US guidelines to use pharmacological treatment for children with mild ADHD or preschool children. In contrast, the UK guidelines declare that pharmacological treatment is reserved for students with severe symptoms and high levels of impairment or children with moderate impairments who have refused non-pharmacological treatment or whose symptoms have not responded much to behavioral interventions. Hence, the CAM model suggested in the research aligns more with the UK guideline of a step-by-step approach starting from the non-pharmacological and CAM interventions. Though many non-pharmacological treatments reported improvements, the overall efficacy findings are limited in scope due to clinical and methodological heterogeneity,

small sample size, lack of randomized controlled trials (RCTs), poor research quality, and absence of long-term follow-ups. This phenomenon necessitates more stringent RCTs with robust research designs. Still, the cost-effective and minimal to no side-effects dimension of CAM makes it an attractive option for students and parents of children with ADHD. The researcher encourages students and parents to try the various CAM modalities and see which one suits their unique needs and adopt them on a long-term basis.

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