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Evidence of Emotion Dysregulation as a Core Symptom of Adult ADHD: A Systematic Review

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Abstract

Attention-Deficit/Hyperactivity Disorder (ADHD) is one of the most prevalent neurodevelopmental disorders, affecting approximately 5–7% of children and adolescents and 3–5% of adults. Traditionally defined by inattention, impulsivity, and hyperactivity, emerging evidence suggests that emotion dysregulation (ED) may represent a core feature of the disorder. ADHD is associated with executive function impairments, heterogeneous manifestations across the lifespan, and high rates of psychiatric comorbidity in adulthood, where diagnostic clarity remains challenging. Growing research indicates that emotional regulation deficits appear early in childhood ADHD and may persist into adulthood, although adult-specific data remain limited. This systematic review followed PRISMA guidelines and included empirical studies published in English involving adults (≥18 years) diagnosed with ADHD according to DSM-IV or later criteria and incorporating standardized emotion regulation measures. Database searches (EBSCOhost, PsycInfo, Medline, ERIC, PsycArticles, Psicodoc, Scopus) and supplementary Google Scholar screening yielded 231 studies, of which 22 met inclusion criteria. Findings were categorized into three domains: (1) studies examining measures and clinical features of emotion regulation in adults with ADHD; (2) studies investigating neurological and psychophysiological correlates of emotion regulation tasks; and (3) studies evaluating interventions targeting emotion regulation outcomes. The review highlights the growing recognition of ED as a clinically significant dimension of adult ADHD and underscores the need for greater diagnostic and therapeutic focus on emotional functioning in this population.

Keywords: ADHD; Emotion dysregulation; Impulsivity; Hyperactivity.

Introduction

ADHD is one of the most prevalent neurodevelopmental disorders (among children and adolescents, it's 5-7% while 3-5% among the adult population) [1]. It has three cardinal symptoms: i) Inattention, ii) Impulsiveness, and/or iii) Hyperactivity [2]. There are three subtypes of ADHD; a) combined, b) Predominantly inattentive, and c) Predominantly hyperactive-impulsive [2]. As per DSM-5 [2], the criteria for diagnosis of ADHD is that symptoms must appear before the age of 12, persistent for a duration of at least 6 months in two or more components that negatively affect social and academic/occupational activities. New evidences suggest that emotion regulation deficits, or emotion dysregulation (ED), are a core symptom of ADHD [3, 4]. ADHD has multiple causes [5] and has heterogeneous manifestations throughout lifespan [6]. In adults, criteria for ADHD is not well established and there is high comorbidity

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as well [7]. It is well known that ADHD is associated with executive function (EF) abnormalities [8]. As per a recent study by Karalunas et al., temperamental irritability is associated with ADHD symptomatology, suggesting that this type of anger dysregulation might be a frequent feature of ADHD [9].

Emotion regulation in ADHD

In ADHD childhood, emotional dysregulation (ED) shows up very early compared to children with typical neurodevelopment [10]. In contrast to children, little is known about ED in adults with ADHD in terms of ED [11].

Method

A systematic literature review was conducted in which principles and phases of the PRISMA model are followed [12].

Inclusion Criteria

Included studies had the following; (a) participants diagnosed with ADHD following DSM-IV or later criteria, (b) over 18 years old, (c) to have an ER measure, (d) empirical studies, (e) published in English.

Exclusion Criteria

The exclusion criteria were: (a) the lack of a clinical diagnosis of ADHD (b) including people under 18 years of age in the study without offering analysis of the data by age range, (c) not providing ADHD participants ER measures (e.g., parents), (d) reviews, qualitative studies or meta-analyses.

Procedure

A search was done through EBSCO host in PsycInfo, Medline, Eric, PsycArticle and Psicodoc, and in Scopus databases from February 1 to 25, 2022 [13]. An informal search was also carried out on Google Scholar throughout the first fortnight of March 2022 [13]. Elimination of non-relevant papers were done by following PRISMA guidelines [14].

Results

Out of 231 studies, twenty-two studies met all the inclusion criteria, they were classified into three sections given the heterogeneity;

1) Studies on measures and features of ER in people with ADHD.
2) Studies that analyses the neurological and psychophysiological activity during the performance on ER tasks in ADHD.
3) Studies that focused on interventions that provided ER outcomes in adults with ADHD.

Table 1: PRISMA 2020 Flow Diagram (Table Format)

Identification	
Records identified through database searching	n = 231
Duplicate records removed	n = 11
Records after duplicates removed	n = 220
Screening	
Records screened (title/abstract)	n = 220
Records excluded	n = 180
• Not focused on Emotional Regulation	n = 95
• Wrong population (not adults with ADHD)	n = 42
• No ER outcome measures	n = 28
• Non-empirical publications	n = 15
Eligibility	
Full-text articles assessed for eligibility	n = 40
Full-text articles excluded	n = 18
• ER not primary outcome	n = 7
• Insufficient statistical data	n = 4
• Pediatric samples only	n = 3
• Conference abstracts only	n = 2
• Non-English language	n = 2
Included	
Studies included in qualitative synthesis	n = 22

Emotion regulation features in adult ADHD

Among the included studies, ten studies found that ADHD group had consistently lower ER scores than control groups, ranging from medium to very large effect sizes [d' = 0.31–2.27] [15-18, 19-24]. A study from a series of two studies, Hirsch et al. [4] worked on investigating the role of ER in ADHD and findings suggested that ED is a core symptom of ADHD. Some other studies showed that women with ADHD presented greater emotion dysregulation and emotionality [25, 26]. Ru¨fenacht et al. found that in ADHD group, emotion dysregulation scores are higher as compared to other clinical and community samples [27]. In regards to an ADHD trend to use maladaptive emotion regulation strategies, Materna et al. found that the ADHD group scored lower on reappraisal but higher on suppression than the control group and their own regulation strategies were more negatively valued than that of the controls [28].

Neurological and psychophysiological activity related to emotion dysregulation in adult ADHD

Shushakova et al. studied the emotion regulation strategies in adults with and without ADHD using Event Related Potentials (ERP) and found that amplitude of the Late Positive Potential (LPP) is greater in the ADHD group than that of the control group [29]. Similarly, the group effect showed that the frontal amplitudes of the LPPs were higher in adults with ADHD without medication as compared to the control group.

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Emotion regulation outcomes in adult ADHD treatment

After doing a randomized-controlled intervention based on Mindfulness training, Mitchell et al. found that the symptoms of inattention, hyperactivity/impulsivity, functional impairment, executive functions and emotion dysregulation were improved [30]. Badoud et al., observed lower ER scores which would indicate a reduction in symptoms with small effect sizes after doing a mentalization-based intervention without a control group [31].

Reimherr et al. measured the effect of atomoxetine and methylphenidate on ED in two double-blinded randomized-controlled trials in ADHD adults. The results showed that both of the medications improved ED measured through the Wender–Reimherr Adult ADHD–Emotion Dysregulation Scale (WRAADDS-EDS) compared to a placebo [32, 33].

Discussion

The aim of this review was to unite the available data related to ED in adults with ADHD. According to the review carried out by Shaw et al., few studies have been conducted with adult population diagnosed with ADHD on emotion dysregulation [34]. Some initial outcomes suggested that emotional dysregulation are core components of ADHD besides inattention, hyperactivity, and impulsiveness [4]. As per the studies which compared ADHD and other disorders such as borderline personality disorder (BPD), no significant differences were found in ED and that is a controversial point [19, 23]. While ER features of people with ADHD were analysed by using different measures, it was found that the ADHD group have consistently lower ER scores compared to the controls [15–24]. Some evidences indicate that high emotional dysregulation scores are associated with greater socio-functional impairment [4, 24, 35]. The emotional impairment could be the cause of many health problems in adults with ADHD such as substance misuse, psychiatric comorbidity, poor academic and occupational performance, personal relationships, self-esteem, and daily activities [7, 36, 37].

Adults with ADHD often rely on ineffective emotion regulation strategies like suppression, self-blame, and rumination, which can prolong emotional distress and worsen dysregulation [24,15,16]. While suppression is commonly used, it delays emotional recovery compared to acceptance [38]. However, improvements in ADHD symptoms and targeted emotion regulation training, especially in children, can enhance emotional control [34,39]. Additionally, usual ADHD medications help reduce emotional dysregulation, highlighting the importance of combined therapeutic and pharmacological approaches [32,33].

The analysis of ADHD symptoms and their link to emotion dysregulation (ED) reveals that current evidence does not allow a clear distinction between ADHD subtypes through ER measurement tools [21]. However, the combined subtype is more directly associated with higher ED levels , and symptom severity correlates positively with emotion dysregulation [24]. This aligns with findings in children and adolescents with ADHD [40]. Conversely, Hirsch et al. identified high negative affect and ineffective adaptive ER strategies as key characteristics in adult ADHD [4]. Additionally, parental ADHD symptoms, especially maternal, indirectly increase ED risk [26]. Supporting this, Mazursky-Horowitz et al. showed that maternal ED mediates the relationship between maternal ADHD symptoms and harsh parenting responses to adolescents' negative emotions [41].

Early findings suggest mindfulness training effectively improves emotional dysregulation (ED) in individuals with ADHD[39]. Conversely, mentalization-based interventions show no significant results, though there is a noticeable trend toward symptom improvement[31]. More research on treatments addressing emotional factors is required. Notably, Mitchell et al. found enhancements in executive function (EF) through surveys but not through laboratory assessments[39]. Barkley argued that daily EF and emotional regulation (ER) correlate in rating scales but not in lab assessments, a point supported by Silverstein et al. [35].

Using fMRI, Materna et al. found no differences in brain activation during explicit emotional regulation when participants reappraised images less negatively. However, during passive viewing, the ADHD group showed significant activation in dorsal and ventral anterior cingulate cortex compared to controls, suggesting reliance on implicit regulation. Since ADHD individuals often favor emotional suppression over reappraisal, targeted therapy to enhance adaptive strategies like reappraisal may boost emotional skills, as previously noted [15].

According to Shushakova et al., evoked potentials and found that the amplitudes of the LPP in central parietal and frontal regions, along with the N2pc (linked to attentional bias), correlated with ADHD symptom severity [16,43]. The N2pc assures attentional bias to emotional trigger in ADHD, while an increased frontal LPP indicates greater cognitive effort for emotion regulation, supporting emotional hyper-reactivity in response to aversive stimuli. This aligns with difficulties in top-down regulation via frontal networks. Barkley posits that dysregulation in ADHD primarily stems from top-down control deficits rather than bottom-up processes[3]. This dysregulation appears independent of IQ, as adults with ADHD and high IQ still exhibit impairments in everyday executive function alongside abnormal resting-state EEG patterns when compared to controls [18].

Adults with ADHD exhibit abnormal brain activation patterns, particularly in regions integrating attention, memory, and emotion like the anterior cingulate cortex (ACC),

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which activates the dorsolateral prefrontal cortex (dlPFC) to aid decision-making based on emotional and objective data [44]. ADHD-related atypical activations bias attention toward emotionally salient signals, disrupting emotional regulation and executive function governed by the dlPFC due to insufficient emotional-contextual input[16,43,45,46]. Intervention strategies such as Mindfulness, which target attentional control, show promise in normalizing these patterns, supported by initial findings [39,47]. Bailey and Jones' integrated regulation model underpins this by linking emotion regulation development to foundational attentional and inhibitory mechanisms often impaired in ADHD from childhood [48].

Limitations of research

Research aligning with the defined inclusion standards are limited and highly varied in goals and sample characteristics, especially regarding sex, medication use, and comorbidities. Ignoring gender and the presence of comorbidities like BPD may inflate differences in emotional dysregulation (ED) scores between ADHD and controls, while ADHD medications might reduce ED symptoms, masking differences [32,33]. The absence of standardized criteria for assessing ADHD and ED complicates comparisons and hinders broad conclusions. Additionally, recent findings recommend incorporating performance tests into ADHD diagnosis to detect malingering, as symptom-based tests which are the primary diagnostic tool but are less reliable [49] . This heterogeneity reduces the feasibility of future meta-analyses unless focusing on a small group of comparable studies.

Conclusion

In conclusion, this review underscores the emotional challenges faced by adults with ADHD and the need for further research. While emotional dysregulation is evident in ADHD, its presence in other disorders suggests it is not a defining symptom. Standardized diagnostic guidelines and targeted interventions focusing on emotional regulation strategies are essential, with future studies urged to explore factors like sex, comorbidities, and medication effects.

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