



ORIGINAL ARTICLE

Correlates of perceived stress with anxiety symptoms sleep quality and academic performance among Moroccan students



Hakima EL Madani, PhD^{a,*}, Chadya Aarab^b, Nabil Tachfouti^a, Samira EL Fakir^a, Rachid Aalouane^b, Mohamed Berraho^a

^a Faculty of Medicine and Pharmacy of Fez-Morocco, Post Box 1893- Km 2.200 Sidi Hrazem Road, Fez 30070, Morocco

^b Hassan II University Hospital Center of Fez-Morocco, Post Box 1835 Atlas, Avenue Hassan II, Fez 30050, Morocco

Received 16 November 2023; accepted 3 June 2024

KEYWORDS

Medical students;
Perceived stress;
Sleep quality;
Academic performance;
Test anxiety

Abstract

Introduction: The main objective of this study was to verify the association of perceived stress with anxiety, sleep quality, and academic performance among Moroccan medical students.

Methods: This cross-sectional study included 222 students enrolled at the Faculty of Medicine and Pharmacy of Fez in Morocco. An online self-administrated questionnaire, for the sociodemographic characteristics, Perceived Stress Scale (PSS-10), Test Anxiety Scale, and Pittsburgh Sleep Quality Index questionnaire were used for the assessment. A descriptive and correlational design was used in this investigation.

Results: One hundred and thirty-two students completed the survey. A high level of stress was found. A significant positive correlation was observed between the stress level among our population and their levels of anxiety. Stress was also positively correlated with the decrease of students' sleep quality and academic performance.

Conclusion: The results of this investigation present worthy data that highlight the need for this subset of students to anti-stress programs that must be integrated into their curriculum to help them to better manage this psychological issue.

© 2024 The Authors. Published by Elsevier España, S.L.U. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

* Corresponding author.

E-mail address: Hakima.elmadani@usmba.ac.ma (H. EL Madani).

PALABRAS CLAVE

Estudiantes de medicina;
Estrés percibido;
Calidad de sueño;
Desempeño académico;
Prueba de ansiedad

Correlaciones entre el estrés percibido y los síntomas de ansiedad, la calidad del sueño y el rendimiento académico entre estudiantes marroquíes**Resumen**

Introducción: El principal objetivo de este estudio fue verificar la asociación del estrés percibido con la ansiedad, la calidad del sueño y el rendimiento académico entre estudiantes de medicina marroquíes.

Métodos: Este estudio transversal incluyó a 222 estudiantes matriculados en la Facultad de Medicina y Farmacia de Fez en Marruecos. Para la evaluación se utilizó un cuestionario autoadministrado en línea para las características sociodemográficas, la Escala de estrés percibido (PSS-10), la Escala de ansiedad ante los exámenes y el cuestionario del Índice de calidad del sueño de Pittsburgh. En esta investigación se utilizó un diseño descriptivo y correlacional.

Resultados: Ciento treinta y dos estudiantes completaron la encuesta. Se encontró un alto nivel de estrés. Hubo una correlación positiva significativa entre los niveles de estrés y ansiedad. El estrés también se correlacionó positivamente con la disminución de la calidad del sueño y el rendimiento académico de los estudiantes.

Conclusión: Los resultados de esta investigación presentan datos valiosos que resaltan la necesidad de que este subconjunto de estudiantes reciba programas antiestrés que deben integrarse en su plan de estudios para ayudarlos a gestionar mejor este problema psicológico.

© 2024 The Authors. Publicado por Elsevier España, S.L.U. Este es un artículo Open Access bajo la licencia CC BY-NC-ND (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Background

The medical profession is inherently stressful. In parallel, physicians report a high level of stress and burnout.¹ This high prevalence is mirrored in the literature among medical students, underling the need for the integration of a multiple anti-stress process into the medical curriculum. Such integration requires a deep understanding of potential stressors and impact of stress within this population. Actually, it was widely reported that medical students are facing with supplemental stressors such as being in perpetual contact with patients and performing clinical work. These stressors could generate psychological issues for students if they are coped with maladaptive strategies. In light of this, it will be not surprising that, when asked, medical students rate their time in medical school as stressful,² with dissatisfaction with academic performance, examinations, and fear of failing as commonly cited reasons for their stress.³

The impacts of chronic stress on medical students are preponderant; the decrease of academic achievement,⁴ and poor sleep quality.⁵ In addition, damaging consequences on students' physical and psychological health⁶ have been reported.

Several studies have investigated the relationship between psychological stress and academic achievements.⁷ Kötter et al. (2017) reported that academic performance⁷ is predicted by students' age and gender, making older female students with high stress scores a potential risk group for the vicious circle of stress and poor academic performance. Adams et al.⁸ investigated the correlations between several students' characteristics and academic integration, the findings illustrating that perceived stress mediates students'

integration. Moreover, Sohail et al.⁹ examined the association between stress and academic performance, and the results showed a significant correlation between stress level and poor academic performance.

It has been widely reported that medical students typically suffer from sleep deprivation or poor sleep quality more than their non-medical students' peers.¹⁰ The decrease in sleep quality was specially related to students' psychological problems including stress.⁵ Almojali et al. (2017) reported the high prevalence of stress and poor sleep quality among Saudi medical students, with a statistically significant association between these 2 variables.¹¹ Furthermore, this investigation indicated that students who are not suffering from stress are more likely to have poor sleep quality. In the same way, Rebello et al. (2018) reported the positive correlation between high levels of perceived stress and poor sleep quality among Indian medical students.² Moreover, a study investigating a multilevel analysis exploring the link between stress and sleep problems showed that perceived stress is an element determining element variable of stress quality.

Previous studies have shown that medical students often experience significant anxiety, as indicated by notable rates such as 54.5%, reported by Yusoff et al.,¹² and 64.3%, reported by Wahed et al.¹³ This psychological challenge is commonly linked to perceived stress. Shamsuddin highlights a positive correlation between stress and anxiety symptoms among Indian university students. Additionally, the outcomes of this research support the link between stress and anxiety among Malaysian university students.¹⁴

Even though the association of stress with some psychological and academic impacts among medical students has been widely discussed at the international level, these types

of measures have not to be investigated in the Moroccan context. The picture of the need to investigate the correlation between stress and its impacts among Moroccan medical students during their academic curriculum is considered of vital importance to support this subset of students. Therefore, the main objective of this study was to assess the correlation between psychological stress and sleep quality, anxiety, and academic performance.

Methods

Sample

In the period between November–December 2017, first-year to fifth-year medical students enrolled at the Faculty of Medicine and Pharmacy of Fez-Morocco were invited to take part in an online study looking at stress and its impacts. The average time required for participants to answer the questionnaire was around 15 min. To prevent an overestimation of stress levels among students, we scheduled our study a month before the final exams. All students were invited through the faculty's website and printed posters were placed in several areas around the faculty's campus. The advertisements included brief information about the study, the inclusion and exclusion criteria, the questionnaire's link published on the faculty's website, and potential contact information about the project as well as the mailing address of the project, and contact persons. Prospective participants who expressed their interest in the survey got access to the questionnaire's link.

Sample size and sample technique

The sample size was estimated by assuming the following factors: confidence interval, 95%; margin error, 5%; and the prevalence of perceived stress among Moroccan students was 17.17%.¹⁵ The following equation was used, where z is the Z-score=1.96, ε is the margin of error=0.05 and p is the prevalence=0.171: $n = \frac{z^2 \times p(1-p)}{\varepsilon^2}$.

Using this formula, the estimated sample size was 217. Basing on these results, a sample size of 222 of Moroccan medical students was used for this study.

Inclusion and exclusion criteria

First-year to fifth-year Medical students enrolled at Faculty of Medicine and Pharmacy of Fez were included in the study. Exclusion criteria: Students reporting having psychiatric disorder were excluded from the study.

Materials

The survey was comprised of the following:

- Sociodemographic questions (age, gender, study's cycle...). The study cycle was subdivided into 2 sections including the pre-clinical cycle (first or the second year of study) and the clinical cycle (third, fourth, or fifth year of study).

- Several validated questionnaires assessed aspects of perceived stress, anxiety sleep quality, and academic performance as detailed below.

Perceived stress

A French validated version of the Perceived Stress Scale with 10 items (PSS-10)¹⁶ was used to examine students' stress levels. The questionnaire requires participants to assess their stress by indicating how often over the last month they have felt a particular situation using 5-Likert (0—never to 5—all the time). Higher scores reflected an increased perceived psychological stress.

Anxiety symptoms

Students' anxiety symptoms were assessed using the Test Anxiety questionnaire. Test Anxiety is an adapted version of the Test-Anxiety Inventory questionnaire.¹⁷ The Test Anxiety Scale is a 10-item instrument with a 5-point scale items ask about worry and dread, which interfere with concentration, and self-assessed performance impairment related to anxiety.¹⁷

Sleep quality

Pittsburgh Sleep Quality Index scale (PSQI)¹⁸ was used to measure students' sleep quality during the previous month. The scale consists of 7 domains (19 items) self-rated questions evaluating usual sleep habits during the last month. The possible scores range from 0 to 21, with greater than 5 indicative of impaired sleep quality.

Academic performance

The academic performance of students was assessed using Study Management and Academic Results Test scale (SMART). SMART scale comprised 19 questions measuring study-related cognitions, time management, and study habits among students.¹⁹ Each question is based on a 5-point Likert scale ranging from "strongly agree" to "strongly disagree".

Participants were required to answer mandatory questions covering essential sociodemographic information, stress levels, anxiety, and sleep quality scales. Additionally, there were optional questions, such as those inquiring about the presence of family in the living city or potential conflicts with their family.

Data analysis

Statistical analysis were performed using the Statistical Package for the Social Sciences (SPSS) version 21.0. Student's unpaired *t*-test and Pearson's chi-square test were applied to compare subgroups. The Spearman's rank correlation test was used to examine the correlation between the PSS-10 score and the scores for Anxiety-test, SMART, and PSQI. The normality of the quantitative variables was assessed using the Kolmogorov–Smirnov test. A p -value $\leq .05$ was accepted as statistically significant.

Ethical considerations

Following the local legislation, ethical as well as scientific approval for the protocol of the study was obtained from the University Hospital Centre Hassan II of Fez, Morocco.

Analytic strategy

SPSS software for Windows version 21.0 was used for the statistical analyses. The prevalence of psychological stress was calculated with a 95% confidence interval (CI). The association between psychological stress and its potential impact factors was determined with Univariate analysis using Pearson's chi-square test for categorical variables and the Pearson test was used to analyze correlations. p -value $< .05$ was considered statistically significant.

Results

Sociodemographic characteristics of the study sample

Among the invited students, 222 ($n=222$) co-operated in this study. After the elimination of the uncompleted responses, 132 students were included in the study of which 37.1% ($n=49$) were male and 62.9% ($n=83$) were female. The mean age was 19.92 (SD=2.43) years. According to the results of the survey, 62.2% ($n=82$) did not exercise any type of extra-curricular activity, and 54.5% of them declared living in a family apartment. The majority of our population falls within the middle social class (59.1%) and have reported walking to get to the university (46.2%). Table 1 shows the

Table 1 Sociodemographic characteristics of the study sample ($n=132$).

Sociodemographic variables	Frequency (%)	M (SD)
Age		19.91 (2.43)
Gender		
Female	83 (62.9)	
Male	49 (37.1)	
Academic cycle		
Pre-clinical cycle	67 (50.8)	
Clinical cycle	65 (49.2)	
Parents' marital status		
Married	116 (87.9)	
Other	16 (12.2)	
Dwelling type		
Individual apartment	22 (16.7)	
University campus	3 (2.3)	
Parental	72 (54.5)	
Flat-sharing	35 (26.5)	
Monthly income of the family		
Low of 300\$	11 (8.3)	
Between 300 \$ and 3000 \$	78 (59.1)	
Extra-curricular activity practice		
Yes	50 (37.9)	
No	82 (62.2)	
Means of transport		
Car	41 (31.1)	
Bus/Taxi	26 (19.7)	
Walk	61 (46.2)	
Other	4 (3.0)	

All data were expressed as mean \pm SD, or percentage, as appropriate.

detailed sociodemographic characteristics of the respondents.

In univariate analysis, no gender differences in socio-demographic characteristics were found in our study sample except for monthly family incomes ($p=.014$), in which females constitute the majority within the middle economic range (Table 2).

Prevalence of perceived stress

Perceived stress was assessed using the PSS-10 scale. Some scores were reverse coded before the sum scores being calculated. Respondents who scored 20 or above were deemed as experiencing "high stress" levels. Using this criterion, 11.4% ($n=15$) of respondents reporting a "high stress" level and 51.5% ($n=68$) of them had moderate stress levels. Adopting a multicategorical approach, it was established that 37.1% of students ($n=49$) experienced "normal" or "low" stress level (non-stressed), whereas 62.9% ($n=83$) of our study participants exhibited stress level ranging from "moderate" to "high" (stressed). More details are given in Table 3.

Correlation between perceived stress and sleep quality

The mean (SD) PSQI score was 7.03 (3.31) proving that the average of medical students have a poor sleep quality (PSQI score \geq "5"). Of the 7 components of the PSQI scale, the mean scores of subjective sleep quality, sleep latency, sleep duration, sleep disturbance, and daytime dysfunction were above '1,' making them the highest contributing subscales to the global PSQI score. However, habitual sleep efficiency and use of sleep medication had mean scores below "1". The correlations between the PSS-10 score and the scores of the 7 components of the PSQI scale are outlined in Table 4. The analysis reveals a significant and notably positive correlation between perceived stress and the total sleep quality score ($r=0.41$; $p=.01$), indicating that stressed students are more likely to have lower sleep quality. In addition, an examination of the correlation between perceived stress and various components of the PSQI scale highlights positive associations with 6 specific components. These components include subjective sleep quality ($r=0.44$; $p=.01$), sleep latency ($r=0.26$; $p=.05$), sleep duration ($r=0.26$; $p=.05$), usage of sleep medication ($r=0.233$; $p=.05$), and daytime dysfunction ($r=0.434$; $p=.01$).

Correlation between perceived stress and anxiety symptoms

The average score of Anxiety Test was 2.82 (SD=1.09). High to extremely high anxiety level was found among 31.8% of our population. Table 5 shows the correlations between PSS-10 scores and Test Anxiety score. The results of these measures highlighted the high positive correlation between perceived stress and the global anxiety score ($r=0.404$; $p=.01$). Furthermore, stressed students seem to have anxiety symptoms since 45.8% of them ($n=38$) had a high to extremely high-stress level. However, only 8.2% of non-stressed students ($n=4$) had this psychosomatic problem.

Table 2 Gender differences in sociodemographic characteristics.

Sociodemographic variables	Students' gender		p-value	OD (95% CI)
	Male	Female		
Age; M (SD)	20.74 (3.11)	19.63 (2.09)	.062	[-2.261, 0.056]
Academic cycle				
Pre-clinical cycle	14 (20.9)	53 (79.1)	.195	[0.764, 3.708]
Clinical cycle	20 (30.8)	45 (69.2)		
Parents' marital status				
Married	27 (23.3)	89 (76.7)	.079	[0.133, 1.146]
Other	7 (43.8)	9 (56.3)		
Dwelling type				
Individual apartment	6 (27.3)	16 (72.7)	.711	—
University campus	0 (0.0)	3 (100)		
Parental	20 (27.8)	20 (27.8)		
Flat-sharing	8 (22.9)	8 (27.8)		
Monthly income of the family				
Less than 300\$	6 (54.5)	5 (45.5)	.014*	[1.257, 17.197]
Between 300 \$ and 3000 \$	16 (20.5)	62 (79.5)		
Extra-curricular activity practice				
Yes	17 (34.0)	33 (66.0)	.091	[0.892, 4.349]
No	17 (20.7)	65 (79.3)		
Means of transport				
Car	6 (14.6)	35 (85.4)	.054	—
Bus/Taxi	11 (42.3)	15 (57.7)		
Walk	15 (24.6)	46 (75.4)		
Other	2 (50.0)	2 (50.0)		

p-values were calculated using Pearson's chi-square test for categorical variables and Student's *t*-test for quantitative variables.* Significant *p*-value (<.05).

Correlation between perceived stress and students' academic performance

Table 6 shows a significant negative correlation between perceived stress scores and the 4 components of SMART scale including academic skills ($r=-0.278$; $p=.01$), skills test ($r=-0.501$; $p=.01$), stress management ($r=-0.364$; $p=.364$), and strategic studying ($r=-0.315$; $p=.01$).

Gender-based variations in stress, anxiety, academic performance, and sleep quality

Various independent *t*-tests were conducted to compare differences in total PSS, test anxiety, SMART test, and PSQI scores, as well as established categories of perceived stress, anxiety, academic performance, and sleep quality levels between males and females. Overall, no gender differences were observed in our study population for the 3 psychological determinants, including perceived stress ($p=.469$),

anxiety ($p=.335$), and sleep quality ($p=.858$). The same results were observed for the 4 scores of the SMART subscales, including academic skills ($p=.606$), skills test ($p=.064$), stress management ($p=.996$), and strategic studying ($p=.898$), proving the absence of gender differences for the academic performance determinants.

Discussion

A notable prevalence of stress among medical students is a cause of concern, considering its potential impacts on mental health, academic prowess, and, consequently, the delivery of patient care after graduation. The current study seeks to assess potential correlations between perceived stress, anxiety, sleep quality, and academic performance among Moroccan medical students. No gender differences were found in our study population concerning the main sociodemographic characteristics excluding for the students' economic status, which is similar to the findings of

Table 3 Perceived stress prevalence.

PSS-10 score	0–10	11–20	21–30	31–40
Interpretation of stress score	Low	Normal	Moderate	High
Pre-clinical cycle, <i>n</i> (%)	3 (2.3)	21 (15.9)	34 (25.8)	9 (6.8)
Clinical cycle, <i>n</i> (%)	0 (0)	25 (18.9)	34 (25.8)	6 (4.5)
Total, <i>n</i> (%)	3 (2.3)	46 (34.8)	68 (51.5)	15 (11.4)
Stress status, <i>n</i> (%)	Non-stressed, 49 (37.1)		Stressed, 83 (62.9)	

Table 4 Correlation between Perceived Stress Scale-10 score and scores of components of the Pittsburgh Sleep Quality Index among the participants, $n=132$.

PSQI components	Total (mean \pm SD)	Stress subgroups		Pearson's rank correlation coefficient (r)
		Yes ($n=83$), (mean \pm SD)	No ($n=49$), (mean \pm SD)	
Global PSQI score	7.03 \pm 3.31	5.38 \pm 2.39	7.94 \pm 3.40	0.41**
Subjective sleep quality	1.41 \pm 0.79	1.67 \pm 0.75	0.92 \pm 0.62	0.44**
Sleep latency	1.23 \pm 0.94	1.47 \pm 0.94	0.82 \pm 0.79	0.26*
Sleep duration	1.33 \pm 0.92	1.45 \pm 0.91	1.06 \pm 0.89	0.21*
Habitual sleep efficiency	0.61 \pm 1.05	0.50 \pm 0.91	0.80 \pm 1.24	-0.62
Sleep disturbance	1.00 \pm 0.72	1.06 \pm 0.74	0.90 \pm 0.66	0.92
Usage of sleep medication	0.24 \pm 0.72	0.32 \pm 0.81	0.10 \pm 0.49	0.233*
Daytime dysfunction	1.59 \pm 0.96	1.85 \pm 0.97	1.13 \pm 0.75	0.434**

* The correlation was significant at $p=.05$. PSQI: Pittsburgh Sleep Quality Index.

** The correlation was significant at $p=.01$.

previous researches.²⁰ The uniformity of our study sample and the parity in opportunities for both male and female students could offer potential explanations for these outcomes.

The overall prevalence of stress in our investigation, standing at 62.9% mirrors to the Saudi Arabia study (63.7%),²¹ but higher than study in Syria (50.6%).²² Potential contributors to these variations include the utilization of different stress assessment tools, the presence of institutional support, levels of mental health awareness, or the influence of sample size.

The current study provided evidence of the significant correlation between perceived stress and sleep quality among Moroccan medical students. It shows that a high level of stress is a major contributor to poor sleep quality. In addition, the average score of sleep quality among non-stressed students was 7.94, whereas this value decrease to 5.38 among stressed students. This is similar to the findings of many investigations conducted in Saudi Arabia and India among medical students.^{2,11} These results may support the hypothesis that stressed medical students are reducing their

sleeping hours to meet various academic and clinical requirements, considering that sleep is not a priority compared to these demands,¹¹ which may heighten their sleep disturbance, especially during exam periods. Physiological investigations have consistently demonstrated a close relationship between sleep, stress, and the hypothalamo-pituitary-adrenal (HPA) axis, providing a possible explanation for the interconnection of these 2 factors.²³

Besides, as per our research, students might have a problem falling asleep soon after getting into bed, as measured by sleep latency. This problem could be explained by their high stress' level since the measure of association between these 2 variables indicated their significant correlation. The other components of sleep quality were also affected by stress including subjective sleep quality, sleep duration, usage of sleep medication, and daytime dysfunction, which may harm students' learning process.²⁴ In light of these results, the establishment of appropriate interventions targeting university students is required to promote good sleep hygiene to this population and to provide them alternative skills such as time management

Table 5 Correlation between Perceived Stress Scale-10 score and Test Anxiety scale.

Test anxiety scores	Test anxiety interpretation	Study group, $n=132$	Stress subgroups		Pearson's rank correlation coefficient (r)
			Stressed ($n=83$), (mean \pm SD)	Non-stressed ($n=49$), (mean \pm SD)	
1–1.9, n (%)	Comfortably low anxiety level	21 (15.9)	5 (6.0)	16 (32.7)	
2–2.5, n (%)	Normal to moderate anxiety level	18 (13.6)	6 (7.2)	12 (24.5)	
2.6–2.9, n (%)	Normal to high anxiety level	26 (19.7)	16 (19.3)	10 (20.4)	
3–3.4, n (%)	Moderately high anxiety level	19 (14.4)	13 (15.7)	6 (12.2)	
3.5–3.9, n (%)	High anxiety level	25 (18.9)	21 (25.3)	4 (8.2)	
4–4.9, n (%)	Extremely high anxiety level	17 (12.9)	17 (20.5)	0 (0)	
Global test anxiety score (mean \pm SD)		2.82 \pm 1.09	3.13 \pm 1.12	2.3 \pm 0.82	0.404**

** The correlation was significant at $p=.01$.

Table 6 Correlation between perceived stress and different components of SMART scale.

SMART components	Total (mean±SD)	Stress subgroups		Spearman's rank correlation coefficient (r)
		Yes (n=83), (mean±SD)	No (n=49), (mean±SD)	
Academic skills	3.33±0.73	3.23±0.78	3.50±0.63	-0.278**
Skills test	2.373±0.72	2.103±0.64	2.803±0.65	-0.501**
Stress management	2.06±0.5	1.88±0.5	2.35±0.56	-0.364**
Strategic studying	3.21±0.68	3.03±0.70	3.46±0.59	-0.315**

** The correlation was significant at $p=.01$. SMART: Study Management and Academic Results Test scale.

skills to help them to cope effectively with their stressful environment.

Another significant finding in this study is that there was a significant association between students' stress scores and anxiety levels. Furthermore, stressed students seem to have anxiety symptoms since 45.8% of them had a high to extremely high-stress level. However, only 8.2% of non-stressed students had this psychosomatic problem. This is in agreement with the findings reported by Saxena et al.²⁵ confirming that stress participates in developing different psychological morbidities among the medical population including anxiety. These results could be explained by the fact that the permanent contact of stressed students with stressors such as exams or contact with patients could lead them to develop more psychological morbidities including anxiety. The decrease in medical students' well-being could negatively affect patients' care. This hypothesis is supported by the results of previous studies affirming that increased stress and anxiety levels can affect medical students' effective functioning and increase the risks for errors.²⁶

Our results revealed also a significant correlation of perceived stress with the decrease in students' academic performance. This academic accomplishment was assessed by measuring students' academic, stress management, and studying skills. These confirm some previous findings²⁷ affirming the negative impact of psychological stress on academic performance, but contrasting others.²⁸ The decrease of all these academic skills could negatively affect students' success by reducing their anticipating, planning, and understanding abilities.²⁷

This study identified that there were no notable variations between genders concerning perceived stress levels, anxiety, sleep quality, and academic performance. This contrasts with earlier research among medical students in Ethiopia, revealing gender differences in self-reported stress and anxiety levels, notably higher among female students.²⁹ The rationale behind our findings may be attributed to the likelihood that both males and females in our study population may employ similar coping mechanisms in response to stressors, contributing to comparable levels of perceived stress and anxiety, which may equally influence their sleep quality and their academic performance.

As this investigation is a cross-sectional study, our research generates only a snapshot of the deep facts. Furthermore, this investigation utilized a survey method; as a result, several types of bias inherent in this type of methodology must be considered, including non-response bias, selection bias, and reporting bias. The study was also

conducted in one university and might not be generalized to whole university students. Despite these limitations, the study expanded our knowledge on the association between the main characteristics of psychological morbidity and the decrease of academic performance among medical students. It also provides an insight for the Moroccan university administrators and stakeholder valuable insights for addressing the problem. Additionally, the present results could serve as initial data for subsequent studies with advanced methods and involving multiple centers.

Conclusions

While the medical curriculum is a source of stress, if it surmounts an individual psychiatric capacity, it could have detrimental consequences for his mental health. In this study, a good proportion of medical students were stressed. This stress was significantly associated with the decrease in students' academic performance and sleep quality, in addition to its correlation with anxiety symptoms within our population. These findings highlight the need for adequate interventions targeting medical students to help them develop adaptive strategies for better stress management.

Source of funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not for-profit sectors.

Ethical approval

Following the local legislation, ethical as well as scientific approval for the protocol of the study was obtained from the University Hospital Centre Hassan II of Fez, Morocco (N°17/17; Date: June 2017).

Consent to participate

Only students who fully understood the nature of the survey given in the background and agreed to participate were included.

Consent for publication

Not applicable.

Authors contribution

EMH wrote a draft of the manuscript and performed the statistical analyses of the work. AC was involved in the conception and the validation of the questionnaire used in the study. EFS and TN contributed to the conception and design of the study supported the acquisition of data and the statistical analyses. AR contributed to the conception and the design of the study. BM gave final approval of the version to be submitted and agreed to be accountable for all aspects of the work.

Declaration of competing interest

The authors declare that they have no conflict of interest.

Acknowledgments

The authors are grateful to the medical students who participated in the study. This study is not funded by any institutions.

References

- Romani M, Ashkar K. Burnout among physicians. *Libyan J Med*. 2014;9, 23556.
- Rebello CR, Kallingappa PB, Hegde PG. Assessment of perceived stress and association with sleep quality and attributed stressors among 1st-year medical students: a cross-sectional study from Karwar, Karnataka, India. *Tzu Chi Med J* [Internet]. 2018;30(4):221–6 [cité 16 avr 2021]. Disponible sur: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6172897/>.
- Bashir MBA, Mohamed SOA, Nkfusai CN, Bede F, Oladimeji O, Tsoka-Gwegweni JM, et al. Assessment of minor psychiatric morbidity, stressors, and barriers of seeking help among medical students at the University of Khartoum, Khartoum, Sudan. *Pan Afr Med J*. 2020;35:87.
- Fawzy M, Hamed SA. Prevalence of psychological stress, depression and anxiety among medical students in Egypt. *Psychiatry Res*. Sep 2017;255:186–94.
- Safhi MA, Alafif RA, Alamoudi NM, Alamoudi MM, Alghamdi WA, Albishri SF, et al. The association of stress with sleep quality among medical students at King Abdulaziz University. *J Family Med Prim Care*. Mar 2020;9(3):1662–7.
- McLuckie A, Matheson KM, Landers AL, Landine J, Novick J, Barrett T, et al. The relationship between psychological distress and perception of emotional support in medical students and residents and implications for educational institutions. *Acad Psychiatry*. 9 Nov 2017.
- Kötter T, Wagner J, Brüheim L, Voltmer E. Perceived medical school stress of undergraduate medical students predicts academic performance: an observational study. *BMC Med Educ*. 16 Déc 2017;17(1):256.
- Adams DR, Meyers SA, Beidas RS. The relationship between financial strain, perceived stress, psychological symptoms, and academic and social integration in undergraduate students. *J Am Coll Health*. 4 Mar 2016.
- Sohail N. Stress and academic performance among medical students. *J Coll Physicians Surg Pak*. Jan 2013;23(1):67–71.
- Khero M, Fatima M, Shah MAA, Tahir A. Comparison of the status of sleep quality in basic and clinical medical students. *Cureus* [Internet]. Mar 2019;11(3) [cité 13 oct 2021]. e4326. Disponible sur: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6538409/>.
- Almojali AI, Almalki SA, Allothman AS, Masuadi EM, Alaqeel MK. The prevalence and association of stress with sleep quality among medical students. *J Epidemiol Glob Health*. Sep 2017;7(3):169–74.
- Yusoff MSB, Abdul Rahim AF, Baba AA, Ismail SB, Mat Pa MN, Esa AR. Prevalence and associated factors of stress, anxiety and depression among prospective medical students. *Asian J Psychiatry* [Internet]. 1 Avr 2013;6(2):128–33 [cité 19 févr 2021]. Disponible sur: <https://www.sciencedirect.com/science/article/pii/S1876201812001864>.
- Wahed WYA, Hassan SK. Prevalence and associated factors of stress, anxiety and depression among medical Fayoum University students. *Alexandr J Med* [Internet]. 2017;53(1):77–84 [cité 8 juin 2021]. Disponible sur: <https://www.ajol.info/index.php/bafm/article/view/154055>.
- Shamsuddin K, Fadzil F, Ismail WSW, Shah SA, Omar K, Muhammad NA, et al. Correlates of depression, anxiety and stress among Malaysian university students. *Asian J Psychiatry* [Internet]. août 2013;6(4):318–23 [cité 21 mars 2016]. Disponible sur: <http://www.sciencedirect.com/science/article/pii/S1876201813000592>.
- El Madani H, El Harch I, Tachfouti N, El Fakir S, Aalouane R, Berraho M. Psychological stress and its related factors among Moroccan nursing students: a cross-sectional study. *Enfermería Clínica* (English Edition) [Internet]. 1 mai 2023;33(3):205–15 [cité 12 mars 2024]. Disponible sur: <https://www.sciencedirect.com/science/article/pii/S2445147923000024>.
- Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav*. déc 1983;24(4):385–96.
- Sarason IG, Sarason BR. Test anxiety. In: Leitenberg H, editor. *Handbook of Social and Evaluation Anxiety* [Internet]. Boston, MA: Springer US; 1990. p. 475–95. [cité 31 août 2021]. Disponible sur: https://doi.org/10.1007/978-1-4899-2504-6_16.
- Buyse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res*. mai 1989;28(2):193–213.
- Kleijn W, Ploeg H, Topman R. Cognition, study habits, test anxiety, and academic performance. *Psychol Rep*. 1 janv 1995;75:1219–26.
- Bíró É, Balajti I, Ádány R, Kósa K. Determinants of mental well-being in medical students. *Soc Psychiat Epidemiol* [Internet]. 1 févr 2010;45(2):253–8 [cité 17 juin 2021]. Disponible sur: <https://doi.org/10.1007/s00127-009-0062-0>.
- Abdulghani HM, AlKhanhal AA, Mahmoud ES, Ponnampereuma GG, Alfariis EA. Stress and its effects on medical students: a cross-sectional study at a college of medicine in Saudi Arabia. *J Health Popul Nutr* [Internet]. oct 2011;29(5):516–22 [cité 31 août 2021]. Disponible sur: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3225114/>.
- Al Hourri HN, Jomaa S, Arrouk DMN, Nassif T, Al Ata Allah MJ, Al Hourri AN, et al. The prevalence of stress among medical students in Syria and its association with social support: a cross-sectional study. *BMC Psychiatry* [Internet]. 7 févr 2023;23(1):97 [cité 3 janv 2024]. Disponible sur: <https://doi.org/10.1186/s12888-023-04593-3>.
- P P, Gp C. Metabolic consequences of stress during childhood and adolescence. *Metab Clin Exp* [Internet]. mai 2012;61(5) [cité 7 juin 2021]. Disponible sur: <https://pubmed.ncbi.nlm.nih.gov/22146091/>.
- 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.
- Saxena SK, Mani RN, Dwivedi AK, Ryali VSSR, Timothy A. Association of educational stress with depression, anxiety, and substance use among medical and engineering undergraduates in India. *Ind Psychiatry J* [Internet]. 2019;28(2):160–9 [cité 18

- févr 2021]. Disponible sur: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7660013/>.
26. Dyrbye LN, Thomas MR, Shanafelt TD. Systematic review of depression, anxiety, and other indicators of psychological distress among U.S. and Canadian medical students. *Acad Med* [Internet]. avr 2006;81(4):354 [cité 16 sept 2018]. Disponible sur: https://journals.lww.com/academicmedicine/Fulltext/2006/04000/Systematic_Review_of_Depression,_Anxiety,_and.9.aspx.
27. da Fonseca JRF, Calache ALSC, Santos MRD, da Silva RM, Moretto SA. Association of stress factors and depressive symptoms with the academic performance of nursing students. *Rev Esc Enferm USP*. 2019;53, 03530.
28. Dendle C, Baulch J, Pellicano R, Hay M, Lichtwark I, Ayoub S, et al. Medical student psychological distress and academic performance. *Med Teacher* [Internet]. 2 déc 2018;40(12):1257–63 [cité 4 janv 2024]. Disponible sur: <https://doi.org/10.1080/0142159X.2018.1427222>.
29. Asfaw H, Fekadu G, Tariku M, Oljira A. Anxiety and stress among undergraduate medical students of Haramaya University, Eastern Ethiopia. *Neuropsychiatr Dis Treat* [Internet]. 22 janv 2021;17:139–46 [cité 4 janv 2024]. Disponible sur: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7837556/>.