Non-Pharmaceutical Treatments for Adult Attention-Deficit Hyperactivity Disorder: A Literature Review

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ABSTRACT

Objective: This article review seeks to reveal alternative forms of treating attention deficit hyperactivity disorder (ADHD) in adults. This includes holistic therapies such as meditation, cognitive behavioral therapy, and non-stimulant supplementation.

Methods: PubMed, Google Scholar, and various text books were used to search for literature on non-pharmaceutical management and treatment of adult ADHD. This article provides an overview of studies that have conducted research of the non-stimulant therapies for the control of ADHD adults.

Results: Although, the current literature on this topic is scarce, it provides a promising preliminary evidence base for non-medication treatment of adult ADHD.

Conclusion: The current evidence for the use of holistic approaches in treating adults with ADHD can best be described as emerging and lags behind the evidence base for both medication treatment of adult ADHD and cognitive behavioral treatment for other adult disorders.

Key Indexing Terms: *non-stimulant treatments for ADHD; alternative therapies for ADHD; treatment of adult ADHD; non-pharmaceutical supplements for ADHD; cognitive-behavioral therapy and ADHD; meditation and ADHD*

INTRODUCTION

According to Bush, attention deficit hyperactivity disorder is a neuropsychiatric disorder characterized by impulsivity, inattentiveness, hyperactivity, and motor restlessness [1]. DeVito and colleagues, asserted that impulsivity is considered to be a cardinal feature in attention deficit hyperactivity disorder and is the underlying factor for many of the cognitive and behavioral symptoms of the disorder [2]. Tsang and colleagues, state that at least one child in every classroom, on a global scale, is affected by this disorder [3]. An estimated 1 to 36% of children which are identified as having attention-deficit hyperactivity disorder will continue to maintain these symptoms into their adulthood [4]. Furthermore, Nair and Moss discuss the estimates of adults having partial remission to increase the persistence rates to 40% and 60% [4]. Given the established comorbidity associated with ADHD, such as poor academic, occupational, and social functioning, increased rates of substance abuse, traffic accidents, persistent neuropsychological impairments, anxiety, depression, antisocial behaviors, and the increased financial burden to the society, it has been determined that ADHD is a developmental disorder [1,8]. This review examines research literature regarding the management of ADHD with non-pharmaceutical therapies, such as cognitive behavioral therapy and meditation. As of now the most popular forms of treatment for ADHD has been pharmaceutical intervention. However, the aim of this review is not to criticize the use of pharmacological treatments but to offer published evidence of the existing alternative therapies that are being used to manage ADHD in adults. The discussion outlines the components involved in the pathology of the disorder, the normalization model of attention, and the available non-pharmacological treatments for adults diagnosed with attention-deficit/hyperactivity disorder.

DISCUSSION

In an effort to map the pathophysiology of attention-deficit hyperactivity disorder, Dr. Beiderman presumes that an abnormality in central dopaminergic and noradrenergic tone exists

[5]. In addition, Arnsten stated that modifications in the prefrontal cortex and in its connections to the striatum and cerebellum are associated with ADHD [5]. The prefrontal cortex controls behavior, sustains attention over a delay, divides attention, and inhibits distractions [5]. Therefore, one can presume that trauma to this part of the brain manifests distractibility, induces poor concentration and organization, impulsivity, forgetfulness, locomotor hyperactivity, and inhibits planning [5]. Furthermore, the parietal and temporal association cortices, as well as the prefrontal cortex, project to the caudate nucleus as part of the cognitive circuit to the basal ganglia and cerebellum [5]. The basal ganglia could be important in the planning, selection, initiation, and execution of thoughts; the cerebellum may play a part in cognitive function and has been shown to be consistently smaller in children with ADHD [5]. The basal ganglia are heavily modulated by dopamine, and the cerebellum is highly innervated by norepinephrine. In conclusion, Dr. Arnsten presumes that genetic changes that impact catecholamine actions could alter basal ganglia and cerebellum functioning, and alterations in catecholamines have profound effects in the functioning of the prefrontal cortex [5].

Hanania and Smith state that "intelligent behavior requires selecting task-relevant information and minimizing interference from irrelevant information. Selective attention and attention switching are fundamental to almost all cognitive tasks, and deficits in these attentional processes have a wide ranging and cascading consequences for development" [6]. It can be inferred that different mechanisms and different neural processes underlie selection and switching; conversely, the processes underlying these two aspects of attention may overlap and connect in important ways which may lead to related developmental trends [6]. Reynolds and Heeger discuss the normalization model of attention as having three basic components, which are: the stimulation field, the suppressive field, and the attention fields [7]. The responses of a group of neurons to a visual stimulus can be depicted as a neural image in which the brightness at each image location correlates to the response of one neuron [7]. The stimulation field of a neuron in the model characterizes its selectivity, both in terms of spatial position and orientation. The stimulation field is a theoretical concept that would be equivalent to a neuron's receptive field only if there were neither suppression nor attention [7]. The suppressive field characterizes the spatial positions and features that contribute to this suppression; thus, the response of a visual neuron to a preferred stimulus can be suppressed by the simultaneous presentation of a non-preferred stimulus [7]. The attention field is characterized by its recruitment of each neuron in a

group of neurons in terms of its spatial and extents of its feature; the attention field is multiplied by the stimulus field/drive before its normalization, therefore affecting both the stimulus and suppressive fields in determining the output firing rate of each stimulated neuron [7]. Thus, "the resulting stimulated neural responses depend on the size of the stimulus- in terms of the sizes of the stimulation and suppressive fields- the combination of features that make up the stimulus, the spatial extend of the attention field, and the extent of the features in the attention field" [7]. The fundamental idea is that the attention field reshapes the distribution of activity across the population of neurons, altering the balance between excitation and suppression. That is, :

> "consider an example in which two stimuli are presented within a neuron's receptive field, one moving in the neuron's preferred direction and the other in the non-preferred (i.e., opposite) direction. Only the preferred direction contributes to the stimulus drive but both contribute to the suppressive drive such that the response of the neuron to the pair is less than it would be to the preferred direction on its own" [7].

Cognitive-Behavioral Therapy (CBT): Cognitive-behavioral therapy was designed to foster self-controlled behavior by enhancing self-mediation and control strategies [8]. CBT focusses on basic functions that strengthen cognition, specifically attention, retentiveness and memory, visuospatial perception, and executive functions [9]. The goal is to ameliorate the impairment of basic functions and therefore improve competence [9]. Initial trials were based on the conceptualization that impulsive patients with ADHD should be taught to talk to themselves as a means of developing self-control" [8]. Cognitive therapy have been frequently indicated in children with attention-deficit/hyperactivity disorders, where the efficacy of medicinal treatment alone has been ambiguous [9]. Currently, reviews of literature analyzing CBT in adults with acquired brain trauma reveal that it is only sometimes effective [9], but that may be due to the studies' limiting scientific criteria. Therefore, an important question is what is the mechanism of action of cognitive-behavioral therapy in patients with ADHD? In an attempt to explain the therapeutic effects of different treatments, Rapport and colleagues formed a conceptual model of ADHD. According to this model, stimulants (i.e. pharmaceutical treatment) have a direct impact on the neurobiological substrate of ADHD, whereas CBT affects the core psychological (i.e. behavioral and cognitive) features [10]. Other nonspecific and more supportive psychosocial

treatments impact the peripheral or secondary symptoms of attention-deficit hyperactivity disorder; for example, employment or academic underachievement, impaired social skills, and dysfunctional family relationships [8]. Conversely, Rostain and Ramsay hypothesize that patients' symptoms improve in psychotherapy because cognitive-behavioral therapy effectively treats their comorbid conditions rather than the core symptoms of ADHD [11]. "A preliminary comparison of effect sizes across intervention packages suggests that targeted learning and practice of specific behavioral compensatory strategies may be a critical 'active ingredient' in CBT for adult ADHD." [12] That is:

> "These compensatory behavioral strategies can lead to decreases in the associated functional impairments. Finally, cognitive interventions may target dysfunctional thought patterns and associated emotions that contribute to avoidance, procrastination, and attentional shifts. Though the primary symptoms of ADHD are most certainly neurobiological in nature, cognitive-behavioral interventions can play an integral role in breaking the link between core symptoms and continued failure and underachievement." [12]

The initial study that assessed a cognitive-behavioral therapy approach to the treatment of adult ADHD was done by McDermott in 2000, who utilized a modified cognitive therapy [13]. This approach involved teaching patients to stop, re-evaluate, and modify thoughts contributing to intensifying emotions and maladaptive behavior. Patients learned about negative biases in thinking, and were taught to monitor and systematically re-evaluate their thoughts. The therapy also included psychoeducation and environmental modification strategies; such as, organization, scheduling of activities, and problem solving [13]. The study had twenty six participants who received a modified cognitive therapy in addition to medication treatment on an outpatient basis. The patients received an average of thirty six sessions of cognitive therapy over a span of approximately twelve months. The examiners employed clinical-rated Clinical Global Impression (CGI) scores for ADHD symptoms, anxiety symptoms and depression symptoms at baseline, at medication stabilization, and at post-cognitive therapy treatment [13]. The results revealed that participants benefited from cognitive therapy "above and beyond medication treatment" [13]. All CGI scores had relevant decreases from baseline to the time of medication

stabilization and from medication stabilization to the endpoint of cognitive therapy [13]. Furthermore, sixty nine percent of participants were classified as "much improved" or "very much improved" [13]. Twelve participants also provided endpoint self-reports and prospective baseline measures. On the self-report measures, patients showed a thirty three percent reduction in core ADHD symptoms and associated anxiety and depressive symptoms [13]. This study concluded that the combination of medication and structured, skills-based cognitive therapy may have a relevant impact on the treatment of adult ADHD. However, one limitation of this study is the validity of the subjects' self-report; that is, using self-report measurement introduces high variability between participants' responses and opinions of how improvement is measured. While it is true that participants can detect improvements in their own moods, behaviors, and performances, an absolute standard value of these improvements is not applicable to all participants. Another limitation includes a variable and generally long course of treatment in which the mean number of sessions was thirty six while the range was 10-103 sessions [13]; and the average duration of the study was 11.7 months with a range of 13-30 months, and the standard deviation of eight [13]. The last limitation (perhaps the most important one) is the combination of CBT and prescription medication. Although CGI scores were recorded from baseline to the time of medication stabilization and from medication stabilization to the endpoint of cognitive therapy [13], one cannot differentiate whether the medication is the dominant factor in the symptoms' decrease; and therefore would have improved the effectiveness of the cognitive therapy sessions.

Another study that was conducted by Safren in 2006, used a model of cognitive-behavioral therapy for adult ADHD consisting of six modules [14]. Three of the modules were "core modules" [14], and another three were optional modules. The core modules included organizing and planning, distractibility, and cognitive restructuring [14]. The optional modules were procrastination, anger and frustration management, and communication skills [14]. The study consisted of thirty one test subjects. The examiners evaluated the efficacy of the cognitive-behavioral therapy for adults with ADHD who had not responded well to medications alone. Of the thirty one participants who received cognitive-behavioral therapy, fifty six percent were treatment responders and only thirteen percent were non-responders [14]. The study concluded that cognitive-behavioral therapy can be a useful component in the treatment for adults with ADHD who do not respond well to medications alone [14]. Limitations of this study include no

randomization, no control or comparison group, small sample size, and no adequate control of pharmacotherapy.

Stevenson and colleagues developed a cognitive remediation program (CRP) for adults with ADHD, which was designed to reduce the impact of cognitive impairment [15]. In a randomized, controlled trial, a representative sample of adults with ADHD (some medicated, some not) were assigned to either a CRP (N = 22) or a waiting list control (N = 21) [15]. The CRP was delivered in an intensive format with eight two hours, weekly sessions with support people who acted as coaches, and participant workbooks with homework exercises [15]. Participants who completed the CRP reported reduced ADHD symptomatology, improved organizational skills and reduced levels of anger [15]. Thus, the treatment significantly improved ADHD symptoms, organizational skills, and self-esteem. The clinically significant improvements in ADHD symptomatology and organizational skills were maintained by the test subjects one year after the intervention [15]. The authors concluded that these findings suggest that the CRP provides a practical way of enhancing daily functioning for adults with ADHD. Some limitations of this study include its small sample size and the fact that the assessment of treatment outcomes was done only by self-report ratings.

Hesslinger et al. in 2002, evaluated the efficacy of a structured skill-training program in the treatment of adults with ADHD in a small, non-randomized controlled trial consisting of fifteen participants [16]. The therapy was based on the principles of dialectical behavior therapy (DBT), modified to suit the specific needs of adults with ADHD [16]. Dialectical behavior therapy is a cognitive-behavioral approach which was developed for the treatment of borderline personality disorder that blends traditional change oriented CBT skills with acceptance and mindfulness based skills [12]. Mindfulness is a relatively recent construct in Western psychology with an over 2500 year history in Eastern traditions, predominantly Buddhism [17]. It is defined as a receptive attention to present experience and is a construct that has both state and trait qualities [17]. That is, trait qualities are differences that are relatively stable across time, an example might be eye color; and, state qualities are differences that can be induced through practice or training and that do not remain over time, an example might be colored contact lenses that are used to modify eye color [18]. The authors adapted DBT skills training based on the premise that ADHD and borderline personality disorder share overlapping features including problems with affect regulation, impulse control, self-esteem, and interpersonal relationships [16]. The modified DBT

treatment for ADHD was delivered in thirteen, two hours, group-formatted weekly sessions with educational and discussion topics including: psychoeducation about ADHD, neurobiology and mindfulness training in a total of two sessions; “Chaos and Control”: A discussion of disorganized behavior followed by concrete advice about how to plan and organize aspects of participants lives, dysfunctional behavior/behavior analysis also delivered in two sessions, emotion regulation, psychoeducation about depression, psychoeducation about impulse control, psychoeducation about stress, psychoeducation about substance dependency, discussion of relationships and self-respect, and summary discussion and next steps [16]. Eight of the participants were assigned to the treatment group and the other seven acted as a “waitlist control” without random assignment [16]. The test subjects were assessed clinically using psychometric scales such as Attention Deficit Hyperactivity Disorder Checklist according to DSM-IV, sixteen items of the SCL-90-R, Beck-Depression Inventory, and visual analogue scale, prior to and following group therapy [16]. Based on these pre-to-post analysis, the eight participants in the DBT skill group presented with significant improvements on self-report measures of depression, a checklist of ADHD symptoms, and other measures of psychopathology and impairment [16]. The control group did not attain any relevant differences, however, four of the seven participants were lost to follow-up [16]. Although the results of this study showed improvements in ADHD symptoms and an overall reduction of symptomatology, as measured by the psychometric scales, this study had many limitations, including a very small number of patients, and the continuation of medication treatment in some patients. Another study using the similar methodology and outcome measures as the Hesslinger et al. study, was conducted by Philipsen and colleagues in 2007 [19] but used a larger sample size. The study evaluated the program's (i.e. DBT) effectiveness, feasibility, and patient acceptability in a multicenter setting. Seventy two adult ADHD patients were assigned to thirteen, two-hour weekly sessions at four different therapy sites [19]. The therapy was well tolerated and led to significant improvements of ADHD, depressive symptoms, and personal health status [19]. The participants reported that they felt better educated and able to cope with their ADHD symptoms [19]. However, the factors treatment site and medication did not contribute to the overall improvement. Patients regarded the program topics "behavioral analyses," "mindfulness," and "emotion regulation" as the most helpful [19]. In this multicenter study, the therapy program showed therapist-independent effects and seemed to be disorder-specific.

Meditation: Most types of meditation involves an initial focus of attention and are broadly grouped into two categories: concentrative (focused attention) and mindfulness (distributed attention) [20].

> "Concentrative meditation involves focusing attention on a particular object or event, such as one's breathing or a spot on the wall while all other extraneous stimuli are tuned out. Mindfulness meditation, on the other hand, involves entering an open state and being receptive to all kinds of stimulation, such as thoughts, emotions, sensations, and images." [21]

The two types of meditation may be related to different systems of attention [21]. Concentrative meditation has been associated with the orienting and conflict monitoring system, proposed by Posner and Petersen in 1990 as the dorsal attention system, [22] which is described as a voluntary attention system reacting to the presentation of cues indicating perceptual and response features of stimuli to which participants should direct their attention [21]. Conversely, mindfulness meditation can be connected to the alerting system, or the ventral attention system, [22] which is described as an alerting system that is activated during abrupt modifications in sensory stimuli and detection of relevant targets, especially when they are unexpected, are outside of the focus of attention, and have low probability of manifestation [21]. "Both forms of meditation also share certain common key components, such as body relaxation, positive mood, breathing technique, and mental imagery." [21] Meditation has been found to be associated with increased regional blood flow or glucose metabolism in prefrontal and cingulated cortex, which has been shown to be involved in cognitive functions of attention and emotions [23]. Some of the transient changes in brain activity due to meditation include bursts of oscillations and increases in global frontocentral coherences, especially in the lower frequency range (i.e., alpha and theta) [24]. Meditators have been found to self-induce gamma-band oscillations and phase synchronization during meditation, especially in the frontoparietal areas, which signifies an attentive brain [23]. These changes in brain activity and cognitive processes appear beneficial, thus improving overall cognitive functioning [21].

In a study conducted by Lutz and colleagues in 2009 set out to prove that intensive meditation training would significantly improve attentional stability [25]. This study included seventeen practitioners, of which seven were male between the ages of twenty two to sixty four years old, with the average age being forty one years old and an average of eighteen years of

education; they were recruited prior to the start of a three-month meditation retreat at the Insight Meditation Society in Barre, Massachusetts [25]. The authors termed these participants as the "practitioners group" [25]. The "novice group" consisted of twenty three subjects, nine were males with an average age of forty one years old, and an average of seventeen years of education [25]. The subjects in this group had no prior meditation experience and were recruited through advertisements in local newspapers directed at individuals interested in learning about meditation. The participants had no history of mental or neurological illness, and gave informed consent to participate. The practitioners self-selected for the meditation group and all had prior experience with meditation. Their average life experience with meditation was 2967 hours [25]. This average includes daily practice and days in retreat (8 hours of meditation per day of retreat) [25]. The practitioners participated in a three month meditation retreat during which they meditated for ten to twelve hours per day. Retreat participants were trained in Vipassana meditation (Focused Attention (FA) and Open Monitoring (OM) meditations) and also received some training in 'Metta', a loving kindness and compassion meditation [25]. The novice group attended a one hour group instruction class on Vipassana meditation prior to each visit to the laboratory and meditated for twenty minutes each day [25]. Their daily practice prior to data collection was assessed at each visit. Vipassana meditation can be understood as a combination of two styles of practices that we conceptualized as Focus Attention meditation (FA) and Open Monitoring meditation (OM) [25]. The first style, FA meditation, involves voluntary focusing attention on a chosen object in a sustained fashion; and the second style, OM meditation, entails non-reactively monitoring the content of experience from moment to moment, primarily as a means to recognize the nature of emotional and cognitive patterns [26]. This study focused on the long-term impact of FA meditation.

> "FA meditation is a widespread style of Buddhist practice and involves sustaining selective attention moment by moment on a chosen object, such as a subset of localized sensations caused by respiration. To sustain this focus, the practitioner must also constantly monitor the quality of attention. At the beginning of the practice, the attention may wander away from the chosen object, and the typical instruction is to recognize the wandering and then restore attention to the chosen object. For example, while intending to focus on localized sensations around the nostrils caused by breathing, one might notice that one's attention has been lost and

> that one has become unwillingly busy with thoughts unrelated to the task. One then simply releases this distraction, and returns to the intended object. Thus, while cultivating the acuity and stability of sustained attention on a chosen object, this practice also develops three skills regulative of attention: the first is the monitoring faculty that remains vigilant to distractions without destabilizing the intended focus. The next skill is the ability to disengage from a distracting object without further involvement. The last involves the ability to redirect focus promptly to the chosen object." [26]

Progress in this form of meditation is measured, in part, by the degree of effort required to sustain the intended focus [25].

> "The novice contends with more distractions, and the three regulative skills are frequently exercised. As one advances, the three regulative skills can be developed to the point that, for example, advanced practitioners have an especially acute ability to notice when the mind has wandered. Eventually, FA induces a trait change, whereby the attention rests more readily and stably on the chosen focus. At the most advanced levels, the regulative skills are invoked less and less frequently, and the ability to sustain focus thus becomes progressively effortless." [26]

The results of this study revealed the following:

> "A mental training-related increase in phase consistency of theta-band oscillatory neural responses over anterior scalp regions to target stimuli only. Importantly, this change in cortical signal stability predicted the observed reduction in reaction time variability. Secondly, mental training reduced cortical engagement, as reflected by a reduction in event-related desynchronization (ERD) to target tones in the beta (13–30Hz) frequency band. Third and lastly, mental training was associated with enhanced phase-consistency of the brain responses to any deviant tone. Together, these novel findings confirm first-person reports that FA meditation can affect the stability of attentional processes, and reveal the neural mechanisms underlying an improved ability to sustain attention." [25]

CONCLUSION

The studies presented here demonstrate that there are benefits attained by adults with attention-deficit hyperactivity from these alternative therapies. From the data gathered by this literature review, the most effective treatment of adult ADHD is still medication; and the effectiveness of the combination of medication and cognitive-behavioral therapies is nowhere near the efficacy of medication. However, it is important to keep in mind that these alternative therapies do not possess any negative side effects, whereas the current medications prescribed have a plethora of side effects.

The results of these CBT studies warrant the effort of organizing further research in the management of ADHD with cognitive-behavioral therapy alone. Furthermore, future studies need to alleviate the repeated limitations that were evident in the current literature. That is, examiners must find a way to increase the sample size of their experiments to further solidify the positive results that cognitive-behavioral therapy provides ADHD patients, and as a result, encourage more studies to be conducted. The other limitation that is consistent in the aforementioned studies is the validity of test subjects' self-report. Perhaps future researchers can develop a measuring device that is used to retrieve subjects' brain wave activity and/or biochemical information pre-and-post treatment administration.

There is little evidence in the scientific community that examines the efficacy of meditation for managing ADHD. The study that was presented in this review has a major limitation; that is, the authors did not include any subjects that have been diagnosed with adult ADHD. However, one can infer that patients with adult ADHD may benefit from meditation although these subject may encounter greater difficulties and thus take a longer time to attain success. This warrants further research in the effects of meditation on the treatment and possibly preventing adult attention-deficit hyperactivity disorder.

In conclusion, the current literature suggests that cognitive-behavioral therapy has the potential to be utilized as an effective treatment of adult attention-deficit hyperactivity disorder. Although CBT has some overlap with meditation, it appears as the most promising alternative therapy in the current literature to combat adult ADHD. The current evidence for the use of holistic approaches in treating adults with ADHD can best be described as emerging and lags behind the evidence base for both medication treatment of adult ADHD and cognitive behavioral treatment for other adult disorders.

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