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ORIGINAL ARTICLE

Higher Perceived Stress Increases the Subjective Reporting of ADHD: A Sample of Medical Students

Daha Yüksek Algılanan Stres, DEHB'nin Öznel Bildirimini Artırır: Tıp Fakültesi Öğrencileri Örneklemi

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ABSTRACT

This study aimed to evaluate the subjective Attention-Deficit/Hyperactivity Disorder (ADHD) symptoms with self-reported ratings and objective neurocognitive tests among medical students. Also, we examined the psychological factors associated with ADHD reporting among medical students. Medical students (N=57) completed self-report questionnaires, and neurocognitive tests were conducted for attention measures. Participants had a mean age of 20.3 years, and 69.0% were female. Subjective reporting of ADHD by students was associated with high levels of perceived stress, anxiety, and childhood and current ADHD symptoms. However, according to the results of multivariate regression analysis, only the perceived stress level was an affecting factor in reporting ADHD in medical school students [odds ratio [OR] =1.184, 95% confidence interval [CI] = [1.015; 1.381]]. The higher the perceived stress levels, the more likely medical students were to report having ADHD. Objective attention measures had no impact on reporting ADHD subjectively. Screening for perceived stress is necessary for medical students, especially those with subjective ADHD symptoms.

Key words: Attention-Deficit/Hyperactivity Disorder, Adult ADHD, Stress, Stroop/Reverse Stroop Interference, Neurocognitive Measures

ÖZ

Bu çalışmada, tıp öğrencilerinde Dikkat eksikliği/hiperaktivite bozukluğuna (DEHB) ait subjektif semptomların objektif nörobilişsel testler ile birlikte değerlendirilmesi amaçlanmıştır. Ayrıca, tıp öğrencileri arasında subjektif DEHB bildirimi ile ilişkili olası psikolojik faktörler incelenmiştir. Tıp öğrencileri (N=57) öz bildirim anketlerini doldurmuştur ve dikkat ölçümleri için nörobilişsel testler yapılmıştır. Katılımcıların yaş ortalaması 20.3 yıl olup, %69.0'ı kadındır. Öğrencilerin kendilerinde DEHB olduğunu subjektif bildirmeleri; algılanan stres, kaygı düzeyleri, çocukluktaki ve şimdiki DEHB belirtileri ile ilişkili bulunmuştur. Ancak çok değişkenli regresyon analizi sonuçlarına göre tıp fakültesi öğrencilerinde sadece algılanan stres düzeyi DEHB bildirimini etkileyen bir faktördü [olasılık oranı [OR] =1.184, %95 güven aralığı [CI] = [1.015; 1.381]]. Algılanan stres seviyeleri ne kadar yüksekse, tıp öğrencilerinin kendilerinde DEHB olduğunu bildirmeleri daha fazladır. Objektif dikkat ölçümlerinin DEHB'yi subjektif olarak bildirmede etkisi olmamıştır. Algılanan stres düzeyinin taranması, özellikle subjektif DEHB bildirimleri olan tıp öğrencileri için önemli görünmektedir.

Anahtar Kelimeler: Dikkat Eksikliği/Hiperaktivite Bozukluğu, Erişkin DEHB, Stres, Stroop/Ters Stroop Etkileşimi, Nörobilişsel Ölçümler

Introduction

Attention deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder of childhood and adolescence and continues into adulthood in nearly 60% to 78% of diagnosed children and adolescents (1). The estimated adult prevalence rate ranges between 3-5%, but wide variations have been seen across studies (2). In a recent meta-analysis, the global prevalence of symptomatic adult ADHD was 6.76% in the general population (3). ADHD is primarily characterized by two symptom clusters, inattention and hyperactivity-impulsivity (4). The features of ADHD in adults differ from typical ADHD features in children. Hyperactivity or impulsivity are less evident, and inattention symptoms are more prominent in adults (5).

There has been an increase in adult and undergraduate students complaining of ADHD symptoms and wondering if they have caught the disorder in recent years (6-8). Few studies on ADHD among medical students have been conducted globally. 5.5% of medical students in the USA were diagnosed with ADHD, nearly three-quarters after 18 years old (9). In Kenya, the prevalence rate of self-reported ADHD symptoms among medical students was 23.7%. Among the Brazilian medical students, 37% were diagnosed with ADHD by self-reported scales, while 7.9% of the students were determined as ADHD by diagnostic interview (10). Most adults who report ADHD symptoms do not have a prior diagnosis of ADHD, and it is crucial to be aware of the possibility that these adults may be exaggerating these symptoms (11, 12). Thus, supporting ADHD self-reports with objective measurements could be beneficial, and these objective attention measures consist of various neurocognitive test batteries (13). These neurocognitive test batteries, including the Stroop and Trail making tests A and B, are applied to evaluate the

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attention process (13, 14). Neurocognitive tests may help uncover difficulties in adult ADHD on measures of executive function, processing speed, and attention (15, 16).

During medical training, medical students' prevalence of psychological distress, such as anxiety, stress, depression, and mental health-related problems, ranges from 21% to 56% (17-19). An optimal level of stress will enhance the learning ability of students. However, excessive stress will lead to negative consequences (20), such as decreased attention and reduced concentration (21, 22). Besides, individuals with ADHD experience increased subjective stress (23) due to poor self-regulation of emotional expression (23). To our knowledge, ADHD symptom assessments using subjective and objective methods and their relationship with perceived stress and anxiety were not examined in medical students. Thus, we primarily aimed to measure subjective ADHD symptoms with self-reported ratings and attentional performance tests in medical students. Our secondary goal was to identify psychological factors affecting subjective ADHD reporting in our sample.

Methods

Ethical approval was obtained from the Local Ethics Committee of our medical school (Ethic Approval ID: 2022-975).

Participants and Procedure

A total of 56 undergraduate students (39 females and 17 males) between 18 and 23 years of age were recruited from our Medical School. Informed written consent was obtained from the students before the neuropsychological assessment. Being more than 18 years old, having a normal or corrected-to-normal vision, being a medical student and choosing to participate voluntarily in the study were the inclusion criteria for this study. Exclusion criteria were treatment with ADHD medications (stimulants or non-stimulants), reporting any neurological disorders (e.g., epilepsy, brain damage and brain tumours), or any motor difficulties. The sample was divided into two groups (Subjective reporting of ADHD (+)/ Subjective reporting of ADHD (-)) according to the question: "Do you think you have attention deficit hyperactivity disorder?".

Stroop Test and Trail Making Test (TMT-A, B) were administered to the participants by the researchers of our Neuroscience Department. In addition, participants were asked to fill out a sociodemographic data form, Wender Utah Rating Scale-25 (WURS-25), Adult ADHD Self-Report Scale (ASRS), Perceived Stress Scale-10 (PSS-10), State and Trait Anxiety Inventory (STAI).

Measurements and Questionnaires

Attention measurements

The Stroop Test: It includes five sets of tasks that involve either reading words or naming the colours of their letters. Task sets 1 and 2 are word-reading tasks. They involve reading the names of colours printed in black ink on a white background for the task set 1 and reading the names of colours printed in other ink for task set 2. Task sets 3 and 4 are colour-naming tasks. They involve naming the colours of the circles printed in colour (task set 3) and naming the colours of words that are printed in colour but do not refer to a colour (task set 4). In task set 5, colour words are printed in conflicting colours for the interference effect. For example, the word yellow is printed in red ink, and participants are asked to name the ink colour (red) instead of reading the word (yellow). The Stroop interference scores were calculated by subtracting the participants' task set 3 scores from their task set 5 scores (24, 25). Stroop 5th card completion time and interference scores were used in this study.

Trail Making Test: The TMT has two parts; the TMT-A (rote memory) and TMT-B (executive functioning). Both parts of the Trail Making Test consist of 25 circles distributed over a paper. In Part A, the circles are numbered 1 – 25, and the patient should draw lines to connect the numbers in ascending order. In Part B, the circles include both numbers (1 – 13) and letters (A – L); as in Part A, the patient draws lines to connect the circles in an ascending pattern, but with the added task of alternating between the numbers and letters (i.e., 1-A-2-B-3-C, etc.) (26, 27). TMT-A and TMT-B both require focused attention for successful performance. The TMT-B is used to evaluate executive functions, particularly set-shifting ability.

Self-reported questionnaires

Adult ADHD Self-Report Scales (ASRS): It is a self-report scale developed by the World Health Organization (WHO) to screen for ADHD symptoms in adults (28). The scale consists of 18 items based on the Diagnostic and Statistical Manual of Mental Disorders: Fourth Edition (DSM-IV-TR) criteria (29). It is rated on a 5-point Likert scale from 0 (never) to 4 (very often). It has two subscales, attention deficit and hyperactivity/ impulsivity, each consisting of nine questions. Individuals with a sum score on each subscale of 16 or lower are unlikely to have ADHD. Scores of 17–23 are classified as likely ADHD, and 24 or greater as highly likely to have ADHD (30). The Turkish version of ASRS has demonstrated good reliability and validity among university students (31).

Wender Utah Rating Scale (WURS): It is a 25-item self-report questionnaire for assessing childhood ADHD symptoms retrospectively in adults (32). The WURS-includes 25 items, each rated on a 5-point Likert scale from 0 (not at all) to 4 (a lot). High scores mean an increase in childhood ADHD symptoms. The Turkish version of WURS-25 has demonstrated good reliability and validity in adults; the cutoff score point is 36 (33).

State-Trait Anxiety Inventory (STAI): The STAI is a 40-item questionnaire consisting of two subscales; the state subscale (STAI-1) contains 20 items relating to current symptoms of anxiety, and the trait subscale (STAI-2) contains 20 items relating to general symptoms of anxiety. All items are rated using a 4-point scale with answers 'almost never', 'sometimes', 'often', and

'almost always', and the total scores range between 20 and 80(34). High scores mean an increase in anxiety levels. We used both subscales of the Turkish version of STAI in this study (35).

Perceived Stress Scale (PSS-10): The PSS-10 measures an individual's appraisal of their life as stressful (i.e. unpredictable, uncontrollable and overloading) (36). People rated how often they had experienced these feelings in the last week on a five-point Likert scale from 0 = never to 4 = very often. PSS-10 scores were obtained by reversing the scores on the four positive items; the items were 4, 5, 7 and 8. Total scores range from 0 to 40, with higher scores indicating greater overall distress. The Turkish version of PSS-10 has demonstrated good reliability and validity among university students (37).

Data analyses

Sample size analysis

G Power 3.1.8 package program was used to calculate the sample size. Our pilot study's results were used for specifying the effect size by the independent t-test according to the WURS-25 mean and SD scores compared to two groups [Subjective reporting of ADHD (+)/ Subjective reporting of ADHD (-)]. For the 10.5-unit difference between the WURS-25 scores to be considered statistically significant, at least 21 participants must be in each group according to the independent t-test at a minimum power of 80% and an error level of 0.05.

Data analysis

We used the Shapiro-Wilk test to determine normal distribution. Pearson's chi-squared test examined differences between the groups' categorical variables. Continuous variables were analyzed using the Mann-Whitney U test in group comparisons. Binary logistic regression analysis was applied to determine the factors affecting the subjective reporting of ADHD. For the multivariate analysis, the possible factors identified with univariate analysis (p-value < 0.05) were further entered into the multivariate logistic regression model (38). The logistic regression model was statistically significant [$\chi 2$ (5) = 17.5, p=.004]. The model explained 35.8% (Nagelkerke R2) of the variance in subjective reporting of ADHD and correctly classified 75 % of cases. Data analysis was performed using SPSS 22.0, and all the statistical tests were two-tailed with a threshold for significance of a = .05.

Results

Fifty-six participants (39 female, 69 %; mean age 20.33, age range from 18 to 23 years) were included in the study. All participants were university students in Medical School. The sample consisted of 33.3% 1st-grade students, 26.3% 2nd-grade students and 31.6% 3rd-grade students. Four students (7.1 %) had psychiatric disorders at our assessment (2 anxiety disorders, one social phobia, and one depression). Two students had an ADHD history in childhood. 66.6% of the students reported that they had knowledge about ADHD symptoms. 76.8% of the students reported that they had difficulties in medical school education, and 71.4% reported that they had exam anxiety.

Our sample was divided into two groups (Subjective reporting of ADHD (+)/ Subjective reporting of ADHD (-)) based on the question: "Do you think you have attention deficit hyperactivity disorder?" The subjective reporting of ADHD was determined in twenty-seven students (48.2%). 42.9% of those students were determined to have inattentive type ADHD, and 46.4% were determined to have hyperactive type ADHD according to ASRS scores. Comparisons were made between two groups, those self-reported as ADHD (n=27) and self-reported as non-ADHD (n=29). The groups were similar in age and gender (p>0.05). There was no significant difference between two groups in exam anxiety ($\chi 2(1, N = 56) = 2.58$, p = .108). Completion times of attention measurements tests, including Stroop test 5th card, Stroop interference score, TMT-A, and B, were similar in two groups (p>.05). Self-report questionnaire scores, including WURS-25, PSS-10, STAI-1,2, ASRS-attention and ASRS-total, were significantly higher in students who self-reported ADHD (Table1).

Table 1. Sociodemographic features and neuropsychological measurement results in two groups

	Subjective reporting of ADHD (+) (n=27)	Subjective reporting of ADHD (-) (n=29)	Z/ χ2	p
	Median (IQR)	Median (IQR)		
Age (years)[a]	20 (2)	20 (2)	-1.16	.87
Female gender n %[b]	20 (74.1)	19 (65.5)	.48	.48
Stroop test 5th card (sec)[a]	15.4 (5)	16.5 (13.9)	-0.20	.83
Stroop Interference score (sec)[a]	5.5 (3.5)	5.7 (8)	-0.05	.95
TMT-A (sec)[a]	18.3 (12.3)	16.9 (15)	-1.48	.13
TMT- B (sec)[a]	33.2 (14.4)	32.1 (12.5)	-0.43	.66
ASRS[a]				
Attention	17.5 (9)	13,5 (4.5)	-3.20	.001**
Motor hyperactivity	11 (5)	9 (5)	-1.96	.05
Verbal hyperactivity	7 (5)	6 (3)	-1.5	.12
Total	35 (17)	29 (8.75)	-2.6	.009**
WURS-25[a]	37 (18)	30 (12.5)	-2.4	.01**
PSS-10[a]	24 (5)	18 (8.5)	-3.3	.001**
STAI-1[a]	44 (14)	38 (12.5)	-2.4	.01**
STAI-2[a]	49 (12)	46 (14.5)	-2.01	.04*

a Mann-Whitney U test, b Pearson chi-square test, IQR: Interquartile Range, ADHD: Attention deficit hyperactivity disorder, ASRS: Adult ADHD Self-Report Scales, WURS: Wender Utah Rating Scale, STAI: State-Trait Anxiety Inventory, PSS-10: Perceived Stress Scale, TMT: Trail Making Test, * p < .05, ** p < .01

The results of the univariate logistic regression analysis of the possible factors affecting subjective reporting of ADHD in medical school students are presented in Table 2. Univariate analysis showed that age,

gender, knowledge about ADHD, exam anxiety, and neuropsychological tests performance had no impact on reporting ADHD subjectively (p>.05). ASRS scores, WURS-25 scores, state and trait anxiety scores, and perceived stress scores were possible affecting factors to report ADHD subjectively (p<.05). The results of the multivariate logistic regression analysis of these potential factors affecting subjective reporting of ADHD in medical school students are presented in Table 3. In the multivariate logistic regression model, only the perceived stress level was an affecting factor in reporting ADHD in medical school students [OR =1.184, 95% CI = (1.015; 1.381)]. The likelihood of reporting themselves as ADHD was higher when the students' perceived stresses were greater.

Table 2. Univariate analysis results of related factors with subjective reporting of ADHD

	Unadjusted OR (95% CI)	p
Female gender	.665 (.210-2.104)	.488
Age (years)	1.078 (.780-1.492)	.648
The knowledge of ADHD (yes/no)	.398 (.127-1.244)	.113
Exam anxiety (yes/no)	1.771 (.567-5.535)	.326
STAI-1 scores	1.067 (1.002-1.136)	.044*
STAI-2 scores	1.072 (1.004-1.145)	.037*
PSS-10 scores	1.172 (1.055-1.302)	.003**
WURS-25 total scores	1.056 (1.009-1.106)	.019*
ASRS total scores	1.103 (1.028-1.183)	.007**
Stroop test 5th card (sec)	1.051 (.969-1.140)	.231
Stroop Interference score (sec)	1.027 (.876-1.204)	.745
TMT-A (sec)	1.043 (.985-1.105)	.152
TMT-B (sec)	1.013 (.980-1.047)	.437

Univariate logistic regression analysis, ADHD: Attention deficit hyperactivity disorder, ASRS: Adult ADHD Self-Report Scales, WURS: Wender Utah Rating Scale, STAI: State-Trait Anxiety Inventory, PSS-10: Perceived Stress Scale, TMT: Trail Making Test, * p < .05, ** p < .01

Table 3. Multivariate analysis results of related factors with subjective reporting of ADHD

	B	S.E.	p	Exp(B)	95% CI	
					Lower	Upper
STAI-1	.004	.050	.937	1.004	.909	1.108
STAI-2	-.058	.060	.329	.943	.839	1.061
ASRS total	.041	.047	.386	1.042	.950	1.142
PSS-10	.169	.079	.031*	1.184	1.015	1.381
WURS-25 total	.038	.031	.219	1.039	.977	1.104

The multivariate logistic regression analysis, ADHD: Attention deficit hyperactivity disorder, ASRS: Adult ADHD Self-Report Scales, WURS: Wender Utah Rating Scale, STAI: State-Trait Anxiety Inventory, PSS-10: Perceived Stress Scale, * p < .05.

Discussion

This study assessed the subjective ADHD symptoms with self-reported ratings and attentional performance tests, and it further investigated the psychological factors' effects on reporting subjective ADHD among medical students. 48.2% of our sample reported that they thought they had ADHD in themselves. 42.9% of those students had inattentive type ADHD, and 46.4% had hyperactive type ADHD according to self-reported scales. Studies on adult ADHD using current self-report and childhood symptom reports indicate that these self-reported measures have a high rate of false positive results (39). For example, in an adult sample seeking treatment for ADHD concerns, almost half of the individuals did not meet the diagnostic criteria for ADHD. However, they exceeded the cutoff on self-report scores (40). Our sample with ADHD concerns reported higher current and childhood ADHD symptoms consistent with these previous studies.

In our study, students with subjective reporting of ADHD had a similar neurocognitive profile to students reporting non-ADHD. While reviews and meta-analyses reveal more abnormal Stroop interference for the ADHD groups than for non-ADHD groups (41, 42), a recent meta-analysis investigated the developmental effects of ADHD and found no evidence for an ADHD-related deficit in response inhibition by the Stroop task (43). Set shifting is necessary for alternate attention from one task to another to inhibit the previous attentional process and initiate engagement with the new task (44). As the TMT-B measures, the set-shifting ability is a type of interference control similar to the Stroop test (45). Some studies found that adults with ADHD showed poor set-shifting ability than non-ADHD participants (46-48), while other researchers reported no differences between adults with ADHD and non-ADHD participants (49-51). Different measures and calculations of neuropsychological tests could result in these contradictory results (52). Consistent with previous results (41, 49-51), our sample with ADHD concerns was similar in inhibitory control and set-shifting to students reporting non-ADHD. Using only the Stroop test for interference control and TMT B for set-shifting as an objective evaluation of ADHD may have caused not to reveal possible differences in attentional process in our study. A recent study regarding diagnosing adult ADHD showed that neuropsychological tests had a poor ability to discriminate between patients diagnosed with ADHD and patients not diagnosed with ADHD (53). Moreover, a structured diagnostic interview for ADHD (Diagnostic Interview for ADHD in adults (DIVA 2.0) showed a better ability to discriminate between the groups than neuropsychological tests (54). Our results confirmed that the diagnosis of ADHD in the adult population should be made with caution and cannot be diagnosed with only the ADHD symptom checklist.

In our study, medical students who reported ADHD problems were similar in executive functioning to those who did not report ADHD. Considering that medical students' intelligence quotient (IQ) levels are higher than the average, the above-average IQ could have affected our results (55, 56). In a recent study, adults with ADHD and high IQ show less evidence of executive functioning deficits than those with ADHD and standard IQ (57). Studies in patients with ADHD and high IQ showed normal executive functioning,

suggesting that those participants do not have deficits in executive functions (58, 59). These results indicate that neuropsychological tests would be insufficient for an accurate ADHD diagnosis, particularly in individuals with high IQ. Moreover, a higher intellectual efficiency may compensate for executive function deficits, leading to these problems going unnoticed until the beginning of academic life at the university (57). Consistent with these previous studies, almost all our sample did not have ADHD diagnoses until university; only two students had ADHD diagnoses in childhood.

The possible psychological factors affecting subjective reporting of ADHD were childhood and current ADHD symptoms, current anxiety and general anxiety, and perceived stress in our sample. Our findings showed that only the higher perceived stress had an impact on the subjective reporting of ADHD by medical students. It has been demonstrated that medical students often experience higher stress levels than their peers (17, 60, 61). Responsibilities and expectations from medical students are high, and they are in a competitive environment (62). Excessive stress in medical students can lead to negative consequences such as decreased attention and concentration, cheating during exams, and self-medication (21). In an earlier study with college students, higher levels of inattention and hyperactivity/impulsivity were associated with perceived stress (63). Our findings align with studies that found that higher levels of inattention and hyperactivity/impulsivity were associated with perceived stress in college students (63-65). Additionally, studies in adults with ADHD and non-clinical adults showed that more ADHD symptoms were associated with higher stress levels (23, 66). However, attention problems may also increase perceived stress, or increased stress may cause ADHD symptoms. In order to distinguish between ADHD and other clinical illnesses in adults, a psychiatric interview is crucial for gaining a better knowledge of the bidirectional links between these symptoms (67). Consequently, our results suggest that the perceived stress and related psychological factors should be examined in medical students with self-reported ADHD symptoms.

Our study had some limitations. First, the causality could not be established due to the cross-sectional study's limited sample size and single-center experience. Second, the sample consists of only medical students. The characteristics of this non-clinical sample, such as intelligence and executive functions, may have affected our results. Third, structured psychiatric interviews could not be performed. Although neuropsychological assessments were implemented as objective methods with self-report measures of ADHD, it is worth mentioning that deepening these ADHD symptoms with clinical interviews is necessary. Fourth, other psychological factors that might impact the outcomes, other than anxiety symptoms, perceived stress, and ADHD self-ratings, could not be evaluated. Finally, our results may have been affected by other psychosocial factors like peer relationships, parental support, and home and school conditions during the medical training were not assessed in this study. There is obviously a need for future studies, which determines the psychosocial factors affecting subjective reporting of ADHD and perceived stress of medical students.

Conclusion

Despite its constraints, our research suggests that the higher perceived stress levels, the more reported ADHD subjectively by medical students. The tendency to experience more stress during medical training can make medical students particularly vulnerable to feelings of decreased attention and restlessness, resulting in reporting ADHD themselves. Screening for perceived stress and ADHD symptoms would be necessary for the preventive mental health of medical students so that adequate psychosocial support may be given and referred to health professionals. Further research may identify links between medical students' reporting of ADHD symptoms and perceived stress by longitudinal study designs with larger samples.

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