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RESEARCH **ORIGINAL ARTICLE**

Exploring the Interplay of Sleep Quality, Stress, and Academic Performance in Jordanian Medical Students: A National Perspective

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ABSTRACT

BACKGROUND - Sleep is a fundamental biological activity crucial for brain function, memory processing, and learning. Medical students are particularly susceptible to sleep problems due to demanding schedules that potentially affect their cognitive performance and academic achievement. This study aimed to explore the relationship between sleep quality, psychological distress, and academic performance among medical students in Jordan.

METHODS - A self-reported cross-sectional survey was conducted, targeting medical students from six Jordanian universities. Participants completed a questionnaire including demographics, sleep quality using the Pittsburgh Sleep Quality Index (PSQI), psychological distress using the Kessler Psychological Distress Scale (K10), the academic performance of the past year, and other like studying related factors. Statistical analyses used descriptive and Chi-square tests.

RESULTS - The study involved 707 participants, predominantly females (63%), with the majority (39%) aged between 21 and 24 years old. A high prevalence of poor sleep quality was observed (74%), with a mean PSQI score of 8.16 ± 3.67. Psychological distress was prevalent (77%), with 37% of participants experiencing severe distress. The global score of PSQI did not show a significant association with the distress overall score (P-value = 0.6). However, the K10 distress score was significantly associated with all components of the PSQI scale except for component 6. Moreover, K10 score was significantly associated with Grade Average Points (GPA) and gender.

CONCLUSIONS - This study highlighted the substantial prevalence of poor sleep quality and psychological distress among medical students in Jordan. It emphasizes the interconnectedness of sleep quality, psychological well-being, and academic performance. Although global PSQI scores did not correlate with psychological distress, various sleep quality components were associated with psychological distress and academic performance indicators. These findings underscore the need for comprehensive strategies to improve sleep quality and manage psychological distress to enhance the academic performance of medical students.

KEYWORDS - sleep quality, psychological distress, academic performance, medical students, Jordan

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INTRODUCTION

Sleep is a crucial biological activity that all individuals require regularly. Despite extensive medical literature and advanced research in sleep medicine, the complete range of sleep function and physiology remains unclear (1, 2). One of the most important roles of sleep is to support appropriate brain function, including memory processing and learning. This is particularly evident in states of sleep deprivation, which can lead to impairment of higher cognitive processes (1, 3).

Medical students are particularly susceptible to sleep problems, which may be due to their demanding academic schedules and emotionally strenuous environments (4). Consequently, their cognitive performance, including their ability to focus on and complete tasks, can be significantly affected (5). Sleep disorders among students may be associated with unsatisfactory academic achievement (6).

Furthermore, sleep deprivation has been associated with various physiological abnormalities, including elevated cortisol levels, which regulate physiological changes in the body in response to distress. Cortisol works in conjunction with melatonin to regulate the body's 24-hour cycle of body function (1, 7). Consequently, any disturbance in circadian rhythm, often caused by distress and insufficient sleep, can contribute to poor academic performance (6, 8).

In Jordan, one study reported a high prevalence of poor sleep quality(62%) and high levels of psychological distress (66%) among medical students studying at the University of Jordan (9). This study aimed to explore sleep quality, psychological distress, and academic performance among medical students in six medical faculties in Jordan and to determine the interplay of sleep quality, GPA, and other factors. Expanding the survey to include all medical faculties across diverse universities in Jordan could offer a more representative sample, enhancing the generalizability of findings and providing a comprehensive understanding of sleep quality, psychological distress, and academic performance among medical students nationwide. Moreover, it may enable comparative analysis by identifying common trends and variances in student experiences across different universities. Additionally, it allows for an exploration of the role of the university environment in shaping student well-being and academic outcomes. This in turn might generate a broader insight on the factors affecting sleep quality and psychological distress among students and inform targeted interventions and support programs tailored to the specific needs of medical students at various institutions, thereby promoting their overall health and success within the medical education system.

METHODOLOGY

STUDY DESIGN

This observational cross-sectional study aimed to explore the relationships between sleep quality, psychological distress, and academic performance among medical students across six Jordanian medical schools namely University of Jordan (JU), Jordan University of Science and Technology (JUST), The Hashemite University (HU), Mutah University (MU), Yarmouk University (YU), and Al-Balqa' Applied University (BAU). The research design was approved by the Human Research Ethics Committee (HREC) of Mutah University.

SAMPLE SIZE CALCULATION

Participants were included if they were in their second through sixth year of study, and first-year students were excluded because they did not have GPA at that level. There are approximately 20 thousand medical students in Jordan, as reported in the National Human Resources for Health Observatory Annual Report, 2017, distributed among the six universities as follows: JUST (5596, 27%), MU (4415, 21%), HU (3900, 19%), JU (3455, 17%), YU (2343, 11%), and BAU (880, 4%).

The sample size of the 707 participants was calculated using the following formula (10):

$$n = \frac{Z^2 P(1-P)}{d^2}$$

Where:
where, n is the required sample size. Z: Z-score corresponding to the desired confidence level (e.g., 95% confidence level corresponds to Z=1.96). P: is the estimated proportion of the population with the characteristic of interest (e.g., maximum variability of 0.5). E: Desired margin of error.

DATA COLLECTION

Data were collected over a month, from November 14, 2022, to December 18, 2022, using an online Google form self-administered questionnaire (Supplementary files). In Jordan, there are six medical faculties at government universities. Students were approached and recruited through social media communication channels designed for each academic year. The number of participants from each university was not proportion-

ately related to the number of students at that university, as participation was voluntary.

The questionnaire consisted of three distinct sections: the first section focused on participants' characteristics, including demographics, socioeconomic status, academic level, and indicators of academic performance; the second section assessed psychological distress using the Kessler Psychological Distress Scale (K10) (11); and the third section evaluated sleep quality using the Pittsburgh Sleep Quality Index (PSQI) (12). The questionnaire was translated into Arabic and subsequently back-translated into English. The guideline for the Process of Cross-Cultural Adaptation of Self-Report Measures (Beaton et al., 2000) was employed to ensure the translation's equivalency and appropriateness (13). We considered individuals' participation a consent form; no identifier information was asked, such as name or address, and their information was kept confidential.

The Kessler Psychological Distress Scale (K10) is a widely used self-report measure designed to assess psychological distress. It typically consists of 10 items that inquire about various symptoms of psychological distress on a 5-point Likert scale, including (None of the time, A little of the time, Some of the time, Most of the time, All of the Time) experienced over the past month. A total score is generated and then categorized into different levels of distress; where likely well or minimal Distress (10 – 19), mild distress (20 – 24), moderate distress (25 – 29), and severe distress (30 – 50) (14, 15).

The Pittsburgh Sleep Quality Index (PSQI) is a self-report questionnaire used to assess sleep quality over a one-month time interval. Its operational definition typically involves scoring responses across seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. The total score, ranging from 0 to 21, indicates overall sleep quality, with higher scores indicating poorer sleep quality (12). The cut-off point for poor sleep quality was greater than five (16).

STATISTICAL ANALYSIS

The data were analyzed using SPSS version 28 for Windows. Descriptive statistics, including frequencies and percentages, were computed and presented in tabular form. The statistical significance level was set at a P-value of 0.05. The Shapiro-Wilk normality test was used to assess the normality of data distribution. Chi-square tests were performed to assess the association between the K10 and PSQI scores and the association between PSQI components and other relevant variables.

RESULTS

The characteristics of the participants of this cross-sectional study (n=707) are presented in Table 1 and Figure 1. There was no missing data, as proceeding to the next question make it obligatory to answer the current one. Most participants were female (63%), and 99% of participants were aged between 18-24 years, with 61% falling in the 21-24 age group and 38% in the 18-21 age group. Most participants were single (99%), unemployed (93%), and living with their families (70%). In terms of academic level, 30% were in the 2nd year, 18% in the 3rd and 4th year, 22% in the 5th year, and 15% in the 6th year. The academic performance of the students was rated as excellent (24%), very good (40%), or good (30%), whereas 6% had a fair academic performance or were repeating students.

Regarding studying habits, 70% reported daily caffeine consumption. 14% consumed caffeine weekly in an occasional manner, 12% consumed it once weekly, and 8% did not consume it.

The most common bedtime period was from 00:00 to 1:59 (48%), followed by 22:00 to 23:59 (26%). In comparison, only 18% reported bedtime before 22:00. Sixty-five percent of the participants slept 5-7 hours per night, with more than 56% reporting daytime napping.

The prevalence of poor sleep quality among the participants was 74% (n=526), with a mean PSQI score of 8.16 ± 3.67. Moreover, distress was prevalent among participants, with 77% exhibiting positive distress on the K10 scale (N =544). Approximately 37% of the participants reported severe distress, whereas 20% reported moderate or mild distress. However, one-fourth of participants reported being free of distress. The mean K10 score was 26.88 ± 8.69, ranging from 10 to 50. Figure 2 shows the distress categories among different academic levels.

Continuous K10 and PSQI scores showed a significant Shapiro-Wilk test; this indicated that the data may not follow a normal distribution. Therefore, we used categorical tests and descriptive tables. Table 2 presents the associations between various characteristics, including distress, GPA, work status, and other variables, and the components of the PSQI scale.

Component One represents subjective sleep quality; Component Two represents sleep latency; Component Three represents sleep duration; Component Four represents sleep efficiency; Component Five represents sleep disturbance;

Component Six represents the use of sleep medication; and Component Seven represents daytime dysfunction.

While individual components of the PSQI scale showed significant associations with the K10 distress score, the overall distress score did not exhibit a significant association with the global PSQI score except for component 6. Daytime napping was only significantly associated with components three and four. Caffeine intake and gender were not significantly associated with any component. GPA showed significant associations with components two, four, five, and six. Moreover, Figure 3 presents the distribution of distress and sleep quality among different GPA assessments.

The associations of PSQI and K10 scores with gender, caffeine intake, work status, daytime napping, school hours, studying hours, and grade point average (GPA) are presented in Table 3. K10 total scores were significantly associated with gender, GPA, and exams the month before completing the questionnaire (Figure 4). However, the global PSQI scores did not show significant associations with any of the examined factors.

DISCUSSION

The primary purpose of this study was to explore the prevalence and degree of psychological distress and poor sleep quality among Jordanian medical students.

Our findings showed that approximately three-quarters of medical students reported poor sleep quality. This prevalence is lower than the prevalence found in studies conducted in Lebanon 81%(17), Saudi Arabia 76% (18), but more than in Egypt 58.5 % (19), Spain 47% , Mongolia 26% , India 33% ,(20) and China 19%.

The students in the current study sleep less than the recommended hours, as two-thirds of the participants slept 5-7 hours per night. Moreover, most of the studied students do not sleep before midnight despite their schedules requiring waking up before a full night's sleep is accomplished. More than 56% reported daytime napping, which significantly affected sleep duration and efficacy. Similar findings were reported among medical students in Saudi Arabia, where 77% of the participants reported poor quality of sleep (the mean PSQI score was 8.13 ± 3.46) and 63.5% reported some level of psychological stress (mean K10 score: 23.72 ± 8.55) (21). It is reported that individuals commonly adopt regular daytime naps as a coping mechanism for irregular circadian rhythms (22). However, one study found that daytime sleepiness was unrelated to the number of hours slept at night (17). Flexibility in class schedules, as opposed to rigid schedule requirements, may allow students to find a more natural sleep-wake cycle.

The current study revealed no gender-related differences in sleep quality. Similar results were observed in studies of medical students in different contexts despite the balanced distribution of sample genders (23, 24).

The prevalence of distress in participants in the current study was also high, as 77% exhibited positive distress on the K10 scale. Literature has reported a higher prevalence than our findings of 88% (25), whereas lower prevalence was shown in other studies (20 % and 36 %) (26). These differences might be attributed to contextual or reporting differences.

Psychological distress has a significant association with gender. This result was consistent with other studies, which concluded that female medical students experience more distress than their male colleagues (27, 28). However, some studies did not show differences in distress levels between genders (29). Moreover, the results showed no significant association between distress and work, daytime naps, school hours, or study hours (29).

Many studies have reported a close relationship between sleep quality and distress (9, 30, 31). A study conducted in a sample of 90 college students revealed an association between distress and sleep disturbances but not sleep efficiency or latency, hypnotic medication use, daytime dysfunction, or global scores determined by the PSQI (32). Our study found that distress is correlated with various aspects of sleep quality, such as latency, duration, efficiency, disturbance, medication use, and daytime dysfunction. However, the findings revealed a noteworthy association between Index (PSQI) in men, whereas such an association was not observed in women. This is also reported in other studies where men are generally dissatisfied with their sleep quality, whereas women focus more on specific symptoms.

Literature shows this pattern could also apply to symptoms of anxiety and depression. Women may exhibit a tendency to focus more on details compared to men. For instance, the difficulty of falling asleep before an exam, which is linked to depression in men, might be seen by them not as a standard insomnia symptom but rather as a temporary sleep disruption caused by distress (33).

The difference between the two studies could be due to differences in the target population.

The current study showed that academic performance was linked to distress and sleep. Similar findings were reported (34); however, another study reported no evidence of an inverse relationship between anxiety level and performance (35). This may differ according to the coping mechanisms with distress, which requires further investigation.

Our findings showed that academic performance was unrelated to sleep duration or daytime sleep. On the other hand, a systematic review and meta-analysis reported different findings where daytime sleepiness scores correlated significantly with academic performance (36). However, the study also reported that sleep duration is not related to academic performance, whereas sleep quality does (36). The current study found academic performance to be associated with sleep disturbance and latency. These findings are demonstrated in other studies as well(37-39). The correlation between distress and academic performance appeared to be more robust than that between sleep quality and academic performance. The PSQI did not indicate any connection with academic performance, and the relationship with the sleep quality item was statistically insignificant ($P = 0.053$). This observation should be contextualized within the exam period, which is a crucial factor in this analysis. It is reported that students endorse the reduction of sleep duration to manage their numerous academic demands and stressors. This practice initiates a detrimental cycle characterized by distress, diminished sleep quality, and decreased academic performance (40).

This study found no relationship between distress and academic year or between sleep and academic year, consistent with previous studies (41, 42). This could be attributed to the fact that medical students, irrespective of their academic year, encounter comparable stressors like demanding coursework, clinical duties, and examinations. The consistency of these stressors throughout academic years may explain the absence of observable differences.

Regarding the frequency of coffee consumption, studies have identified a significant relationship between caffeine intake and sleep quality, as well as excessive daytime sleepiness (43), along with a correlation between caffeine consumption and distress (44). However, this study did not thoroughly investigate caffeine intake. Further research is needed to assess the relationship between the quantity, type, and timing of caffeinated beverage consumption and both sleep quality and distress.

This study was conducted in six Jordanian medical faculties, which might add to the generalizability of its findings among medical students in Jordan. We also explored the relationship between sleep quality, distress, and academic performance among medical students. However, the cross-sectional methodology of the study has several inherent limitations, such as the inability to show a cause-and-effect relationship between distress and sleep quality and the potential for recall bias because of the use of self-administered questionnaires.

While the study found that a considerable proportion of participants self-reported their academic performance as excellent, it's important to recognize that this assessment relies solely on self-reporting, which may have introduced bias or inaccuracies.

In addition, we recommend that in future studies, researchers collect more detailed information on weekend sleep habits and quality for comparison with weekday parameters. And highlight examination periods for the participants as such periods bring on more distress and poor sleep quality (45). In the interim, enhancing the quality of sleep and reducing distress levels among medical students may be achieved through initiatives focused on educating them about sleep and providing counseling on time management time (46).

CONCLUSION

This study draws attention to the high prevalence of poor sleep quality and psychological distress among medical students in Jordan. It also sheds light on the relationship between sleep quality, psychological distress, and sociodemographic and study-related factors. These findings underscore the need for comprehensive strategies to improve sleep quality and manage psychological distress to enhance medical students' academic performance.

SUPPLEMENTAL MATERIALS

Table 1. Characteristics of medical students in Jordanian Universities

Characteristics	P-value	N (%)	Characteristics	P-value	N(%)	Characteristics	P-value	N(%)
Gender	0.05<		**Academic Level**	0.05<		**Daytime nap**	0.05<	6
Male		263(37.2%)	2nd year		190(29.9%)	Yes, less than		4(9%)
Female		444(62.8%)	3rd year		126(17.8%)	half hour		
			4th year		126(17.8%)	Yes, more		332(47%)
			5th year		158(22.3%)	than half hour		
			6th year		107(15.1%)	No		311(44%)
Age	0.05<		**ASH**	0.05<		**GPA**	<0.05*	
18-20		269(38%)	1-2		54(7.6%)	Excellent		170(24%)
21-24		428(60.5%)	2-3		173(24.5%)	Very good		282(40%)
Older than 24		10(1.4%)	3-4		228(32.2%)	Good		211(29.8%)
			4-5		150(21.2%)	Fair		22(3.1%)
			5<		102(14.4%)	Repeat		22(3.1%)
Residency	0.05<		**Caffeine intake**	0.05<		**Distress**	-	
With family		496(70.2%)	>400 mg daily		157(22.2%)	Well		163(23%)
UD		90(12.7%)	<400 mg daily		316(44.7%)	Mild		144(20%)
Private		121(17.1%)	Weekly		98(13.9%)	Moderate		142(20%)
			< once a week		81(11.5%)	Severe		258(37%)
			never		55(7.8%)			
Marital Status	0.05<		**Work**	0.05<		**PSQ**	0.05<	
Single		699(98.9%)	Yes		47(6.6%)	Poor		526(74.4%)
Engage		8(1.1%)	No		660(93.4%)	Good		181(25.6%)

*Significant, Chi-square association of K10 with other variables, UD: University dormitory, ASH: Average school hours, PSQ: poor sleep quality

Table 2. Displays the contingency-table analysis for each individual PSQI component in relation to participant characteristics and K10.

Characteristics	Comp. 1	Comp. 2	Comp. 3	Comp. 4	Comp. 5	Comp. 6	Comp. 7
Gender	.225	.895	.887	.137	.012*	.655	.01*
Residency	.452	.008*	.045*	.008*	.150	.277	.894
Academic Level	.329	.208	.610	.248	.124	.046*	<.001*
Caffeine intake	.150	.288	.147	.210	.475	.154	.407
Work	.318	.831	.944	.541	.234	<.001*	.429
Daytime nap	.052	.159	.001*	.018*	.279	.395	.256
GPA	.053	.024*	.166	<.001*	<.001*	<.001*	.348
K10	<.001*	<.001*	<.001*	<.001*	<.001*	.006	<.001*

*The Chi-square statistic is significant at the .05 level

Table 3. Contingency table for PSQI and K10 with other participant characteristics

Characteristics	PSQI	K10
Gender	.905	<.001*
Caffeine intake	.184	.876
Work	.721	.902
Daytime nap	.291	.593
School hours	.712	.297
Studying hours	.167	.796
GPA	.457	.019*

* The Chi-square statistic is significant at the .05 level

Figure 1. Illustrates the distribution of distress and sleep quality across the universities. Students from JUST University exhibited the highest incidence of poor sleep quality, followed by MU. Conversely, distress was the most prevalent among MU students, followed by those from JUST University.

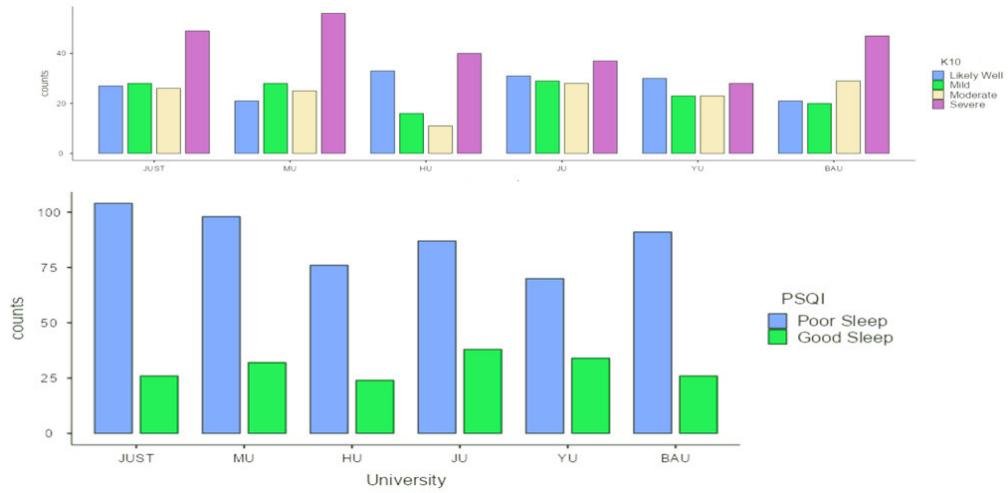


Figure 2. Shows the distribution of distress across years of medical school. It is evident that the second and third years exhibited the highest incidence of severe distress. While there was a noticeable increase in severe distress across most years, the distribution appeared relatively flat among fifth- and sixth-year students.

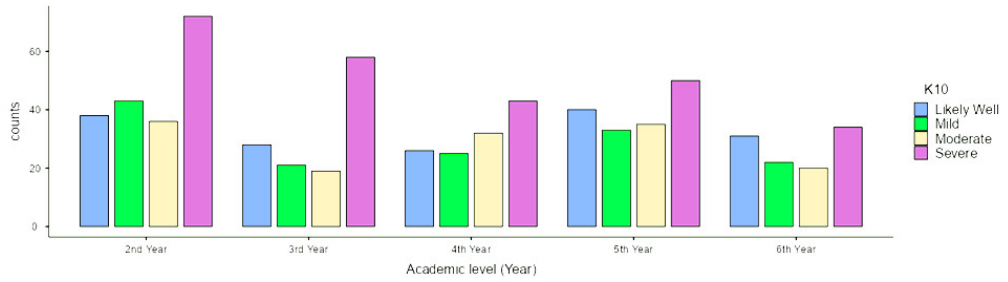


Figure 3. Shows that most students are highly distressed and have poor sleep quality despite their GPA score.

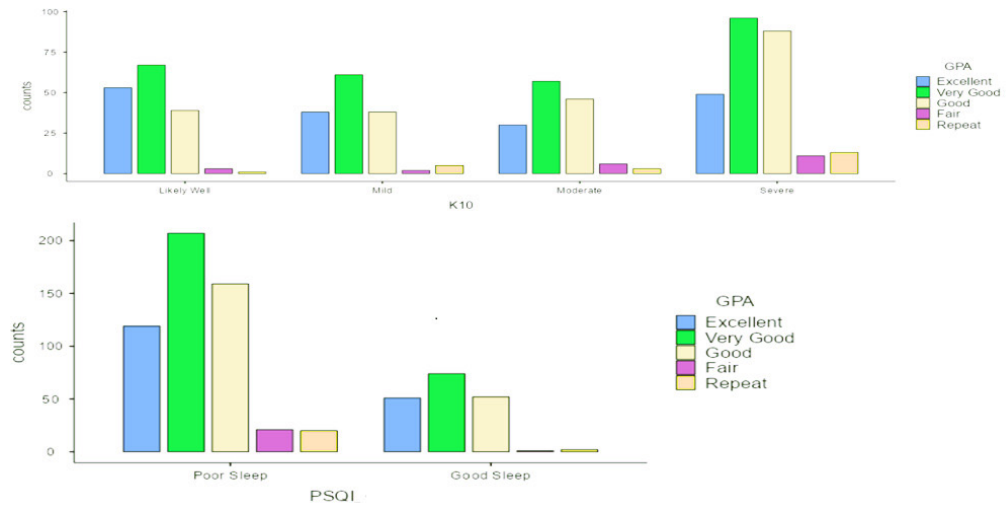
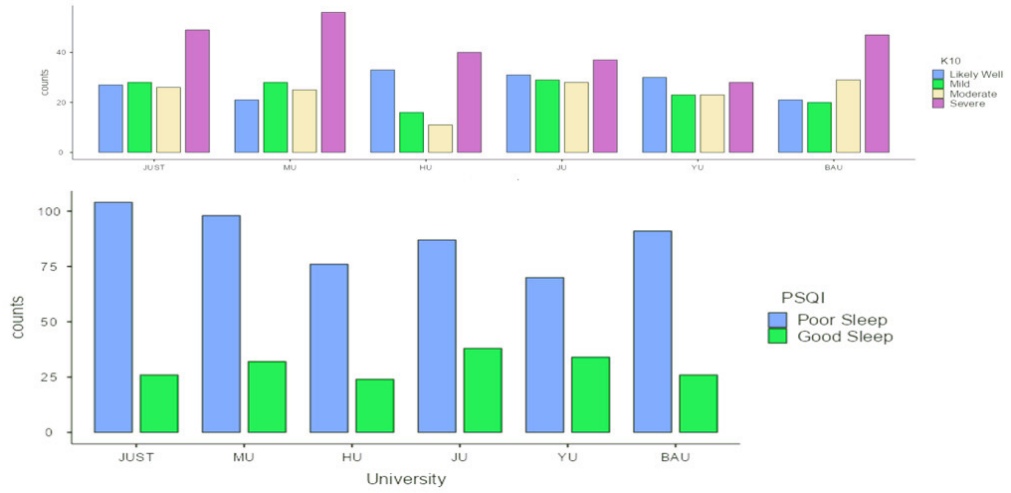


Figure 4. Highlights the significant disparities in sleep quality and distress between males and females. Notably, females exhibit lower sleep quality and higher levels of distress than males.



AUTHORS' CONTRIBUTIONS

JJ conceptualize the research idea. JJ and RA designed the google form and the questions. IA and HE revised the form.JJ and RA distributed the form and follow data collection.JJ and IA and HE planned the analysis plan. JJ and RA Cleaned the Data and performed data analysis .JJ and RA and JR wrote the first draft. JJ and JR revised the draft . HE and IA revised the final draft and approved it.

ETHICAL APPROVAL

This research was approved by the Human Research Ethics Committee (HREC) of Mutah University.

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