



# Prevalence and differences in habitual sleep efficiency, sleep disturbances, and using sleep medication: a national study of university students in Jordan

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## Abstract

**Background** Sleep quality has a significant impact on the physical and mental health of the young population.

**Study aim** To evaluate sleep efficiency, sleep disturbances, and use of sleep medication among university students in Jordan and to examine differences in these problems in relation to selected demographic and health-risk behaviors.

**Methods** The study used a cross-sectional design and a multi-stage sampling technique. Three public universities were randomly selected from three major governorates in Jordan. The Arabic version of the Pittsburgh Sleep Quality Index was used to measure sleep efficiency, sleep disturbances, and the use of sleep medication. Descriptive statistics and Kruskal-Wallis tests were used to analyze the data.

**Results** Of 1308 students who participated in the study, 27% reported sleep efficiency less than 85%, 45% of the students reported nocturnal awakening, 30% reported getting up to use the bathroom, and 9% reported using medication to help sleep. Differences in sleep efficiency, sleep disturbances, and use of sleep medication were found in relation to students' gender, income, marital status, smoking status, and academic achievement.

**Conclusions** Poor sleep efficiency, sleep disturbances, and the use of sleep medications are significant problems affecting sleep quality among university students. Students' gender, marital status, income, smoking status, and academic achievement are important factors associated with sleep quality.

**Implications** Sleep screening among university students is required to identify and provide treatment for sleep problems. Furthermore, educating university students about the effects of smoking on health in general and on sleep in particular should be mandated.

**Keywords** Jordan · Sleep disturbances · Sleep efficiency · Sleep medications · University students

## Introduction

Sleep problems among university students are considered a common health issue that affects their overall physical and mental functionality [1, 2]. Sleep habits of university students often change during study periods due to study requirements, work schedules, and other factors. University students' sleep is usually characterized by irregular sleep-wake cycle and late

sleep schedules. This means that they have short sleep length during weekdays that is compensated by delay in the sleep phase during weekends [1]. Previous research found high rates of sleep disorders among university students. For example, 27% of students are at risk for at least one sleep-related problem, such as sleep apnea, insomnia, restless leg syndrome, and snoring [3, 4]. The Pittsburgh Sleep Quality Index (PSQI) has been considered a gold standard measure of subjective sleep quality including sleep efficiency, sleep disturbances, and using sleep medications [5].

Sleep efficiency is defined as the ratio of the total sleep time in a night compared with the total time spent in bed (Hypersomnia Foundation 2019; [6]). The cutoff point to consider low sleep efficiency among adults is less than 85% [5]. The prevalence of low sleep efficiency among undergraduate students was 30.3%, while it was 12.2% in a sample of

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medical students [7, 8]. Decreased sleep efficiency introduces a potential risk of increased anxiety, fatigue, lack of concentration, and poor performance [3, 9]. However, the literature lacks research studies that examined factors that specifically affect sleep efficiency among young populations.

Regarding sleep disturbances, they reflect some types of sleep fragmentation due to several physiological, psychological, and environmental factors. This results in recurrent awakenings during the night. Examples of these factors are nocturnal urgency, breathing problems, coughing, snoring, feeling too cold or too hot, feeling pain, and having disturbing dreams [5]. Reported sleep disturbances are associated with a significant deterioration of an individual's ability to perform daily activities [9]. The association between sleep disturbances and some related factors has been examined in a few research studies [10]. For example, it was found that cigarette smoking is a risk factor for sleep disturbance [9]. It was also found that students with poor academic performance had a higher risk for several types of sleep disturbances, such as obstructive sleep apnea and snoring [1, 11, 12]. In terms of gender differences, women, in general, have a 40% higher risk of developing insomnia compared with men [13, 14]. Previous research also found that sleep fragmentation was associated with increased insulin resistance, which increases the risk for diabetes and increases body mass index (BMI) [15]. Problems of poor sleep quality due to sleep disturbances were found to be more significant among individuals with low socioeconomic status including low income, lower education, and unemployment [16]. However, this relationship has not been examined specifically among college students.

Using medications to help in sleep has been a common approach in treating insomnia caused by various sleep disturbances [13]. Almost 4% of adults in the USA use sleep-aid medications [17]. The most common sleep-aid medications include hypnotic drugs, antidepressant drugs with a sedative effect, and over-the-counter sedating antihistamines (Mayo Foundation for Medical Education and Research) [13, 18]. Among Saudi Arabian adults, using sleep medications was found to be significantly associated with being married, having sleep difficulties, and having life stressors (Aljohani and Aldughaiter). Among a group of high school students in the United Arab Emirates (UAE), half of the sample complained of inability to sleep during the past year, and 27% reported using a sedative or hypnotic medication as sleep aids [19]. Previous research found an association between poor health behaviors (e.g., cigarette smoking) and using sleep medications among young populations. However, there was some degree of uncertainty about these associations due to small-size investigated samples [20]. Other possible associated factors with using sleep medications among young adults still need examination, such as levels of physical activity, BMI, residency, and using media devices before sleep.

Previous research studies evaluated different sleep problems among various age groups. However, there are few investigated differences in sleep problems of poor sleep efficiency, sleep disturbances, and using sleep medications in relation to important factors. Furthermore, no previous national research studies examined these sleep problems among the young population in Jordan. The objectives of this study were as follows:

1. To describe habitual sleep efficiency, sleep disturbances, and using sleep medication among university students in Jordan, and
2. To examine differences in habitual sleep efficiency, sleep disturbances, and using sleep medication in relation to selected variables including gender, marital status, academic achievement, academic level, employment status, monthly family income, residency, smoking status, physical activity, and BMI.

## Methods

### Study design

The study used a cross-sectional descriptive design.

### Sample and data collection

This study was conducted in three public universities in Jordan. The target population was university students. A multi-strategic sampling technique was employed to select the sample. First, stratified random sampling based on the three major governorates in the country (North, Center, and South) was used to select the three public universities. Then, convenience sampling was used to select students within universities. Jordanian students, who were not disabled or had acute medical conditions affecting sleep such as cancer, and who agreed to participate, were included in the study. The sample size was calculated using the G\*Power program. The following input was entered into the program: an alpha level of 0.05 at the two-tail level of significance, effect size = 0.1 (low), and power = 0.95 (high power). The resulted required sample size was at least 1293 students. The data collection period extended from January until May 2019. Data was collected using a self-administered questionnaire that was administered to students from different schools in classes. The examination period was avoided to not influence the study results. Students returned the questionnaire to researchers at the same lecture in a sealed envelope.

**Table 1** Characteristics of the sample  $N = 1308$ 

Variable	$N$ (%)
Gender $n = 1302$	
Male	401 (30.7)
Female	901 (68.9)
Marital status $n = 1305$	
Single	1275 (97.5)
Married	30 (2.3)
GPA( out of 4) $N = 1308$	
Weak (< 2)	701 (53.6)
Pass (2–2.49)	42 (3.2)
Good (2.5–2.99)	165 (12.6)
Very good (3–3.64)	138 (10.6)
Excellent (3.65–4)	262 (20)
Academic level $n = 1307$	
First year	533 (40.7)
Second year	774 (22.1)
Third year	215 (16.4)
Fourth year	218 (16.7)
Fifth or more	53 (4.1)
Employment status $n = 1298$	
Part-time	80 (6.1)
Full-time	33 (2.5)
Not employed	1185 (90.6)
Monthly family income $n = 1232$	
Less than 352	193 (14.8)
352–825	637 (48.7)
More than 825	402 (30.7)
Residency $n = 1305$	
University campus	210 (16)
With family	195 (83.7)
Smoking status $n = 1306$	
Current smoker	192 (14.7)
Non-smoker	1114 (85.2)
Physical activity $n = 1306$	
Physically active	496 (37.9)
Physically inactive	810 (61.9)
BMI categories $n = 1268$	
Normal body weight	818 (62.5)
Underweight	95 (7.3)
Overweight	241 (18.4)
Obese	114 (8.7)

## Ethical consideration

Ethical approval, including Institutional Review Board (IRB), was obtained from the University of Jordan Ethical Committee. Students who agreed to participate in the study

signed an informed consent form that illustrated the study purpose, that participation in the study was voluntary, and students' right to withdraw from the study any time.

## Measures

**Demographic characteristics** The demographic characteristics of the sample were collected by a sheet developed by the researchers. These characteristics include age, gender, marital status, academic performance (measured by GPA), academic level in years, employment status, monthly family income in JD, residency, smoking status, physical activity level, height in meters, and weight in kilograms. The body mass index (BMI) was calculated using the reported height and weight and categorized into four categories: underweight, normal body weight, overweight, and obese (Center for Disease Control and [21]) [21]. Physical activity was categorized into two categories, physically inactive (i.e., perform physical activity once or less per week) and physically active (i.e., perform physical activity twice or more per week).

**Sleep efficiency, sleep disturbances, and use of sleeping medications** The Arabic version of the Pittsburgh Sleep Quality Index (PSQI) was used to measure sleep efficiency, sleep disturbances, and use of sleeping medications [22]. The PSQI was found to be a reliable and valid measure in previous studies [5, 22]. The PSQI is a measure of sleep quality that is composed of seven components: sleep efficiency, sleep disturbances, and the use of sleeping medications are components of the PSQI [5]. Habitual sleep efficiency was calculated using three questions. The first question asks about hours of actual sleep per night during the past month, the second question asks about time to go to bed at night during the past month, and the third question asks about the time of getting up in the morning during the past month. The second and third questions were used to calculate the number of hours spent on bed. Then, sleep efficiency was calculated using the formula: hours of sleep/number of hours spent in bed  $\times$  100%. After that, habitual sleep efficiency was categorized into four categories, more than 85%, between 75 and 84%, between 65 and 74%, and less than 65%. Sleep disturbances during the past month due to waking up in the middle of the night or early morning, having to get up to use the bathroom, inability to breath comfortably, coughing or snoring loudly, feeling too cold, feeling too hot, having bad dreams, and having pain were measured using a 4-point Likert item with the answers “not during the past month,” “less than once a week,” “once or twice a week,” and “three or more times a week.” A total score of sleep disturbances was calculated and categorized into four categories, zero, from 1 to 9, from 10 to 18, and from 19 to 27. The use of prescribed or over-the-counter medications to help sleep during the past month was assessed using one item with

**Table 2** Description of the study variables

Component 4: habitual sleep efficiency $n = 1217$				
> 85%	865 (66.1)			
75–84%	182 (13.9)			
65–74%	82 (6.3)			
< 65%	88 (6.7)			
Component 5: sleep disturbances				
	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
During the past month, how often have you had trouble sleeping because you wake up in the middle of the night or early morning $n = 1270$	379 (29)	302 (23.1)	275 (21)	314 (24)
Have to get up to use the bathroom $n = 1272$	498 (38.1)	389 (29.7)	252 (19.3)	133 (10.2)
Cannot breath comfortably $n = 1271$	826 (63.1)	215 (16.4)	120 (9.2)	110 (8.4)
Cough or snore loudly $n = 1257$	979 (74.8)	154 (11.8)	80 (6.1)	44 (3.4)
Feel too cold $n = 1263$	533 (40.7)	362 (27.7)	216 (16.5)	152 (11.6)
Feel too hot $n = 1257$	746 (57)	303 (23.2)	152 (11.6)	56 (4.3)
Have bad dreams $n = 1271$	537 (41.1)	390 (29.8)	203 (15.5)	141 (10.9)
Have pain $n = 1262$	718 (54.9)	271 (20.7)	168 (12.8)	105 (8)
Component 6: use of sleeping medications $n = 1300$				
	1094 (83.6)	90 (6.9)	69 (5.3)	47 (3.6)

answers “not during the past month,” “less than once a week,” “once or twice a week,” and “three or more times a week” [5].

**Data analysis** Data were analyzed using the Statistical Package for Social Science (SPSS) version 23 (IBM SPSS Statistics for Windows 2012; [23]). Descriptive statistics (i.e., mean, percentage, and standard deviation) were calculated to describe demographic characteristics, sleep efficiency, sleep disturbances, and use of sleeping medications. A Kruskal-Wallis test was used to examine differences in sleep efficiency, sleep disturbances, and the use of sleeping medications in relation to demographic variables and health-risk behaviors. The higher mean rank (MR) of the results indicated worse outcomes. Results were considered statistically significant if  $\alpha \leq 0.05$ .

## Results

### Description of the sample

One thousand and five hundred students were invited to participate in the study. Eventually, 1308 students participated in the study (response rate = 87%). Most of the sample were females 901 (68.9%) and single 1275 (97.5%). Regarding the academic level, 533 (40.7%) were first year students. The mean age of the study sample was 21.10 (SD = 3.91). Table 1 describes the characteristics of the sample.

### Description of students' sleep efficiency, sleep disturbances, and use of sleeping medications

Among the study sample, 26.9% of the students reported sleep efficiency less than 85%, while 66.1% reported sleep efficiency more than 85%. The most commonly reported sleep disturbances three or more times a week by the students were feeling too cold (11.6%), having bad dreams (10.9%), and getting up to use the bathroom (10.2%). Among the students, 3.6% reported using sleep medication three or more times a week; see Table 2.

### Differences in sleep efficiency, sleep disturbances, and use of sleeping medications in relation to demographic variables and health-risk behaviors

Table 3 describes differences in sleep efficiency, sleep disturbances, and the use of sleep medication according to study variables. There was a statistically significant difference in sleep efficiency according to students' marital status, smoking status, and academic achievement. Married students had a significantly higher mean rank of sleep efficiency (MR = 711.53) compared with single students (MR = 604.57). Students who reported smoking had a higher mean rank of sleep efficiency (MR = 648.26) than students who were not smokers (MR = 601.27). The highest mean rank of sleep efficiency was among students with pass GPA (MR = 736.45). No significant differences were found in sleep efficiency in relation to other variables.

**Table 3** Differences in sleep efficiency, sleep disturbances, and use of sleep medication according to study variables

Variable	Group	Mean rank	Chi-square	<i>P</i> value
Sleep efficiency				
Marital status	Single	604.57	5.51	0.019
	Married	711.53		
Smoking status	Smoker	648.26	4.19	0.041
	Non-smoker	601.27		
Academic achievement (GPA)	Weak	572.55	29.08	< 0.001
	Pass	736.45		
	Good	657.83		
	Very good	657.13		
	Excellent	630.02		
Sleep disturbances				
Gender	Male	543.79	19.6	< 0.001
	Female	623.53		
Income	< 352	643.62	16.01	< 0.001
	352–825	557.98		
	> 825	548.37		
Academic achievement (GPA)	Weak	576.32	12.63	0.013
	Pass	665.49		
	Good	623.82		
	Very good	652.23		
	Excellent	619.02		
Use of sleep medication				
Academic achievement (GPA)	Weak	612.88	27.11	< 0.001
	Pass	730.12		
	Good	651.01		
	Very good	709.33		
	Excellent	680.09		
Smoking status	Smoker	688.63	6.08	0.014
	Non-smoker	642.71		

In terms of sleep disturbances, significant differences were found in students' gender, income, and academic achievement. Male students had a lower mean rank of sleep disturbances (MR = 543.79) compared with female students (MR = 623.53). Students with income lower than 352 JD (MR = 643.62) had the highest mean rank of sleep disturbances. Students with pass GPA (MR = 665.49) had the highest mean rank of sleep disturbances. No significant differences were found in sleep disturbances in relation to other variables.

With regard to using sleep medication, significant differences were found according to students' smoking status and academic achievement. Students who reported smoking had the highest mean of using sleep medication (MR = 688.63) compared with students who were not smokers (MR = 642.71). Students with pass GPA had the highest mean (MR = 730.12) of using sleep medication. No significant differences were found in using sleep medication in relation to other variables.

## Discussion

To the best of our knowledge, this is the first study to evaluate sleep efficiency, sleep disturbances, and using sleep medication among university students in Jordan. In this study, 26.9% of the students reported sleep efficiency less than 85%, 23.5% of students reported having sleep disturbances more than once a week, and 8.9% reported using sleep medication once or more a week. Sleep efficiency, sleep disturbances, and the use of sleep medication differed significantly according to students' gender, marital status, academic performance, monthly family income, and smoking. The high percentage of sleep disturbances is likely accounted for the low sleep efficiency and possibly the high rate of using sleep medication.

The results demonstrated that 26.9% of the students reported sleep efficiency less than 85%. In a previous cross-sectional study that included 1039 college students, the mean of reported sleep efficiency was 90.84% (SD = 5.97%) [24].



In the current study, 80% of the students reported sleep efficiency more than 75%. These results were comparable to a previous study that included 529 Hong Kong college students that found that 86.2% of the students reported having sleep efficiency of more than 75% [25]. Married students were found to have poor sleep efficiency compared with single students. Inconsistently, another study of medical students found that 64.7% of married students had sleep efficiency more than 85%, compared with 69.1% of the single [26]. Further studies are needed to understand the role of marital status in affecting sleep efficiency.

In this study, 23.5% of the students reported having trouble sleeping during the past month due to several disturbances that they experienced once or more a week. For example, 45% reported waking up in the middle of the night or early in the morning, 30.1% reported getting up to use the bathroom, 17.6% reported inability to breathe comfortably, 9.5% reported coughing or snoring loudly, 28.1% reported feeling too cold, 15.9% reported feeling too hot, 26.45% reported having a bad dream, and 20.8% reported having pain. These rates were compared with results from a previous study in the USA on college students. The rates of disturbances were 21.6%, 11.2%, 6.1%, 2.8%, 5.6%, 23.8%, 8.1%, and 7.7%, respectively [27]. In another study in the Middle East, two-thirds of college students reported having at least one nocturnal awakening per night. Nightmares were the most common reason reported by these students, and 18.8% reported having nightmares once or more a week, and only 3.2% of students reported having a snoring problem every night [28]. The results of this study indicated that students from low socioeconomic status had higher means of sleep disturbances compared with students from high socioeconomic status. Consistently, it has been found that low SES was associated with disturbed sleep [9, 16]. The association between disturbed sleep and low SES could be due to living in noisy or high-crime neighborhoods, sharing room with others, or having stress. The findings of this study indicated that female students had higher means of sleep disturbances compared with male students. A previous meta-analysis confirmed that females are at higher risk of sleep disturbance than males [14]. These gender differences can be explained in different ways; females may have a higher prevalence of depression and anxiety that increases their sleep disturbances. Also, this could be explained from a cultural perspective, as females in the Arab culture usually assume multiple responsibilities that may introduce them to more stressors compared with males [29].

In the current study, 8.9% of university students reported using sleep medication at least once a week. In another study that included 2230 Ethiopian college students, 3.30% reported using sleep medicine at least once per week [8]. In another study, it was also found that 4.81% of students used relaxation medications to aid them in sleep in an average of 2.20 nights per week, and 2.02% used over-the-counter medications to

aid them in sleep in an average of 3.62 nights per week [24]. In addition, another study found 2.5% of students reported the use of sleep medication once or more per week [25]. The high mean of using sleep medication could be explained that self-medication is a common health behavior in Jordan [30].

The results of this study demonstrated that students with a pass GPA reported the lowest mean of sleep efficiency, the highest mean of sleep disturbances, and the highest mean of using sleep medication compared with other groups. Similarly, Lemma et al. [31] found that students with sleep efficiency below 65% had the lowest mean of GPA, and the mean GPA decreases as sleep disturbances increase [31]. Our findings are in agreement with prior studies conducted among college students elsewhere [32, 33]. Poor sleep efficiency and higher rates of sleep disturbances affect students' daily functioning and their ability to concentrate [34]. In this study, students with pass GPA had a higher mean rank of using sleep medication compared with other groups. However, in a case-control study that was conducted among 165 medical students, no differences were found between the excellent and average groups for the use of sleep medications [35].

In this study, students who smoke reported poor sleep efficiency (< 85%) and higher means of using sleep medication compared with non-smokers. Similar results were found in a previous study where cigarette smoking was also significantly associated with poor sleep efficiency and increased use of sleep medications [8]. No differences were found in smoking in relation to sleep disturbances in this study.

## Limitations

The findings of the current study should be interpreted in light of some limitations. First, this is a cross-sectional study which means no causal relationship can be inferred from the results. Second, we used a self-administered survey that relied on subjective measures of sleep habits.

## Conclusion

Poor sleep efficiency, sleep disturbances, and the use of sleep medications are significant problems affecting sleep quality among university students in Jordan. Students' gender, marital status, income, smoking status, and academic achievement are important factors associated with sleep quality.

## Implications

The results of the current study highlight the importance of addressing sleep quality among university students. Sleep screening among university students is required for the

identification and treatment of sleep problems, which may improve their physical and mental health and academic performance. Diagnosis and treatment of sleep problems could enhance the quality of sleep for young adults and may improve their cognition. Nursing public health interventions that focus on youth sleep are required. For example, public health nurses should implement health-promoting behavior activities targeting smoking problem, and sleep quality in low-income communities. Additional research is needed to determine the effect of sleep interventions on improving students' academic performance and quality of life. Furthermore, educating university students about the effects of smoking on health in general and on sleep, in particular, should be mandated.

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### Compliance with ethical standards

I confirm that the authors meet the authorship and are in agreement with the content of the manuscript

**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethics approval** Ethical approval, including Institutional Review Board (IRB), was obtained from the University of Jordan Ethical Committee. Students who agreed to participate in the study signed an informed consent form that illustrated the study purpose, that participation in the study was voluntary, and students' right to withdraw from the study any time.

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