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ADHD and Mood Symptoms (Depression, Anxiety, and Stress) in University Students: The Role of Experienced Functional Impairments and Difficulties in Executive Functioning

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Abstract

Objectives: Many studies have indicated a close relationship between ADHD and mood symptoms in university students. In the present study, we explore the role of daily functional impairments and executive functioning in the ADHD-Mood relationship. **Method:** 343 adults (126 males) filled out (1) the Conners' Adult ADHD Rating Scale, (2) the Depression Anxiety and Stress Scale, (3) the Weiss Functional Impairment Rating Scale, and (4) the Executive Function Index Scale. **Results:** The correlation between mood symptoms and ADHD was .48 (moderate correlation) and dropped to .15 (weak correlation) when controlling for functional problems and executive functioning. Hierarchical regression analyses showed that both, functional impairments and executive functioning significantly explained 42-53% of the variance of mood symptoms. The addition of ADHD symptoms to the model slightly increased the explained mood variance by only 1%. **Conclusion:** These findings underline the role of experienced difficulties in triggering mood symptoms in ADHD symptomatology.

Keywords: ADHD, daily life functional problems, executive functions, Mood Symptoms, DASS, CAARS

Executive and Daily Life Functioning Influence the Relationship between ADHD and Mood Symptoms in University Students

Attention Deficit/Hyperactivity Disorder (ADHD) is traditionally defined as a neurodevelopmental disorder, characterized by inattention, hyperactivity, and impulsivity. The disorder is well-recognized as a lifelong condition for about two thirds of the diagnosed individuals (Alexander & Harrison, 2013; Buitelaar, Kan, Asherson, 2011; Gray, Woltering, Mawjee, & Tannock, 2014). Based on the DSM ADHD diagnostic criteria, some studies have reported a ADHD prevalence rate in adults to fall between the range of 2% and 8% (Alexander & Harrison, 2013; for review see Green & Rabiner, 2012). Several studies showed that ADHD symptoms are relatively context-dependent, and that environmental influences contribute, to some extent, to the variations in the level of ADHD symptoms (for meta-analysis see, Nikolas & Burt, 2010; for review see Purper-Ouakil et al., 2004). With this in mind the present study focuses on adult university students with symptoms of ADHD (i.e. college environment). Living in such an environment might be stressful and may contribute to the severity of mood and ADHD symptoms. Norwalk, Norvilitis, and MacLean (2009) have reported that compared to high schools, colleges have less structured academic environments, and as a result provide more distractions than what students experienced in high schools. These distractions, in turn, may lead to an increased level of inattentive symptoms. This may explain why there is an increasing number of college students who report ADHD symptoms (see Weyandt et al., 2013; Weyandt, Oster, Gudmundsdottir, DuPaul, & Anastopoulos, 2017; Wolf, Simkowitz, & Carlson, 2009). It is important also to note that college students with ADHD exhibit more symptoms of comorbid mood disorders and elevated levels of psychological distress compared to those without ADHD (see Prevatt, Dehili, Taylor, & Marshal, 2015; Weyandt et al., 2013). Indeed, Alexander and Harrison (2013) showed that ADHD symptoms were strongly associated with depression, anxiety, and stress in university students.

Tuckman (2007) has proposed that the mood symptoms in ADHD might arise due to certain characteristics of ADHD. For instance, the weak ability to meet certain deadlines or to complete tasks may

cause an anxious/negative mood response towards such shortcomings (Alexander & Harrison, 2013; Tuckman, 2007). In this vein, it could be assumed that students with high levels of ADHD report mood symptoms, which are not manifestations of mood disorders per se, but rather caused by the ADHD and related functional limitations (Hamed, Kauer, & Stevens, 2015) and most especially when those students are not diagnosed (Williamson & Johnston, 2015). In this regard it has been found that, "poor academic achievement owing to ADHD may lead to anxiety" (Assessing adults with ADHD and comorbidities, 2009).

Executive functions may also represent a crucial factor in the ADHD-Mood relationship, as, it can predict functional impairments in university students with ADHD (Wood, Lewandowski, Lovett, & Antshel, 2017). For example, Dvorsky and Langberg (2014) showed that executive functions, tapping motivation and organizational skills, mediate the association between ADHD symptoms and the overall daily functioning, as well as academic achievement (measured by Grade Point Average). These authors have argued that university students are usually expected to independently manage several activities that require organization skills and being engaged in goal directed activities, such as preparing different types of assignments, adhering to a course schedule, planning ahead for exams, and time management. In support of this perspective, Dorr and Armstrong (2018) have shown that ADHD symptoms and self-reported executive functioning explain functional impairments in university students in the United States.

In sum, it is suggested that ADHD symptomatology, including executive function deficits and daily life impairments, may cause an elevated level of mood problems in university students. However, it is still unknown to what extent executive functioning and daily life impairments contribute to the ADHD-mood symptoms relationship. This is the focus of the present study. Specifically, we test whether the association between the severity of ADHD symptoms and mood symptoms is influenced by both, functional impairments and poor executive functioning in daily life. Based on the presented literature, we expect that high levels of ADHD symptoms are related to high levels of negative mood and that this association is reduced when controlling for functional impairment and executive dysfunction. We also

explore which specific daily functional impairments and executive functions can predict mood symptoms best.

Method

Participants

Three hundred forty-three undergraduate students (126 males and 217 females) were recruited from the University of Groningen to participate in the present study via an advertisement posted on a university platform for research participation (i.e. SONA). All students gave informed consent before their participation, and they all received study credits for their participation. The Ethics Committee Psychology of the University of Groningen approved the study. The mean age of the study sample is 20.52 years (*SD* = 2.24), ranging from 18 to 31. A number of participants reported to have a diagnosis with ADHD and/or mood disorders. No systematic diagnostic assessment was performed to confirm the reported diagnosis. Table 1 presents information about the reported disorders and percentage of students who reported each disorder.

(insert table 1 about here)

Measures

Conners' Adult ADHD Rating Scale (CAARS). The CAARS consists of 66 items, which are assessed on a four- point scale (scored from 0= not at all/ never to 3= very much/ very frequently). The behavioral ADHD symptoms are subdivided into the following four subscales: a) inattention/ memory problems, b) hyperactivity/ restlessness, c) impulsivity/ emotional liability and d) problems with self-concept. Additionally, the CAARS includes three subscales measuring DSM-IV ADHD symptoms: Inattentive, Hyperactive-Impulsive Symptoms, ADHD Symptoms Total. The scale includes specific items, which are able to identify individuals who are at risk for having ADHD diagnosis, which together make up the ADHD Index subscale (Conners, Erhardt, & Sparrow, 1999). Raw scores on the CAARS subscales were converted into T-scores. According to the manual, T-scores above 65 represents clinically significant

symptoms in those attending mental health clinic and a T-score of 70 represents clinical symptoms in adults without identified problems (Conners et al., 1999). Generally, higher scores indicate more ADHD problems. Only data from the ADHD Symptoms Total subscale of the CAARS is considered for data analysis in the present study as it reflects the official symptoms reported at the DSM-IV and DSM-5.

The scale is a valid and reliable measure of adult ADHD symptoms (Erhardt, Epstein, Conners, Parker, & Sitarenios, 1999): Test-retest reliability ranges between .85 and .92, sensitivity and specificity are high for all four subscales. The CAARS also represents a cross-culturally valid measure of current ADHD symptoms in adults (Christiansen et al., 2012).

Depression Anxiety and Stress Scale (DASS). The DASS assesses negative moods of depression, anxiety, and stress using three subscales: the Depression, Anxiety and Stress subscales, each consisting of 14 items. Responses were given on a four-point scale (scored from 0 = did not apply to me at all to 3 = applied to me very much). Examples of items are "I felt sad and depressed" and "I found it difficult to relax". Based on the DASS norms, participants can be classified into five distinct categories: normal, mild, moderate, severe, and extremely severe, reflecting the severity level of mood symptoms relative to the population (Lovibond & Lovibond, 1995). The validity and reliability of the DASS scale has been considered strong. The internal consistency is high for each subscale (Cronbach's alphas are 0.94, 0.88, and 0.93 for depression, anxiety, and stress respectively) (see Nieuwenhuijsen, De Boer, Verbeek, Blonk & Dijk, 2003; Parkitny, & McAuley, 2010). Crawford and Henry (2003) tested the convergent and discriminate validity of the DASS by correlating it with measures of depression and anxiety (the HADS and the sAD), and positive and negative affectivity (the PANAS). The authors suggested excellent reliability of the DASS with adequate convergent and discriminant validity.

Executive Function Index Scale (EFI). The EFI was used to measure executive functions in daily life contexts. The EFI has been developed in a normal population, so it can be used for clinical and non-clinical purposes. The scale consisted of 27 items covering five factors namely: Motivational Drive, Organization, Impulse Control, Empathy, and Strategic Planning. The Motivational Drive subscale

addresses behavioral drive, activity level, and interest in novelty. Items of the Organization subscale address abilities like multitasking, sequencing, and keeping things in mind, which are necessary for organized goal-directed behavior. The Impulse Control subscale measures self-inhibition ability, and the tendency toward risk-taking behavior and social conduct. The Empathy subscale reflects an individual's concerns for others' well-being, the tendency to behave in a prosocial way, and the level of a cooperative attitude. Finally, the Strategic Planning subscale assesses disposition to plan and thinking ahead, as well as the tendency to use strategies (Spinella, 2005). Subjects rate themselves on a 5-point Likert scale (scored from 1 = not at all to 5 = very much).

A higher total score of the EFI indicates better executive functioning (Spinella, 2005). The EFI was developed in a non-clinical population. The EFI shows strong correlations with other self-rating executive functioning instruments, which were validated in clinical and neuroimaging studies such as the Frontal Systems Behavior Scale (Spinella, 2005). The EFI demonstrates good internal consistency (Cronbach's alpha ranged from .69 to .82). The scale was originally developed from a college student community population to measure the level of executive functions skills instead of classifying individuals as having normal or deficient executive functioning. However, several studies indicated that the EFI is suitable for healthy populations showing enough variance (Kruger, 2011; Weatherly & Ferraro, 2011). Scores on the EFI scale have been found to predict scores on other scales measuring everyday behaviors such as the Motivated Strategies for Learning Questionnaire (MSLQ) that reflect the use of cognitive and metacognitive strategies (e.g. self-monitoring and planning), and academic effort regulation in college students (Garner, 2009).

Weiss Functional Impairment Rating Scale (WFIRS). The WFIRS consisted of 70 items measuring adult's impairment in seven major life domains/subscales: Family, Work, College, Life Skills, Self-Concept, Social Functioning, and Risk Taking. Items represent impairments in a number of everyday situations not overlapping directly with ADHD symptoms. Each item is measured on a four-point scale (scored from 0 = never or not at all to 3 = very often or very much). Additionally, participants had an

option to response ‘not applicable’ for items, which were not applied for them; for instance, ‘road rage’ for adults who do not drive. Items with ‘not applicable’ response were not counted for the overall score of the domain that they belong to (WFIRS; NACE, 2014; Weiss, 2010).

The WFIRS scale shows moderate convergent validity with other measures of functioning such as the Columbia Impairment Scale and the Global Assessment of Functioning Scale (Takeda, Tsuji, Kanazawa, Sakai, & Weiss, 2017), and strong convergent validity with functional impairments self-reported scales in student population such as the Pediatric Quality of Life Inventory and the Current Symptom Scale (Hadianfard, Kiani, & Weiss, 2017). Previous psychometric studies have also shown that the WFIRS has good psychometric characteristics in a normal population (see, Weiss, McBride, Craig, & Jensen, 2018). In this regard the study of Canu, Hartung, Stevens, and Lefler (2016) is of interest since it showed that the WFIRS scale provides enough variance in university students. In sum, the WFIRS shows adequate convergent, concurrent, and discriminate validity as well as good internal consistency. For Family, Work, College, Life Skills, Self-Concept, Social Functioning, and Risk Taking, α were .86, .91, .90, .89, .94, .88, and .88, respectively (see Canu et al., 2016; Gajria et al., 2015).

Data Analysis

Means and standard deviations of scores on all questionnaires were calculated. Spearman correlations were calculated to test the correlations between scores on the DASS subscales (tapping depression, anxiety and stress symptoms), the DSM-IV ADHD Total Symptoms of the CAARS (ADHD symptoms), the EFI (executive functions), the WFIRS (daily functional impairments) scales.

Whether the relationship between mood and ADHD symptoms is influenced by factors of daily functional impairments and executive functioning is tested using nonparametric partial correlations. Here, the association between scores on the DASS subscales and scores on the DSM-IV ADHD Total Symptoms of the CAARS is tested after controlling for total scores on the EFI and the WFIRS scales.

A regression analysis was performed to test the contribution of ADHD symptoms to the severity of mood symptoms. The independent variable was scores on the CAARS DSM-IV Total Symptoms

subscale and the dependent variable was the total score on the DASS. Following on from this, a subsequent hierarchical regression analysis was performed to investigate the contribution of ADHD symptoms to mood symptoms, after controlling for functional impairments and executive functioning. The total scores on the EFI and the total scores on the WFIRS were entered in step 1, and scores on the CAARS DSM-IV Total Symptoms subscale were entered in step 2. The dependent variable was the total score on the DASS. Because the data violated the normality assumption of linear regression analysis, we decided to report Bootstrap confidence intervals for all regression coefficients. Bootstrapping was executed using a bias-corrected approach with 1000 sample replicates. P-values from bootstrapping will be reported.

Previous studies have revealed inconsistent outcomes regarding gender differences in ADHD and mood symptom representations. For example, while males have more ADHD symptoms compared to females (Gershon, 2002), females demonstrate increased levels of depression, anxiety and stress compared to males (Gudjonsson, Sigurdsson, Smari, & Young, 2009; Panevska, Zafirova-Ivanovska, Vasilevska, Isjanovska, & Kadri, 2015). A more recent review by Williamson & Johnston (2015) suggested gender differences in ADHD prevalence, comorbidities, and functional impairments in the adult population. Biederman, Faraone, Monuteaux, Bober, and Cadogen (2004) indicated that despite of the previously reported evidence for gender differences in ADHD and mood symptoms, gender did not moderate the association between ADHD and other psychiatric disorders such as major depression and anxiety. In addition, the number of females is higher than (almost twice as) the number of males in the present study sample. Thus, gender differences is treated as a confounding factor. Consequently, we checked whether the outcomes are influenced by the gender. To do so, hierarchical regression analysis was performed. In step 1, the Gender was entered as a dummy variable. In step 2, the total scores on the EFI and the total scores on the WFIRS were entered. In step 3 scores on the DSM Total Symptoms subscale of the CAARS were added.

To explore which specific daily functional impairments and executive dysfunctions can predict mood symptoms, regression analyses were performed. Scores on the EFI and WFIRS subscales were implemented as independent variables. The dependent variable in both analyses was the total score on the DASS.

Results

Mean and standard deviation of scores on the CAARS, WFIRS, EFI, and DASS scales are presented in table 2. Table 3 and table 4 show the prevalence of severity of mood and ADHD symptoms according to both the DASS and CAARS cut-offs scores.

(insert table 2, table 3 and table 4 about here)

(insert table 5 about here)

The correlations, as presented, in table 5 show that higher total scores on the DASS scale were strongly associated with higher total scores on the WFIRS (r_s = .66, p =.000), and moderately associated with lower total scores on the EFI (r_s = -.37, p =.000). The total scores on the DASS were also correlated with scores on all subscales of the WFIRS and EFI, except for the scores on the Empathy subscale of the EFI. As can be seen from table 5, correlations between the DASS subscales and scores on the CAARS DSM-IVADHD Total Symptoms subscale were moderate (r_s = .43 to .48): higher scores on the CAARS are associated with higher scores on the DASS. However, after controlling for the total scores on the EFI and the total scores on the WFIRS these correlations with scores on the CAARS DSM-IVADHD Total Symptoms subscale turned out to be low and less significant (r_s = .02, p = .70 for the Depression scale, r_s = .17, p = .001 for the Anxiety scale, r_s = .22, p = .000 for the Stress scale, and r_s = .15, p = .004 for the total scores on the DASS).

A simple regression analysis predicting the severity of mood symptoms from ADHD symptoms indicated that the level of ADHD symptoms measured by the CAARS DSM-IV Total Symptoms scale explained 21% of the variance of mood symptoms measured by the total score on the DASS (R = .462, R^2 = .214, B = .765, p = .000).

Subsequent hierarchical regression analysis showed that the total scores on both the WFIRS and EFI scales significantly accounted for about 41% of the variance of the total scores on the DASS (R^2 = .406, see the outcomes of step 1 in table 6). Here only the total scores on the WFIRS represented a significant predictor. When adding scores on the CAARS DSM-IVADHD Total Symptoms scale to the model, the explained mood variance slightly increased by only 1% (R^2 change = .010, see the outcome of step 2 in table 6).

Taken together, the outcomes of these regression analyses suggest that the explained mood variance by ADHD symptoms drops (from 21% to 1%) after controlling for daily functional impairments and executive functioning.

To test whether gender confounded the outcomes, gender was entered as a dummy independent variable in step 1 in the just mentioned regression analysis. Results revealed that gender did not explain any of the mood variance (R^2 = .003, p = .319).

(insert table 6 about here)

A regression analysis, wherein all the EFI and the WFIRS subscales scores were entered, showed that the subscales accounted for 53% of the variance of the total DASS scores. The significant predictors were scores on the Organization and the Strategic Planning subscales of the EFI and scores on the Self-Concept, and Risk Taking subscales of the WFIRS (see table 7).

(insert table 7 about here)

Discussion

The present study examined the relationship between ADHD symptomatology and mood problems from the perspective of daily life impairments and executive functioning in university students. In this study, the ADHD and mood symptoms were moderately associated, but after controlling for executive functioning and daily life functional impairments, the association was significantly reduced. This indicates that the elevated level of mood symptoms in ADHD are influenced mainly by daily functional impairments and difficulties in executive functioning. These factors alone predicted a considerable proportion (41-53%) of the variance of the mood symptoms. The importance of the present study is that mood symptoms can be seen as a result of coping with the negative outcomes individuals with ADHD experience in daily life, and that ADHD symptoms such as inattention, hyperactivity and impulsivity do not play a role in the ADHD-mood relationship. This suggestion is compatible with, so far, untested theoretical discussions, especially about undiagnosed university students, who may suffer from ADHD and potentially are not receiving an appropriate treatment (Combs, Canu, Broman-Fulks, Rocheleau, & Nieman, 2015; Fier & Brzezinski, 2010; Panevska et al., 2015).

The association of mood symptoms with ADHD and related problems has a complex nature. Although, the present study shows that mood symptoms like depression and stress can be seen as result of coping with increased severity of ADHD symptoms, especially in non-clinal sample adults, the study does not rule out the possibility that ADHD symptoms may rise from mood symptoms (Nankoo, Palermo, Bell, & Pestell, 2018) and stressors arising from the university environment (Alexander & Harrison, 2013). Said differently, after enrolling at a university, a new phase of life begins with changes in lifestyle, financial responsibilities, and the rise of academic worries and a preoccupation with post-graduation life (Ibrahim, Kelly, Adams & Glazebrook, 2013). Theses worries and stressors may increase anxiety, depression and stress level leading to high prevalence rate of mood symptoms (Daddona, 2011; Fier & Brzezinski, 2010; Ibrahim et al., 2013), which in turn may lead to problems with concentration and impulsivity, and behaviors that resemble ADHD symptoms (Alexander & Harrison, 2013).

Examining the relative contribution of each of the specific daily functional impairments and executive functions, revealed that out of the studied functions only poor organization and planning skills, as well as problems with self-concept and risk taking were significant predictors of mood symptoms. This is consistent with those few studies testing the association of planning and organization skills with mood symptoms in university students (Abdallah, & Gabr, 2014; Ajilchi & Nejati, 2017; Simmons, Crook, Cannonier, & Simmons, 2018). For example, Abdallah and Gabr (2014) showed that weak organization skills (i.e. organizing lectures and timetable) are associated with anxiety and stress measured by the DASS scale. The same holds for the association of depression with risk taking (Bannink, Broeren, Heydelberg, van't Klooster, & Raat, 2015; Pailing, & Reniers, 2018) and problems with self-esteem (see a meta-analysis by Sowislo, & Orth, 2013; Aboalshamat et al., 2017; Nankoo et al., 2018). On the one hand, students may take risky actions (e.g. smoking Cannabis), as a distracting mean, to decrease anxious, depressive, and/or stressful feelings (Arbel, Perrone, & Margolin, 2018; Michael, & Ben-Zur, 2007). On the other hand, being engaged continuously in risky behaviors, may increase levels of anxiety concerning future career. Regarding the self-esteem, Orth, Robins, and Roberts (2008) explained possible ways in which low self-esteem can lead to mood symptoms such as depressive symptoms. Here, students with high levels of low self-esteem may find themselves not fitting with their peers in a challenging university setting. As a result, they may avoid social interactions or persistently seek for extensive positive support from their social ties to increase their self-confidence. This, in turn, increases the chance of being socially rejected and being depressed/anxious/stressed.

Remarkably, and in contrary to previous studies' suggestions, empathy did not explain mood symptoms. Previous studies indicated that experiencing others' negative feelings/pain may lead to high levels of psychological distress and negative moods (Schreiter, Pijnenborg, & Aan Het Rot, 2013). It may worth to note that empathy was probably not a useful executive function construct to predict mood symptoms, as it may only have a slight or no direct impact on daily functioning.

However, this particular research area (i.e. testing which of the specific executive functions and daily problems may lead to increased mood symptoms) is insufficiently addressed in the literature. As consequence we call for future studies to replicate the present outcomes in different samples of university students.

The study showed that outcomes are not confounded by gender differences. Indeed, gender did not explain the variance in mood symptoms. Although this is consistent with studies showing no evidence for moderation effects of gender on the association between ADHD and mood symptoms (Biederman et al., 2004), other previous studies indicated that females are more vulnerable to develop mood disorders than males (Gudjonsson et al., 2009; Williamson & Johnston, 2015). However, these studies focused on patients with clinical ADHD and mood disorders. Non-clinical university students represent different sample since they could manage to reach university level and showed academic success. It could be speculated, therefore, that male and female university students use the same strategies (e.g. by sharing these experiences with their peers or seeking for efficient support in academia) to compensate for the elevated level of distress and negative moods. However, future research is required to investigate this speculation. It is important to note that the absence of gender effects could be due to the fact that our sample included more females than males, and thus the present findings could be considered to reflect more the association between ADHD and mood symptoms in females. Clearly, future studies are required in order to elaborate on the role of gender in the association between ADHD and mood symptoms in non-clinical university students, using equal numbers of males and females.

Conclusion and Relevance

The present study suggests that a considerable proportion of the severity of mood symptoms can be predicted from daily functional problems and difficulties in executive functioning in subjects with varying degrees of ADHD symptoms. When controlling for these predictors, the key behavioral symptoms of ADHD (namely inattention, hyperactivity and impulsivity) on their own, showed a very minor contribution to mood symptoms.

The study has considerable clinical relevance to those who are working with distressed students in the university setting. The focus of clinicians should be shifted towards looking at how the patients' distress is inflicted by functional impairments and executive dysfunctions more than symptom severity per se. During the diagnostic assessment, clinicians should be more cautious when giving a diagnosis of mood disorders in students with ADHD. Clinicians may also monitor whether there is an enhancement of mood symptoms in those who show reduced risky activities and less problems with self-concept, organization and planning in ADHD. Furthermore, repeating the assessments of mood disorders and daily functioning in patients with ADHD over different periods of times is recommended to investigate whether the mood symptoms disappear overtime in order to focus treatment on ADHD symptoms only. Although the treatment of mood symptoms could wait until treatment that addresses functional impairments is in place, doing so may run a risk of having delayed treatment for individuals who have indeed 'genuine' mood disorders and ADHD.

Limitations

In general, the contemporary literature cautions against the singular use of self-report checklists to assess ADHD symptoms in adults Even adults with ADHD may overestimate or underestimate their ADHD characteristics (McCann & Roy-Byrne, 2004). However, it is still problematic to find other ways (than self-report scales) to assess ADHD in adults. Clinicians mainly use responses to self-reported scales and subjective observations to decide about a clinical ADHD diagnosis in adults.

Another limitation could be the sampling method, the study used a convenient sample from only one university. Thus, the findings can not be generalized on the whole university student population. The study does not count for cultural differences and equal representations of demographic variables such as race and social-economic level.

In addition, selection procedure of participants (using a posted advertisement) may lead to a bias towards higher participation of student interested in ADHD, including those with ADHD symptoms or a diagnosis of other disorders. As such, the study sample may not be representative. How strong this bias is

may be estimated from reference data on prevalence of ADHD amongst University students. Table 1 shows that about 16% of the sample reported a diagnosis with ADHD. However, having a sample, which may be enriched with a higher proportion of ADHD symptomatology, may be advantageous for statistical power of the study analysis.

Finally, by using only the EFI, the present study did not extensively cover all detailed aspects of executive functioning. Indeed, the EFI was used more as a fast screening tool to estimate the overall level of executive functioning in a large student population. To get more insights into various executive functions, future studies could use the Behavior Rating Inventory of Executive Function-Adult version (BRIEF-A), which is the most common measure of executive functions, consisting of 75 items covering several executive functions, namely inhibition, self-monitoring, planning, working memory, shifting, initiation, task monitoring, emotional control, and organization (Roth, Isquith, & Gioia, 2005).

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Table 1. Number of participants who reported a former diagnosis with ADHD, anxiety, and/or depression

The reported disorder	**Number of participants (%)**	**Males (%)**
ADHD	57 (16.6%)	25 (7.3%)
Anxiety	14 (4.1%)	5 (1.5%)
Depression	14 (4.1%)	2 (0.6%)
Anxiety and depression	14 (4.1%)	3 (0.9%)
ADHD with anxiety and/or depression	7 (2%)	3 (0.9%)

Note. No systematic diagnostic assessment was performed to confirm the reported diagnosis.

Table 2. Mean and standard deviation scores on the CAARS, WFIRS, EFI, Depression, Anxiety, Stress scales for females and males.

		CAARS								*DASS*			*EFI*							*WFIRS*								
		Inattention/ Memory	Hyperactivity/ Restlessness	Impulsivity/ Emotional Lability	Problems with Self-Concept	DSM-IV Inattentive Symptoms	DSM-IV Hyperactive Symptoms	DSM-IV ADHD Symptoms Total	ADHD Index	Depression	Anxiety	Stress	MD	ORG	IC	EM	SP	Total score	Family	Work	School	Self-concept	Life Skills	Social Functioning	Risk Taking	Total score
Female	*M*	52.99	48.65	50.65	49.24	53.08	47.67	50.86	50.49	7.82	8.39	12.78	14.55	16.62	17.43	25.62	23.19	97.54	0.53	0.30	0.54	0.70	1.00	0.41	0.42	3.89
	SD	11.06	8.86	10.25	10.65	11.72	11.02	11.71	10.03	8.99	8.24	8.92	2.69	3.86	3.69	2.93	4.24	10.75	0.42	0.82	0.47	0.54	0.80	0.42	0.36	2.75
Males	*M*	53.10	47.87	48.02	48.02	61.85	53.01	59.52	50.13	7.86	7.30	11.48	14.57	16.10	16.24	23.66	21.32	91.78	0.66	0.49	0.80	0.86	0.73	0.57	0.67	4.81
	SD	10.90	10.14	9.71	9.08	13.81	12.57	14.24	9.63	7.32	6.21	8.06	2.91	3.43	3.41	3.46	5.07	9.68	0.49	0.57	0.57	0.55	0.71	0.47	0.43	2.86

DASS = Depression, Anxiety, and Stress Scales; EFI = Executive Function Index Scale; MD = Motivational Drive subscale; ORG = Organization subscale; IC = Impulse Control subscale; EM = Empathy subscale; SP = Strategic Planning subscale; WFIRS = Weiss Functional Impairment Rating Scale; Total Score = sum score of all subscales.

Table 3. Number and Percentage of Students Scoring in Various Ranges on the DASS Subscales for males (n=126) and females (n=217) apart

DASS Subscales	Normal		Mild		Moderate		Severe and extremely severe	
	Males	Females	Males	Females	Males	Females	Males	Females
Depression	83(65.9%)	161(74.2%)	14(11.1%)	15(6.9%)	20(15.9%)	18(8.3%)	9(7.1%)	23(10.6%)
Anxiety	73(57.9%)	133(61.3%)	15(11.9%)	13(6.0%)	22(17.5%)	35(16.1)	16(12.7%)	36(16.6%)
Stress	84(66.7%)	136(62.7%)	16(12.7%)	29(13.4%)	20(15.9%)	29(13.4%)	6(4.8%)	23(10.6%)

Table 4. Number of Students with a T-Score between 65 and 70 and those with a T-Scores of 70 or above on the all CAARS Subscales (n =343)

	Inattention/ Memory Problems	Hyperactivity/ Restlessness	Impulsivity/ Emotional Lability	Problems with Self-Concept	DSM-IV Inattentive Symptoms	DSM-IV Hyperactive Symptoms	DSM-IV ADHD Symptoms Total	ADHD Index
70 >T-score > 65	11	9	10	16	23	13	14	17
T-score ≥ 70	41	11	19	12	56	23	49	15

Table 5. Spearman's correlations between scores on the DASS subscales, and scores on the CAARS, EFI, and WFIRS Subscales.

DASS	**DSM-ADHD Total Symptoms subscale of the CAARS**	**EFI**						**WFIRS**							
		MD	ORG	IC	EM	SP	Total Score	Family	Work	College	Life Skills	Self-concept	Social Functioning	Risk Taking	Total Score
Depression	.44**	-.29**	-.42**	-.22**	-.01	-.26**	-.42**	.39**	.24**	.53**	.54**	.67**	.52**	.35**	.68**
Anxiety	.43**	-.10	-.35**	-.24**	.02	-.13*	-.29**	.43**	.23**	.38**	.45**	.49**	.38**	.33**	.55**
Stress	.46**	-.05	-.38**	-.29**	.04	-.15**	-.30**	.39**	.18**	.38**	.42**	.50**	.45**	.33**	.55**
Total score DASS	.48**	-.16**	-.41**	-.27**	.02	-.19**	-.37**	.45**	.23**	.47**	.51**	.62**	.50**	.37**	.66**

**$p < .005$, *$p < .05$. Total score DASS = sum score of scores on the Depression, Anxiety, and Stress Scales; EFI = Executive Function Index Scale; MD = Motivational Drive subscale; ORG = Organization subscale; IC = Impulse Control subscale; EM = Empathy subscale; SP = Strategic Planning subscale; WFIRS = Weiss Functional Impairment Rating Scale; Total Score = sum score of all subscales.

Table 6. Hierarchical Regression Analysis Predicting the total scores on the DASS from scores on the EFI, WFIRS, Gender, and DSM ADHD Total Symptoms Scales.

Steps	Predictors	Coefficients					Model				
		β (B)	*Bias (BCa)*	*SE*	*Bootstrap 95% Confidence Interval*		*R*	R^2	R^2*change*	*Adjusted* R^2	*F*
					lower	upper					
Step 1	EFI	.061 (0.127)	.002	0.118	-0.105	0.355	.637**	.406**	.406**	.403**	115.919**
	WFIRS	.675(5.294)**	.033	0.568**	4.276	6.483					
Step2	EFI	.116(0.239)*	.000	0.118*	-0.006	0.461	.645**	.416**	.010**	.411**	80.243**
	WFIRS	.622(4.876)**	.044	0.604**	3.841	6.251					
	ADHD Symptoms	.139(0.231)*	-.004	0.097*	0.041	0.407					

Table 7. Hierarchical Regression Analysis Predicting the total score on the DASS from scores on all EFI and WFIRS subscales

Predictors	Coefficients					Model			
	β (B)	*Bias (BCa)*	*SE*	*Bootstrap 95% Confidence Interval*		*R*	R^2	*Adjusted* R^2	*F*
				lower	upper				
MD	-.053(-0.424)	.041	0.371	-1.183	0.427	.732**	.535**	.518**	31.502**
ORG	-.119(-0.708)*	.011	0.318*	-1.291	-0.023				
IC	-.082(-0.498)	.024	0.317	-1.177	0.220				
EM	.028(0.191)	-.004	0.335	-0.483	0.840				
SP	.132(0.625)**	-.009	0.204**	0.263	1.013				
Family	.081(4.011)	-.081	2.612	-1.287	9.101				
Work	-.035(-1.038)	-.468	1.860	-5.629	.897				
School	.068(2.902)	.310	3.178	-3.995	10.195				
Life Skills	.010(0.386)	.249	2.704	-4.630	6.338				
Self-Concept	.456(12.948)**	.042	1.640**	9.827	16.285				
Social Functioning	.096(4.729)	-.029	3.255	-2.376	11.283				
Risk Taking	.143(7.827)*	-.135	3.484*	.989	14.089				

**$p < .005$, *$p < .05$; BCa = Bias corrected accelerated; MD = Motivational Drive subscale of the EFI; ORG = Organization subscale of the EFI; IC = Impulse Control subscale of the EFI; EM = Empathy subscale of the EFI; SP = Strategic Planning subscale of the EFI.