

Executive Functioning and Sluggish Cognitive Tempo as Potential Mediators in the Relationship Between ADHD and Emotional Intelligence

Emma Bradley
Westminster College

Mentor: Jessica D. Rhodes
Westminster College

Abstract

Introduction. ADHD is a neurodevelopmental disorder characterized by executive functioning (EF) deficits and is associated with sluggish cognitive tempo (SCT) and reduced emotional intelligence (EI). The present study evaluated the mediating roles of EF and SCT in the ADHD-EI relationship. **Methods.** Forty-nine participants completed self-report measures of ADHD symptoms, EF, and EI. Participants were remunerated \$10 for their participation. **Results.** Regression analyses demonstrated that ADHD symptoms predicted both EI ($\beta = -0.36, p = 0.001$), EF ($\beta = -0.73, p < 0.001$), and SCT ($\beta = 0.285, p < 0.001$). EF also predicted decreased EI ($\beta = -0.358, p < 0.001$), as well as SCT ($\beta = -0.61, p < 0.001$). Contrary to hypotheses, EF and SCT did not mediate the relationship between ADHD and EI. **Conclusion.** Future research ought to aim to explore more potential mechanisms accounting for the impairments associated with ADHD and EI. A better understanding of this complex relationship can lead to more effective intervention strategies for those with ADHD.

Keywords:

ADHD, Emotional Intelligence, Executive Functioning, Sluggish Cognitive Tempo

Introduction

Attention-Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder (American Psychological Association, 2013) characterized by impairments in cognition, psychosocial functioning, and mood regulation (Hammerness, 2009). Research has suggested that deficits in executive functioning lie at the core of the disorder (Antshel, et. al 2014). Symptoms of ADHD have also been associated with an inability to successfully evaluate and process emotion in oneself, as well as in others, known as emotional intelligence (EI; Banaschewski et al., 2012 & Mayer et al., 1997). The present study investigated potential mediators in the relationship between ADHD symptoms and decreased EI.

Previous research has demonstrated that ADHD is associated with decreased social and communicative skills resulting in social impairments, commonly with family and peers (Wehmeier et al., 2010) subsequently resulting in relational distress and lower quality of life (Ayers-Glassey & MacIntyre, 2021). One potential causal factor responsible for this social impairment among individuals with ADHD is deficient emotional intelligence (EI), or an inability to accurately process one's own emotions, as well as the emotions of others (Mayer & Salovey, 1997). Due to deficits in emotion perception, understanding, and management, decreased EI is linked with impairments in intrapersonal relationships and difficulties with self-esteem (Mayer et al., 1997). Research demonstrates that adults with ADHD exhibit deficits in recognition, expression, and regulation of emotion in general (Quintero et al., 2020) and EI specifically (Pollock et al., 2017). Childhood ADHD has also been linked with greater EI deficits and impairment in adulthood (Barkley & Fischer, 2010). This comorbid presentation predicts more frequent outbursts of impulsive aggression towards others, as well as increased self-harming behaviors (Dowson & Blackwell, 2010). As such, it is imperative that intervention strategies for individuals with ADHD directly target improvements in EI. A better understanding of the mechanisms that underlie the relationship between ADHD and EI may lead to more effective treatment strategies that reduce emotional processing deficits and subsequently improve relationships among these individuals.

One such mechanism is executive functioning (EF), which is associated with organizing, prioritizing, regulating alertness and

effort, managing frustration and emotions, utilizing working memory, and self-regulatory actions (Boonstra et al., 2005). EF deficits are central in ADHD (Antshel et al., 2014) and are associated with functional impairments (Brown et al., 2013) in areas including, but not limited to, writing skills (Soto et al., 2021), premorbid intelligence (Pluck & Ruales-Chieruzzi, 2021), and decision-making (Warmingham et al., 2021), as well as deficits in emotion regulation (Groves et al., 2021). Specifically, as ADHD symptom severity increases, both executive dysfunction (Sjöwall & Thorell, 2022) and functional impairments (Caleb et al., 2022) worsen. Research has also demonstrated a significant relationship between deficits in EF and EI, suggesting that both emotion generation and expression are negatively impacted by the presence of executive functioning deficits (Henry et al., 2006; Stephens et al., 2022). Similarly, significant associations have been found between ADHD, EF, depressive/anxiety symptoms, and quality of life (QoL), and EF deficits in combination with emotive symptoms have significantly mediated those relationships (Zhang et al., 2021). Taken together, this research suggests that EF deficits play an important role in the functional and emotional impairments associated with ADHD, and thus ought to be explored as a potential mechanism in the ADHD-EI relationship.

In addition to EF deficits, ADHD has been associated with the increased symptoms of sluggish cognitive tempo (SCT), which is characterized by lethargy, absent-mindedness, sluggishness, and daydreaming (Barkley, 2011a; Gafoor, 2022; Penny et al., 2009) and has been linked specifically to the inattentive symptoms of ADHD (Carlson & Mann, 2002; Garner et al., 2010; Hartman et al., 2004), social impairments (Becker & Langberg, 2013; Carlson & Mann, 2002; Garner et al., 2010; Mikami et al., 2007), and academic difficulties (Becker & Langberg, 2013). Currently, the literature suggests that SCT and ADHD are unique psychological constructs (Barkley, 2014; Becker & Barkley, 2018; Burns et al., 2013; Gafoor, 2022; Garner et al., 2013; Servera, et. al., 2018) that when co-occurring together, increase the risk for poor outcomes (Camprodon-Rosana et al., 2017; Watabe et al., 2014). Similarly, emotional impairments have been noted as central to the construct of SCT (Becker & Barkley, 2018; Becker et al., 2020; Mueller et al., 2014; Ferretti et al., 2019; Sevincok et al., 2021; Taylor et al., 2020). Research has demonstrated the negative impacts of SCT on EI in

individuals with ADHD, suggesting that emotion regulation was impaired when SCT symptoms were present (Becker et al., 2018). Taken together, this literature suggests SCT as a viable mediator and potential treatment target in the ADHD-EI relationship.

Given the functional impairments associated with the relationship between ADHD and EI, it is important to identify potential mechanisms that may increase vulnerability among individuals with ADHD, and EF and SCT may be potential factors that influence the severity of this relationship. The primary aim of the present study is to examine the potential mediating roles of EF and SCT individually in the ADHD-EI relationship. We hypothesized that a) ADHD would be associated with deficits in EI, EF, and SCT, and b) EF and SCT would at least partially mediate the ADHD-EI relationship. This study is the first to our knowledge to examine EF and SCT as mediators in the association between ADHD and EI deficits.

Methods

Participants and Procedures

All procedures were approved by the Westminster College Institutional Review Board. Participants ($n=50$; aged 18-21) were recruited on a volunteer basis from the Westminster College student population. No exclusion criteria were used. Following informed consent, participants completed a series of self-report measures (described in detail below) and a Continuous Performance Task (CPT) (initial analyses demonstrated significant ceiling effects in performance and was unrelated to ADHD symptom reports, r 's $<.17$, p 's $>.26$); order of assessment was counterbalanced across participants. All procedures took place in a designated testing area, which included a chair, computer, and white noise machine. Following completion of the study procedures, participants were debriefed and remunerated with a \$10 gift card for their participation.

Measures

Barkley Adult ADHD Rating Scale-IV (BAARS-IV). The BAARS-IV (Barkley, 2011a) is a measure used to assess symptoms of inattention, hyperactivity, impulsivity, and SCT in adults. Both summary scores and symptom counts can be derived from item responses. This measure was used to calculate the predictor variable

(ADHD symptoms), as well as one of the potential mediators (SCT). The BAARS-IV demonstrates satisfactory psychometric properties (for a review, see Barkley, 2011a).

Barkley Deficits in Executive Functioning Scale (BDEFS). The BDEFS (Barkley, 2011b) is an assessment of executive functioning components in everyday life. This measure was used to calculate one of the potential mediators (EF). Similar to the BAARS-IV, BDEFS demonstrates appropriate psychometric properties (for a review, see Barkley, 2011b).

Barkley Functional Impairment Scale (BFIS). The long form of the BFIS (Barkley, 2011c) evaluates fifteen domains of adult functioning and the associated functional impairment experienced. Again, the BFIS demonstrates adequate psychometric properties (for a review, see Barkley, 2011c).

Self-Report Emotional Intelligence Scale-Revised (SREIS-R). The SREIS-R is a measure of emotional intelligence based upon the following domains: perceiving, usage, understanding, managing self, and social management of emotions. This measure was used to estimate the outcome variable (EI). The SREIS-R demonstrates satisfactory construct validity and reliability (for a review, see Brackett et al., 2006).

Data Analysis

Using the scoring procedures outlined in the BAARS-IV manual (Barkley, 2011a), ADHD total symptom scores were computed for each participant by calculating the sum of the Inattention, Hyperactivity, and Impulsivity subscales (the SCT subscale was not included in the total symptom calculation). To assess mediation, a series of regressions were run utilizing the PROCESS macro developed by Andrew F. Hayes (Hayes, 2013) for IBM SPSS Statistics, version 27.

Results

Table 1 displays demographic and descriptive information for 49 participants, as one participant was dropped from the study for inaccurate completion of assessments. In sum, the sample consisted of mostly White, female students with no previous diagnosis of ADHD, EF disorder, or mood disorder. Table 2 displays descriptive data derived from the self-report measures. Despite the report of minimal previous diagnoses, results suggested variability in reporting ADHD symptoms.

Table 1. Demographic Characteristics

Variable	%
Ethnicity (White)	85.7
Gender (Female)	75.5
STEM Major	40.8
Previous ADHD Diagnosis	10.2
Previous EF Disorder Diagnosis	6.1
Previous Emotion/Mood Disorder Diagnosis	22.4

Note: The mean age of the sample was 19.35 years old (SD = 1.28).

Table 2. Descriptive Statistics for Self-Report Measures

Variable	ADHD	SCT	EF	Impairment	EI
Symptom Count	6.40 (4.03)	4.21 (2.48)	6.21(4.64)	1.69 (2.63)	--
Summary Score	76.00 (13.01)	22.98 (5.38)	41.98 (11.68)	31.76 (21.48)	40.73 (9.42)

Note: The calculation of ADHD symptoms does not include the SCT factor from the BAARS-IV. Values represent Mean (SE).

All tested pathways in the mediational analyses are displayed in Figure 1. Consistent with hypotheses, ADHD significantly predicted EI, EF and SCT (p 's<.001). Contrary to hypotheses, neither EF (Figure 1a; $R^2 = .26$, indirect effect = $-.14$, $SE = .14$, 95%CI = $-.43$, $.12$) nor SCT (Figure 1b; $R^2 = .25$, indirect effect = $-.06$, $SE = .10$, 95%CI = $-.24$, $.14$) significantly mediated the relationship between ADHD and EI.

Figure 1. Mediation Analyses

Figure 1a. Executive Functioning

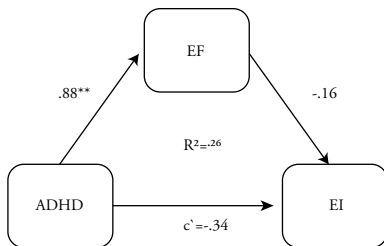
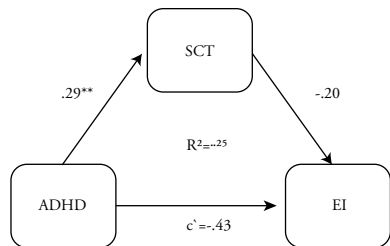


Figure 1b. Sluggish Cognitive Tempo (SCT)



Note: Values reflect regression coefficients. ** $p < .001$, * $p < .05$, ***significant indirect effect.

Discussion

The primary aim of the present study was to better understand the relationship between ADHD and EI by exploring potential mechanisms of action to inform more effective treatments for individuals with ADHD. Specifically, we sought to examine the extent to which EF and SCT mediated the ADHD-EI relationship. Results of the present study replicated previous research demonstrating relationships between ADHD and EI (Quintero et al., 2020), EF (Brown et al., 2013), and SCT (Leikauf & Solanto, 2017; Becker & Barkley, 2018). However, contrary to our expectations neither EF nor SCT significantly mediated the ADHD-EI relationship.

One potential explanation for the lack of mediation lies within the methodology implemented. The present study utilized self-report measures of EF and SCT which has demonstrated validity-related limitations (William et al., 2017). Previous research has suggested that alternative EF measures incorporating more difficult computerized tasks ought to be utilized to assess deficits among adult samples (Faria et al., 2015). Similarly, new scales have been developed that specifically and more comprehensively assess the entire construct of SCT (McBurnett et al., 2014; Penny et al., 2009; Pfiffner et al., 2007). Future research should consider implementing a multi-modal assessment of EF and SCT that includes both self-report and behavioral measures that demonstrate satisfactory variability and discriminability.

Beyond methodological considerations, future research ought to also consider alternative mediators that could better inform treatment and prevention efforts among adult samples. For example, research has demonstrated the genetic (Barzman et al., 2015) and physiological (Beauchaine, 2012) basis for emotion dysregulation that has been linked with adult psychopathology, and research has suggested a link between EI and emotional regulation (Zysberg & Raz, 2019). Similarly, research has demonstrated significant relationships between EI and self-esteem (e.g., Bibi, Saqlain, & Mussawar, 2016) and neuroticism (e.g., Smith, Sklosfke & Nordstokke, 2014), both of which have been associated with ADHD (Harpin, Mazzone, Kahle, & Hodgkins, 2013; White, 1999). Moving forward, it will be important to consider the role of these constructs in impairing the relationship between ADHD and EI.

Although this is the first study to our knowledge to investigate SCT and EF as potential mediators of the ADHD-EI relationship, it is not without limitations. In addition to the methodological considerations described above, the present study utilized self-report measures of all constructs, including ADHD symptomatology, which can be problematic among individuals with symptoms of ADHD (Sibley et al., 2010). Future studies ought to consider the use of collateral report of such constructs. Additionally, the present study utilized a small sample, thus limiting generalizability. Future research should include a larger and more diverse sample, such as those obtained through crowdsourcing platforms (Mortensen & Hughes, 2018).

In sum, although neither EF nor SCT mediated the ADHD-EI relationship, the present study highlights the need for more research into this important relationship and has outlined several steps for future research to take in this investigation. A better understanding of the mechanisms that underlie this relationship will provide more specific targets for intervention efforts. This specificity will reduce the significant impairment associated with the relationship between ADHD and deficient emotional intelligence.

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