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The association between academic stress and the severity of depressive symptoms among students:

The mediating role of sleep quality

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ABSTRACT

Objective: In 2023, 44% of 32.000 Dutch students reported depressive or anxiety symptoms. This research investigated the relationship between academic stress and depressive symptoms among students and examined whether sleep quality mediates the association between academic stress and depressive symptoms.

Methods: A cross-sectional design was employed, involving N = 315 Dutch students. (mean age = 20.8 (SD = 2.5), 78.4% women). Participants completed questionnaires measuring academic stress, sleep problems, and depressive symptoms.

Results: Linear regression analyses indicated that higher academic stress was significantly associated with more depressive symptoms ($B = .217, p < .001$) and poorer sleep quality ($B = .083, p < .001$). Additionally, a poorer sleep quality was positively associated with more depressive symptoms ($B = .873, p < .001$). Mediation analysis confirmed that sleep quality partially mediated the relationship between academic stress and depressive symptoms.

Conclusion: These findings suggest that academic stress contributes to depressive symptoms partly through its impact on sleep quality. This study highlights the importance of addressing sleep quality in interventions aimed at reducing the negative mental health effects of academic stress. More extensive and longitudinal research is advised to further investigate the underlying mechanisms of the correlations found in this study. Future research should focus on developing and testing stress management interventions that also target sleep problems, to prevent depressive symptoms in student populations.

INTRODUCTION

Depressive and anxiety symptoms are prevalent mental health issues among students. A study carried out by the Dutch National Institute for Public Health and the Environment (RIVM) and the Trimbos Netherlands Institute of Mental Health and Addiction in 2023, found that 44% of the 32.000 participating students reported experiencing depressive or anxiety symptoms (Nuijen et al., 2023).

According to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5; American Psychiatric Association, 2013), Major Depressive Disorder (MDD) is characterized by symptoms such as depressed mood most of the day, nearly every day, diminished interest or pleasure in almost all activities, significant weight changes, insomnia or hypersomnia, psychomotor agitation or retardation, fatigue or loss of energy, feelings of worthlessness or excessive guilt, impaired cognition (memory, concentration and indecisiveness), and recurrent thoughts of death or suicide. To meet the criteria for MDD, an individual must at least experience five of these symptoms during a two-week period, and experience significant impairment in social or occupational functioning (American Psychiatric Association, 2013).

Previous studies have shown a high comorbidity between stress and depression (Loannou et al., 2019), where stress is often seen as a significant contributor to the onset of depression. Depression hinders the ability to manage stress, leading to a vicious cycle where depression intensifies stress, and elevated stress, in turn, exacerbates depression (Wheatley, 1997). The well-known 'fight or flight' reaction also plays a part in this relationship as it can induce anxiety in response to acute stressors (Zhang et al., 2022), while prolonged stress, such as academic stress, can lead to the development of depressive symptoms (Wheatley, 1997). In both Western and Asian countries, academic concerns are the leading causes of both chronic and sporadic stress for young people (Zhang et al., 2022). Academic stress can be defined as the external and internal evaluation of academic performance and achievement that leads to unpleasant emotions of stress and anxiety (Ang & Huan, 2006). Academic pressure is prevalent among young adults and is linked to both academic problems and low academic performance, and an increased likelihood of experiencing depression (Ang & Huan, 2006; Çelik et al., 2019). Adolescents who faced academic stress were 2.4 times more likely to exhibit depressive symptoms (Zhang et al., 2022).

Additionally, research has indicated a link between reduced sleep quality during exam periods and increased perceived stress levels in university students (Zunhammer et al., 2014). However, further research mostly focusses on samples of medical students. One study reported a high prevalence of academic stress and poor sleep quality among medical students in Pakistan (Waqas et al., 2015). In their 2015 study they concluded that academic stressors significantly contributed to one's perceived stress and sleep disorders (Waqas et al., 2015). Other studies highlight similar results (Alotaibi et al., 2020; Alsaggaf et al., 2016). They reported significant relations between higher levels of stress and poor sleep quality, excessive daytime sleepiness, and sleep deprivation in medical students during preclinical and clinical years (Alotaibi et al., 2020; Alsaggaf et al., 2016). Although, most of the research has been done on medical students or on samples of strictly university students, there is reason to believe that similar results can be extended to a more general sample of students.

Similarly, depression can be predicted by poor sleep quality (Zhang et al., 2022). Students reporting more sleep problems and therefore poor sleep quality are 3.28 times more likely to develop depressive symptoms (Çelik et al., 2019). Additionally, sleep disturbance is a common physical symptom of depression (American Psychiatric Association, 2013). Research consistently demonstrates a strong relationship between sleep quality and depressive symptoms. O'Callaghan et al. (2021) found that all categories of sleep problems were significantly associated with depressive symptoms. Logically, while most categories of sleep problems were positively correlated with depressive symptoms, 'sleep duration' showed a negative correlation which meant that a shorter sleep duration was correlated to more depressive symptoms. On the other hand, the category sleep quality had the highest correlation and was found to be more reliably correlated with depressive symptoms (O'Callaghan et al., 2021). This aligns with findings from other studies and meta-analyses indicating that perceived sleep quality is a crucial indicator of mood and anxiety symptomatology (O'Callaghan et al., 2021; Pensuksan et al., 2015). Poor sleep quality is linked to increased psychological problems, including irritability, anxiety, tension, depression, confusion, and general health issues (Keshavarz Akhlaghi & Ghalebandi, 2009). Additionally, sleep disturbances and dissatisfaction with sleep are widespread among undergraduates globally, highlighting the significant impact of sleep quality on mental health across diverse populations (Clegg-Kraynok et al., 2011). Thus, focusing on sleep

quality therefore may provide an accurate and comprehensive understanding of the relationship between sleep and depressive symptoms.

Lastly, given that academic stress is known to disturb sleep quality, and sleep quality is shown to have a significant relationship with depressive symptoms, it is crucial to investigate ‘sleep quality’ as a mediating variable in the relationship between ‘academic stress’ and ‘depressive symptoms’. Investigating sleep quality as a mediator in this relationship is compelling for several reasons. Research by Liu et al. (2023) highlights that academic stress not only directly affects depression, but also exerts its influence through mediators such as ‘negative affect’ and ‘sleep quality’. Prior research has predominantly focused on children and adolescents (O’Callaghan et al., 2021), and has largely underestimated the influence of academic stress on college students (Liu et al., 2023). Little is currently known about the mediating role of sleep quality in the relationship between academic stress and depression among students. This results in a research gap that presents a valuable opportunity for further exploration.

Based on the literature review, four hypotheses can be formulated:

Hypothesis 1: Academic stress is positively associated with depressive symptoms among students. This is supported by previous research on the link between stress and depression (Ang & Huan, 2006; Çelik et al., 2019; Wheatley, 1997; Zhang et al., 2022)

Hypothesis 2: Academic stress is negatively associated with more sleep problems among students. This is based on previous findings indicating that stress can disrupt sleep patterns (Zunhammer et al., 2014).

Hypothesis 3: More sleep problems is positively associated with increased depressive symptoms among students. This hypothesis is supported by studies showing that decreased sleep quality is linked to a higher risk of developing depressive symptoms (Çelik et al., 2019; Zhang et al., 2022).

Hypothesis 4: Sleep problems mediate the relationship between academic stress and depression. It is expected that higher levels of academic stress lead to poorer sleep quality. Which, in turn, will be associated with depressive symptoms (Çelik et al., 2019; Zunhammer et al., 2014).

The aim of this study is to further investigate and deepen the understanding of the relationships between academic stress, sleep quality, and depressive symptoms among students, and determine whether sleep quality functions as a mediator in the association

between academic stress and depressive symptoms. The findings of this research may provide valuable insights for developing intervention methods aimed at mitigating the negative effects of academic stress on student mental health, while emphasizing the importance of sleep in this context and student population.

METHODS

This study has a cross-sectional (correlational) study design. The data were collected at a single point in time, allowing to examine associations between variables at that specific moment.

Participants

In 2020, a total of $N = 382$ Dutch speaking students from Leiden, The Hague, Delft, Rotterdam, and Amsterdam took part in an online study. Inclusion criteria included: being enrolled as a student (either full-time or part-time), being ≥ 18 years old and being fluent in Dutch. Recruitment efforts involved distributing flyers throughout university buildings, utilizing social media platforms, and word-of-mouth publicity. Interested students received a link to enter an online platform where they could learn more about the study and sign an online informed consent form. Subsequently, they filled in the questionnaires; a process that took approximately 30 minutes. Participation was incentivized with a lottery to win small monetary amounts up to €50. All data were stored anonymously.

After evaluating the inclusion and exclusion criteria, $n = 25$ participants were excluded from the analysis because they were not students at any of the three Dutch educational levels (MBO, HBO or university), $n = 4$ participants were excluded because they were younger than 18 years, $n = 38$ participants showed missing data on one or more of the three main variables. This resulted in a new sample of $N = 315$ participants that were included in the analysis. Of the total sample, 21.6% identified as male and 78.4% identified as female. The mean age was 20.8 ± 2.5 years, with a range of 18 to 30 years. Furthermore, 1.3% of the sample attended MBO (secondary vocational education), 12.1% attended HBO (higher professional education) and 86.7% attended university.

Materials

In 2020, three self-report questionnaires were administered to participants, and used to evaluate the four hypotheses proposed in this research. These questionnaires measured the primary variables of interest: academic stress, sleep quality, and depressive symptoms. Additionally, general demographic data (gender, age, and educational level) were collected.

Academic Stress

In this study, the variable ‘academic stress’ was measured with the Law Student Perceived Stress Scale (LSPSS; Bergin & Pakenham, 2015).

The LSPSS is a 24-item scale used to measure perceived stress among law students. These items are grouped into four subscales and rated on a 5-point scale (1 = not at all – 5 = very stressful). The four subscales include: academic demands, social isolation, career pressure, and study/life imbalance. The numerical values of the responses for all items are summed to obtain a total score. This total score represents the overall level of perceived stress. Higher scores on each dimension are associated with increased depression and anxiety symptoms. The LSPSS has shown an internal reliability and split-half reliability for the full-scale of $r = .89$, indicating a high consistency and stability (Bergin & Pakenham, 2015).

Poor Sleep Quality

To assess ‘poor sleep quality, the Pittsburgh Sleep quality Index (PSQI; Buysse et al., 1989) was utilized. This scale was developed to provide a standardized measure of sleep quality over the previous month using 19 self-rated questions. These questions assess several factors related to sleep quality, such as sleep duration, sleep onset latency and the frequency and severity of sleep-related problems.

The 19 items are grouped into seven components: subjective sleep quality, sleep onset latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction. Each component score is measured on a 0-3 scale, and the sum of these component scores is then translated into a general PSQI-score ranging from 0 to 21, with higher scores indicating poorer sleep quality (Buysse et al., 1989).

The overall reliability coefficient (Cronbach’s α) for the seven components scores in the PSQI is .83, indicating a high internal consistency. Therefore, it can be assumed that the seven components measure the same underlying construct: sleep quality. Moreover, the individual items of the PSQI show a general reliability coefficient (Cronbach’s α) of .83, indicating strong correlations among the items (Buysse et al., 1989). However, when calculating the Cronbach’s α in the sample of this study, a reliability coefficient of .64 was measured.

Depressive Symptoms

The Quick Inventory of Depressive symptoms self-report was utilized to assess depressive symptoms in participants during the previous seven days. The QIDS-SR is a 16-item measure to gauge the severity of depressive symptoms (QIDS-SR; Rush et al., 2003). The 16 items are grouped into nine domains that correspond to the DSM-5 criteria: sad mood, concentration, self-criticism, suicidal ideation, interest, energy/fatigue, sleep disturbance (initial, middle, and late insomnia or hypersomnia), decrease/increase in appetite/weight, and psychomotor agitation/retardation (Rush et al., 2003). The total QIDS-SR score, ranging from 0 to 27, is obtained by summing the scores from these nine domains, with higher scores indicating more severe depressive symptoms. The QIDS-SR demonstrates a high internal consistency (Cronbach's α) of .86 (Rush et al., 2003).

Procedure

Firstly, descriptive statistical analyses were conducted on demographics and all key variables. This preliminary step provided a comprehensive overview of the sample characteristics and the distribution of the variables. Following this, a multiple regression analysis (MRA) was employed to examine the relationship between the independent variable 'Academic Stress' and the dependent variable 'Depressive Symptoms', while controlling for potential confounding effect of 'gender'. To further explore the complex interaction between these variables, a mediation analysis was performed on the effect of sleep quality in the relationship between academic stress and depressive symptoms. To estimate the different paths in this model, the mediation analysis was performed using PROCESS for SPSS v2.16.3 (Model number 4) (Hayes, 2014). The significance of the indirect effect, which represents the effect of the independent variable (X: academic stress) on the dependent variable (Y: depressive symptoms) via the mediator (M: sleep problems), was assessed using the bootstrapping procedure with 5000 resamples (Hayes, 2014). All statistical tests were conducted at a significance level of alpha .05 (two-sided). The analyses were carried out using IBM SPSS Statistics 27.0 (IBM, Armonk, NY, USA).

Results

The results from the statistical analysis on the total questionnaire scores are summarized in the table below. Table 1 shows the mean total questionnaire scores and their standard deviation scores, based on all 315 participants.

Table 1. Questionnaire scores (N = 315).

Questionnaires	M(SD)
Academic Stress (LSPSS score)	37.0 (8.3)
Depressive symptoms (QIDS-SR score)	6.2 (3.8)
Sleep Problems (PSQI -score)	5.6 (2.5)

To analyze the first hypothesis (“Academic stress is **positively** associated with depressive symptoms among students”), a Linear Regression Analysis was conducted on the relationship between academic stress and depressive symptoms, while controlling for gender. The following results were found: (academic stress) $B = .217$, $p. < .001$. This positive regression coefficient showed that in this sample more academic stress was associated with more depressive symptoms, which is in line with the hypothesis. Furthermore, the general model had a high explained variance correlation: $R \text{ square} = .210$; no effect of gender on depressive symptoms was found.

To analyze the second hypothesis (“Academic stress is **positively** associated with poor sleep quality among students”), a second Linear Regression Analysis was conducted on the relationship between academic stress and poor sleep quality, while controlling for gender. The following results were found: (academic stress) $B = .083$, $p. < .001$. Also here, the positive regression coefficient showed that in this sample, more academic stress was associated with poorer sleep quality, which confirms the second hypothesis. This model had a low explained variance: $R \text{ square} = .070$ and no effect of gender on sleep problems was found.

A third Linear Regression Analysis was conducted on the relationship between sleep problems and depressive symptoms, while controlling for gender, to analyze the third hypothesis (“Poor sleep quality is **positively** associated with more depressive symptoms among students”). The following results were found: (sleep problems) $B = .873$, $p. < .001$. This shows a significant and positive correlation. Therefore, we can conclude that in this sample, having more sleep problems was associated with having more depressive symptoms. This is in line with the third hypothesis. Additionally, the data showed a high level of explained variance for this model ($R \text{ square} = .340$), and no effect of gender was found on depressive symptoms.

This study assessed the mediating role of sleep quality on the relationship between academic stress and depressive symptoms (hypothesis four). The results showed a significant indirect effect of the impact of academic stress on depressive symptoms through sleep quality: $b = .0620$, the 95% confidence interval for this effect was $[.0317, .0968]$. This confirms the fourth hypothesis of a mediating role of sleep problems. However, the analysis also showed a significant direct effect of academic stress on depressive symptoms, in presence of a mediator ($b = .1545$, $t = 7.3830$, $p < .001$). Hence, sleep quality only partially mediated the relationship between academic stress and depressive symptoms. This means that in the presence of the mediator (sleep problems), some of the impact of academic stress on depressive symptoms is mediated by sleep problems, while some of the impact is direct. A mediation analysis summary is presented in Table 2.

Table 2. Mediation Summary.

Relationship	Effect (<i>b</i>)	<i>SE</i>	<i>t</i>	<i>p</i>	Lower Bound	Upper bound
Academic stress - sleep quality (a)	.083	.017	4.819	< .001	.049	.117
Sleep quality - depressive symptoms (b)	.744	.066	11.252	< .001	.614	.875
Direct effect academic stress – depressive symptoms (c')	.155	.021	7.383	< .001	.113	.196
Indirect effect	.062	.016	-	-	.032	.097
Total effect	.217	.024	9.054	< .001	.170	.264

DISCUSSION

This research aimed to investigate the relationship between academic stress and depressive symptoms among students, and the possible mediating role of sleep problems.

The results confirmed that academic stress was positively associated with depressive symptoms, supporting the first hypothesis. This finding is consistent with prior research establishing a link between stress and depression (Wheatley, 1997; Zhang et al., 2022). The second hypothesis was also supported: higher academic stress is linked to poorer sleep quality, suggesting that stress negatively impacts sleep quality. However, the effect size in our study was small, with an unstandardized regression coefficient of .083 ($p < .05$). Still, this association aligns with studies suggesting that stress disrupts sleep patterns. Similarly to our results, Zunhammer et al. (2014) also found a small-to-moderate effect size (.085). Furthermore, a significant positive association was found between sleep problems and depressive symptoms, consistent with previous research indicating sleep disturbances are a significant predictor of depression (Ang & Huan, 2006; Çelik et al., 2019; Wheatley, 1997; Zhang et al., 2022). The mediation analysis supported the fourth hypothesis, revealing that sleep quality partially mediated the relationship between academic stress and depressive symptoms. This implies that academic stress contributes to depressive symptoms, both directly and indirectly, through its impact on sleep quality. These findings are further supported by Liu et al. (2023), who also demonstrated that academic stress significantly impacts depression directly and indirectly through sleep quality. However, in their study, they also investigated another possible mediator: 'negative affect', suggesting that other factors may also contribute to this relationship. Furthermore, it should be noted that their sample consisted of solely Chinese college students with a different cultural background than our sample of Dutch students. This is an important difference as the social and cultural values in China, where academic excellence is a social norm, contribute to the high levels of academic stress experienced by Chinese college students (Liu et al., 2023). Which may be higher than in Dutch students.

The importance of stress management, especially in the context of mental health should not be underestimated. According to Loannou et al. (2019), managing stress levels before addressing depressive symptoms can equip individuals with skills such as realistic risk estimation and de-catastrophizing, that help lower depressive symptoms and improve

one's self esteem. As stated in their 2020 research, Stächele et al. highlight the growing popularity of internet-based stress management programs in today's society. Therapies and intervention methods are being preferred that are both cost-effective and widely accessible. These programs are often grounded in cognitive behavioral therapy (CBT) and focus on several components such as reducing perceived stress and improving coping skills. They aim to target emotional exhaustion, depressive symptoms, and sleep quality as well. In the context of sleep quality, specific internet-based therapy grounded in cognitive-behavioral principles has shown significant effectiveness in alleviating sleep problems and insomnia (Stächele et al., 2020). The confirmation of the mediating role of sleep problems suggested that interventions aimed at improving sleep quality could be effective in mitigating the negative mental health impacts of academic stress. This emphasizes the importance of addressing sleep issues in the context of academic stress management. However, the findings also highlighted that while improving sleep quality is crucial, it alone may not be sufficient to completely alleviate depressive symptoms associated with academic stress. This is due to the direct correlation that exists between depressive symptoms and academic stress. Therefore, a comprehensive approach is necessary that first focusses on academic stress management and secondly on sleep quality and other stress-related factors.

Several limitations to this research should be acknowledged. Firstly, the cross-sectional design of the study does not allow causal inferences. Longitudinal studies are needed to more firmly establish the relationships found in this research. Secondly, the reliance on self-report measures may introduce response biases, such as social desirability or recall bias. Furthermore, the generalizability of the research findings to the broader population of 'students' may be subject to scrutiny, given that the majority of the sample (86.7%) consisted of university students and 78.4% were women. However, the results provide valuable insights that should be taken into consideration for example in counseling services or by mental health practitioners.

Our dataset was collected in 2020 during the worldwide COVID-19 pandemic. Research has recently shown that the pandemic has been a risk factor that led to an increase in mental problems in college students (Chang et al., 2021). In their 2021 research Chang et al. concluded an elevated prevalence of anxiety and depressive symptoms during this time. The pandemic's high morbidity and mortality rates, along with much uncertainty, have caused considerable mental distress worldwide (Sameer et al., 2020). Individuals facing

persistent stressors such as job loss, financial struggles, heightened responsibilities, work-related stress, interpersonal losses, social isolation, and virus exposure were at a heightened risk of developing anxiety and depression (Vajpeyi Misra et al., 2022). This historic event could be seen as a possible threat to the internal validity of this research as it might have influenced the responses of our sample leading to higher scores on academic stress, poor sleep quality and depressive symptoms, and therefore stronger correlations. Nevertheless, given that our findings align closely with prior and more recent research on the same topic, it can be argued that the pandemic's impact on our results may be considered negligible.

Lastly, the relatively low Cronbach's alpha for the PSQI in this sample (.64) suggests a questionable reliability, indicating that the items may not be consistent with each other and therefore may not consistently measure sleep quality as intended. Recently, there has been more criticism about the role of the Cronbach's α within the field of psychological research (McNeish, 2018). Even though it's still a commonly used measure of reliability, it's limitations must be acknowledged, particularly in the context of complex multidimensional constructs such as sleep quality. The Cronbach's α is known to be lower bound to the reliability and in many cases misleading and a gross underestimate (Revelle & Zinbarg, 2009; Sijtsma, 2009). To be 'lower bound' to reliability means that the value is a minimum estimate of the true reliability. The actual reliability of the measure is likely to be higher than this estimate, resulting in measures appearing to be less reliable than they truly are (McNeish, 2018). As previously stated, the PSQI's α of .64 in our study indicates a questionable reliability. However, this does not necessarily invalidate its use. The PSQI is one of the most common sleep questionnaires (O'Callaghan et al., 2021), and remains a widely accepted instrument for assessing various dimensions of sleep quality (Buysse et al., 1989; Dietch et al., 2016). Moreover, given our sample size of $N = 315$, the variability in responses can still provide meaningful insights into the relationship between sleep quality, academic stress, and depressive symptoms. Future studies could benefit from using alternative reliability estimates such as the McDonald's ω , which may offer a more accurate assessment of the internal consistency of the instruments used (Revelle & Zinbarg, 2009).

Future research should also aim at a more balanced sample in which students from MBO (secondary vocational education), and HBO (higher professional education) are also included, to improve the external validity. Additionally, other potential mediators and moderators could be interesting to take into consideration, to provide a more comprehensive

understanding of the mechanisms underlying the relationship between academic stress and depressive symptoms. For example, social support. Social support has been shown to act as a protective factor against depressive symptoms, and its influence on sleep quality and stress responses is well-documented (Gordon et al., 2021; Loannou et al., 2019; Palmer et al., 2022). While some researchers found a difference between female and male participants, with females at a greater risk of experiencing sleep problems such as insomnia (Bauducco et al., 2024), others did not find similar gender differences (Palmer et al., 2022). Both, the quantity, and quality of social connections are crucial. While loneliness and victimization negatively affect sleep (Gordon et al., 2021), which can exacerbate depressive symptoms, supportive relationships enhance one's perceived sleep quality (Gordon et al., 2021). Supporting these findings, Liu et al. (2023) concluded that social support moderates the impact of negative affect on sleep quality, with stronger effects observed in students with lower social support compared to students with higher social support. This study revealed that college students that suffer from academic stress, perceived more negative affect, which further damages their sleep quality and thus increases their risk of depression (Liu et al., 2023). Therefore, an active social life, which is protective against depression (Rinker et al., 2016), might also reduce sleep opportunities during school nights, adding complexity to the relationship between social support, academic stress, and depressive symptoms.

In conclusion, this study found that academic stress is related to depressive symptoms in a sample of Dutch students. A mediating factor in this relationship was poor sleep quality. These findings emphasize the importance of addressing sleep disturbances in interventions aimed at mitigating the negative effects of academic stress on mental health. By improving our understanding of these relationships, this research contributes to the broader field of clinical psychology and students' well-being.

REFERENCES

- Alotaibi, A., Alosaimi, F., Alajlan, A., & Bin Abdulrahman, K. (2020). The relationship between sleep quality, stress, and academic performance among medical students. *Journal of Family and Community Medicine, 27*(1), 23–28.
https://doi.org/10.4103/jfcm.JFCM_132_19
- Alsaggaf, M. A., Wali, S. O., Merdad, R. A., & Merdad, L. A. (2016). Sleep quantity, quality, and insomnia symptoms of medical students during clinical years: Relationship with stress and academic performance. *Saudi Medical Journal, 37*(2), 173–182.
<https://doi.org/10.15537/smj.2016.2.14288>
- Ang, R. P., & Huan, V. S. (2006). Relationship between academic stress and suicidal ideation: Testing for depression as a mediator using multiple regression. *Child Psychiatry and Human Development, 37*(2), 133–143. <https://doi.org/10.1007/s10578-006-0023-8>
- Bauducco, S., Boersma, K., & Gradisar, M. (2024). Sleepy and popular? The association between popularity, sleep duration, and insomnia in adolescents. *Frontiers in Sleep, 3*.
<https://doi.org/10.3389/frsle.2024.1346806>
- Bergin, A., & Pakenham, K. (2015). Law Student Stress: Relationships Between Academic Demands, Social Isolation, Career Pressure, Study/Life Imbalance and Adjustment Outcomes in Law Students. *Psychiatry, Psychology and Law, 22*(3), 388–406.
<https://doi.org/10.1080/13218719.2014.960026>
- Buysse, D. J., Reynolds III, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: A New Instrument for Psychiatric Practice and Research. *Psychiatry Research, 28*, 193–195.
- Çelik, N., Ceylan, B., Ünsal, A., & Çağan, Ö. (2019). Depression in health college students: relationship factors and sleep quality. *Psychology, Health and Medicine, 24*(5), 625–630.
<https://doi.org/10.1080/13548506.2018.1546881>

- Chang, J. J., Ji, Y., Li, Y. H., Pan, H. F., & Su, P. Y. (2021). Prevalence of anxiety symptom and depressive symptom among college students during COVID-19 pandemic: A meta-analysis. In *Journal of Affective Disorders* (Vol. 292, pp. 242–254).
<https://doi.org/10.1016/j.jad.2021.05.109>
- Clegg-Kraynok, M. M., McBean, A. L., & Montgomery-Downs, H. E. (2011). Sleep quality and characteristics of college students who use prescription psychostimulants nonmedically. *Sleep Medicine*, *12*(6), 598–602.
<https://doi.org/10.1016/j.sleep.2011.01.012>
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders, DSM-5* (5th ed.) [Unknown]. American Psychiatric Association.
- Dietch, J. R., Taylor, D. J., Sethi, K., Kelly, K., Bramoweth, A. D., & Roane, B. M. (2016). Psychometric evaluation of the PSQI in U.S. college students. *Journal of Clinical Sleep Medicine*, *12*(8), 1121–1129. <https://doi.org/10.5664/jcsm.6050>
- Gordon, A. M., Carrillo, B., & Barnes, C. M. (2021). Sleep and social relationships in healthy populations: A systematic review. In *Sleep Medicine Reviews* (Vol. 57). W.B. Saunders Ltd. <https://doi.org/10.1016/j.smr.2021.101428>
- Hayes, A. F. (2014). *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach* (1st ed.) [Book]. Guilford Publications.
- Ioannou, M., Kassianos, A. P., & Symeou, M. (2019). Coping with depressive symptoms in young adults: Perceived social support protects against depressive symptoms only under moderate levels of stress. *Frontiers in Psychology*, *9*(JAN).
<https://doi.org/10.3389/fpsyg.2018.02780>
- Keshavarz Akhlaghi, A.-A., & Ghalebandi, M. F. (2009). Sleep Quality and Its Correlation with General Health in Pre-university Students of Karaj, Iran. In *Original Article Iranian Journal of Psychiatry and Behavioral Sciences (IJPBS)* (Vol. 3, Issue 1).

- Liu, Y., Chen, J., Chen, K., Liu, J., & Wang, W. (2023). The associations between academic stress and depression among college students: A moderated chain mediation model of negative affect, sleep quality, and social support. *Acta Psychologica*, 239. <https://doi.org/10.1016/j.actpsy.2023.104014>
- McNeish, D. (2018). Thanks coefficient alpha, We'll take it from here. *Psychological Methods*, 23(3), 412–433. <https://doi.org/10.1037/met0000144>
- Nuijen, J., Verweij, A., Dopmeijer, J., Van Wamel, A., Schouten, F., Buijs, M., Van Der Horst, M., & Van Den Brink, C. (2023). *Monitor Mentale Gezondheid en Middelengebruik Studenten Hoger Onderwijs*. <https://doi.org/DOI.10.21945/RIVM-2023-0412>
- O'Callaghan, V. S., Couvy-Duchesne, B., Strike, L. T., McMahon, K. L., Byrne, E. M., & Wright, M. J. (2021). A meta-analysis of the relationship between subjective sleep and depressive symptoms in adolescence. In *Sleep Medicine* (Vol. 79, pp. 134–144). Elsevier B.V. <https://doi.org/10.1016/j.sleep.2021.01.011>
- Palmer, C. A., Powell, S. L., Deutchman, D. R., Tintzman, C., Poppler, A., & Oosterhoff, B. (2022). Sleepy and Secluded: Sleep Disturbances are Associated With Connectedness in Early Adolescent Social Networks. *Journal of Research on Adolescence*, 32(2), 756–768. <https://doi.org/10.1111/jora.12670>
- Pensuksan, C. W., Lertmaharit, S., Lohsoonthorn, V., Rattananupong, T., Sonkprasert, T., Gelaye, B., & Williams, M. A. (2015). Relationship between Poor Sleep Quality and Psychological Problems among Undergraduate Students in the Southern Thailand. *Walailak Journal*. <http://wjst.wu.ac.th>
- Revelle, W., & Zinbarg, R. E. (2009). Coefficients alpha, beta, omega, and the glb: Comments on sijtsma. *Psychometrika*, 74(1), 145–154. <https://doi.org/10.1007/s11336-008-9102-z>

- Rinker, D. V., Krieger, H., & Neighbors, C. (2016). Social Network Factors and Addictive Behaviors Among College Students. In *Current Addiction Reports* (Vol. 3, Issue 4, pp. 356–367). Springer. <https://doi.org/10.1007/s40429-016-0126-7>
- Rush, A. J., Trivedi, M. H., Ibrahim, H. M., Carmody, T. J., Arnow, B., Klein, D. N., Markowitz, J. C., Ninan, P. T., Kornstein, S., Manber, R., Thase, M. E., Kocsis, J. H., & Keller, M. B. (2003). The 16-Item Quick Inventory of Depressive Symptomatology (QIDS), Clinician Rating (QIDS-C), and Self-Report (QIDS-SR): A Psychometric Evaluation in Patients with Chronic Major Depression. *Biol Psychiatry*, *54*, 573–583. [https://doi.org/10.1016/S0006-3223\(03\)01866-8](https://doi.org/10.1016/S0006-3223(03)01866-8)
- Sameer, A. S., Khan, M. A., Nissar, S., & Banday, M. Z. (2020). Assessment of Mental Health and Various Coping Strategies among general population living Under Imposed COVID-Lockdown Across world: A Cross-Sectional Study. In *Ethics, Medicine and Public Health* (Vol. 15). Elsevier Masson s.r.l. <https://doi.org/10.1016/j.jemep.2020.100571>
- Sijtsma, K. (2009). On the use, the misuse, and the very limited usefulness of cronbach's alpha. *Psychometrika*, *74*(1), 107–120. <https://doi.org/10.1007/s11336-008-9101-0>
- Stächele, T., Domes, G., Wekenborg, M., Penz, M., Kirschbaum, C., & Heinrichs, M. (2020). Effects of a 6-Week Internet-Based Stress Management Program on Perceived Stress, Subjective Coping Skills, and Sleep Quality. *Frontiers in Psychiatry*, *11*. <https://doi.org/10.3389/fpsy.2020.00463>
- Vajpeyi Misra, A., Mamdouh, H. M., Dani, A., Mitchell, V., Hussain, H. Y., Ibrahim, G. M., & Alnakhi, W. K. (2022). Impact of COVID-19 pandemic on the mental health of university students in the United Arab Emirates: a cross-sectional study. *BMC Psychology*, *10*(1). <https://doi.org/10.1186/s40359-022-00986-3>

- Waqas, A., Khan, S., Sharif, W., Khalid, U., & Ali, A. (2015). Association of academic stress with sleeping difficulties in medical students of a Pakistani medical school: A cross sectional survey. *PeerJ*, 2015(3). <https://doi.org/10.7717/peerj.840>
- Wheatley, D. (1997). Stress, anxiety and depression. *Stress Medicine*, 13(3), 173–177. [https://doi.org/10.1002/\(SICI\)1099-1700\(199707\)13:3<173::AID-SMI739>3.0.CO;2-6](https://doi.org/10.1002/(SICI)1099-1700(199707)13:3<173::AID-SMI739>3.0.CO;2-6)
- Zhang, X., Gao, F., Kang, Z., Zhou, H., Zhang, J., Li, J., Yan, J., Wang, J., Liu, H., Wu, Q., & Liu, B. (2022). Perceived Academic Stress and Depression: The Mediation Role of Mobile Phone Addiction and Sleep Quality. *Frontiers in Public Health*, 10. <https://doi.org/10.3389/fpubh.2022.760387>
- Zunhammer, M., Eichhammer, P., & Busch, V. (2014). Sleep Quality during Exam Stress: The Role of Alcohol, Caffeine and Nicotine. *PLoS ONE*, 9(10). <https://doi.org/10.1371/journal.pone.0109490>