The association of stress with sleep quality among medical students at King Abdulaziz University

Maha A. Safhi[1], Raghad A. Alafif[1], Nouf M. Alamoudi[1], Malak M. Alamoudi[1], Wejdan A. Alghamdi[1], Shatha F. Albishri[1], Hisham Rizk[2]

[1]Faculty of Medicine, King Abdulaziz University, [2]Department of Surgery, University of Jeddah, Jeddah, Saudi Arabia

ABSTRACT

Objective: This study aims to determine the prevalence and the association of stress with sleep quality among medical students at King Abdulaziz University (KAU), Jeddah, Saudi Arabia. **Methods:** A cross-sectional study was done among 326 medical students of KAU using a stratified random sampling technique. An electronic self-administered questionnaire was used. Kessler Psychological Distress Scale (K10) and Pittsburgh Sleep Quality Index (PSQI) were used to assess the stress and sleep quality, respectively. **Results:** The overall students who experienced stress were 65%. The prevalence of poor sleep quality (total PSQI score ≥5) was 76.4%. There was a strong association between stress and poor sleep quality (value of Cramer's $V = 0.371$, $P < 0.001$), and it showed that the increase in stress level is a significant predictor of poor sleep quality. **Conclusion:** A high prevalence of stress and poor sleep quality was found among the students and the study confirms a strong association between them. We recommend establishing courses focusing on educating the students about proper sleep hygiene and how to deal with the stressful environment.

Keywords: Cross-sectional, medical students, Saudi Arabia, sleep disorders, stress

Introduction

Medical fields are considered to be a stressful area of education due to the high academic requirements and demanding professionals, the fact that shows a negative influence on both the mental and physical health of the students.[1,2] Several factors contribute to this situation, including the academic overload, overnight on-call duties, contact with diseases and deaths, frequent examinations, and comprehensive curricula.[1,3-6] Furthermore, these students facing multiple stressors outside their medical school: physical, social, emotional, and family problems.[7,8]

A large body of evidence supports the rising incidence levels of stress among medical students. Based on a systemic review done during 2006, medical students in Canada and the United States suffer from greater levels of suicidal ideation, depression, and psychological distress than the general community.[9] The prevalence of stress recorded as 20.9%, 41.9%, 90% in a Nepali, Malaysian, and Pakistani medical students, respectively.[10-12] In Saudi Arabia, stress prevalence documented as 63% and 53% in King Saud and King Faisal Universities, respectively.[13,14] The potential adverse effects of psychological stress include impairment of the functioning performance of the students in the classroom and clinical practice, cognitive deficits, illness, increased the possibility of developing anxiety, depression, and reduced life satisfaction.[15-17] Poor health behaviors were also related to high-stress levels; students who experienced higher stress consumed more unhealthy food, less likely to get exercise, and more likely to get inadequate sleep. Consequently, physical, mental, behavioral, and academic difficulties were the cost of stress for students.[16]

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The quality of sleep can be defined by both quantitative and qualitative components of sleep.

The quantitative part includes the duration of sleep, whereas the qualitative part is a subjective measure of the depth and feeling of restfulness upon awakening.[18] Reductions in sleep duration and sleep quality have unfavorable health consequences; resulting in increased morbidity and mortality.[19] Sleep difficulties can precipitate into several life dimensions, including mental, emotional, physical, social, academic, and professional problems. Among the general population, excessive and uncontrolled sleepiness is significantly associated with vocational accidents, work dismissal,[20,21] and nearly seven times more road traffic accidents than people without any subjective fatigue or known sleep disorders.[22] Among the students, poor quality of sleep is strongly linked to emotional disturbance; feeling of anger, tension, depression, confusion and exhaustion; cognitive and memory dilemmas; and overall low life satisfaction.[23] Sleep deprivation considered as one of the most common causes of daytime sleepiness and tiredness; students go to bed late and has to wake up early; thus, they get insufficient sleep throughout the day. Sleep deprivation can arise from poor sleep behaviors, as the use of social media applications and technology before going to bed can also affect sleep quality adversely. Many students have poor sleep hygiene, which in combination with their delayed circadian rhythm, stimulate sleep deprivation.[24]

The rising levels of poor sleep quality and psychological distress have an adverse effect on mental and physical health.[25,26] The long-term implications of this study will impact on identifying significant problems facing our students, which can eventually improve the healthcare quality provided by future doctors. Literature reviews have indicated that there were no recent studies that had been done before to investigate the association of sleep quality with stress among medical students at King Abdulaziz University (KAU). From our perspective, it is essential to evaluate the level of mental and physical health of our students and identify the gaps to enhance students' quality of life. Therefore, the objective of this study is to determine the prevalence and the association of stress and sleep quality among medical students at KAU, Jeddah, Saudi Arabia.

Material and Methods

Study design and setting

A cross-sectional study was done at KAU during the academic year 2018 among medical students from the second to the sixth academic year. Students who have a history of psychiatric problems or being a visiting student at King Abdulaziz University Hospital (KAUH) were excluded.

Sample size and sampling procedure

The sample size required for this study was calculated as 326 participants for 95% confidence level and a margin of error of 5%, the calculations were made using the Raosoft sample size calculator.[27] We used a stratified random sampling technique. First, the proportion of students in each academic year was considered as a stratum. Then, randomly ask students in both female and male section to fill the questionnaire.

Data collection instruments

A standardized, anonymous questionnaire was used and distributed as an electronic form using Google forms and consisted of three parts: the first part inquired about demographic information, habits, and educational achievement. The second part was used to assess the stress using Kessler Psychological Distress Scale (K10), developed by Kessler and colleagues.[28] This instrument has been applied extensively in many epidemiological studies to estimate current (1-month) distress and severity associated with psychological symptoms. The K10 questionnaire was observed to have excellent psychometric properties with a Cronbach's α of 0.93, it composes of ten items; each item has five response categories: (1) "none of the time"; (2) "a little of the time"; (3) "some of the time"; (4) "most of the time"; and (5) "all of the time". The scores ranged from 10 to 50 and classified according to the following: less than 20 are likely to be well, from 20 to 24 were classified as mild, from 25 to 29 were classified as moderate, 30 and more are likely to have severe stress.

The last part was to measure the quality of sleep using Pittsburgh Sleep Quality Index (PSQI),[18] which is the gold standard questionnaire for assessing subjective sleep quality and has been validated in both clinical and nonclinical populations.[29,30] It has acceptable standards of test–retest reliability and validity.[18] A global PSQI score >5 yielded a diagnostic sensitivity of 89.6% and specificity of 86.5% (kappa = 0.75, $P < 0.001$) in defining good and poor sleepers. This questionnaire investigates seven components; sleep quality, sleep latency, sleep duration, habitual sleep efficiency, step sleep disturbances, use of sleeping medication, and daytime dysfunction. The seven component scores of the PSQI had an overall reliability coefficient (Cronbach's α) of 0.83, indicating a great degree of internal consistency.[18] The questionnaire composed of 19 self-rated questions and five questions rated by the bed partner or roommate (if available). Only, self-rated questions are included in the scoring. Each component has a score range of 0 to 3; 0 indicates no difficulty, whereas 3 indicates sever sleep difficulty. The seven component scores are then added to one global score, which ranges from 0 to 21, where "0" indicates no difficulty at all and "21" indicates severe difficulties.

Analysis

Microsoft Excel 2016 was used for data entry and statistical analysis was performed using IBM© SPSS© Statistics version 21 (IBM© Corp., Armonk, NY, USA). Frequencies and percentages were done for the categorical variables and measures of central tendency were calculated for the continuous variables. Analysis of variance, independent-samples *t*-test, and Chi-Square test of independence were used in the analysis. Binary logistic regression was used to determine the predictors

of sleep quality and to calculate the odds ratio (OR) and 95% confidence intervals (95% CI). All *P* value < 0.05 were considered statistically significant.

Research ethics

This study was approved by the biomedical ethical committee at KAUH (Ref: 386-18). All participants were notified about the study objectives and response confidentiality and we took their consent.

Results

Demographics

The total responses were 326 medical students that responded and completed the questionnaire, 50.6% of them were males. The mean age of the participants was 21.86 ± 1.7 years. Students' demographics demonstrated in Table 1.

Stress

The mean stress score among the students was 25 ± 8.66, and the overall students who experienced stress were 65%, 18.7% of them had mild stress, 15% had moderate stress, and 31.3% had severe stress. There was a reduction in the stress scores as the year of study increased except for the final year ($P = 0.016$). There was no statistically significant difference between stress level and gender ($P = 0.175$), marital status ($P = 0.466$), living with family ($P = 0.66$), or consumption of caffeine beverages ($P = 0.682$). Further analysis did not find any statistical significance between stress and Grade Point Average (GPA) ($P = 0.707$, *F* value = 0.465).

Quality of sleep

The mean global PSQI score was 7.41 ± 3.66. The prevalence of poor sleep quality (total PSQI score ≥ 5) was 76.4% ($n = 2\,49$). The students who estimated their sleep quality as very good sleep quality were 41 (12.6%), fairly good 150 (46%), fairly bad 94 (28.8%), very bad 41 (12.6%) students. Of the PSQI, the subjective sleep quality, sleep latency, sleep duration, and use of medications are shown in Table 2. There was a significant difference between sleep quality and caffeine consumption ($P = 0.007$). Otherwise, there was no apparent significant difference with sleep quality and the academic year ($P = 0.693$) nor living with family ($P = 0.067$). Further analysis did not reveal any statistical significance between the quality of sleep and GPA ($P = 0.413$).

The Chi-square test of independence showed a strong association between stress and poor sleep quality (value of Cramer's $V = 0.371$, $P < 0.001$). Logistic regression showed that Kessler score was a significant predictor of PSQI score ($\beta = 0.155$; OR = 1.167; 95% CI 1.036—1.315; $P = 0.011$).

It showed that the increase in stress level is a significant predictor of poor sleep quality and that 74.4% of poor sleepers were in stress, whereas 56.1% of nonstressed students were poor

Table 1: Students' demographics

Characteristics	Levels	*n*	Percentage
Gender	Male	165	50.6
	Female	161	49.4
Marital status	Single	320	98.2
	Married	4	1.2
	Divorced	2	0.6
Living with family	Yes	299	91.7
	No	27	8.3
Academic year	Second	80	24.5
	Third	65	19.9
	Fourth	60	18.4
	Fifth	63	19.3
	Sixth	58	17.8
Academic score (GPA out of 5)	4.76-5	60	18.4
	4.51-4.75	73	22.4
	4.01-4.50	105	32.2
	3.51-4.00	61	18.7
	<3.50	27	8.3
Caffeine consumption	Daily	167	51.2
	Weekly	72	22.1
	Prior examination only	53	16.3
	Never	34	10.4

Table 2: PSQI components

Components	Levels	*n*	Percentage
Sleep latency	≤15 min	122	37.4
	16-30 min	100	30.7
	31-60 min	64	19.6
	>60 min	40	12.3
Sleep quality	Very good	41	12.6
	Fairly good	150	46.0
	Fairly bad	94	28.8
	Very bad	41	12.6
Sleep duration	>7 h	86	26.4
	6-7 h	83	25.5
	5-6 h	80	24.5
	<5 h	77	23.6
Use of sleep medication	Yes[a]	56	17.2
	No[b]	270	82.8

a: Less than once a week, once or twice a week, and three or more times a week, b: not during the past month

sleepers. Table 3 demonstrates the relationships between sleep quality, stress levels, and sociodemographic variables of the students.

Discussion

This study highlights the high prevalence of psychological distress (65%) and poor sleep quality (76.4%) among the medical students at KAU. When compared with other studies, our results demonstrate a higher prevalence of stress than a Pakistani medical school (59.7%) and King Saud University (53.2%), respectively.[1,25] However, it appears to be less than other Pakistani and Indian medical schools who describe that more than 90% of their students suffered from stress.[12,31] A possible explanation for this variation might be due to using different

Table 3: Relationships between sleep quality, stress levels, and sociodemographics of medical students at King Abdulaziz University

Variable		Stress level classification				X^2	P	Quality of sleep		X^2	P
		Well	Mild	Moderate	Severe			Good	Poor		
Gender	Female	47	32	28	54	4.961	0.175	36	125	0.159	0.690
	Male	67	29	21	48			41	124		
Academic year	Second	17	18	14	31	19.396	0.079	15	65	2.232	0.693
	Third	22	12	9	22			16	49		
	Fourth	22	15	9	14			13	47		
	Fifth	32	8	10	13			18	45		
	Sixth	21	8	7	22			15	43		
Marital status	Single	113	60	49	98	5.628	0.466	76	244	2.011	0.366
	Married	0	1	0	3			0	4		
	Divorced	1	0	0	1			1	1		
Living with family	Yes	107	56	48	88	7.180	0.066	75	224	3.365	0.067
	No	7	5	1	14			2	25		
Caffeine consumption	Daily	51	31	27	58	6.564	0.682	35	132	12.270	0.007
	Weekly	30	14	7	21			13	59		
	Prior examination only	22	8	9	14			13	40		
	Never	11	8	6	9			16	18		

stress assessment instruments. It is well known that during the medical training, the students facing multiple stressors and challenges,[32,33] if these challengeable difficulties left and neglected, they will contribute to further stresses.[9] Medical training itself considered as a risk factor in developing depressive symptoms,[34-36] which may explain the increased levels of stress among the students.

Consistent with previous studies, the current study confirms the rising prevalence of poor sleep quality among medical students. There are several possible factors explained this result, medical students have various activities, and they are also handling multiple stressors, which may lead them to study during the night.[1,25,26,37,38]

This study also confirms that stress level is significantly associated with poor sleep quality. It demonstrates that the high level of stress is a significant predictor for the poor quality of sleep, in line with recent studies conducted at King Saud University, and a Pakistani medical school.[1,25] Psychological distress considered as a triggering factor for sleep disturbance.[39] In response to stressors, physiological changes take place to help the body coping with the situation.[40] However, chronic activation of these stress responses, which include the sympathetic–adrenal–medullary axis and the hypothalamic–pituitary–adrenal axis, can give rise to the persistent production of epinephrine and cortisol, which called "stress hormones."[21,41,42] Similarly, sleep deprivation can affect the circadian rhythm of cortisol secretion.[42] Therefore, it represents a vicious cycle that has a negative effect on the mental health of the students.[1]

The current study showed no gender dominance within stress or sleep quality, which coincides with two recent studies.[1,25] In the Faculty of Medicine, KAU, the examinations, and requirements are the same for both campuses, so there are no differences between females and males. Contrary to the findings of our study, some studies have reported that female students have worse stress levels,[43,44] and sleep disorders.[45] However, the cross-sectional design of this study limits details analysis of gender difference.

Interestingly, our results revealed no significant association between stress level and GPA, which goes in agreement with a study published at King Saud University in 2018.[44] The precise cause of such a result is difficult to understand and could not be explained by this study. However, this could be due to the students who have been able to develop a coping mechanism and adaptation despite their grades. Abdulghani *et al.* illustrated a conflicting relationship between the academic level and stress.[13] Similarly, the current study demonstrates that the stress levels decreased as the academic level increased except for the final year. This could be due to the study design of this study is not a longitudinal study and limit the assurance of decreasing stress levels of the participants.

Concerning hygienic sleep habits, our results confirm that poor sleepers reported greater caffeine consumption in comparison with good sleepers. This finding agrees with two recent studies conducted in Saudi Arabia and South Australia.[37,46] In excess, caffeine can lead to a disruption of sleep; depending on the consumed amount, it has both positive and negative behavioral and cognitive effects.[47] Consumption of caffeine beverages markedly reduces sleep time, prolong the bedtime and overall disrupts the quality of sleep.[48,49]

The present study makes several significant and noteworthy findings; however, in the cross-sectional studies, there is a potential for reporting bias as this study was based on a self-administered questionnaire filled by the students. Also, the validation of GPA records was a limitation.

Conclusion

The current study found a high prevalence of stress and poor quality of sleep among medical students with a significant association between them. Medical students suffer from poor sleep quality and chronic stress that will lead to unhealthy behaviors like consuming a lot of unhealthy food and less likely to exercise. Incontestably, they are more susceptible to have chronic diseases. If these problems neglected, it will reflect on the health care provided to their future patients. As part of primary health care practice is to prevent and detect the risk factors of the diseases. Accordingly, we recommend providing adequate support and counseling, guidance, and mental health prevention programs for undergraduate students as part of their clinical rotations. Another longitudinal study could be conducted to identify the stress levels and quality of sleep among undergraduate students in the medical school and the associated factors.

Conflicts of interest

There are no conflicts of interest.

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