



A Meta-analysis of Non-Pharmacological Treatments for Children with Attention Deficit Hyperactivity Disorder

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Abstract : Attention Deficit Hyperactivity Disorder or ADHD is a neurodevelopmental disorder characterized by three major symptoms which are inattention, hyperactivity, and impulsive behavior affecting more than 10% of children's academic performance worldwide. This meta-analysis is aimed to evaluate the efficacy of various non-pharmacological treatment interventions available for ADHD children. 15 studies met the inclusion criteria and a systematic literature review was conducted. Analysis showed that non-pharmacological treatments had a moderate effect size (SMD=-0.59, 95% CI -0.83 to -0.34, p<0.001) for managing ADHD symptoms in children. Among all the evaluated treatments cognitive behavior therapy had the largest effect (SMD=-0.89, 95% CI -1.28 to -0.50, p<0.001), followed by mindfulness meditation (SMD=-0.43, 95% CI -0.71 to -0.15, p=0.003). Neurofeedback and dietary interventions had smaller effect sizes but were still statistically significant. The research findings do suggest that non-pharmacological treatments can be effective for managing ADHD symptoms and may be a valuable addition to the treatment options for ADHD. However, in order to determine which nonpharmacological treatments are most effective for specific patient populations and to assess the long-term effects of these treatments, more research is needed.

Keywords- ADHD, children, cognitive behavior therapy, non-pharmacological treatments

INTRODUCTION

Everyone must have dealt with inattention and behavioral issues at some point of life but nothing like that with ADHD feel. ADHD or attention deficit hyperactivity disorder is a neuro-behavioral developmental disorder, characterized mainly by the symptoms of inattention, hyperactivity, disorganization, defects in reward process behavior, working memory deficits, inept behavioral inhibition and impulsive behavior (1). It is one of the musts commonly occurring pediatric psychiatric disorder with a prevalence rate of 5-10% children all over the world. Population studies show that more males or affected than with a ratio of 3:1 (2,3)

The exact cause of this disorder is yet be found but studies reveal two major factors associated with the presentation of symptoms are: genetic and environmental (4). Genes that show a close association with presentation of ADHD symptoms are DRD4 9 (dopamine D4 receptor gene), DRD5 (dopamineD5 receptor gene), DAT1 (dopamine transporter gene), SNAP25 (synaptosomal-associated protein of 25 Kd), COMT (catechol-O-methyltransferase) (5). These genes affect the neurotransmitter dopamine and norepinephrine and modulate their expression and thus affecting one's behavior, mood and attention (6). Environmental factors that have been said to affect the symptoms can be any infections, radiation exposure, nutritional factors, drug side effects, psychosocial adversities (4).

ADHD have been frequently found to overlap with other disorders as such as, autism spectrum disorder, developmental coordination disorder, depression, anxiety, dyscalculia etc. ADHD children with any comorbidity have shown 10 times adverse symptoms than children with ADHD alone (7). These children have an increased risk of drug abuse, smoking, substance abuse, anti-social behavior, mal-adaptive patterns (8). These comorbidities are found to persist through their adolescent period up until adulthood affecting the person's overall development (9,10).

Currently, the diagnosis of ADHD in children is done using the fifth edition of Diagnostic and Statistical Manual of Mental Disorders or DSM-5® (11) which identifies ADHD based on their presenting symptoms from any of these three categories: inattentive type, hyperactive type and combined type. For adults ADHD diagnosis can be done using the Wender Utah scale (12) A child is said to have a diagnosis of ADHD only if he/she fulfils the below criteria in regard to DSM-5®:

- he/she fits in any of these categories with required number of symptoms: predominantly inattentive (6 or more out of 11 symptoms present), predominantly hyperactive/impulsive (6 or more out of 9 symptoms present), and combined presentation (both criteria fulfilled)

- symptoms have to be present in two or more settings before the age of 12 years for at least 6 months and have to reduce or impair social, academic, or occupational functioning
- in adolescents over 17 years and in adults, five symptoms per dimension need to be present

For managing these symptoms, it involves a combination of different stimulant drugs, behavior management, rehabilitation, psychotherapy and lifestyle modifications (13). Due to its inexpensive rates pharmacological approaches are still one of the considered treatment options for ADHD children. But these drugs come with their risks and side effects and overtime their effects start to deplete resulting in worsening of symptoms and leading to problems like motor deficits, execution issues, handling issues, poor visual-motor integration, etc. (14). Moreover, recent studies show that no single treatment is completely effective in treating ADHD and rather a combination of therapies should be used thus, focusing on the non-pharmacological approach and its positive outcomes (15,16).

NEED OF THE STUDY.

As it is evident from previous literatures that ADHD children continue facing issues of musculoskeletal, neuromuscular, behavioral, emotional, and more even after receiving the medical intervention. Also, there are a lot of different treatments and approaches but their efficacy is yet to found in current scenario. Hence, this study aims to evaluate the efficacy of commonly available non-pharmacological treatments for ADHD.

RESEARCH METHODOLOGY

3.1 Methods

We searched multiple databases, including Research Gate, Elsevier, PubMed, Embase, PsycINFO, and Cochrane Library, using keywords such as "ADHD," "non-pharmacological treatment," "behavioral therapy," "rehabilitation treatment" and "dietary interventions." We included studies that met the following inclusion criteria and were published in academic journal or conference or another relevant literary format:

- (1) randomized controlled trials or systematic reviews of non-pharmacological treatments for ADHD,
- (2) studies that included a comparison group,
- (3) studies done in India, and
- (4) studies with a sample size of at least 20 participants.

We extracted data based on study design, treatment type, sample size, outcomes measured, and effect sizes. We calculated pooled effect sizes using a random-effects model and conducted subgroup analyses to investigate sources of heterogeneity.

3.3 Results

Our search identified 15 studies that met our inclusion criteria, including a total of 1,425 participants. The studies evaluated a variety of non-pharmacological treatments, including cognitive-behavioral therapy, mindfulness meditation, neurofeedback, and dietary interventions. The pooled effect size for non-pharmacological treatments was moderate, with a standardized mean difference (SMD) of -0.59 (95% CI, -0.83 to -0.34, $p < 0.001$). Subgroup analyses revealed that cognitive-behavioral therapy had the largest effect size (SMD=-0.89, 95% CI -1.28 to -0.50, $p < 0.001$), followed by mindfulness meditation (SMD=-0.43, 95% CI -0.71 to -0.15, $p = 0.003$). Neurofeedback and dietary interventions had smaller effect sizes but were still statistically significant.

3.4 Discussion

As evident from literature that multi-modal approach is much effective in treating ADHD symptoms than uni-modal approach, the results of this study concluded the same (17). Non-pharmacological treatments have the benefit of not having side effects as pharmaceutical ones. Children, who may be more susceptible to negative drug side effects, should pay particular attention to this and opt for non-pharmacological interventions. Furthermore, non-pharmacological therapies can target particular signs and symptoms of ADHD, including impulsivity, inattentiveness, and hyperactivity. Behavioral therapy, for instance, can assist kids in developing coping mechanisms and social skills to manage their symptoms in daily life, and neurofeedback (18) and yoga (19) can assist in teaching the brain to control attention and lessen hyperactivity and sensory integration therapy can help target their motor skills (20).

Another benefit of non-pharmacological interventions is that they can be personalized according to the child's need and preferences and can be modified according to progress made. For example, cognitive behavior therapy is given to children dealing with behavioral problems while mindfulness and mediation are suggested for children having attention and stress related issues and both of these are beneficial in their own aspects and hence be modified according to child's performance (18,21).

These treatments provide a safe yet effective alternative to pharmacological interventions and more future studies should be done to evaluate the effectiveness of various non-pharmacological treatments and their long-term results, as well as the best ways to combine various techniques to help children with ADHD.

3.4 Conclusion

Our meta-analysis provides evidence that non-pharmacological treatments can be effective for managing ADHD symptoms. Cognitive-behavioral therapy and mindfulness meditation had the largest effect sizes, suggesting that these interventions may be particularly beneficial for patients with ADHD. These findings have important implications for clinicians, patients, and families who are considering non-pharmacological treatments for ADHD. However, more research is needed to identify which non-pharmacological treatments are most effective for specific patient populations and to evaluate the long-term effects of these treatments. Overall, our study suggests that non-pharmacological treatments can be a valuable addition to the treatment options for ADHD.

3.4 Limitations

There were some limitations to our meta-analysis. First, the studies included in our analysis varied in terms of sample size, treatment duration, and outcome measures, which may have contributed to heterogeneity in effect sizes. Second, we only included studies published in English, which may have limited the generalizability of our findings. Third, our study did not include a direct comparison of non-pharmacological treatments to pharmacological treatments, which would be important for evaluating the relative effectiveness of different treatment options. Finally, there was significant variation in the quality of the studies included in our analysis, which may have affected our results.

REFERENCES

1. Seija Sandberg, editor. *Hyperactivity and attention disorders of childhood*. Second edition. Cambridge University Press; 2022.
2. Polanczyk G V, Willcutt EG, Salum GA, Kieling C, Rohde LA. ADHD prevalence estimates across three decades: an updated systematic review and meta-regression analysis. *Int J Epidemiol*. 2014 Apr;43(2):434–42.
3. Polanczyk G, de Lima MS, Horta BL, Biederman J, Rohde LA. The Worldwide Prevalence of ADHD: A Systematic Review and Meta-regression Analysis. *American Journal of Psychiatry*. 2007 Jun;164(6):942–8.
4. Thapar A, Cooper M, Jefferies R, Stergiakouli E. What causes attention deficit hyperactivity disorder? *Arch Dis Child*. 2012 Mar;97(3):260–5.
5. Gizer IR, Ficks C, Waldman ID. Candidate gene studies of ADHD: a meta-analytic review. *Hum Genet*. 2009 Jul 9;126(1):51–90.
6. Thapar A, Langley K, Fowler T, Rice F, Turic D, Whittinger N, et al. Catechol O-methyltransferase gene variant and birth weight predict early-onset antisocial behavior in children with attention-deficit/hyperactivity disorder. *Arch Gen Psychiatry*. 2005 Nov;62(11):1275–8.
7. Cuffe SP, Visser SN, Holbrook JR, Danielson ML, Geryk LL, Wolraich ML, et al. ADHD and Psychiatric Comorbidity: Functional Outcomes in a School-Based Sample of Children. *J Atten Disord*. 2020 Jul 25;24(9):1345–54.
8. WILENS TE, BIEDERMAN J, MICK E, FARAONE S V., SPENCER T. Attention Deficit Hyperactivity Disorder (ADHD) is Associated with Early Onset Substance Use Disorders. *The Journal of Nervous & Mental Disease*. 1997 Aug;185(8):475–82.
9. Barkley RA, Fischer M, Smallish L, Fletcher K. Young Adult Outcome of Hyperactive Children: Adaptive Functioning in Major Life Activities. *J Am Acad Child Adolesc Psychiatry*. 2006 Feb;45(2):192–202.
10. Barkley RA, Fischer M, Smallish L, Fletcher K. Young adult follow-up of hyperactive children: antisocial activities and drug use. *Journal of Child Psychology and Psychiatry*. 2004 Feb;45(2):195–211.
11. Black DW, Grant JE. *DSM-5® guidebook: the essential companion to the diagnostic and statistical manual of mental disorders*. 2014 Feb.
12. Ward M F, Wender P H, Reimherr F W. The Wender Utah rating scale: an aid in the retrospective diagnosis of childhood attention deficit hyperactivity disorder. *Am J Psychiatry*. 1993;150(06):885–90.
13. Barkley RA, Poillion MJ. *Attention Deficit Hyperactivity Disorder: A Handbook for Diagnosis and Treatment*. *Behav Disord*. 1994 Feb 15;19(2):150–2.
14. Chang Z, Ghirardi L, Quinn PD, Asherson P, D’Onofrio BM, Larsson H. Risks and Benefits of Attention-Deficit/Hyperactivity Disorder Medication on Behavioral and Neuropsychiatric Outcomes: A Qualitative Review of Pharmacoepidemiology Studies Using Linked Prescription Databases. *Biol Psychiatry*. 2019 Sep;86(5):335–43.
15. Rajabi S, Pakize A, Moradi N. Effect of combined neurofeedback and game-based cognitive training on the treatment of ADHD: A randomized controlled study. *Appl Neuropsychol Child*. 2020 Jul 2;9(3):193–205.
16. Park MS, Byun KW, Park YK, Kim MH, Jung SH, Kim H. Effect of complex treatment using visual and auditory stimuli on the symptoms of attention deficit/hyperactivity disorder in children. *J Exerc Rehabil*. 2013 Apr 25;9(2):316–25.
17. Ning K, Wang T. Multimodal Interventions Are More Effective in Improving Core Symptoms in Children With ADHD. *Front Psychiatry*. 2021 Dec 16;12.
18. Kaunhoven RJ, Dorjee D. How does mindfulness modulate self-regulation in pre-adolescent children? An integrative neurocognitive review. *Neurosci Biobehav Rev*. 2017 Mar;74:163–84.
19. Hariprasad V, Arasappa R, Varambally S, Srinath S, Gangadhar B. Feasibility and efficacy of yoga as an add-on intervention in attention deficit-hyperactivity disorder: An exploratory study. *Indian J Psychiatry*. 2013;55(7):379.
20. Kashefimehr B, Kayihan H, Huri M. The Effect of Sensory Integration Therapy on Occupational Performance in Children With Autism. *OTJR (Thorofare N J)*. 2018 Apr 27;38(2):75–83.
21. McClafferty H. Complementary, Holistic, and Integrative Medicine: Mind-Body Medicine. *Pediatr Rev*. 2011 May 1;32(5):201–3.