

The Mediating Role of Emotion Regulation on the Relation between ADHD Symptoms, Cognitive Disengagement Syndrome of Anxiety and Depression among College Students

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Abstract

Introduction: The purpose of the present study was to extend previous knowledge concerning the link between Attention-Deficit/Hyperactivity Disorder (ADHD) and cognitive disengagement syndrome with anxiety and depression by examining the mediating role of emotion dysregulation among Iranian college students.

Method: In 2022, the sample of the study consisted of 612 college students (493 females, 119 males) in the age group of 18–40 years from various universities in Iran which were selected using convenience sampling. The used measures were the Barkley Adult ADHD Rating Scale (BAARS), Gross Emotion Regulation Strategies Questionnaire (ERQ), and questions from the Beck Depression Inventory-Second Edition (BDI-II) and Beck Anxiety Inventory (BAI).

Results: The findings of the study revealed that at a significance level of 0.05, the reappraisal strategy mediates the relationship between hyperactivity and impulsivity symptoms with symptoms of anxiety and depression. Conversely, the suppression strategy mediates the relationship between impulsivity and cognitive disengagement syndrome with symptoms of depression.

Conclusion: In the treatment of ADHD, intervention in emotion regulation strategies can affect the efficiency of the treatment.

Keywords: Cognitive Disengagement Syndrome, Attention-Deficit/Hyperactivity Disorder, Emotional Disorders, Reappraisal, Suppression

Introduction

Attention-Deficit/Hyperactivity Disorder (ADHD) is a common and heterogeneous neurodevelopmental disorder, which is characterized by abnormal development of attention level and/or hyperactivity and impulsivity [1]. ADHD usually starts in childhood, but a high rate of it continues into adulthood [2]. The prevalence rate of ADHD is 6-10% in childhood and 4.4% in adulthood [3]. It is estimated that 2 to 12% of students have ADHD [4]. Anxiety and depression are frequently associated with ADHD symptoms [5]. Anxiety disorders can develop secondary to ADHD or independently [6]. Braaten et al. [7] presented several hypotheses related to the comorbidity of ADHD and anxiety disorders: the first hypothesis suggests that ADHD and anxiety disorders are different manifestations of the same genetic risk factor, the second hypothesis states that patients with comorbidity ADHD and anxiety disorders form a distinct subtype of ADHD and the third theory; ADHD and anxiety disorders are transmitted independently.

In adulthood, mood disorders such as major depression and persistent depressive disorder are also among the most common comorbid disorders with ADHD [8, 9]. The prevalence of mood disorders in ADHD ranges from approximately 3% in childhood to approximately 6% in adolescence, 25% in young adults, and 70% in adults over 30 years old [10]. The lifetime prevalence of major depressive disorder in adolescents and adults with ADHD is significantly higher (up to 55%) than in non-afflicted people. Most importantly, longitudinal studies show that children and adolescents with ADHD are at risk of developing depression when they reach adulthood. Better understanding of the factors that contribute to the increased risk of depression in patients with ADHD, can create new opportunities for the development of prevention and early intervention strategies [11].

In recent years, there has been a growing focus on Emotion Regulation (ER) in studies examining the emotional challenges associated with ADHD (12). Murray et al.'s research [5] shows that emotion dysregulation significantly mediates the relationship between ADHD and anxiety and depression disorders. Research by Reimherr et al. [13] also shows that adults with ADHD and high levels of anxiety symptoms show emotion dysregulation. As per Gross [14], emotional self-regulation, or ER, entails a multifaceted process through which individuals regulate their emotions to guide their behavior towards specific goals, employing strategies such as cognitive change (e.g., reappraisal) and response modulation (e.g., suppression). This process initiates when preexisting responses conflicting with the intended goal surface [15]. About 70% of adults with ADHD report emotion dysregulation or emotional instability [16]. In review studies, there are different conceptualizations of ADHD comorbidity and emotion dysregulation. The first model conceptualizes emotional dysregulation as a core symptom of ADHD based on the continuum of neurological deficits, so that emotional dysregulation in ADHD is based on broader aspects of self-regulation and executive control. The second model posits that emotional dysregulation necessitates certain distinct neuropsychological components beyond mere executive functioning deficits. Hence, it appears that emotion dysregulation and ADHD are interrelated yet distinct dimensions, characterized by overlapping and distinct neurological deficits. They actually have a separate identity. The third pattern emphasizes the need to consider the comorbidity of ADHD and emotion dysregulation as an independent entity due to the observed overlap between ADHD and emotion dysregulation [17].

In recent years, researchers have increasingly explored Cognitive Disengagement Syndrome (CDS) alongside emotional dysregulation in studies examining ADHD and its comorbid disorders. The CDS is a term for a cluster of symptoms that includes excessive daydreaming, mental confusion and foggy, slowed behavior and thinking [18], inactivity, sleepiness, daytime sleepiness, and lethargy. The CDS in adults is associated with endocrine disorders and attention deficit symptoms of ADHD [19].

Although it is currently unclear whether CDS is better described as a distinct diagnosis or a trans-diagnostic concept, symptoms of CDS occur frequently in clinical populations and are particularly often reported in ADHD samples [20]. Few studies have examined CDS in relation to emotion, but existing research shows that CDS is related to problems in emotional functioning or specifically problems in emotional regulation. CDS is significantly associated with endogenous symptoms such as anxiety and depression, and it has been well established that endogenous symptoms themselves are related to problems in experienced emotions and cognitive behavioral regulation of negative emotions. As emerging studies suggest that CDS may be more related to internalizing symptoms than externalizing psychopathology, it is reasonable to expect that CDS is associated with ER difficulties [21].

Despite the extensive research on Emotional Dysregulation (ED) in children with ADHD, there is a lack of understanding regarding ED in adults with ADHD. The discrepancies in aspects related to ER between individuals with and without ADHD remain inconclusive. For instance, while some studies suggest that adults with ADHD tend to utilize maladaptive ER strategies like emotional suppression more frequently than controls [22, 23], others do not support this finding [24]. In this study, we aim to investigate the mediating role of ER strategies in the relationship between ADHD symptoms (including attention deficit, hyperactivity, and impulsivity) and CDS, with symptoms of anxiety and depression.

Method

The current study is descriptive and employs correlation and path analysis methodologies. The research population consists of students from various regions across Iran. There are diverse perspectives on determining sample sizes for multivariate correlation studies, ranging from a minimum of 10 [25] to 20 [26] observations per predictor variable, up to $n=500$ [27]. Considering the required sample size based on these references, this study, with six predictive variables, included 612 participants.

Participants were recruited from different Iranian universities in 2022, including Ferdowsi University of Mashhad, Babol University of Medical Sciences, Mazandaran University of Medical Sciences, Mazandaran University, Jiroft University of Medical Sciences, and Bahonar University of Kerman. Electronic questionnaires were designed and distributed via student groups (online). Using convenience sampling, 119 men and 493 women aged 18 to 40, with an average age of 24, completed the electronic surveys. Prior to accessing the questionnaire section, participants were required to provide voluntary and informed consent by filling out a consent form placed at the beginning of the questionnaire.

This research has been registered with the IR.UM.REC.1398.079 code of ethics at Ferdowsi University of Mashhad.

The tools used in this study were as follows;

Barkley Adult ADHD Rating Scale (BAARS): This scale is the result of 20 years of Barkley's research, which is based on the diagnostic criteria of ADHD in DSM-IV-TR and experimental evidence. This 27-question scale is a self-report tool for people aged 18 to 73 years. Answering is based on a four-point Likert scale (never to always). This scale has four subscales. The 27 questions of this scale measure the three main symptoms of ADHD, i.e. attention deficit (nine questions), hyperactivity (five questions) and impulsivity (four questions). In addition, the other nine questions of this scale measure the CDS component. The implementation of this scale usually takes 5 to 7 minutes. Cronbach's alpha coefficient was reported as 0.91 for the whole scale and 0.90, 0.77, and 0.80 for the subscale of attention deficit, hyperactivity, and impulsivity, respectively. Also, the test-retest reliability coefficient for the whole scale is 0.75 and for the subscale of attention deficit, hyperactivity, and impulsivity, it is reported as 0.66, 0.72, and 0.76, respectively, and of which are significant at the 0.001 level [28]. In Mashhadi et al.'s study [29], Cronbach's alpha method, correlation of subscales with the total score, and confirmatory factor analysis were used to investigate the psychometric properties of the Persian form of the BAARS scale. Cronbach's alpha coefficients for the total score of the scale were 0.86 and for the subscales of attention deficit, hyperactivity, impulsivity and CDS were reported as 0.82, 0.72, 0.70 and 0.83, respectively. Furthermore, the correlation coefficients of attention deficit component, hyperactivity, impulsivity and CDS with the overall score of the scale were 0.87, 0.80, 0.74 and 0.68, respectively. In this study, the Cronbach's alpha coefficients for the total score of the scale were 0.90, indicating high internal consistency. Additionally, for the subscales of attention deficit, hyperactivity, impulsivity, and CDS, the coefficients were 0.86, 0.86, 0.70, and 0.87, respectively. These values suggest strong internal reliability for each assessed dimension.

It should be mentioned that the symptoms of CDS in the present study were measured by the final nine questions of the BAARS.

Beck Anxiety Inventory (BAI): This questionnaire is a 21-item scale introduced by Beck et al. in 1990. In each subject, the subject chooses one of the four options that indicate the intensity of anxiety. The four options of each question are scored on a four-part scale from 0 to 3. Each test item describes one of the common symptoms of anxiety (mental, physical and panic symptoms). Therefore, the total score of this questionnaire is in the range of 0 to 63. The suggested cut-off points for this questionnaire are: 0 to 7 scores of none or the lowest, 8 to 15 mild, 16 to 25 moderate and 26 to 63 severe. The conducted studies show that this questionnaire has high reliability and validity. Its internal consistency coefficient (alpha coefficient) is 0.92, its reliability is 0.75 with the retest method after one week, and the correlation of its items varies from 0.30 to 0.76. Five types of content validity, concurrent, construct, diagnostic and factor have been measured for this test, which all indicate the high efficiency of this tool in measuring the intensity of anxiety [30]. In examining the psychometric properties of this test

in the Iranian population, they reported a validity coefficient of about 0.72, the test-retest reliability coefficient of 0.83 and Cronbach's alpha of 0.92 after one month [31].

Beck Depression Inventory-II (BDI-II): The BDI was first developed in 1961 by Beck et al. and was substantially revised in 1996. The BDI-II is the revised form of the BDI, which was developed to measure the severity of depression. The revised form of the BDI is more compatible with DSM-IV compared to the original form and covers all the elements of depression based on the cognitive theory of depression. This inventory consists of 21 items, for each item the subject chooses one of the four options that indicate the severity of the depression symptom. Each item gets a score between 0 and 3, and thus the total score of the inventory ranges from 0 to 63. This inventory can be used in the population of 13 years and above. The 21 items of the BDI are classified into three groups: emotional symptoms, cognitive symptoms, and physical symptoms. Psychometric studies conducted on this inventory show that it has good validity and reliability [32]. The internal consistency of this tool has been reported as 0.73 to 0.92 with an average of 0.86 and alpha coefficient for the patient group as 0.86 and for the non-patient group as 0.81. The internal consistency method was used to study the validity of the BDI-II Iranian form. The value of Cronbach's alpha coefficients for the whole inventory was reported as 0.86, for the first (cognitive-emotional) factor as 0.84, and for the second (physical) factor as 0.78 [31].

Emotion Regulation Questionnaire (ERQ): This questionnaire was designed in 2003 by Gross and John to evaluate two ER strategies including suppression and cognitive reappraisal. This questionnaire has 10 items that are graded on a 7-point scale from completely disagree to completely agree. Cronbach's alpha coefficient is 79.0 for reappraisal, 73.0 for suppression and 69.0 for the entire scale. The internal consistency coefficient of this scale at Milan University has been obtained from 48.0 to 68.0 for reappraisal and from 42.0 to 63.0 for suppression [33]. In Iran, Basharat obtained the psychometric characteristics of this questionnaire in 2008. In Tashek's research in 2011, Cronbach's alpha of the reappraisal scale was 87.0 and the suppression scale was 90.0. In confirmatory factor analysis, acceptable fit indices were obtained [34].

Results

Among the students participating in the research, which were 612 people in total, undergraduate students were the most frequent (255 people) and doctoral students were the least frequent (55 people). There were 493 girls and 119 boys. Also, there were 487 single individuals and 125 married individuals. In this sample of students, there were 523 people without a history of psychiatric diseases and 89 with a history of the disease. In the field of drug use, there were 531 people without a history and 81 people with a history of drug use. The average age and GPA of this sample group were 24.60 and 17.36, respectively. The descriptive statistics for the research variables have been presented in Table 1.

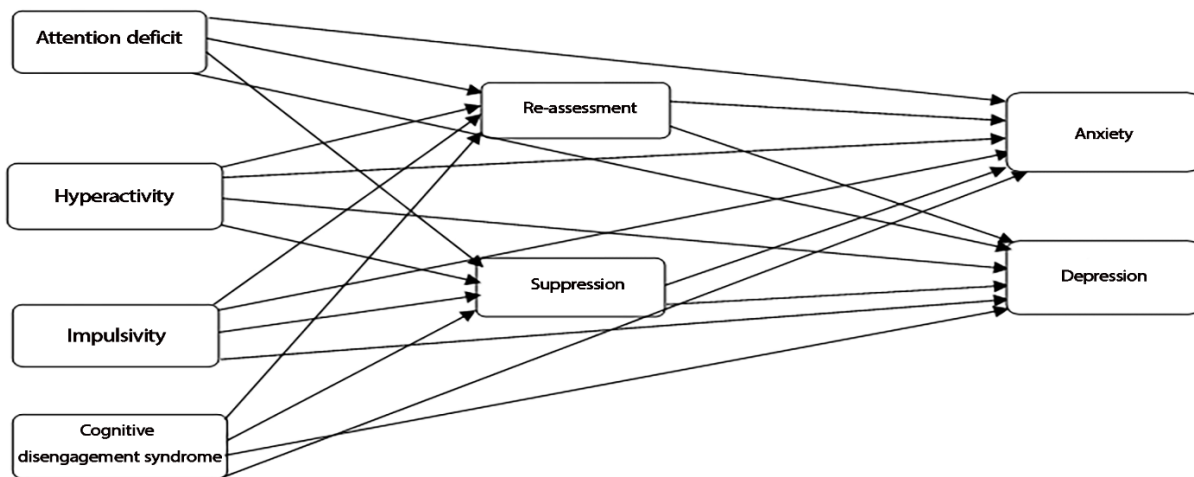


Figure 1. The conceptual model of the research.

Table 1. Descriptive Statistics of Research Variables

Variable	Subscale	Mean	SD	skewness	kurtosis
Symptoms of DHD	Attention deficit	15.79	4.80	1.73	4.22
	hyperactivity	8.00	3.03	1.44	2.48
	impulsivity	6.47	2.21	1.28	1.86
Emotion regulation	Re-assessment	24.49	8.19	-0.28	-0.44
	Suppression	13.52	6.13	0.24	-0.98
Cognitive disengagement syndrome		19.47	5.80	0.87	0.23
Anxiety		14.07	11.99	1.34	1.60
Depression		17.08	13.31	1.38	1.69

Pearson's correlation coefficients for the relationship between ADHD symptoms and anxiety ranged from 0.35 to 0.62 and with depression from 0.42 to 0.66, and all these coefficients were significant at the level of 0.001. The relationship between CDS with anxiety was 0.57 and with depression was 0.69, both of which were significant at the level of 0.001. In addition, these results showed that among ADHD symptoms, only the relationship between impulsivity and reappraisal component was significant ($r=0.01$, $p<0.10$). For the relationship between ADHD symptoms and another component of ER, i.e. suppression, the results showed that attention deficit has a significant positive relationship ($r=0.001$, $p<0.13$) and impulsivity has a significant negative relationship ($r=0.01$, $p<0.11$) with this component. CDS had a positive and significant relationship with both components of ER, i.e. reappraisal ($r=0.35$) and suppression ($r=0.16$) at the level of 0.001. Finally, the relationships of ER components with anxiety and depression were such that re-evaluation had a significant negative relationship at the level of 0.001 with anxiety ($r=-0.18$) and depression ($r=-0.24$). However, the suppression component showed a significant positive relationship with depression ($r=0.05$, $p<0.10$).

To check the normality of the scores of the research

variables, skewness and kurtosis indices were used, which were not more than 3 and 10, respectively (Table 1). Referring to the opinion of Chou and Bentler [35] about the skewness index (cut point ± 3) and the opinion of Kline [36] about the kurtosis index (values less than ± 10), it can be said that the distribution of scores for the research variables was normal. Also, to check the absence of multiple collinearities variance inflation and tolerance factor statistics were used, according to the resulting values, variance inflation for predictor variables was not greater than 10 (between 1.21 and 3.60) and all tolerance values for These variables were also between zero and one (between 0.27 and 0.82). Therefore, there was no multicollinearity between predictor variables and this assumption was also maintained. In total, the results of the above investigations indicated that the statistical assumptions were established, and therefore, the use of path analysis was not an obstacle. The results indicated that this model did not fit. This is because the overall fit indices did not have the necessary standards. These standards [37] along with the results of the initial model review are reported in Table 2, and the misfit model is also presented in Figure 2.

Table 2. Model Fit Indices

Fit index	Acceptable range	P
Chi-2 ²	-	197.77
Chi-2 ratio to degrees of freedom	Less than 3	98.88
Comparative Fit Index (CFI)	Greater than 0.90	0.94
Incremental Fit Index (IFI)	Greater than 0.90	0.94
goodness of fit index (GFI)	Greater than 0.90	0.93
Root mean square error of approximation (RMSEA)	Less than 0.1	0.40

As it can be seen in Figure 2, some paths in the model were non-significant (shown with a dashed line) and because of this, the overall fit of the model was problematic. Therefore, modifications were made to the model, during which non-significant paths were removed and the fit of the model was re-examined. Finally, the model presented in Figure 3 was confirmed with a good fit because its overall fit indices ($\chi^2/df = 2.10$, IFI = 1.00, CFI = 1.00, GFI = 0.99, 0.4 RMSEA = 0) had the standards presented in Table 2. In addition to the general indices of model fit, the path coefficients for each of the causal paths in the model are also important. Path coefficients indicate the relative strength of each path, which have been presented in Figure 3.

According to the path coefficients presented in Figure 3 for each of the causal paths from exogenous variables to

mediating and endogenous variables, and from mediating variables to endogenous variables; Exogenous variables i.e. attention deficit and CDS had positive and significant effects on both endogenous variables i.e. anxiety and depression, as well as hyperactivity on anxiety. Also, exogenous variables, i.e. hyperactivity, had a significant effect on the mediating variable of reappraisal of negative affect, impulsivity had a significant effect on the reappraisal of positive affect and suppression of negative affect, and CDS had a significant effect on suppression of positive affect. Finally, based on the information shown in Figure 3, the mediating variable i.e. reappraisal had a significant negative effect on both endogenous variables of anxiety and depression, while the other mediating variable i.e. suppression only had a significant positive effect on depression.

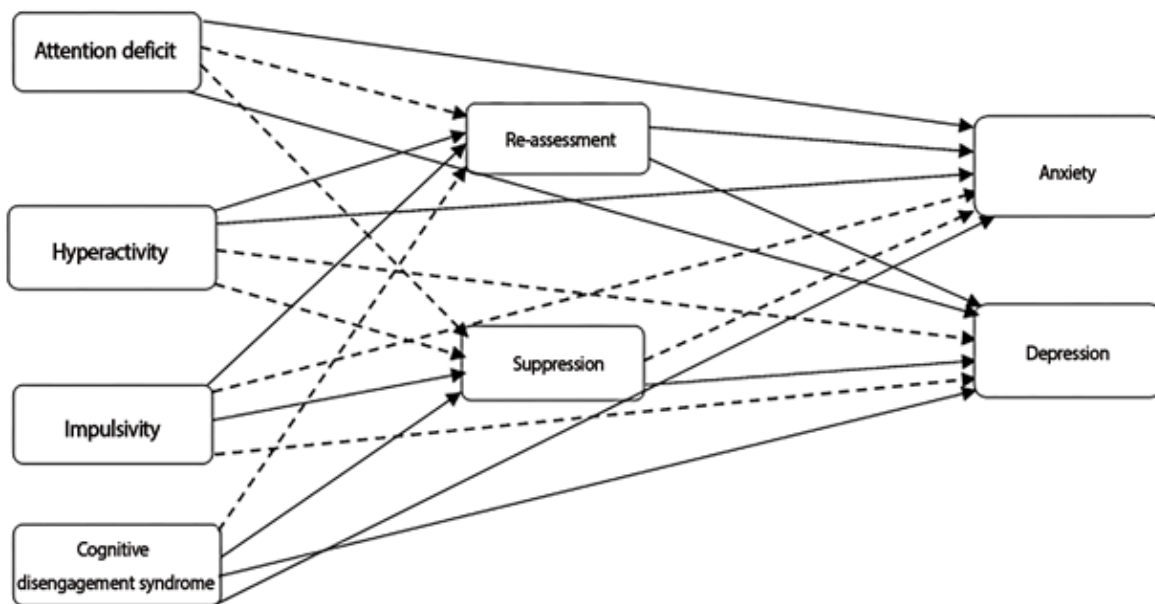


Figure 2. Misfit model.

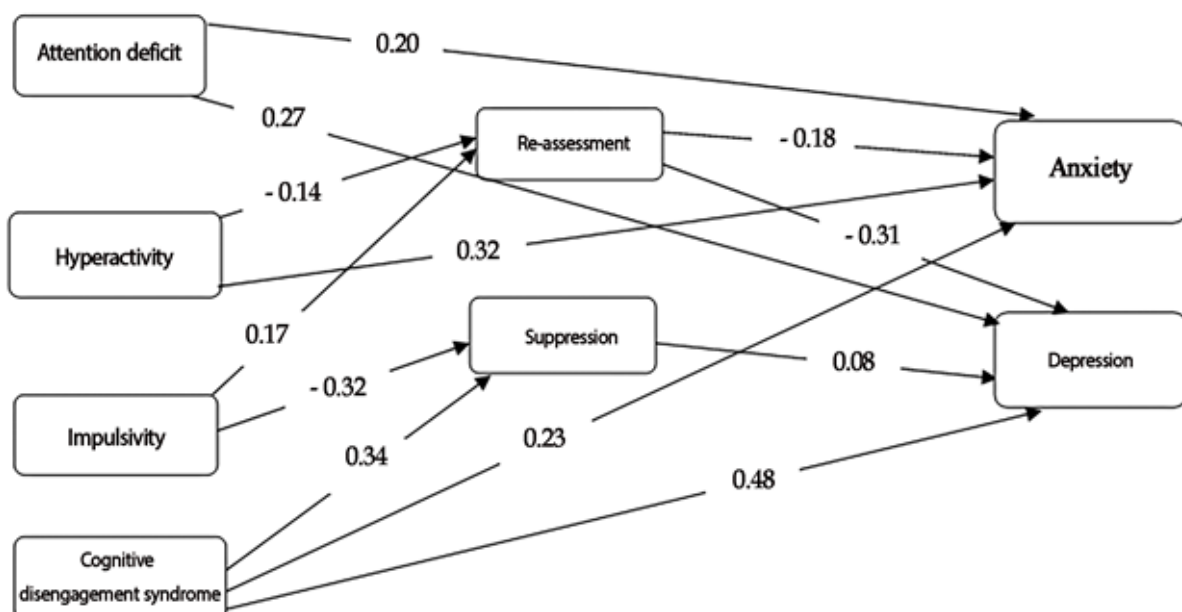


Figure 3. The verified model (all path coefficients are significant at the 0.05 level).

Table 3. Path Coefficients of Direct, Indirect and Total Effects in Final Validated Model

Variables	Direct impact	Indirect impact	Total impact
On anxiety from:			
Attention deficit	0.20	-	0.20
Hyperactivity	0.32	0.02*	0.34
Impulsivity	-	-0.03*	-0.3
Cognitive disengagement syndrome	0.23	-	0.23
On re-assessment of:	-0.18	-	0.18
Depression			
Attention deficit	0.27	-	0.27
Hyperactivity	-	0.04*	0.04
Impulsivity	-	-0.2** and 0.05*	-0.07
Cognitive disengagement syndrome	0.48	0.02*	0.50
Re-assessment	-0.31	-	-0.31
suppression	0.08	-	0.08
On re-assessment of			
hyperactivity	-0.14	-	-0.14
impulsivity	0.17	-	0.17
Suppression			
impulsivity	-0.32	-	-0.32
Cognitive disengagement syndrome	0.34	-	0.34

* Indirect effect through reappraisal

** Indirect effect through suppression

Table 3 presents the coefficients of direct, indirect and total research variables. As it can be seen in this table, among the four exogenous variables, only attention deficit and CDS had significant direct effects on anxiety and depression, and the hyperactivity variable could only have a significant direct effect on anxiety. Also, among these variables, hyperactivity and impulsivity had indirect effects on both anxiety and depression variables, and CDS only had an indirect effect on depression. It should be noted that all of these indirect effects are determined by the mediating role of reappraisal and only in the case of one of them, the indirect effect of impulsivity on depression, the suppression variable also had a mediating role. In general, it can be stated that the components of ER have been able to play a significant mediating role in the effects of symptoms of ADHD and CDS on anxiety and depression.

Discussion

The aim of this study was to explore the mediating function of ER strategies in the correlation between ADHD and CDS components with anxiety and depression among students. Given the intricate interplay between ADHD, CDS, anxiety, and depression, we chose to employ emotion dysregulation as a trans-diagnostic variable, acting as a mediator to elucidate a segment of this intricate network. We conducted a path analysis model in order to examine this relationship.

Our findings indicate that emotional dysregulation did not serve as a mediating factor in the connection between attention deficit symptoms and anxiety or depression symptoms. Attention deficit demonstrated a positive and significant direct influence on both anxiety and depression symptoms. This outcome may be elucidated by considering other contributing factors such as executive dysfunction. Previous studies [38, 39], have demonstrated that the attention deficit subtype of ADHD, via executive dysfunction, impacts the quality of life of

individuals, ultimately leading to anxiety and depression. Additionally, psychosocial challenges associated with ADHD, such as peer victimization/rejection and academic/occupational setbacks, contribute to diminished self-esteem and elevate the risk of depression and/or anxiety. In the association between hyperactivity with anxiety and depression, the reappraisal strategy emerged as a significant mediating factor, exerting a negative effect. This suggests that hyperactivity disrupts the application of the reappraisal strategy. Adults experiencing hyperactivity often feel excessively restless, impeding their ability to employ reappraisal strategies effectively, thereby heightening the likelihood of experiencing symptoms of anxiety and depression. Furthermore, our results demonstrate that the reappraisal strategy mediates the relationship between impulsivity and anxiety and depression. Impulsivity is linked to increased utilization of the reappraisal strategy, consequently reducing symptoms of anxiety and depression. This finding warrants further investigation to elucidate the role of moderating factors and aligns with studies indicating a higher comorbidity of internalizing disorders with the attention deficit subtype of ADHD compared to other ADHD subtypes [40]. The reappraisal strategy did not serve as a mediator in the correlation between CDS and anxiety or depression. However, the suppression strategy did play a mediating role in the relationship between CDS and depression. Symptoms of CDS are linked to heightened utilization of the suppression mechanism, consequently contributing to elevated depression symptoms. This discovery aligns with prior research that emphasizes the association between CDS and depression rather than anxiety [41].

In addition, the role of learning and its important effect on ER strategies should not be overlooked. Parents of children with ADHD usually face greater educational and parenting challenges that can challenge their adaptive ER strategies and as a result, in the long term, affect directly

and indirectly on children's ER strategies or the experience of anxiety and depression symptoms in them. Another factor influencing ER strategies as a mediating variable is the presence of other comorbid disorders, such as personality disorders and substance abuse. These disorders, which were not investigated or controlled for in the present study, could potentially elucidate some of the strong and weak effects observed in the study's results. The observed effects may be significantly influenced by executive dysfunction, as executive functions and ER are often closely intertwined. It is believed that ER alongside cognitive and social regulation, evolves and becomes more intricate, relying on fundamental components such as inhibition, attention, working memory, and shifting. However, this study did not explore executive dysfunction. By investigating or controlling its effects, clearer explanations for the observed effects could be offered. Furthermore, delving into the neuropsychological mechanisms underlying ADHD symptoms, CDS, and emotional dysregulation could shed light on other aspects of the effects observed in this study.

Conclusion

This study aimed to explore the mediating role of ER strategies in the correlation between ADHD symptoms and CDS with symptoms of anxiety and depression disorders. Our results showed that the suppression strategy in ER has a mediating role in the relationship between CDS and depression. Among the symptoms of ADHD, the reappraisal strategy in ER plays a mediating role in the relationship between hyperactivity and anxiety and depression. While in the relationship between impulsivity and anxiety, reappraisal strategy and in the relationship between impulsivity and depression, suppression strategy has a mediating role. It is worth mentioning that in the relationship between attention deficit and anxiety and depression, no mediating role was found for ER strategies. The present study's limitation stemmed from the absence of control over the specific types of psychotherapy and medication administered, potentially influencing symptom severity and ER approaches. Future research investigating the interplay between ADHD symptoms and emotional disorders should explore the impact of avoidance strategies in ER as well as the effects of executive dysfunctions

Conflict of Interest

There is no conflict of interest between the authors.

Ethical Approval

All ethics were considered in the present study.

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References

- Baker BH, Lugo-Candelas C, Wu H, Laue HE, Boivin A, Gillet V, et al. Association of prenatal acetaminophen exposure measured in meconium with risk of attention-deficit/hyperactivity disorder mediated by frontoparietal network brain connectivity. *JAMA pediatrics*. 2020;174(11):1073-81. doi:10.1001/jamapediatrics.2020.3080
- Franke B, Michelini G, Asherson P, Banaschewski T, Buitelaar JK, et al. Live fast, die young? A review on the developmental trajectories of ADHD across the lifespan. *European Neuropsychopharmacology*. 2018;28(10):1059-88. <https://doi.org/10.1016/j.euroneuro.2018.08.001>
- Anbarasan D, Kitchin M, Adler LA. Screening for adult ADHD. *Current psychiatry reports*. 2020;22:1-5. <https://doi.org/10.1007/s11920-020-01194-9>
- Banaschewski T, Coghill D, Zuddas A. Oxford textbook of attention deficit hyperactivity disorder: Oxford University Press; 2018.
- Murray AL, Wong S-C, Obsuth I, Rhodes S, Eisner M, Ribeaud D. An ecological momentary assessment study of the role of emotional dysregulation in co-occurring ADHD and internalising symptoms in adulthood. *Journal of Affective Disorders*. 2021;281:708-13. <https://doi.org/10.1016/j.jad.2020.11.086>
- Halldorsdottir T, Ollendick TH, Ginsburg G, Sherrill J, Kendall PC, Walkup J, et al. Treatment outcomes in anxious youth with and without comorbid ADHD in the CAMS. *Journal of Clinical Child & Adolescent Psychology*. 2015;44(6):985-91. <https://doi.org/10.1080/15374416.2014.952008>
- Braaten EB, Beiderman J, Monuteaux MC, Mick E, Calhoun E, Cattan G, Faraone SV. Revisiting the association between attention-deficit/hyperactivity disorder and anxiety disorders: a familial risk analysis. *Biological psychiatry*. 2003;53(1):93-9. [https://doi.org/10.1016/S0006-3223\(02\)01434-8](https://doi.org/10.1016/S0006-3223(02)01434-8)
- Solberg BS, Halmøy A, Engeland A, Igland J, Haavik J, Klungsoyr K. Gender differences in psychiatric comorbidity: a population-based study of 40 000 adults with attention deficit hyperactivity disorder. *Acta Psychiatrica Scandinavica*. 2018;137(3):176-86. <https://doi.org/10.1111/acps.12845>
- Chen Q, Hartman CA, Haavik J, Harro J, Klungsoyr K, Hegvik T-A, et al. Common psychiatric and metabolic comorbidity of adult attention-deficit/hyperactivity disorder: A population-based cross-sectional study. *PloS one*. 2018;13(9):e0204516. <https://doi.org/10.1371/journal.pone.0204516>
- Libutzki B, Ludwig S, May M, Jacobsen RH, Reif A, Hartman CA. Direct medical costs of ADHD and its comorbid conditions on basis of a claims data analysis. *European Psychiatry*. 2019;58:38-44. <https://doi.org/10.1016/j.eurpsy.2019.01.019>
- Mayer JS, Bernhard A, Fann N, Boxhoorn S, Hartman CA, Reif A, Freitag CM. Cognitive mechanisms underlying depressive disorders in ADHD: A systematic review. *Neuroscience & Biobehavioral Reviews*. 2021;121:307-45. <https://doi.org/10.1016/j.neubiorev.2020.12.018>
- Barkley RA. Emotional dysregulation is a core component of ADHD. 2015.
- Reimherr FW, Marchant BK, Gift TE, Steans TA. ADHD and anxiety: clinical significance and treatment implications. *Current psychiatry reports*. 2017;19:1-10. <https://doi.org/10.1007/s11920-017-0859-6>
- Gross JJ. Emotion regulation: Current status and future prospects. *Psychological inquiry*. 2015;26(1):1-26. <https://doi.org/10.1080/1047840X.2014.940781>
- Soler-Gutiérrez A-M, Pérez-González J-C, Mayas J. Evidence of emotion dysregulation as a core symptom of adult ADHD: A systematic review. *PloS one*. 2023;18(1):e0280131. <https://doi.org/10.1371/journal.pone.0280131>
- Beheshti A, Chavanon M-L, Christiansen H. Emotion dysregulation in adults with attention deficit hyperactivity disorder: a meta-analysis. *BMC psychiatry*. 2020;20(1):1-11. <https://doi.org/10.1186/s12888-020-2442-7>
- Hirsch O, Chavanon ML, Christiansen H. Emotional dysregulation subgroups in patients with adult Attention-Deficit/Hyperactivity Disorder (ADHD): a cluster analytic approach. *Scientific Reports*. 2019;9(1):5639. <https://doi.org/10.1038/s41598-019-42018-y>
- Becker SP, Willcutt EG, Leopold DR, Fredrick JW, Smith ZR, Jacobson LA, et al. Report of a work group on sluggish cognitive tempo: Key research directions and a consensus change in terminology to cognitive disengagement syndrome. *Journal of the American Academy of Child & Adolescent Psychiatry*. 2023;62(6):629-45. <https://doi.org/10.1016/j.jaac.2022.07.821>
- Leikauf JE, Solanto MV. Sluggish cognitive tempo, internalizing symptoms, and executive function in adults with ADHD. *Journal of Attention Disorders*. 2017;21(8):701-11.

- <https://doi.org/10.1177/1087054716682337>
20. Lunsford-Avery J R, KSH, Mitchell J T. Cognitive disengagement syndrome in Adults Referred for an ADHD Evaluation: A Psychometric Analysis of Self- and Collateral Report. *Journal of Attention Disorders*. 2018;0(00):1-10.
 21. Flannery AJ, Becker SP, Luebbe AM. Does emotion dysregulation mediate the association between sluggish cognitive tempo and college students' social impairment? *Journal of attention disorders*. 2016;20(9):802-12. <https://doi.org/10.1177/1087054714527794>
 22. Shushakova A, Ohrmann P, Pedersen A. Exploring deficient emotion regulation in adult ADHD: electrophysiological evidence. *European archives of psychiatry and clinical neuroscience*. 2018;268(4):359-71. <https://doi.org/10.1007/s00406-017-0826-6>
 23. Materna L, Wiesner CD, Shushakova A, Trieloff J, Weber N, Engell A, et al. Adult patients with ADHD differ from healthy controls in implicit, but not explicit, emotion regulation. *Journal of Psychiatry and Neuroscience*. 2019;44(5):340-9. <https://doi.org/10.1503/jpn.180139>
 24. Thorell LB, Tilling H, Sjöwall D. Emotion dysregulation in adult ADHD: Introducing the comprehensive emotion regulation inventory (CERI). *Journal of Clinical and Experimental Neuropsychology*. 2020;42(7):747-58. <https://doi.org/10.1080/13803395.2020.1800595>
 25. Howell D. *Statistical Methods for Psychology*, 6th Edn Belmont. CA: Wadsworth. 1997;293.
 26. Lindeman RH, Merenda PF, Gold RZ. *Introduction to bivariate and multivariate analysis*. (No Title). 1980.
 27. Kerlinger FN. *Multiple regression in behavioral research*. 1973.
 28. Barkley RA. *Barkley Adult ADHD Rating Scale-IV (BAARS-IV)*: Guilford Press; 2011.
 29. Mashhadi A, Mirdoraghi F, Hasani J, Yaghoobi H, Hamzeloo M, Maleki ZH. The prevalence of attention deficit/hyperactivity disorder symptoms and its association with Sluggish Cognitive Tempo in Students. *Journal of Research in Behavioural Sciences*. 2014;12(1):103-11.
 30. Beck A, Steer R. *Manual of the Beck Anxiety Inventory*. San Antonio, TX: The Psychology Corporation. Harcourt, Brace; 1990.
 31. A FA. *Psychological tests: evaluation of personality and mental health*. Tehran: Besat2012.
 32. Beck AT SR, Brown GK. *Beck depression inventory*. New York: Harcourt Brace Jovanovich1987.
 33. Gross JJ, John OP. Individual differences in two emotion regulation processes: implications for affect, relationships, and well-being. *Journal of personality and social psychology*. 2003;85(2):348. <https://psycnet.apa.org/doi/10.1037/0022-3514.85.2.348>
 34. Taherifar Z FS, Mutabi F, Mazaheri M, Fati L. The mediating role of failure of emotion regulation strategies in the relationship between negative emotion intensity and safety motivation with generalized anxiety symptoms. *Contemporary psychology Biannual Journal of the Iranian Psychological Association*. 2016;10(2):51-66.
 35. Chou C-P, Bentler PM. *Estimates and tests in structural equation modeling*. 1995.
 36. Kline RB. *Principles and practice of structural equation modeling*: Guilford publications; 2023.
 37. Schermelleh-Engel K MH, Müller H. Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. *Method Psychol Res*. 2003;8:23-74.
 38. Zhang S-Y, Qiu S-W, Pan M-R, Zhao M-J, Zhao R-J, Liu L, et al. Adult ADHD, executive function, depressive/anxiety symptoms, and quality of life: A serial two-mediator model. *Journal of affective disorders*. 2021;293:97-108. <https://doi.org/10.1016/j.jad.2021.06.020>
 39. Haugan A-LJ, Sund AM, Thomsen PH, Lydersen S, Nøvik TS. Executive functions mediate the association between ADHD symptoms and anxiety in a clinical adolescent population. *Frontiers in psychiatry*. 2022;13:834356. <https://doi.org/10.3389/fpsy.2022.834356>
 40. Sevincok D, Ozbay HC, Ozbek MM, Tunagur MT, Aksu H. ADHD symptoms in relation to internalizing and externalizing symptoms in children: The mediating role of sluggish cognitive tempo. *Nordic journal of psychiatry*. 2020;74(4):265-72. <https://doi.org/10.1080/08039488.2019.1697746>
 41. Başay Ö, Çiftçi E, Becker SP, Burns GL. Validity of sluggish cognitive tempo in Turkish children and adolescents. *Child Psychiatry & Human Development*. 2021;52:191-9. <https://doi.org/10.1007/s10578-020-01110-5>