Journal of Contemporary Studies in Epidemiology and Public Health
2025, 6(1), ep25004
e-ISSN: 2634-8543
https://www.jconseph.com

MODESTUM

Original Article

OPEN ACCESS

Academic performance and depression among university students: The serial mediating role of sleep duration and psychological stress

Adekola Babatunde Ademoyegun [1,2]*, Adebukola Ibitoye [1,3], Joshua Afolabi [4], Taofeek Awotidebe [2], Chidozie Mbada [5]

[1] Department of Physiotherapy, Osun State University Teaching Hospital, Osogbo, Osun State, NIGERIA
[2] Department of Medical Rehabilitation, Obafemi Awolowo University, Ile-Ife, Osun State, NIGERIA
[3] Department of Physiotherapy, Faculty of Medical Rehabilitation, University of Medical Sciences, Ondo, Ondo State, NIGERIA
[4] Department of Physiotherapy, Redeemer's University, Ede, Osun State, NIGERIA
[5] Department of Health Professions, Faculty of Health and Education, Manchester Metropolitan University, Manchester, UK
***Corresponding Author:** aademoyegun@gmail.com

Citation: Ademoyegun AB, Ibitoye A, Afolabi J, Awotidebe T, Mbada C. Academic performance and depression among university students: The serial mediating role of sleep duration and psychological stress. J CONTEMP STUD EPIDEMIOL PUBLIC HEALTH. 2025;6(1):ep25004. https://doi.org/10.29333/jconseph/17215

ARTICLE INFO

Received: 31 Oct. 2024

Accepted: 16 Sep. 2025

ABSTRACT

The psychological process that underpins the nexus between academic performance and depression among students is still largely unspecified. This study aimed to investigate whether sleep duration and psychological stress sequentially mediate the relationship between academic performance and depression. 510 consented Nigerian physiotherapy undergraduates responded in this cross-sectional survey. Depression and psychological stress were assessed using the depression and stress sub-scale of the depression, anxiety and stress scale-21; while sleep duration and academic performance were assessed by self-report using a proforma. A serial mediation analysis was performed. The prevalence of depression, psychological stress, and sleep disturbance was 36.5%, 22.5%, and 73.9%, respectively. Serial mediation analysis showed that academic performance was negatively associated with depression (β = -1.003; 95% confidence interval [CI]: -1.716, -0.291). Psychological stress (β = -1.157; 95% boot CI: -1.994, -0.334) but not sleep duration (β = 0.030; 95% boot CI: -0.048, 0.122), significantly mediated this relationship. Although sleep duration alone was not a significant mediator, it contributed as the initial step in a significant serial mediation pathway, where reduced sleep duration increased psychological stress, which in turn heightened depression (β = -0.159; 95% boot CI: -0.346, -0.031). The total indirect effect of sleep duration and psychological stress was significant (β= -1.287; boot CI: -2.119, -0.471) and accounted for 56.2% of the total effect of academic performance on depression. Sleep duration and psychological stress jointly mediate the relationship between academic performance and depression among university students. Efforts to mitigate depression in this population should therefore address the interconnected roles of academic demands, sleep, and stress.

Keywords: mental health, education, insomnia, college students

INTRODUCTION

Depression, which is characterized by moodiness, grief, constant low spirit, unhappiness, low self-esteem, pessimism, and suicidal thoughts or attempt, is very common among university students [1]. Depression has been linked with many negative life and health indices, including low economic productivity, cardiovascular health disease, functional limitation, and suicidal deaths [2-4]. Evidence has shown that the rate of depression in this population is higher compared to the prevalence of depression reported in society generally [5, 6]. Thus, a deeper understanding of the mechanisms involved in the higher rate of depression in university students is needed.

Reports have shown that personal and environmental factors are consistent predictors of depressive symptoms [1, 7]. Academic performance is one of the personal and environmental factors that can precipitate or perpetuate depression in university students. In many societies, getting opportunities, employment, societal recognition, parental, teacher, peer acceptance, etc., are associated with good academic performance, which ultimately undermines the mental health of students [4, 8]. However, evidence of the impact of academic performance on depression among this population is still inconclusive. While studies have identified school performance as a major contributor to depression among university students [9, 10], the recent data in [1] showed that university students with low academic performance had higher but insignificant depressive symptoms. Meanwhile, depression among students is associated with other factors, including sleep disturbance and psychological stress [4]. It is therefore crucial to further assess the mechanism by which the level of depression in university students is influenced by academic performance.

In addition to the foregoing, sleep is known to be associated with depression among university students [3]. Generally, sleep is important for general well-being and is influenced by many interacting factors, including bio-psychosocial and environmental factors [11]. Individuals with inadequate sleep duration present with chronic inflammation, dysfunction of melatonin, and neurological, and hormonal balance, which are known precursors of depression [3]. The study in [1] reported that about 80% of university students had sleep disturbances, while the study in [3] found that about 27.4% of Chinese university students do not sleep up to 7 hours per night. Several studies have linked poor academic performance with sleep disturbance in university students [12-14]. As much as sleep disturbance does impair memory, attention, and cognition and often leads to poor academic performance [15], similarly, students with poor academic performance may 'lose' sleep because of career, life, and social implications associated with academic performance. It was reported that the higher the academic performance, the better the sleep quality among university students in Malaysia [16]. Furthermore, students intentionally cut down their sleep time to maintain or improve their academic performance [17-19]. Meanwhile, the findings of the studies in [1, 3, 20] showed significant associations among sleep duration, sleep quality and depression among university students.

Furthermore, psychological stress is a common risk of depressive symptoms [1, 21]. University students are reportedly under tremendous mental stress, especially health science students [1, 21]. Among university students, the rate of psychological stress obtained in different nationalities is high and ranges from 20.9% to 90% [22]. While different potential stressors for university students have been identified in the literature, academic-related stressors are a major source of mental stress to students [1, 21, 22]. Among all academic-related stressors, academic performance is a major contributor. The study in [22], while assessing the relative contribution of different potential academic stressors, found that academic performance was responsible for 57.4 % of all academic-related stressors and was rated as 7 on a 1-10 severity scale of academic stressors among university students. Only exam frequency (73.6%) had a higher stressor frequency than academic performance but had similar stressor severity [22]. Furthermore, as psychological stress is associated with elements of demand and failure [23], academic performance is a potent source of stress to university students. Studies have shown that psychological stress initiates or worsens depression among university students [21, 22, 24, 25]. The association between psychological stress and depressive symptoms has been attributed to the same biological and cognitive pathways between the two mental disorders [26, 27].

Evidence abounds on the association among sleep disturbance, stress, and depression [26-29]. Researchers have propounded that chronic psychological stress induces sleep disturbance, which often leads to depressive symptoms [30]. However, the stress-sleep association is bidirectional [30, 31], indicating that one can cause the other. Short or disturbed sleep is a stressor on its own through the activation of stress systems (the hypothalamus pituitary adrenal and autonomic nervous system) [32], which invariably initiates or prolongs existing stress [31]. Sleep disturbance has been linked with high psychological stress in prospective studies [33]. A study revealed that sleep disturbance just within 24 hours causes dysregulation of inflammatory biomarkers and increases stress hormones of medical residents [34] and young healthy adults [32, 35]. Merril showed in their findings that adults with insomnia are significantly prone to stress [30]. The study in [29] revealed that USA adults aged 18-64 with short sleep duration were more than twice as prone to developing psychological stress. Among university students, findings of research in Indonesia reported that students with disturbed sleep are about five times more prone to higher mental stress than those with normal sleep [28]. Thus, the presence of sleep disturbance can induce or perpetuate psychological stress and lead to depressive symptoms.

In summary, there are established linear associations among academic performance, depression, sleep duration, and psychological stress. However, it is not clear yet how sleep duration and psychological stress mediate the mechanism between academic performance and depression. Understanding the mechanisms involved in these associations may help in tackling the high rate of depression among university students by designing effective interventions. Several studies suggest that university students with poor academic performance may present with short sleep duration, which may initiate or compound psychological stress and consequently higher risk of depression [1, 16, 21, 22, 28, 29]. Thus, in this study, the following hypotheses are proposed:

- **H1.** Academic performance is negatively associated with depression in university students;
- **H2.** Sleep duration mediates the association between academic performance and depression;
- **H3.** Psychological stress mediates the association between academic performance and depression; and
- **H4.** Sleep duration and psychological stress serially mediate the association between academic performance and depression.

The overarching aim of this study was to investigate whether sleep duration and psychological stress sequentially mediate the relationship between academic performance and depression.

MATERIAL AND METHOD

Participants

This was part of a cross-sectional online survey assessing the mental health and behavioral indices of physiotherapy undergraduates across 8 Nigerian universities that offer physiotherapy course. The respondents' characteristics have been described elsewhere [36]. The survey was anonymous and was designed to ensure complete data before submission and prevent multiple submissions from the same individual. All respondents provided written informed consent. The study was approved by the Ethics Research Committee at the Redeemer's University, Ede, Osun State, Nigeria (RUN/REC/2023/054). The survey ran from January to June 2023, and a total of 510 students responded.

Assessments

Depression and psychological stress were evaluated by the depression and stress sub-scales of the depression, anxiety and stress scale-21 (DASS-21). The 7 items on each depression and stress subscale are rated on a 4 Likert scale (0-3) and multiplied by two to correspond with the original DASS-42. Higher scores for each scale indicate a greater level of clinical depression or

Table 1. The correlation matrix among study variables

	Mean ± standard deviation	1	2	3	4	5	6
1. Academic performance	2.83 ± 0.70	1					
2. Sleep duration	5.74 ± 1.59	0.109*	1				
3. Psychological stress	9.63 ± 7.96	-0.140**	-0.171**	1			
4. Depression	8.45 ± 8.64	-0.185**	-0.122*	0.753**	1		
5. Age	21.3 ± 2.62	-0.047	-0.023	-0.038	-0.009	1	
6. Gender[a]	-	-0.012	0.007	-0.076	-0.015	0.160**	1

Note. Female: 0; Male: 1; *Correlation at $p < 0.05$; & **Correlation at $p < 0.01$

Table 2. Serial mediation of sleep duration and psychological stress in the association between academic performance and depression

Dependent variable	Independent variable	R	R^2	F	B	T	95% boot CI (LLCI, ULCI)
Sleep duration	Age	0.114	0.013	2.238	-0.011	-0.441	-0.060, 0.038
	Gender				0.035	0.255	-0.231, 0.300
	Academic performance				0.233	2.526*	0.052, 0.415
PS	Age	0.224	0.050	6.669	-0.110	-0.827	-0.372, 0.152
	Gender				-1.157	-1.604	-2.574, 0.260
	Academic performance				-1.423	-2.873*	-2.397, -0.450
	Sleep duration				-0.840	-3.542**	-1.306, -0.374
Depression	Age	0.759	0.576	137.103	0.032	0.330	-0.158, 0.222
	Gender				0.694	1.322	-0.337, 1.725
	Academic performance				-1.003	-2.768*	-1.716, -0.291
	Sleep duration				0.127	0.729	-0.215, 0.469
	Psychological stress				0.813	25.173**	0.750, 0.876

Note. Boot LLCI & ULCI: Lower and upper limit 95% CI of bootstrap method; *Significant association at $p < 0.05$; **Significant association at $p < 0.001$; & Age and gender are covariates in the model

psychological stress, with scores ≥ 10 or ≥ 15 considered as a mark for depression or stress caseness. For depressive symptoms, scores were categorized as mild (10-13 scores), moderate (14-20 scores), severe (21-27 scores), and extremely severe (≥ 28 scores) depression. Stress scores were similarly categorized into mild (15-18 scores), moderate (19-25 scores), severe (26-33 scores), and extremely severe (≥ 34 scores) psychological stress [37]. The validity and reliability of DASS-21 have been reported as excellent among Nigerian undergraduates [38]. The Cronbach's alpha for DASS-21 total, depression, and stress subscales in the present study was 0.892, 0.814, and 0.832, respectively.

The sleep duration of the respondents was evaluated by a single-item question: "On the average, how many hours did you sleep each night during the past week?". A single-item measure is well-validated in assessing sleep duration [39, 40]. Average sleep duration of less than 7 hours was considered inadequate [40, 41]. A self-developed proforma with a single-item question "How would you rate your recent academic performance" was employed to evaluate the academic performance. The response was scored with a 4-point Likert scale ranging from 1 (poor) to 4 (excellent), with higher scores suggesting better academic performance. A similar scale has been employed in a previous study [1]. The Cronbach's alpha for this item was 0.823. Furthermore, data on age and gender were assessed and used as covariates.

Data Analysis

Data was summarized using mean, standard deviation, frequency, and percentage. The Pearson correlation coefficients were used to investigate the association among the variables. A mediation analysis using PROCESS macro (model 6) was undertaken to investigate the sequential mediation of sleep duration and psychological stress in the nexus between academic performance and depression. Age and gender were added as covariates in the model. Bootstrapping analysis with 5000 samples at a 95% confidence interval (CI) was employed to test the significance of the mediation model. The alpha level was set at $p < 0.05$. IBM SPSS (version 21) and PROCESS macro were used to perform the analyses.

RESULTS

The mean age was 21.33 ± 2.62 years, with the majority being female (62.4%). Using the DASS-21 cut-off values, 22.5% and 36.5% of the respondents were considered as having clinical psychological stress and depression. The rates of psychological stress were 9.2% (mild), 9.0% (moderate), 3.1% (severe), and 1.2% (extremely severe). Furthermore, the rates of depression were 12.4% (mild), 14.5% (moderate), 4.9% (severe), and 4.7% (extremely severe). The majority of the respondents (73.9%) reported sleep disturbance (< 7 hours of sleep). **Table 1** presents the correlation matrix among the observed variables. Pearson correlation analyses showed that academic performance was positively correlated with sleep duration ($r = 0.109$; $p = 0.014$) and negatively correlated with psychological stress ($r = -0.140$; $p = 0.001$) and depression ($r = -0.185$; $p = 0.001$). Depression had a significant positive correlation with psychological stress ($r = 0.753$; $p = 0.001$) and a negative correlation with sleep duration ($r = -0.122$; $p = 0.006$). Furthermore, sleep duration was negatively correlated with psychological stress ($r = -0.171$; $p = 0.001$).

The results of serial mediation (**Table 2**) show that academic performance had a direct significant negative association with depression ($\beta = -1.003$; $p = 0.006$), supporting **H1**. Meanwhile, academic performance was significantly and positively associated with sleep duration ($\beta = 0.233$; $p = 0.012$), but in turn, was not significantly associated with depression ($\beta = 0.127$; $p = 0.466$), not supporting **H2**. Moreover, academic performance was significantly and negatively associated with

Table 3. The direct, indirect and total effects of academic performance on depression

	Beta	Standard error	95% CI	
			Lower limit	Upper limit
Total effect	-2.290	0.538	-3.348	-1.233
Direct effect	-1.003	0.362	-1.716	-0.291
Total indirect effect	-1.287	0.419	-2.119	-0.471
Academic performance → sleep duration → depression	0.030	0.041	-0.048	0.122
Academic performance → psychological stress → depression	-1.157	0.419	-1.994	-0.334
Academic performance → sleep duration → psychological stress → depression	-0.159	0.081	-0.346	-0.031

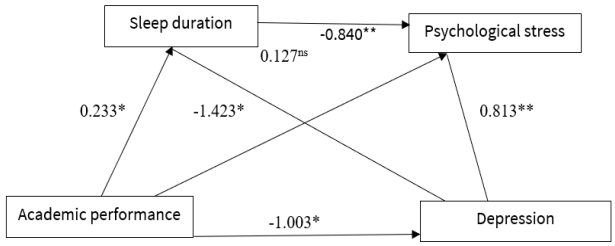

Figure 1. The serial mediation of sleep duration and psychological stress (*significant association at $p < 0.05$; **significant association at $p < 0.001$; & ns: not significant) (Source: Authors' own elaboration)

psychological stress (β = -1.423; p = 0.004), which in turn had a significant and positive association with depression (β = 0.813; p < 0.001), supporting **H3**. Furthermore, sleep duration was significantly and negatively associated with psychological stress (β = -0.840; p < 0.001), indicating a serial mediation model supporting **H4**.

The results of the bootstrap analysis (**Table 3**) indicated that psychological stress partially mediated the association between academic performance and depression. However, sleep duration was not a significant mediator. The sequential mediation of sleep duration and psychological stress (-0.159) (academic performance → sleep duration → psychological stress → depression) accounts for 6.94% of the total effect. The total mediating effect was -1.287, responsible for 56.2% of the total effect.

The mediation path is shown in **Figure 1**.

DISCUSSION

The high prevalence of depression among university students has attracted interest from scholars [1, 5, 6]; however, little is known about the influence of academic performance on this phenomenon. Moreover, the emotional process that underpins the nexus between academic performance and depression among students remains largely unspecified. Thus, the objective of this study was to investigate whether sleep duration and psychological stress sequentially mediate the nexus between academic performance and depression. First, in line with earlier reports of high prevalence of depression, psychological stress, and sleep disturbance among university students, the results of this study showed 36.5% and 22.5% prevalence of depression [42, 43] and psychological stress [42] among the sampled university students. Further, the mean sleep duration was 5.74 ± 1.59 hours, with 73.9% reported sleep duration of < 7 hours [1, 3].

The serial mediation analysis showed that academic performance was negatively related to depression and psychological stress and positively associated with sleep duration. However, while psychological stress mediates the relationship between academic performance and depression, sleep duration does not. Furthermore, the findings showed that sleep duration and psychological stress serially mediate the relationship between academic performance and depression. The total indirect effect of sleep duration and psychological stress accounts for 56.2% of the overall effect of academic performance on depression, suggesting the importance of sleep duration and psychological stress in the academic performance-depression nexus.

The observed association between academic performance and depression can be explained by context development theory. The theory postulates that loneliness or social isolation is a precursor of mood disorder and negatively interacts with the emotional health of individuals [44-47]. Meanwhile, poor academic performance is a known cause of social isolation and loneliness, as it diminishes social support obtainable from parents, teachers, peers, etc. [48, 49], and therefore may lead to depressive symptoms as observed in this study. The results of this study showed that academic performance was positively associated with sleep duration, which correlated with reports of some previous studies [16-19]; however, the effect of academic performance on depression was not mediated through sleep duration. Although few studies have linked sleep duration with depressive symptoms among university students [3, 20], the mechanisms underlying the relationship are still largely unknown [3].

Although sleep duration was positively associated with academic performance, its direct path to depression was not statistically significant. This indicates that sleep duration alone may not independently mediate the relationship between academic performance and depression. Instead, its influence appears to operate indirectly through psychological stress, as shown by the significant serial mediation pathway. In this pathway, shorter sleep duration may elevate stress levels, which in turn contribute to higher depressive symptoms. This finding highlights that the role of sleep is more complex than a simple linear mediation, and factors such as sleep quality, lifestyle behaviors, or coping strategies may moderate the relationship between sleep and depression. Future research should therefore explore these moderating variables to better understand the interplay between academic performance, sleep, stress, and mental health outcomes.

In the present study, psychological stress was not only significantly associated with academic performance, but it also mediated the relationship between academic performance and depression. These findings are not surprising and are consistent with earlier results, which have shown academic performance as a major source of stress for university students [22]. The concept of success or failure, which is often associated with academic performance, is linked with psychological stress [23]. Furthermore, psychological stress can mediate the relationship between academic performance

and depression because psychological stress and depression have the same psycho-physiological pathways [26, 27]. It has also been postulated in earlier research that psychological stress can initiate or worsen symptoms of depression among university students [21-25]. We have been able to show in this study that apart from other sources of stress, poor academic performance tends to increase mental stress among university students, which may initiate or aggravate the symptoms of depression.

The findings of our study showed that sleep duration and psychological stress play a serial mediating role in the academic performance-depression nexus. This result indicates that poor academic performance was associated with shorter sleep duration, which was in turn related to higher psychological stress, and subsequently was associated with higher depressive symptoms. Numerous studies have reported a negative association between sleep duration and psychological stress [28-30, 32, 35]. Specifically, it was found that the relationship between sleep disturbance and mental stress is bidirectional [30, 31]. Researchers have posited that insomnia is a stressor [32] and that individuals with shorter sleep duration are more at risk of presenting with higher psychological stress [28, 29]. Moreover, evidence has shown that university students with poor academic performance have disturbed sleep and are more stressed [16, 22] and that both sleep disturbance and stress are associated with depression [1, 21]. This may explain the observed serial mediation of sleep duration and psychological stress in the association between academic performance and depression. Thus, the results of this study show the significance of developing strategies for university students on how to maintain healthy sleep habits, and in the management of psychological stress of academic and non-academic origin. Furthermore, the present study provides evidence that interventions targeting disturbed sleep and psychological stress may reduce symptoms of depression among university students. There may also be a need for a cultural shift in de-emphasizing the notion that academic performance is mandatory or tantamount to life attainment and societal acceptance, and a philosophical change in the present success or failure concept of academic performance in this population.

The study has some limitations. This includes the cross-sectional nature of the study. Thus, making definite conclusions on the magnitude and directions of the models obtained in this study is limited. Longitudinal and experimental studies are required to clarify definite associations among academic performance, sleep duration, psychological stress, and depression among university students. The use of self-report items to assess sleep duration, depression, psychological stress, and academic performance may introduce report bias. Future studies should employ objective measures such as actigraphy or polysomnography, which could provide a more accurate assessment of sleep duration and quality, while validated academic records could replace self-reported academic performance. The study sample was restricted to physiotherapy undergraduates from Nigerian universities, which may not fully represent the broader university student population, as health science students are known to experience considerable mental stress. Future research should include students from diverse academic disciplines and geographical regions to improve the generalizability of the findings.

CONCLUSION

In summary, this study demonstrates that academic performance is negatively associated with depression among university students, and that sleep duration and psychological stress act as sequential mediators in this relationship. While sleep duration alone did not directly predict depression, its role in the serial pathway highlights the complex interplay between sleep, stress, and mental health. These findings emphasize the need for universities, public health practitioners, and policymakers to address not only academic pressures but also sleep and stress management when developing strategies to promote student well-being. Future research should investigate potential moderating factors such as sleep quality, coping mechanisms, and lifestyle behaviors to further clarify these relationships and guide more tailored interventions.

Author contributions: ABA, AI, JA, TA, & CM: data acquisition, analysis, and interpretation & **ABA:** study conceptualization and design. All authors have sufficiently contributed to the study and agreed with the results and conclusions.

Funding: No funding source is reported for this study.

Ethical statement: This study was approved by the Ethics Research Committee at the Redeemer's University, Ede, Osun State, Nigeria (RUN/REC/2023/054). Written informed consents were obtained from the participants.

AI statement: The authors stated that generative AI or AI-based tools were not used.

Declaration of interest: No conflict of interest is declared by the authors.

Data sharing statement: Data supporting the findings and conclusions are available upon request from the corresponding author.

REFERENCES

1. Alhemedi AJ, Qasaimeh MG, Abdo N, et al. Depression among university students in Jordan after the COVID-19 pandemic: A cross-sectional study. Psychol Res Behav Manag. 2023;16:4237-49. https://doi.org/10.2147/PRBM.S436293 PMid:37873060 PMCid:PMC10590589
2. Frasure-Smith N, Lesperance F, Talajic M. Depression following myocardial infarction. Impact on 6-month survival. JAMA. 1993;270(15):1819-25. https://doi.org/10.1001/jama.1993.03510150053029 PMid:8411525
3. Li W, Yin J, Cai X, Cheng X, Wang Y. Association between sleep duration and quality and depressive symptoms among university students: A cross-sectional study. PLoS One. 2020;15(9):e0238811. https://doi.org/10.1371/journal.pone.0238811 PMid:32915844 PMCid:PMC7485879
4. Liu Y, Chen J, Chen K, Liu J, Wang W. 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, 2023;239:104014. https://doi.org/10.1016/j.actpsy.2023.104014 PMid:37633175
5. Akhtar P, Ma L, Waqas A, et al. Prevalence of depression among university students in low and middle income countries (LMICs): A systematic review and meta-analysis. J Affect Disord. 2020;274:911-9. https://doi.org/10.1016/j.jad.2020.03.183 PMid:32664032

6. Zou Y, Lu Y, Zhou F, et al. Three mental health symptoms of frontline medical staff associated with occupational stressors during the COVID-19 peak outbreak in China: The mediation of perceived stress and the moderation of social support. Front Psychol. 2022;13. https://doi.org/10.3389/fpsyg.2022.888000 PMid:35712133 PMCid:PMC9197123
7. Kaplan GA, Shema SJ, Leite CMA. Socioeconomic determinants of psychological well-being: The role of income, income change, and income sources during the course of 29 years. Ann Epidemiol. 2008;18(7):531-7. https://doi.org/10.1016/j.annepidem.2008.03.006 PMid:18504142 PMCid:PMC2771109
8. Yun CTP, Greenwood KM. Stress, sleep, and performance in international and domestic university students. J Int Stud. 2022;12(1):81-100. https://doi.org/10.32674/jis.v12i1.3299
9. Liu XQ, Guo YX, Zhang WJ, Gao WJ. Influencing factors, prediction and prevention of depression in college students: A literature review. World J Psychiatry. 2022;12(7):860-73. https://doi.org/10.5498/wjp.v12.i7.860 PMid:36051603 PMCid:PMC9331452
10. Wagner F, Wagner R, Kolanisi U. The relationship between depression symptoms and academic performance among first-year undergraduate students at a South African university: A cross-sectional study. BMC Public Health. 2022;22:2067. https://doi.org/10.1186/s12889-022-14517-7 PMid:36368962 PMCid:PMC9651123
11. Zhuang J, Mou Q, Zheng T, et al. A serial mediation model of social media addiction and college students' academic engagement: The role of sleep quality and fatigue. BMC Psychiatry. 2023;23:333. https://doi.org/10.1186/s12888-023-04799-5 PMid:37173670 PMCid:PMC10176952
12. Gomes AA, Tavares J, de Azevedo MHP. Sleep and academic performance in undergraduates: A multi-measure, multipredictor approach. Chronobiol Int. 2011;28(9):786-801. https://doi.org/10.3109/07420528.2011.606518 PMid:22080785
13. Desouky EM, Lawend JA, Awed HA. Relationship between quality of sleep and academic performance among female nursing students. Int J Nurs Didact. 2015;5(1):6-13.
14. Cates ME, Clark A, Woolley TW, Saunders A. Sleep quality among pharmacy students. Amn J Pharm Educ. 2015;79(1):09. https://doi.org/10.5688/ajpe79109 PMid:25741025 PMCid:PMC4346821
15. Ma XQ, Jiang CQ, Xu L, et al. Sleep quality and cognitive impairment in older Chinese: Guangzhou Biobank Cohort Study. Age Ageing. 2019;49(1):119-24. https://doi.org/10.1093/ageing/afz120 PMid:31665199
16. Ong SC, Azman N, Ho HT. Factors associated with sleeping quality and behaviors among university students in Malaysia. Sleep Med Res. 2023;14(1):43-9. https://doi.org/10.17241/smr.2022.01536
17. Zhang X, Dimitriou D, Halstead EJ. Sleep, anxiety, and academic performance: A study of adolescents from public high schools in China. Front Psychol. 2021;12:678839. https://doi.org/10.3389/fpsyg.2021.678839 PMid:34276498 PMCid:PMC8281015
18. Chen T, Wu Z, Shen Z, Zhang J, Shen X, Li S. Sleep duration in Chinese adolescents: Biological, environmental, and behavioral predictors. Sleep Med. 2014;15:1345-53. https://doi.org/10.1016/j.sleep.2014.05.018 PMid:25277663
19. Yang Y-T, Kaplan KA, Zeitzer JM. A comparison of sleep, depressive symptoms, and parental perceptions between U.S. and Taiwan adolescents with self-reported sleep problems. Sleep Adv. 2020;1(1):zpaa004. https://doi.org/10.1093/sleepadvances/zpaa004 PMid:33345187 PMCid:PMC7731573
20. Supartini A, Honda T, Basri NA, et al. The impact of sleep timing, sleep duration, and sleep quality on depressive symptoms and suicidal ideation amongst Japanese freshmen: The EQUSITE study. Sleep Disord. 2016;2016:8737654. https://doi.org/10.1155/2016/8737654 PMid:27042358 PMCid:PMC4794596
21. Stanković M, Nešić M. Association of internet addiction with depression, anxiety, stress, and the quality of sleep: Mediation analysis approach in Serbian medical students. Curr Res Behav Sci. 2022;3:100071. https://doi.org/10.1016/j.crbeha.2022.100071
22. Waqas A, Khan S, Sharif W, Khalid U, Ali A. Association of academic stress with sleeping difficulties in medical students of a Pakistani medical school: A cross sectional survey. PeerJ. 2015;3:e840. https://doi.org/10.7717/peerj.840 PMid:25802809 PMCid:PMC4369327
23. Bennett KS, Shepherd JM. Depression in Australian women: The varied roles of spirituality and social support. J Health Psychol. 2013;18(3):429-38. https://doi.org/10.1177/1359105312443400 PMid:22679264
24. Sherina MS, Rampal L, Kaneson N. Psychological stress among undergraduate medicalstudents. Med J Malaysia. 2004;59(2):207-11.
25. Wang X, Cai L, Qian J, Peng J. Social support moderates stress effects on depression. Int J Ment Health Syst. 2014;8(1):41. https://doi.org/10.1186/1752-4458-8-41 PMid:25422673 PMCid:PMC4242489
26. LeMoult J. From stress to depression: Bringing together cognitive and biological science. Curr Dir Psychol Sci. 2020;29(6):592-8. https://doi.org/10.1177/0963721420964039 PMid:33343103 PMCid:PMC7727022
27. Kim I-B, Lee J-H, Park S-C. The relationship between stress, inflammation, and depression. Biomedicines. 2022;10(8):1929. https://doi.org/10.3390/biomedicines10081929 PMid:36009476 PMCid:PMC9405608
28. Herawati K, Gayatri D. The correlation between sleep quality and levels of stress among students in Universitas Indonesia. Enferm Clin. 2019;29(S2):357-61. https://doi.org/10.1016/j.enfcli.2019.04.044
29. Blackwelder A, Hoskins M, Huber L. Effect of inadequate sleep on frequent mental distress. Prev Chronic Dis. 2021;18:200573. https://doi.org/10.5888/pcd18.200573 PMid:34138697 PMCid:PMC8220958
30. Merrill, RM. Mental health conditions according to stress and sleep disorders. Int J Environ Res Public Health. 2022;19:7957. https://doi.org/10.3390/ijerph19137957 PMid:35805615 PMCid:PMC9265846
31. Nollet M, Wisden W, Franks NP. Sleep deprivation and stress: A reciprocal relationship. Interface Focus. 2020;10:20190092. https://doi.org/10.1098/rsfs.2019.0092 PMid:32382403 PMCid:PMC7202382
32. Schwarza J, Gerhardssona A, van Leeuwena W, et al. Does sleep deprivation increase the vulnerability to acute psychosocial stress in young and older adults? Psychoneuroendocrinology. 2018;96:155-65. https://doi.org/10.1016/j.psyneuen.2018.06.003 PMid:29982098

33. Akerstedt T, Nordin M, Alfredsson L, Westerholm P, Kecklund G. Predicting changes in sleep complaints from baseline values and changes in work demands, work control, and work preoccupation–The WOLF-project. Sleep Med. 2012;13(1):73-80. https://doi.org/10.1016/j.sleep.2011.04.015 PMid:22177346
34. Morales J, Yanez A, Fernandez-Gonzalez L, et al. Stress and autonomic response to sleep deprivation in medical residents: A comparative cross-sectional study. PLoS One. 2019;14(4):e0214858. https://doi.org/10.1371/journal.pone.0214858 PMid:30947295 PMCid:PMC6448892
35. Thompson KI, Chau M, Lorenzetti MS, Hill LD, Fins AI, Tartar JL. Acute sleep deprivation disrupts emotion, cognition, inflammation, and cortisol in young healthy adults. Front Behav Neurosci. 2022;16:945661. https://doi.org/10.3389/fnbeh.2022.945661 PMid:36212194 PMCid:PMC9538963
36. Ademoyegun AB, Ibitoye AG, Afolabi J, et al. Can physical activity attenuate the impact of internet addiction on anxiety in young adults? A moderation analysis. J Affect Disord Rep. 2024;16:100718. https://doi.org/10.1016/j.jadr.2024.100718
37. Lovibond PF, Lovibond SH. The structure of negative emotional states: Comparison of the depression anxiety stress scales (DASS) with the beck depression and anxiety inventories. Behav Res Ther. 1995;33(3):335-43. https://doi.org/10.1016/0005-7967(94)00075-U PMid:7726811
38. Coker AO, Coker OO, Sanni D. Psychometric properties of the 21-item depression anxiety stress scale (DASS-21). Afr Res Rev. 2018;12(2):135-42. https://doi.org/10.4314/afrrev.v12i2.13
39. Hays RD, Martin SA, Sesti AM, Spritzer KL. Psychometric properties of the medical outcomes study sleep measure. Sleep Med. 2005;6:41-4. https://doi.org/10.1016/j.sleep.2004.07.006 PMid:15680294
40. McIntyre E, Lauche R, Frawley J, Sibbritt D, Reddy P, Adams J. Physical activity and depression symptoms in women with chronic illness and the mediating role of health-related quality of life. J Affect Disord. 2019;252:294-9. https://doi.org/10.1016/j.jad.2019.04.057 PMid:30991257
41. Spritzer KL, Hays RD. MOS sleep scale: A manual for use and scoring, version 1.0. Los Angeles, CA: RAND; 2003.
42. Bayram N, Bilgel N. The prevalence and socio-demographic correlations of depression, anxiety and stress among a group of university students. Soc Psychiatry Psychiatr Epidemiol. 2008;43(8):667-72. https://doi.org/10.1007/s00127-008-0345-x PMid:18398558
43. Xu Y, Qi J, Yang Y, Wen X. The contribution of lifestyle factors to depressive symptoms: A cross-sectional study in Chinese college students. Psychiatry Res. 2016;245:243-9. https://doi.org/10.1016/j.psychres.2016.03.009 PMid:27565695
44. Hardie B. What do parents do? Towards conceptual clarity in the study of parental influence on adolescent developmental and behavioural outcomes. New Ideas Psychol. 2022;66:100936. https://doi.org/10.1016/j.newideapsych.2022.100936
45. Tian LM, Chen HH, Wang SQ, et al. Effects of parental support and friendship support on loneliness and depression in early and middle adolescents. Acta Psychol Sin. 2012;07:944-56. https://doi.org/10.3724/SP.J.1041.2012.00944
46. Munir T, Shafiq S, Ahmad Z, Khan S. Impact of loneliness and academic stress on psychological well being among college students. Acad Res Int. 2015;6(2):343.
47. Lan Z, Liu H, Huang X, Wang Q, Deng F, Li J. The impact of academic pressure and peer support on adolescents' loneliness: A polynomial regression and response surface analysis. Psychol Res Behav Manag. 2023;16:4617-27. https://doi.org/10.2147/PRBM.S435977 PMid:37954932 PMCid:PMC10637237
48. Stankovska G, Dimitrovski D, Angelkoska S, et al. Emotional intelligence, test anxiety and academic stress among university students. Educ Mod Soc. 2018;2018:157.
49. Benner AD. Latino adolescents' loneliness, academic performance, and the buffering nature of friendships. J Youth Adolesc. 2011;40(5):556-67. https://doi.org/10.1007/s10964-010-9561-2 PMid:20571900 PMCid:PMC3033456