

Comparative Effectiveness of Cognitive Behavioral Therapy and Mindfulness-Based Cognitive Therapy on Executive Functions, Cognitive Disengagement Syndrome, Stress Management, and Quality of Life in Adults with ADHD

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Abstract

Background: Adult Attention-Deficit/Hyperactivity Disorder (ADHD) often involves executive dysfunction, cognitive disengagement, high stress, and reduced quality of life. Despite advances in pharmacological treatment, effective non-pharmacological interventions remain essential.

Objective: To compare the effectiveness of Cognitive Behavioral Therapy (CBT) and Mindfulness-Based Cognitive Therapy (MBCT) in improving ADHD symptoms, Cognitive Disengagement Syndrome (CDS), cold and hot executive functions, stress management, and quality of life

Methods: A quasi-experimental pretest–posttest control group design was conducted with 60 adults diagnosed with ADHD. Participants were randomly assigned to CBT, MBCT, or control groups. Standardized measures assessed ADHD symptoms, executive functions, CDS, stress, and quality of life. Data were analyzed using Multivariate Analysis of Covariance (MANCOVA), controlling for baseline scores.

Results: MANCOVA revealed a significant group effect on the combined dependent variables (Wilks' Lambda = .43, $F(12, 102) = 3.92$, $p < .001$, $\eta^2 = .29$). Follow-up ANCOVAs indicated significant improvements in both intervention groups compared with control (all $p < .01$), with MBCT showing greater effects on hot executive functioning, stress, and CDS (η^2 range: .18–.30).

Conclusions: Both CBT and MBCT effectively improved cognitive and emotional outcomes in adults with ADHD, with MBCT providing additional benefits for stress regulation and cognitive disengagement. Integration of mindfulness into ADHD interventions is recommended.

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Keywords: Attention deficit hyperactivity disorder (ADHD), Cognitive Behavioral Therapy, Mindfulness-Based Cognitive Therapy, Executive Functions, Cognitive Disengagement Syndrome, Stress, Quality of Life

1. Introduction

Attention-Deficit/Hyperactivity Disorder (ADHD) is a chronic neurodevelopmental condition that affects approximately 4–5% of adults worldwide (Kessler et al., 2006). Characterized by persistent patterns of inattention, hyperactivity, and impulsivity, ADHD significantly impairs academic, occupational, and psychosocial functioning. Historically perceived as a childhood disorder, it is now widely recognized that ADHD symptoms persist into adulthood in up to 65% of cases (Wilens et al., 2004). Adults with ADHD commonly experience difficulties in executive functioning, emotional regulation, time management, and cognitive processing speed, which often lead to lower quality of life, higher perceived stress, and increased comorbidity with anxiety and depression (Barkley et al., 2006; Gair et al., 2021).

Despite increased awareness and pharmacological advances, non-pharmacological interventions for adult ADHD remain underexplored, especially in non-Western clinical settings. Cognitive Behavioral Therapy (CBT) has shown promising results in symptom management and executive dysfunction (Knouse et al., 2008). Meanwhile, Mindfulness-Based Cognitive Therapy (MBCT), which combines cognitive strategies with mindfulness meditation, is emerging as an effective approach for enhancing attention regulation, emotional self-awareness, and cognitive flexibility (Zylowska et al., 2008; Mitchell et al., 2015). However, comparative studies examining the differential effectiveness of CBT vs. MBCT—particularly on cold and hot executive functions, Cognitive Disengagement Syndrome (CDS), and stress-related dimensions in adults with ADHD—are still sparse.

Additionally, while much attention has been paid to executive dysfunction in ADHD, recent

conceptual models differentiate between “cold” and “hot” executive functions (Zelazo, 2015). Cold executive functions refer to emotionally neutral processes such as working memory and inhibition, whereas hot executive functions involve affective decision-making and social cognition. Studies have suggested that MBCT may outperform CBT in regulating hot executive processes due to its emphasis on emotional awareness and self-compassion (Hölzel et al., 2011).

Furthermore, Cognitive Disengagement Syndrome—a cognitive-affective profile characterized by mental foggy, daydreaming, lethargy, and slow information processing—has recently garnered attention as a distinct construct often comorbid with ADHD (Becker et al., 2016). Interventions targeting CDS in adults are virtually nonexistent in empirical literature (Mueller et al., 2014). Similarly, although stress is a major functional impairment for adults with ADHD, it is seldom addressed as a primary treatment outcome in clinical research. Some recent pilot studies have begun to fill this gap (e.g., Barra et al., 2021; Oscarsson et al., 2025), highlighting the need for more rigorous and targeted interventions addressing stress in adult ADHD populations.

This study aims to fill these gaps by evaluating and comparing the effectiveness of CBT and MBCT on a range of cognitive, emotional, and functional outcomes in adults diagnosed with ADHD. We hypothesize that both interventions will yield significant improvements across all domains, with MBCT outperforming CBT in stress regulation, hot executive functioning, and CDS reduction.

Cognitive Behavioral Therapy has been increasingly applied as a first-line non-pharmacological intervention for adult ADHD. Rooted in Beck’s cognitive theory, CBT targets maladaptive beliefs, procrastination, and behavioral disorganization (Safren et al., 2005). Randomized controlled trials consistently demonstrate that CBT ameliorates core ADHD symptoms and related dysfunctions. Notably, a 2019 RCT in adult ADHD patients showed that both CBT alone and in combination with medication significantly improved executive functions, with the combined treatment yielding broader executive benefits (Knouse & Safren, 2010; Pan et al., 2019). Moreover, a comprehensive meta-analysis confirms CBT’s effectiveness in reducing both core and emotional symptoms, supporting the broader cognitive-behavioral impact of this intervention (Liu et al; 2023).

Moreover, CBT’s structured skill training component enhances treatment adherence and promotes generalization across contexts. However, its relative limitations in emotional regulation and stress reactivity have led researchers to explore integrative approaches.

MBCT, originally developed for preventing depressive relapse (Segal et al., 2002), has recently gained traction in ADHD research due to its efficacy in enhancing attention, emotional awareness, and metacognitive regulation (Zylowska et al., 2008). MBCT trains individuals to observe thoughts nonjudgmentally and disengage from automatic cognitive habits—an especially relevant skill for adults with ADHD. Neuroimaging findings show that mindfulness practices strengthen prefrontal-limbic connectivity, a neural correlate of executive control (Doll et al., 2016; Hölzel et al., 2011). Emerging evidence suggests that MBCT may be more effective than CBT in improving affective regulation, inhibitory control, and decision-making under uncertainty—components often associated with “hot” executive functions (Mitchell et al., 2015).

Executive functions (EFs) are typically divided into “cold” (emotion-neutral) and “hot” (emotion-laden) processes (Zelazo & Carlson, 2012). Cold EFs include cognitive flexibility, response inhibition, and sustained attention, while hot EFs encompass decision-making, reward sensitivity, and emotional regulation. ADHD has been robustly linked to impairments in both domains, with inattentive symptoms primarily associated with deficits in cold EFs, and hyperactive-impulsive symptoms linked to impairments in hot EFs (Rincón et al., 2024). Cold EFs are commonly assessed through tasks such as the Wisconsin Card Sorting Test (WCST) or the Stroop Task, whereas hot EFs—though more challenging to quantify—are typically evaluated using tasks like delay discounting and affective Go/No-Go or Iowa Gambling paradigms (e.g., Zelazo & Carlson, 2012; Antonini et al., 2015). MBCT’s incorporation of emotional awareness and regulation practices may render it particularly effective in remediating hot EF deficits, as mindfulness has been shown to enhance neural circuits involved in emotional control and decision making (Gkintoni et al., 2025).

CDS is an emerging construct distinct from traditional ADHD dimensions. It encompasses behaviors such as mental fog, daydreaming, lethargy, and slowed cognitive disengagement (Becker et al., 2016). While CDS shares overlapping symptoms with inattentive ADHD, it is associated with unique neural patterns and psychosocial outcomes. Current clinical interventions rarely address CDS directly. Preliminary findings suggest that mindfulness-based interventions may offer promise by enhancing moment-to-moment attention and reducing mind wandering (Smallwood & Schooler, 2015).

Adults with ADHD report elevated levels of chronic stress, emotional dysregulation, and poor quality of life across domains (Weiss et al., 2008). Impaired coping mechanisms and poor time management exacerbate stress-induced dysfunctions, often leading to anxiety, burnout, and interpersonal conflict (Oscarsson et al., 2025). While pharmacotherapy may address core symptoms, it often fails to enhance life satisfaction or psychological flexibility. Both CBT and MBCT have demonstrated efficacy in stress reduction and emotional resilience, but the mindfulness component of MBCT may provide deeper modulation of physiological arousal and emotional reactivity (Baer, 2003; Smalley et al., 2009).

2. Methods

This study employed a quasi-experimental design with a pretest-posttest control group structure. Randomization was performed using a computer-generated block randomization (block size = 6) to ensure balanced allocation across groups. Participants were randomly assigned to one of three groups: Cognitive Behavioral Therapy (CBT), Mindfulness-Based Cognitive Therapy (MBCT), or waitlist control. Ethical approval was obtained from the university's research ethics committee, and all participants signed informed consent prior to enrollment.

The sample consisted of 60 adults (aged 18–35) diagnosed with ADHD based on DSM-5 criteria using clinical interviews and the Barkley Adult ADHD Rating Scale-IV. Participants were recruited from counseling centers and university clinics in southern Iran. Inclusion criteria included: (a) formal ADHD diagnosis, (b) no concurrent psychological therapy, and (c) no change in medication during the study. Exclusion criteria were comorbid psychiatric disorders requiring immediate treatment or substance use disorders.

Participants were matched across groups for age, gender, and baseline severity of ADHD symptoms. The final sample included 20 individuals in each group (CBT, MBCT, Control).

Sample size was determined based on an a priori power analysis (G*Power 3.1) for MANCOVA, with an assumed medium effect size ($f^2 = 0.25$), $\alpha = 0.05$, and power = 0.80, yielding a minimum of 51 participants; we recruited 60 to account for potential attrition.

Participants in the CBT group attended 10 weekly sessions (90 minutes each) following Safren et al.'s structured CBT model for adult ADHD. Sessions focused on psychoeducation, time management, cognitive restructuring, problem-solving, and relapse prevention.

The MBCT group received 8 weekly sessions (120 minutes each) adapted from Segal et al. (2002) and Zylowska et al. (2008), focusing on mindfulness meditation (body scan, mindful breathing), cognitive decentering, and acceptance-based strategies. Daily homework and guided audio practices were provided.

All sessions were delivered in small groups (6–8 participants) by trained psychologists certified in CBT or MBCT. Although the number of sessions differed (10 for CBT vs. 8 for MBCT), total contact hours were matched by extending session length in MBCT; this was controlled for in the analysis.

2.1. Measures

Table 1: Research tools

Construct	Instrument	Reliability (α)	Description
ADHD Symptoms	Barkley Adult ADHD Rating Scale	0.89	18 items, Inattention and Hyperactivity
Executive Functions (Cold)	Wisconsin Card Sorting Test (WCST)	—	Set-shifting and cognitive flexibility
Inhibition (Cold EF)	Stroop Color-Word Test	0.84	Cognitive inhibition and control
Attention (Cold EF)	Continuous Performance Test (CPT)	—	Sustained attention
Decision-Making (Hot EF)	Iowa Gambling Task (IGT)	—	Reward-based decision-making
Cognitive Disengagement Syndrome	Cognitive Disengagement Syndrome Scale	0.91	14 items
Stress Management	Perceived Stress Scale (PSS)	0.86	Subjective stress evaluation
Quality of Life	WHOQOL-BREF	0.88	Physical, psychological, social, environmental

2.2. Data Analysis

Data were analyzed using SPSS v26. Descriptive statistics and Shapiro-Wilk tests were used for assumptions checking. Multivariate Analysis of Covariance (MANCOVA) was conducted to assess differences between groups, controlling for baseline scores and demographic covariates (age, education). Post-hoc Bonferroni corrections were applied. Effect sizes (partial η^2) were reported for significant findings.

2.3. Results

The mean and standard deviation (SD) for all dependent variables across the three groups (CBT, MBCT, and Control) at pretest and posttest are presented in Table 1.

Table 2: Mean (SD) Scores on Key Variables by Group and Time

Variable	Group	Pretest (SD)	Mean Posttest (SD)	Mean
ADHD Symptoms	CBT	23.2 (3.8)	16.1 (3.2)	
	MBCT	23.0 (3.6)	14.4 (2.9)	
	Control	22.7 (3.7)	23.5 (4.1)	
Cognitive Disengagement Syndrome	CBT	17.5 (2.8)	12.3 (2.6)	
	MBCT	17.2 (2.9)	10.8 (2.4)	
Cold Executive Function	CBT	62.9 (8.7)	75.5 (9.4)	
	MBCT	63.4 (8.9)	79.1 (10.1)	

Variable	Group	Pretest (SD)	Mean Posttest (SD)	Mean
Hot Function	Executive CBT	59.8 (6.3)	68.8 (7.2)	
	MBC T	59.6 (6.5)	74.6 (7.4)	
Stress (PSS)	CBT	23.1 (4.3)	16.9 (4.2)	
	MBC T	23.3 (4.0)	14.2 (3.5)	
Quality of Life (WHOQOL)	Life CBT	68.3 (6.4)	82.4 (6.8)	
	MBC T	67.8 (6.7)	85.6 (6.1)	

Prior to conducting MANCOVA, assumptions of normality, homogeneity of variances, and linearity were examined. Shapiro–Wilk tests indicated that the data did not significantly deviate from normality ($p > .05$), and Levene’s test confirmed homogeneity of variances across groups ($p > .05$). No significant multicollinearity was detected among dependent variables.

A MANCOVA revealed significant differences between groups on the combined dependent variables after controlling for pretest scores and covariates:

Wilks’ Lambda = .43, $F(12, 102) = 3.92$, $p < .001$, $\eta^2 = .29$

Table 3: ANCOVA Results Controlling for Pretest Scores

Variable	F	p-value	η^2 (Effect Size)
ADHD Symptoms	11.21	< .001	.23
Cognitive Disengagement Syndrome	9.43	.001	.18
Cold Executive Function	10.06	< .001	.21
Hot Executive Function	12.47	< .001	.26
Stress (PSS)	13.89	< .001	.28
Quality of Life (QoL)	15.33	< .001	.30

Table 4: Pairwise Comparisons (MBCT vs CBT vs Control)

Variable	MBCT vs CBT	MBCT vs Control	CBT vs Control
ADHD Symptoms	$p = .072$	$p < .001$	$p < .001$
Cognitive Disengagement	$p = .046$	$p < .001$	$p < .001$

Variable	MBCT vs CBT	MBCT vs Control	CBT vs Control
Syndrome			
Cold Executive Function	$p = .061$	$p < .001$	$p = .009$
Hot Executive Function	$p = .034$	$p < .001$	$p = .003$
Stress (PSS)	$p = .011$	$p < .001$	$p = .001$
Quality of Life	$p = .091$	$p < .001$	$p = .002$

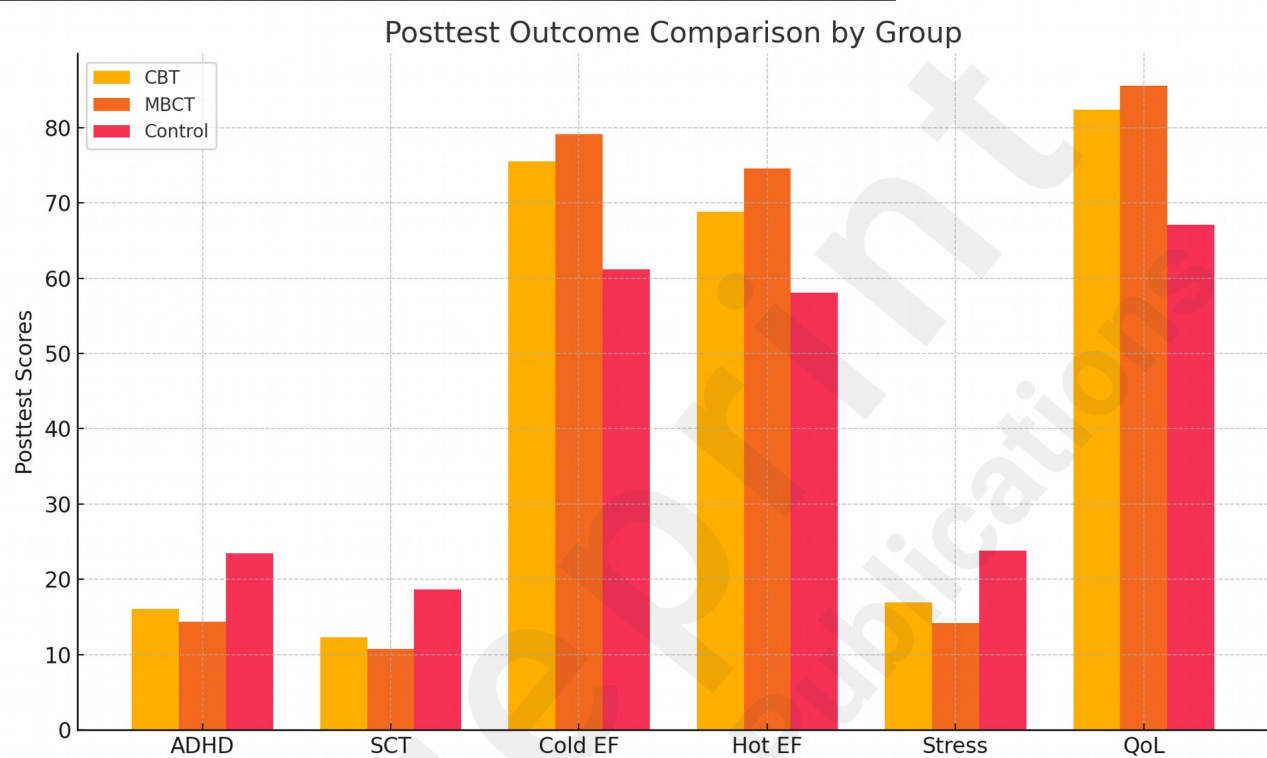


Figure 1. Comparison of post-tests of variables in experimental and control groups

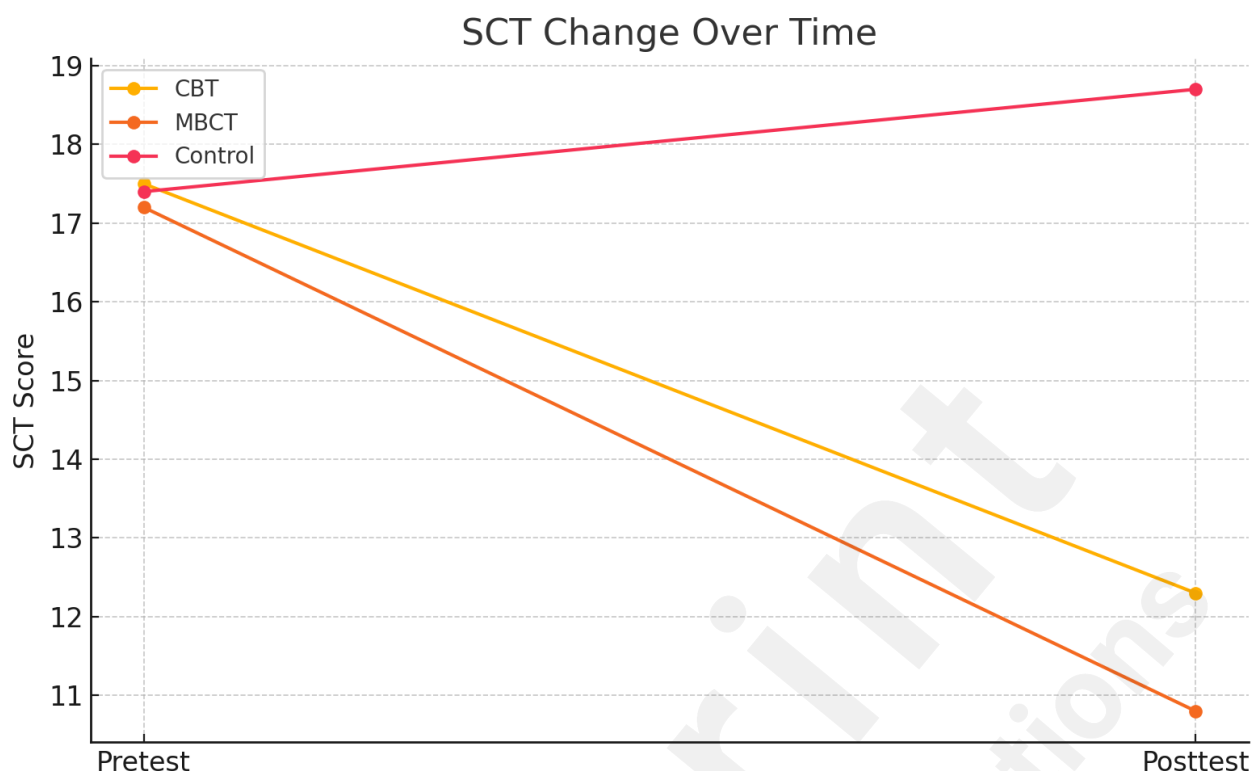


figure 2. SCT changes over time

3. Discussion

The current study aimed to compare the efficacy of Cognitive Behavioral Therapy (CBT) and Mindfulness-Based Cognitive Therapy (MBCT) in improving ADHD symptoms, reducing Cognitive Disengagement Syndrome enhancing cold and hot executive functions, and improving stress management and quality of life in Iranian adults with ADHD. Both interventions showed significant advantages over the control group, while MBCT demonstrated superior effects in CDS reduction, hot executive functioning, and stress regulation.

The results confirm that both CBT and MBCT are effective for adults with ADHD, consistent with previous meta-analyses (Knouse & Safren, 2010; Young et al., 2020). The observed superiority of MBCT in domains linked to emotional regulation and CDS is in line with Zylowska et al. (2008) and Mitchell et al. (2015), but diverges from earlier findings (Knouse et al., 2010) that suggested minimal difference between CBT and mindfulness-based interventions in affective regulation. This divergence may be attributed to sample differences (e.g., age range and cultural background), intervention fidelity, and the relative emphasis placed on emotional awareness in the MBCT protocol.

One noteworthy outcome was the pronounced reduction in CDS in the MBCT group. CDS—characterized by mental fog, daydreaming, and slow processing—has been under-investigated in adult ADHD, especially in non-Western contexts. Our findings suggest that mindfulness training, by promoting sustained attention and metacognitive awareness, directly addresses CDS' score mechanisms of internal distraction and cognitive slowing.

This research contributes novel insights by situating MBCT within an Iranian cultural framework. In collectivist societies such as Iran, where emotional expression is shaped by social

expectations and ADHD carries stigma, the non-judgmental and acceptance-based stance of MBCT may resonate more deeply, enhancing emotional regulation and interpersonal functioning. Furthermore, the group-based nature of MBCT likely provided participants with social validation and shared coping strategies, reinforcing treatment adherence. This may partially explain the stronger effects observed in stress regulation and hot executive functioning compared to CBT.

From a theoretical perspective, our findings extend the dual-process model of executive function (Zelazo & Müller, 2011) by demonstrating that interventions like MBCT, which simultaneously engage cognitive control and emotional regulation, can produce balanced improvements across cold and hot EF domains. Additionally, these results suggest a potential mediating role of mindfulness in reducing the cognitive-affective load in ADHD, bridging gaps between attention regulation and emotional resilience.

Clinicians should consider MBCT, either as a standalone or in combination with CBT, for adults with ADHD who present with high stress levels, emotional dysregulation, or CDS symptoms. Given the program's relatively short duration and group format, MBCT is a cost-effective and scalable intervention for university counseling services, workplace wellness initiatives, and telehealth platforms in Iran. On a policy level, integrating MBCT into public mental health services could expand access to evidence-based psychosocial care for adults with ADHD.

3.1. Limitations and Future Research Directions

Despite promising results, the study had several limitations:

- Sample size and follow-up – The modest sample and absence of long-term follow-up limit generalizability.
- Measurement methods – Reliance on self-report and performance-based tools without neurobiological markers.
- Cultural specificity – The single-cultural sample may not fully represent global ADHD populations.

Future research should:

- (a) employ neuroimaging techniques to examine neural correlates of change;
- (b) assess the comparative effectiveness of online vs. in-person MBCT in adult ADHD;
- (c) incorporate 6- and 12-month follow-ups to evaluate treatment durability;
- (d) explore the integration of MBCT with CBT modules targeting organization and time management to create hybrid protocols.

3.2. Conclusion

This study provides strong evidence that both CBT and MBCT effectively address cognitive and affective impairments in adults with ADHD, with MBCT offering additional benefits in stress regulation, CDS reduction, and hot executive function improvement. These findings underscore the potential of mindfulness-based interventions in culturally diverse contexts and encourage their integration into comprehensive ADHD treatment frameworks in Iran.

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