

Structure Equation Modeling Relationship between Symptoms of ADHD based on Depression and Anxiety and Mediating Role of Mind-Wandering and Motivation

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Abstract

Introduction: Many people with Attention Deficit/Hyperactivity Disorder (ADHD) suffer from comorbidity of depression or anxiety. Also, in ADHD patients Mind-Wandering (MW) and lack of motivation are common. This study aimed to examine the mediating role of motivation and MW in the relationship between depression and anxiety with ADHD symptoms.

Method: This research was a correlational study which was run within the Structural Equation Modelling framework. The statistical population consisted of all university students of Isfahan in 2020-2021 with ADHD symptoms, of whom 211 were selected based on the stratified method at first and then by using the multi-stage clustering sampling method. The research instruments included the Barkley Adult ADHD Rating Scale-IV (BAARS-IV), Diagnostic Interview for Adult ADHD (DIVA), Mental Health questionnaire (SCL-90), Mind-Wandering questionnaire (MW), Internal Motivation Inventory (IMI), and Cattell Culture Fair Intelligence Test (CFIQ). The Maximum Likelihood Estimation and the Bootstrap test were used to evaluate the hypothesized model and indirect effects. The statistical procedures were run in SPSS24 and AMOS24.

Results: Findings revealed that the hypothesized model fit the observed data with good domain indices. Also, there was a significant indirect relationship between depression and anxiety with ADHD symptoms through the mediating role of MW. Moreover, there were significant direct relationships between depression and motivation, anxiety and MW, MW and ADHD symptoms.

Conclusion: The study findings confirmed the hypothesized model's goodness of fit. Therefore, the use of this model is recommended to identify the factors affecting ADHD symptoms in university students.

Keywords: ADHD, Adults, Anxiety, Depression, Mind-Wandering, Motivation

Introduction

Attention Deficit/Hyperactivity Disorder (ADHD) is a neuro-developmental disorder with onset in childhood and persistence into adulthood in 40 to 60 % of sufferers [1, 2]. Attention deficiency, impulsivity, unsuitable level of activity, and recently introduced sluggish cognitive tempo [3] are symptoms of the disorder. In addition to the main signs of the disorder, many people with ADHD experience the comorbidity of other psychiatric disorders like depression and anxiety. There is a bulk of evidence that refers to a high rate of adult ADHD comorbidity with depression and anxiety [4-9]. Even it is confirmed that anxiety and depression in adults with ADHD increase with age over time [10].

From the etiological point of view, a reduction of hippocampal and prefrontal cortex dopamine gating is observed which could be related to amygdala-based anxiety in children with ADHD [11]. Moreover, some research clarifies that the low rates of dopamine and serotonin in depressed people [12] have an effect on motivation and emotion. Furthermore, they have an effect on cognitive performance like decision making [13]. Thus, lack of motivation and cognitive function in people with ADHD who have depression will be predictable and as indicated before, some research have confirmed them. Also, cognitive impairments in ADHD during childhood may be responsible for anxiety and during development such anxiety exacerbates the ADHD symptoms [14]. There is growing evidence about the increase of the risk for depression by 6.5 fold within the first year of ADHD diagnosis [14, 15]; in fact, it addresses the onset of depression followed by ADHD [16]. Twin studies confirmed that ADHD and depression co-occurrence is largely explained by common genetic factors [17, 18].

Also, depression and anxiety lead to the deficiency of executive functions and consequently impairments in executive functions associated with elevated ADHD symptoms [19]. In other words, inflexibility in the information processing system is the basis of cognitive impairments in deficiency of executive functions, attention, and memory in anxious people [20]. Furthermore, there is a shred of strong evidence that attention could be destroyed with anxiety and depression [21] specially, selective attention [22] which is considered as the main symptoms of ADHD.

In ADHD patients MW and lack of motivation are common impairments. MW is defined as a deviation in the contents of thought far away from an ongoing task. This condition is considered as a very popular problem in ADHD patients [23, 24]. MW could be induced deliberately which is a good capability in some situations [25]. However, MW in ADHD people always occurs spontaneously and reflects difficulties in continual mental activity which losses topics cohesion and contents consistency [23]. Indeed, the severity of depression positively correlated with spontaneous MW [26-28]. Also, serious confrontation with anxiety could be respectively addressed as wandering thoughts and absent-mindedness which is confirmed in several studies. Based on the previous studies in anxious conditions, typical mental state of diffused attention (i.e. MW) instead of focusing on inner states is common [29-31].

Motivation in ADHD people is also a matter of conflict. Motivation is defined as getting involved in a continuum of behavior from autonomous to organized regulation [32]. Reaching the end of the continuum needs high encouragement, which is considered as the determinant of behavior like acting for obtaining rewards or avoiding punishments [33]. A low degree of motivation causes difficulty in maintaining a certain level of preparedness for action with reinforcements. ADHD people demonstrate very poor motivation to reach the end of progress, thus for this reason they fail to experience the ultimate actual rewards of the process. Some evidence illustrated the

problematic motivation of adults with ADHD [34-36]. Furthermore, the role of depression in decreasing motivation in individuals is established in other studies [13]. Millan et al. [37] refer to the crucial role of cognitive control in keeping motivated. In depression conditions, cognitive control is destroyed with the impairments of attention, concentration, and memory which are a set of processes that allow the flexible adaptation of behavior following current goals. As mentioned before, cognitive impairments due to depression or anxiety result in ADHD symptoms [20].

Motivation annihilation is prevalent in people who suffer from a high level of anxiety. Initially, a low level of anxiety arouses the emotional components of psychological activity, and according to the approach theory of activity, emotions are treated as specific signals pointing to subjectively perceived successes or failures while fulfilling a certain action. Emotions reflect the relation between motives and the accomplishment of the activity corresponding to these motives as confirmed in a previous research [38]. Emotional problems in the case of severe anxiety, in contrast, are supposed to be the evidence of motivational conflicts usually in the avoidance path.

According to the ongoing clinical controversy, evidence suggests that ADHD remains under-recognized in adults [39] and clarification about the main process involving in adult ADHD is needed. It is noted that in previous studies, it has been emphasized that ADHD symptoms are comorbid with the depression and anxiety, while here in this study, we supposed the novelty of the idea that depression and anxiety in adults have a fundamental role in the creation of ADHD symptoms. Also, based on the previous studies we could shift our attention to the mediating role of motivation and MW. In fact, the selection of variables as input, output, and mediators' variables was based on the approach of Baron and Kenny [40]. Accordingly, the present study aimed to test the model of depression and anxiety and ADHD symptoms concerning the mediating role of MW and motivation in university students who were suffering from ADHD.

Method

The university students with ADHD symptoms were selected based on initial screening with appropriate tools in Isfahan, Iran. The statistical population consisted of all university students of Isfahan in 2020-2021 with ADHD symptoms, of whom 211 students were selected purposefully based on inclusion/exclusion criteria. The participants with the following inclusion criteria were included in the sample: 1) being a university student at the time of the study, 2) having sufficient fluency in the Persian language both in reading and writing skills, 3) not using any specific psychiatric medication at the time of analysis, 4) getting a score above the cut-off point in ADHD Barkley scale and diagnostic interview of ADHD and 5) having moderate to high intelligence based on the Cattell Culture Fair Intelligence Test. The exclusion criteria were unwillingness to participate in the study and drug addiction in the period of performing analysis, and

comorbidity of other psychiatric disorders that possibly affect the analysis like bipolar or autism spectrum disorder. This resulted in acute findings of university students with ADHD symptoms.

Using the stratified sampling method, all the universities of Isfahan city were classified. Then, in each class, using the multi-stage cluster sampling method, academic departments were randomly selected, and after selecting the departments, a number of classes were randomly selected. Finally, all the students of the selected classes participated in the screening of ADHD symptoms based on the questionnaire. Actually, among 1318 Isfahan university students who participated in the screening of ADHD symptoms recall procedure, in fall 2020 about 310 university students were screened based on the cut-off point of screening questionnaires. All of them were informed about the continuation of the investigation and from the clinical point of view, they were subjected to a diagnostic interview. Accordingly, 230 students were diagnosed with ADHD symptoms based on diagnostic interview and were invited to take part in the study. Out of them, 211 university students were willing to participate in the present research. Finally, based on the multivariate index of normality of data in AMOS software, 11 students were excluded from the structural equation modeling as outliers. Thus, the sample of analysis consisted of 200 university students with ADHD symptoms. Considering the adequacy of the size of sample it should be noted that the sample size in SEM is often considered based on the number of free parameters. However, there are several controversies over the exact number of participants per parameter. For example, Bentler and Chou [41] suggested that a ratio as low as five cases per variable is sufficient while Kline [42], proposed the ratio of 10- 20:1 is suitable. Accordingly, 200 participants as the sample size of the present study are proper to perform SEM analysis.

Ethical approval was granted by the relevant university committee. All study procedures including informed consent (before testing) were compiled on APA ethical guidelines and approved by the ethics committee of the University of Isfahan with the ethical code of: IR.UI.REC.1399.100.

The tools used in this study were as follows:

Diagnostic Interview for ADHD in Adults (DIVA): The DIVA [43] was used for screening ADHD in university students. The interview consists of three sections including 1) the criteria for attention deficit (A1), 2) the criteria for hyperactivity-impulsivity (A2), and 3) the age of onset and impairment accounted for ADHD symptoms. To simplify the evaluation of each of the 18 symptom criteria for ADHD, the interview manual provides a list of concrete and realistic examples, for both current and retrospective (childhood) behavior. Diagnosis of ADHD symptoms in university students was decided based on five or more symptoms present in each section.

Barkley Adult ADHD Rating Scale-IV (BAARS-IV): This scale was used for obtaining ADHD symptoms. It actually consists of 30 items subdivided into four subscales: attention deficiency (9 items, NO. 1- 9), hyperactivity (5

items, NO. 10- 14), impulsivity (5 items, NO. 15-19), and sluggish cognitive tempo (8 items, NO. 20- 27) with response scale ranging from 1 to 4 and cut-off point about 39. The scores range from 27 to 108 and the higher the scores indicate the greater the severity of the disorder. The internal consistency of the total questionnaire was reported as 0.91 and that of subscales was 0.9, 0.77, 0.87, and 0.86 [44]. The Iranian version has an internal consistency of 0.7, 0.83, 0.85, 0.81, and 0.86, respectively [45]. The Cronbach's Alpha of the total items in the present study was 0.94, attention deficit 0.91, impulsivity 0.92, hyperactivity 0.94, and sluggish cognitive tempo 0.94.

Symptom Checklist-90 (SCL90-R): The subscales of depression and anxiety in SCL-90 developed by Derogatis [46] were used to assess the depression and anxiety severity of the participants. The internal consistency of the questionnaire was checked through various studies and reports from 0.82 to 0.98 for SCL90R subscales [46]. The Persian-converted version of the SCL-90 with 90 items in nine subscales was approved in a study; internal consistency for all dimensions of the questionnaire was over 0.70 and the correlation coefficient of the questionnaire based on pre-test and post-test was 0.97. [47]. Each item is scored on a scale from 0 to 4 based on how much an individual was bothered by each item in the last week. The score in depression ranges from 0 to 52 and in anxiety from 0 to 40. The higher the score, the more severe of problems in mental health dimensions. In the present study, Cronbach's Alpha was 0.83 for the depression sub-scale and 0.86 for the anxiety sub-scale. It is noted that other sub-scales of the questionnaire were used to check the exclusion criteria of the participants.

Mind-Wandering Questionnaire (MW): To obtain MW scores of the participants with ADHD symptoms, the MW scale of Carriere, et al. [47] was used. This scale consists of seven items in two subscales which are spontaneous (items NO. 1-3) and deliberate (items NO. 4- 7) MW with a response scale from 1 to 7. The spontaneous sub-scale range from 3 to 21 and the deliberate sub-scale range from 4 to 28. In each subscale, a higher score means more MW. The psychometric properties of the scale in the original study were evaluated as 0.88 for deliberate MW and 0.84 for spontaneous MW [47]. In the Persian version, Cronbach's Alpha of the scale was reported 0.80 [48]. In the present study, the Cronbach's Alpha was 0.87 for spontaneous and 0.82 for the deliberate sub-scale of the questionnaire.

Intrinsic Motivation Inventory (IMI): For measuring motivation, the IMI of Deci and Ryan [49] was administered. This inventory involved 45 items in subscales including interest/enjoyment, perceived competence, effort, value/usefulness, felt pressure, and tension and perceived choice while performing a given activity, thus yielding six subscale scores, and 7-point Likert scale scoring from not at all true (1) to very true (7). The scores range from 45 to 315 and higher scores mean better internal motivation. The Cronbach's Alpha of the inventory in the English version was 0.86 with an inter-correlation of about 0.63 [49]. The Cronbach's Alpha

coefficients of the Iranian version range from 0.74 to 0.88 for sub-scales and 0.86 for the total score of the inventory. Cronbach's Alpha of the inventory with the data of this study was 0.84 for the total score.

Cattell Culture Fair Intelligence Test (CFIQ): To evaluate the normal intelligence of participants as inclusion criteria, CFIQ was used. This test attempts to measure cognitive abilities devoid of sociocultural and environmental influences and consists of three scales with non-verbal visual puzzles. This test has 50 items drawn in the form of spatial figures, which are presented in the form of four sections. The items are given in order of difficulty and each question has a right and wrong answer. The relatively high loading of the CFIQ on the fluid intelligence factor indicates that the test has a reasonably high direct concept validity concerning the concept of fluid intelligence [50]. Recent reviews about this tool have confirmed the factors of the test and it has been introduced as a tool with a good condition to check intelligence in adults [51]. Cronbach's Alpha of this tool has been reported as 0.78 in the Iranian sample [52]. In the present study, Cronbach's Alpha coefficient was 0.81. After obtaining permission from the administrators of the public and private universities of Isfahan, and based on the purposeful sampling method explained in the participant section, questionnaires were made available to participants. Informed consent was attained from them all

before the onset of the analysis. The study design is correlational with SEM analysis. The hypothesized model of depression and anxiety to ADHD symptoms with the mediating role of MW and motivation was considered. In other words, depression and anxiety as input in observed mode, MW and motivation as mediators in latent mode, and ADHD symptoms in latent mode, were considered as the output of the analysis. For interpreting the significance of direct/indirect effects, Bootstrapping test with the biased-corrected percentile method two-tailed significance (BC) was adopted to evaluate the significance of the direct/indirect effects with 200 bootstraps resamples. The analysis was performed with AMOS24 and SPSS24.

Results

Table 1 shows the demographic features of the sample. According to the assumptions of SEM analysis, correlation coefficients, collinearity, independence of observations (Durbin-Watson coefficient), and normality of data was all checked in advance. Table 2 presents the mean score, standard deviation, and Pearson correlation of the VIF (the optimal range in total is less than 10). Tolerance index (acceptable range above 0.1), Durbin-Watson coefficient (suitable range between 1.5 and 2.5), and Kolmogorov-Smirnov test results have been presented in Table3.

Table 1. Demographic Statistics of the Sample

		Sex			Total
		Female	Male	Other	
University level	Diploma	4 (1.89 %)	4 (1.89 %)	0 (0.00 %)	8 (3.79 %)
	Undergraduate	84 (39.81 %)	107 (50.71 %)	3 (1.42 %)	194 (91.94)
	Graduate	2 (0.94 %)	5 (2.36 %)	0 (0.00%)	7 (3.31 %)
	PhD candidate	1 (0.47 %)	1 (0.47 %)	0 (0.00 %)	2 (0.94 %)
Economic level	Not good	6 (2.84 %)	18 (8.53 %)	0 (0.00 %)	24 (11.37 %)
	Relatively good	37 (17.53 %)	61 (28.90 %)	1 (0.74 %)	99 (46.91 %)
	good	44 (20.58 %)	35 (16.58 %)	2 (0.94 %)	81 (38.38%)
	Very good	4 (1.89 %)	3 (1.42 %)	0 (0.00 %)	7 (3.31 %)
Job	Occupied	33 (15.63 %)	35 (16.58)	0 (0.00 %)	68 (32.22 %)
	Not occupied	56 (26.54 %)	80 (37.91 %)	3 (1.42 %)	139 (65.87 %)
	other	2 (0.94 %)	2 (0.94 %)	0 (0.00 %)	4 (1.89 %)
Marital status	Single	84 (39.81 %)	99 (46.91 %)	3 (1.42 %)	186 (88.15 %)
	Married	6 (2.84 %)	8 (3.79 %)	0 (0.00 %)	14 (6.63 %)
	Divorced	0 (0.00 %)	1 (0.47 %)	0 (0.00 %)	1 (0.47 %)
	Widow	0 (0.00 %)	2 (0.94 %)	0 (0.00 %)	2 (0.94 %)
	other	1 (0.47 %)	7 (3.31 %)	0 (0.00 %)	8 (3.79 %)
Smoking cigarette	Yes	82 (38.86 %)	102 (48.34 %)	3 (1.42 %)	187 (88.62 %)
	No	9 (4.26 %)	15 (7.10 %)	0 (0.00 %)	24 (11.37 %)

Table 2. Mean, Standard Deviation, and Pearson Correlation Coefficients between Considering Variables for Students with ADHD Symptoms

Variable	Mean	S.D	1	2	3	4	5	6	7	8
1.Depression	2.24	2.13	1							
2.Anxiety	1.53	1.70	0.77**	1						
3.Mind-wandering	14.12	10.22	0.35**	0.38**	1					
4.Motivation	141.99	25.24	-0.25**	-0.20**	-0.43**	1				
5.ADHD Attention deficiency	24.18	6.93	0.19**	0.27**	0.62**	-0.19**	1			
6.ADHD Hyperactivity	7.14	3.48	0.36**	0.38**	0.86**	-0.39**	0.60**	1		
7.ADHD Impulsivity	11.69	5.38	0.39**	0.46**	0.70**	-0.27**	0.59**	0.78**	1	
8.ADHD Sluggish Cognitive Tempo	13.46	5.73	0.38**	0.40**	0.65**	-0.29**	0.58**	0.69**	0.86**	1

According to the findings of Table 2 and 3, all assumptions of the SEM analysis were optimal. The structural equation model is displayed in Figure 1. All coefficients are indicated by the arrows. In order to improve fit of the postulated model, it is needed to modify or check different models by adding or deleting the indices. So, some modification indices were added to the model based on previous studies. The fitting indices of the model in Table 4 demonstrated a relatively appropriate model. As Hu and Bentler [53] indicated, there is a relatively good fit between the hypothesized model and the observed data. All fit indices are in optimal level except RMSEA which is acceptable. Hayduk and Glaser [54] believe that the RMSEA should not be taken seriously. Meanwhile, the

RSMEA =0.06 is considered as reasonable and good output [55]. The possible direct effects of analysis are presented in Table 5. The direct effects of depression on motivation, anxiety on MW, and MW on ADHD symptoms were significant. Other direct effects were not significant. Moreover, indirect effects of depression and anxiety on ADHD symptoms were significant ($P < .05$). Further, the total R square of ADHD symptoms in the model was 0.94. Based on the finding in the SEM analysis it could be concluded that the main hypothesis of this study which is examining the indirect effect of depression and anxiety on ADHD symptoms concerning mediators was approved.

Table 3. VIF, Tolerance Index, Durbin-Watson Coefficient, and Kolmogorov-Smirnov Test Results of the Observed Data

	VIF	Tolerance index	Durbin-Watson	Normality of data			
				Kurtosis	Skewness	K-S test	
						Index	P
Depression	2.59	0.38	2.06	-1.04	0.41	0.22	0.10
Anxiety	2.56	0.31		0.61	1.14	0.20	0.09
Mind-wandering	1.39	0.71		1.05	1.23	0.32	0.11
Motivation	1.26	0.79		1.12	-1.06	0.16	0.09
ADHD	-	-		0.16	0.59	0.16	0.07

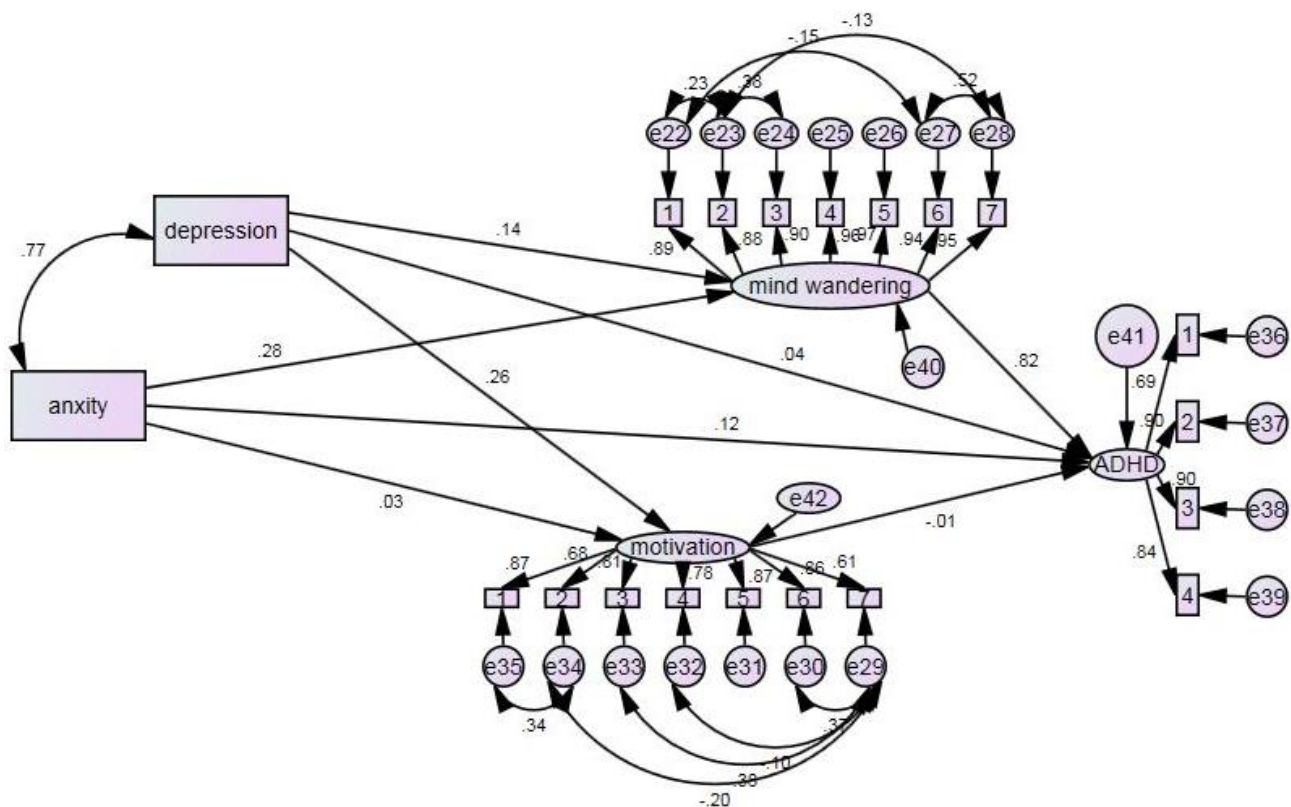


Figure 1. Model of depression, anxiety, mind-wandering, motivation and ADHD symptoms.

Table 4. Model Fit Indices

Index	χ^2	df	χ^2/df	P	AGFI	GFI	PGFI	RMSEA	CFI	IFI	TLI	NFI
Value	557.44	153	3.64	0.001	0.91	0.97	0.57	0.06	0.90	0.91	0.92	0.90
Acceptable domain	-	-	<3	<0.01	>0.9	>0.9	<0.1	<0.08	>0.9	>0.9	>0.9	>0.9

Table 5. Direct and Indirect Effects of Analysis

Independent variable	Dependent variable	Mediator	Effect type	β	P	Standardized Regression Weights
Depression	Mind-wandering	-	Direct	0.14	0.11	0.13
	Motivation	-	Direct	0.26	0.00	0.26
	ADHD	-	Direct	0.04	0.48	0.01
Anxiety	Mind-wandering	-	Direct	0.28	0.03	0.28
	Motivation	-	Direct	0.03	0.96	0.03
	ADHD	-	Direct	0.12	0.50	0.04
Motivation	ADHD	-	Direct	-0.01	0.77	0.05
Mind-Wandering	ADHD	-	Direct	0.82	0.01	0.90
Depression	ADHD	Mind-Wandering	Indirect	0.11	0.04	-
Anxiety	ADHD	Mind-Wandering	Indirect	0.22	0.03	-

*indirect effects were shown in bold.

Discussion

This study aimed to examine the mediating role of motivation and MW in the relationship between depression and anxiety to ADHD symptoms in university students who were with ADHD symptoms. According to the SEM results, the hypothesized model was fit with the observed data. The direct effects of depression on motivation, anxiety on MW, and MW on ADHD symptoms were significant ($P < .05$). Indirect effects of this analysis were significant ($P < .05$).

The findings of this analysis were consistent with numerous studies. For instance, Grahek et al. [13] declared that lack of motivation and cognitive control impairments are related to depression. The relationship between depression and ADHD symptoms was investigated in the bulk of analyses (for example Powell et al. [9]). Also, the relationship between anxiety and MW has been confirmed in previous studies [30] and motivational differences in ADHD people were demonstrated in several studies [34-36]. Eventually, the relationship between MW and ADHD has been investigated in various studies in adult samples and children with ADHD [23, 24].

Three of the direct effects of the analysis were significant ($P < 0.05$). In explanation of the direct effect of depression on motivation, the idea that depression alters the level of energy and psychomotor activity in daily life so physical/mental slowness contributes to a lack of motivation is a matter of fact. In fact, depressed people always show many impairments in their level of motivation [13] since, the rate of dopamine and serotonin are low in depressed people as mentioned by some researchers [12]. Moreover, they are trapped by worthless and hopeless feelings. Thus, a cycle of motivation, hopeless, depression, failure in decision making, and worthlessness start in ADHD who are depressed and their mental health system is actually shut down by this cycle. Further, the direct effect of anxiety on MW could be explained based on the amount of distress that anxiety causes for a person. Anxious people resort to wandering their thoughts to reduce their suffering and distress. Although wandering of thought is considered as a kind of incompatible strategy, it leads to a kind of habit that can manifest as symptoms of attention deficit/hyperactivity disorder. The use of such strategies usually increases when people perceive themselves to be very helpless

against the situation. University students with ADHD symptoms are generally among the people who are very disappointed and unsuccessful, and because of their high anxiety, they experience extreme mental wandering. This distress and suffering add to the problems and worsen the ADHD symptoms. Thus, the significant direct effect of anxiety on MW in the sample of university students with ADHD symptoms was explained.

To interpret the direct effect of MW on ADHD symptoms, the abnormality in the default mode neural network and executive control should be mentioned. A wandering mind has less ability to maintain attention on the main issue. This lack of ability to maintain attention, which is caused by a weak neurological structure, is considered as one of the main symptoms of ADHD especially in adulthood. Hence, alongside with previous research [23], it is not far from expectation that MW is directly related to the symptoms of ADHD.

According to the findings, the indirect significant effects of depression and anxiety on ADHD symptoms ($P < .05$) were completely mediated by the mediators. It means that the effect of depression and anxiety on ADHD symptoms are not direct and depression or anxiety indirectly effect ADHD symptoms. Based on the significance of indirect effects, the mediating role in this analysis is dedicated to MW. In anxious and depressed people the rise of confusing thoughts and getting lost in too many dreams known as MW is a common unadaptable mechanism for managing thoughts [29]. High spontaneous MW due to anxiety or depression ends in elevating ADHD symptoms. To exactly clarify the effect, we should refer to the amount of turbulence that depression or anxiety make for university students with ADHD symptoms, while they may regularly struggle not to become isolated or to advance their affairs. Instead, they engage in ineffective strategies such as MW which is very easily accessible and dangerous. On the other hand, it leads to the deterioration of the symptoms of ADHD.

Extensive studies have pointed out to the comorbidity of depression and anxiety with ADHD, but the process of this coexistence has not yet been investigated. Based on the findings of this study, the high comorbidity of depression and anxiety with ADHD symptoms is mediated by MW. Along with other studies, this research faced limitations. Among these, we could name the lack of comparing the

mentioned model between males and females with ADHD symptoms since the path might be different between males and females. Hence, it is suggested to examine this model in a sample consisting of a different gender. For elaborating the research, studying the mediating role of other variables such as executive function is also recommended. Also, the other limitation of this study was the participants who were not selected from the clinical population due to the limitations in this field, including the lack of a dedicated laboratory for ADHD specifically. It is recommended to consider this limitation in future studies.

The theoretical application of the present study is to expand future studies on the origins of ADHD in adulthood and its practical application is related to inventing ways to treat ADHD in adulthood to create the stable and long-lasting treatment.

Conclusion

In general, based on the findings of the present study and previous research, it could be of notice that ADHD symptoms relate to depression and anxiety with the mediating role of MW. The results of this study showed that motivation does not play a mediating role in the relationship between depression and anxiety and the relationship between depression and anxiety is completely indirect through MW.

Conflict of interest

The authors declare that they have no conflicts of interest.

Ethical approval

This article took into account all ethical principles under the supervision of the University of Isfahan research committee with the ethical code of: IR.UI.REC.1399.100. Researchers informed the participants about the study's objective. They were also assured that their information would remain confidential.

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