



Sleep quality, sleep latency, and sleep duration: a national comparative study of university students in Jordan

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Received: 26 May 2020 / Revised: 7 September 2020 / Accepted: 9 September 2020
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Abstract

Background Sleep problems have significant negative health consequences on university students.

Study aim To assess subjective sleep quality, sleep latency, and sleep duration in a national sample of university students and investigate differences in these components with selected variables.

Methods A cross-sectional analysis and multi-stage sampling were conducted to select a sample of 1308 students from three major areas in Jordan. Sleep quality, sleep latency, and sleep duration were measured by an Arabic version of the Pittsburgh Sleep Quality Index (PSQI). Data were analyzed using measures of frequency and central tendency and Kruskal-Wallis tests.

Results Two-thirds of university students described their sleep quality as fairly bad and very bad and 20 reported sleep latency of more than 30 min during the past month. There was a significant difference in subjective sleep quality according to the student's place of residence. Sleep latency differed according to students' income, physical activity, use of media devices before sleep, smoking status, and academic achievement. Significant differences were also found in sleep duration with students' academic achievement, academic level, and body mass index.

Conclusions University students suffer from poor sleep quality, delayed sleep phase, and sleep deprivation. Lower-income, smoking, physical inactivity, and using media devices before sleep contributed to students' sleeping problems.

Implications Interventional programs that focus on improving physical activity, controlling tobacco use, healthy sleep education, and reducing screen time are essential public health interventions to reduce sleep problems among youth.

Keywords Sleep duration · Sleep latency · Sleep quality · University students

Introduction

Like food and air, sleep is an essential physiological need for human functioning. The university is a period in which students continue their growth and development as they transit from adolescence to adulthood. Previous studies indicated that university students obtain insufficient sleep, experience low sleep quality, and report delayed sleep phase [1–3].

Sleep quality is a complex concept that can be measured subjectively and objectively through quantitative sleep aspects such as sleep latency and sleep duration [4]. Poor sleep quality

is highly prevalent among university students; Lemma et al. [1] reported that more than half of university students reported having poor sleep quality [1]. Sleep duration is defined as the total amount of sleep during the night or for 24 h [5]. Only one-third of university students reported getting the average amount of sleep time required for young adults which is 8 or more hours of total sleep [2]. Sleep latency is defined as the duration of time when the lights are turned off as the person attempts to sleep until falling asleep at night [6]. The prevalence of long-sleep latency (more than 30 min) in a previous study of university students was 8.4% [3].

The Pittsburgh Sleep Quality Index (PSQI) is a very common measure used to assess subjective sleep quality, sleep latency, and sleep duration. While subjective measures of sleep are not always in line with objective measures, the validity of PSQI was examined among young populations and it showed good validity. Specifically, correlations were found between these three PSQI components and sleep diary, while only sleep latency and sleep duration components were found to be correlated with total sleep time in actigraphy [7].

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These components of sleep assessment are associated with risk factors and lifestyle behaviors that some previous research examined. However, research studies about gender differences in these problems were inconclusive [8, 9]. In addition, findings of previous studies on the association between physical activity and sleep quality were inconsistent [10–12]. In terms of socio-economic status (SES), it was found that unemployment and lower levels of income and education have significant detrimental effects on individuals' mental and physical health including sleep problems [13]. Smoking was also found to be associated with specific sleep problems in young populations, such as poor sleep quality, increased sleep latency, and shorter duration of sleep [1, 14, 15].

Media use is defined as using devices, such as smartphones and tablets to communicate, play, and gather with others [16]. Young adults become more independent in using media devices compared with adolescents, which is associated with more time spent in using these devices [17]. It is estimated that more than half of young adults keep their phones on when they go to sleep [18]. Recent research studies found associations between using media devices and sleep-related problems among young adults [16]. The literature has documented several studies on the significant association between sleep duration and body mass index (BMI). Decreased sleep duration has been linked to the risk of developing obesity in all age groups [19–21].

To the best of our knowledge, this is the first study to evaluate sleep components and its associated factors among university students in Jordan. It has not been examined whether young populations who are university students could have problems with poor sleep quality, increased sleep latency, or short sleep duration in national samples. There has been little previous evidence for the relationship between sleep quality, sleep latency, and sleep duration among university students with socio-demographic conditions and health-risk behaviors. Thus, the objectives of the current study were to assess subjective sleep quality, sleep latency, and sleep duration in a national sample of university students and investigate differences in sleep quality, sleep latency, and sleep duration with selected variables.

Methods

Study design

The study employed a cross-sectional comparative design to examine the prevalence of poor sleep quality, sleep latency, and sleep duration among university students and to compare differences in these outcomes.

Sample and sampling

The target population for the study was university students in Jordan. The sample was selected at two levels; at the first

level, stratified random sampling was conducted to select three large universities in the North, Center, and South of the country. Next, students within the randomly selected universities were selected according to a convenience sampling method. The inclusion criteria were Jordanian university students, who agreed to participate, and were not disabled or had acute medical conditions that affect their participation or their sleeping habits, such as chronic heart diseases and cancer. The G power program was used to determine the required sample size. With the input of alpha level 0.05 at the two-tail level of significance, effect size = 0.1 (low), and power = 0.95 (high power), at least 1293 students were needed for this study.

Ethical consideration

Before data collection, Institutional Review Board (IRB) approval was received from (removed for blinded review). Informed consent was obtained from students who agreed to participate in the study. The consent form illustrated the study purpose, identified that participation was voluntary, and affirmed the right to withdraw from the study any time.

Data collection

Data were collected between January and May 2019 using self-administered questionnaires from all schools and departments of these universities. The questionnaires were administered to the students in their classes during the weeks that had no midterm or final exams to not influence the study outcomes. Participants filled out the questionnaires and returned them to the research assistants at the same lecture in a sealed envelope.

Measures

The demographic data included age, sex, marital status, employment, monthly income, residency, academic performance/graduate point average, academic level, smoking status, physical activity, height in meters, and weight in kilograms.

Subjective sleep quality, sleep latency, and sleep duration are three components measured by the Pittsburgh Sleep Quality Index (PSQI) that was translated into the Arabic language by Suleiman et al. [22]. The first component, "subjective sleep quality," asks the participants to rate their overall quality of sleep. The sleep latency component is assessed in two questions about the duration in minutes to fall asleep each night and about the frequency of being unable to fall asleep within 30 min at night. The sleep duration component asks participants to report the number of hours of actual sleep they get each night [4]. PSQI has high internal consistency (reliability coefficient Cronbach's $\alpha = 0.83$) and has high test-retest reliability with the global Score Pearson product-moment correlation between T1 and T2 is 0.85 ($P < 0.001$)

[4]. The Arabic version of PSQI showed high internal consistency reliability (0.74). Component to component correlations was moderate to high ranging between 0.36 and 0.84. The Arabic version of PSQI showed high convergent validity with the insomnia severity index (ISI) [22].

Data analysis

The Statistical Package for Social Science (SPSS) version 23 was used to analyze the data [23]. The demographic characteristics of the sample, sleep quality, sleep latency, and sleep duration were described using means, percentages, and standard deviations. Students' physical activity level was categorized into two groups; physically inactive students who perform physical activity once or less per week and physically active students who perform physical activity twice or more per week. Students' reported height and weight were used to calculate the BMI. Calculated BMI was categorized into four groups underweight, normal body weight, overweight, and obese [24]. As subjective sleep quality, sleep latency, and sleep duration are ordinal dependent variables and the study covariates are with two or more levels, the Kruskal-Wallis test was used to examine differences in these sleep components with the study variables. In this test, higher mean ranks indicate poor sleep outcomes, such as worse sleep quality, longer sleep latency, and shorter sleep duration. The level of significance was set at $\alpha \leq 0.05$.

Results

One thousand three hundred and eight students participated in the study (response rate = 87%). The average age of the students was 21.10 (SD = 3.91). The sample consisted of 901 (68.9%) female students. Most of the students were single 1275 (97.5%). Almost half of the students reported having a weak graduate point average (GPA) (see Table 1).

Description of the study variables

Table 2 describes subjective sleep quality, sleep latency, and sleep duration among the study sample. Seventy-three percent of the study sample rated their sleep quality as fairly and very bad. Among these students, 287 (20.4%) reported sleep latency of more than 30 min during the past month. Regarding the frequency of trouble sleeping during the last month because of the inability to sleep within 30 min, 533 (40.8%) of the students reported having trouble more than once a week. More than one-third of the students 541 (41.4%) reported a sleep duration of fewer than 6 h per night during the last month.

Table 1 Demographic characteristics of the study sample $N=1308$

Variable	<i>N</i> (%)
GPA $N=1308$	
Weak	701(53.6)
Pass	42(3.2)
Good	165(12.6)
Very good	138(10.6)
Excellent	262(20)
Sex $n=1302$	
Male	401(30.7)
Female	901(68.9)
Academic level $n=1307$	
First year level	533(40.7)
Higher than the first year	774(59.2)
Marital status $n=1305$	
Single	1275(97.5)
Married	30(2.3)
Employment $n=1298$	
Part-time job	80(6.1)
Full-time job	33(2.5)
Unemployed	1185(90.6)
The total family income per month in JD $n = 1232$	
< 352	193(14.8)
35–825	637(48.7)
> 825	402 (30.7)
Residency $n= 1305$	
Live on campus	210 (16)
Live with family	195 (83.7)
Smoking status $n=1306$	
Smoker	192 (14.7)
Non-smoker	1114 (85.2)
Physical activity $n=1306$	
Not active	243 (18.6)
< Once in a month	144 (11)
Once a month	147 (11.2)
Once a week	276 (21.1)
2–3 times a week	258 (19.7)
4–6 times a week	78 (6)
Every day	160 (12.2)
BMI categories $n=1268$	
Normal body weight	818 (62.5)
Underweight	95 (7.3)
Overweight	241 (18.4)
Obese	114 (8.7)

Jordanian Dinar = US\$1.41

Table 2 Description of university students' subjective sleep quality, sleep latency, and sleep duration

Sleep components	<i>N</i> (%)
Component 1: Subjective sleep quality	
Very good	114 (8.7)
Fairly good	214 (16.4)
Fairly bad	653 (49.9)
Very bad	314 (24)
Component 2: Sleep latency	
How long it usually takes you to fall in sleep <i>N</i> =1308	
≤15 min	635 (48.5)
16–30 min	406 (31)
31–60 min	182 (13.9)
> 60 min	85 (6.5)
During the past month how often you had trouble sleeping because you cannot get to sleep within 30 min <i>n</i> = 1280	
Not during the past month	489 (37.4)
Less than once a week	258 (19.7)
Once or twice a week	226 (17.3)
Three or more times a week	307 (23.5)
Component 3: Sleep duration <i>n</i> =1268	
> 7 h	454 (34.7)
6–7	273 (20.9)
5–6	320 (24.5)
< 5	221 (16.9)

Differences in subjective sleep quality, sleep latency, and sleep duration

Table 3 shows the differences in sleep problems (quality, latency, and duration) that were reported in mean ranks (MR), with the higher MR indicated worse outcomes. There was a statistically significant difference in subjective sleep quality scores between students who live with their families (MR = 654.89) and students who live in university housing (MR = 594.35), $\chi(1) = 4.76$, $P = 0.029$. No significant differences were found in subjective sleep quality with all other investigated covariates.

Sleep latency (duration to fall in sleep and frequency of trouble sleeping due to inability to sleep within 30 min) differed significantly in five variables; students' income, physical activity, use of media devices before sleep, smoking status, and academic achievement. First, duration to fall in sleep and frequency of trouble sleeping were the highest among students with income lower than 352 JD (670.52); (MR = 671.74), $\chi(2, 1230) = 6.97$, $P = 0.031$ and (MR = 670.52), $\chi(2, 1204) = 10.86$, $P = 0.004$, respectively. Second, duration to fall in sleep and frequency of trouble sleeping were also the highest among physically inactive students; (MR = 669.69), $\chi(1, 1305) = 4.61$, $P = 0.032$ and (MR=656.03), $\chi(1, 1277) = 4.62$, $P = 0.032$, respectively. Third, students who used media

devices before bed had a significantly higher mean rank of duration to fall in sleep and frequency of trouble sleeping; (MR = 654.16), $\chi(1, 295) = 5.82$, $P = 0.016$ and (MR = 641.26), $\chi(1, 1267) = 8.07$, $P = 0.004$, respectively. Fourth, the MR of duration to fall in sleep was significantly higher among students who reported smoking; (MR = 704.94) $\chi(1, 1305) = 4.91$, $P = 0.027$, compared with nonsmokers. Fifth, the highest MR of the frequency of trouble sleeping was among students with a very good GPA; (MR=699.76), $\chi(4, 1274) = 10.72$, $P = 0.03$. No significant differences were found in sleep latency with students' gender, marital status, employment status, residency, academic level, and BMI.

In terms of sleep duration, significant differences were found in students' academic achievement, academic level, and BMI. The highest MR of sleep duration (fewest number of sleep hours) was among students with pass GPA; (MR = 702.07), $\chi(4, 1263) = 11.02$, $P = 0.026$. The MR of sleep duration was significantly higher among students who were at first-year level; (MR = 597.69), $\chi(1, 1267) = 9.56$, $P = 0.002$, and obese students had the highest MR; (MR=706.06), $\chi(3, 1229) = 8.89$, $P = 0.031$. No significant differences were found in sleep duration with the remaining study covariates.

Discussion

This study examined sleep quality, sleep latency, and sleep duration among university students in Jordan and examined differences in sleep quality, sleep latency, and sleep duration. Most university students in this study reported poor sleep quality (74%). In comparison to a study of medical university students in Saudi Arabia which found that 30% of the students reported poor sleep quality, the sleep quality in our population is extremely worse [25]. Another study of university students in the Middle East found that only 28% of the students rated their sleep quality as satisfactory and poor [26]. In another study, university students reported sleep quality as fairly and very poor at lower rates than our study sample, which was 15.4% [27].

Sleep quality was poorer among students who live with their families rather than students who live in university housing. These results disagree with previous reports which revealed that students who live on campus experience problems of uncomfortable room temperature and noise [28, 29]. Two-thirds of the students in this study reported average sleep time less than 7 h, which means that most of the students had insufficient sleep. Similarly, in a study that was conducted with 1125 students in the USA, 29.4% of students reported sleeping for 8 h or more each night [2]. In our study, 41.4% of the students slept less than 6 h per night. Comparable to our findings, another study that included 2854 Thai college students, 38.9 % of the study samples reported sleeping ≤ 6 h per

Table 3 Differences in PSQI components in relation to study variables reported in mean ranks

Variable	Group	Mean rank	Chi-square	<i>P</i> value
Subjective sleep quality				
Residency	With Family	654.89	4.76	0.029
	University housing	594.35		
Sleep latency (how long it usually takes you to fall asleep)				
Income	< 352	671.74	6.97	0.031
	352-825	611.93		
	> 825	597.23		
Smoking status	Smokers	704.94	4.91	0.027
	Non-smokers	644.63		
Physical activity	Active	627.05	4.61	0.032
	Inactive	669.69		
Using media devices before sleep	No	553.67	5.82	0.016
	Yes	654.16		
Sleep latency (how often you had trouble sleeping)				
Academic achievement (GPA)	Weak	620.27	10.72	0.030
	Pass	641.05		
	Good	697.61		
	Very good	699.76		
	Excellent	625.07		
Income	< 352	670.52	10.68	0.004
	352-825	602.96		
	> 825	572.80		
Physical activity	Active	627.05	4.62	0.032
	Inactive	656.03		
Using media devices before sleep	No	518.77	8.07	0.004
	Yes	641.26		
Sleep duration				
Academic achievement (GPA)	Weak	652.75	11.02	0.026
	Pass	702.07		
	Good	576.67		
	Very good	619.19		
	Excellent	604.02		
Academic level	First year	597.69	9.56	0.002
	Senior years	659.84		
BMI	Underweight	603.89	8.89	0.031
	Normal weight	602.85		
	Overweight	618.24		
	Obese	706.06		

day [8]. Our results indicated that first-year students had longer sleep duration than other students. This can be explained as students move to higher academic levels, they experience greater responsibilities that may affect their sleep duration.

In our study, students with obesity had lower sleep duration compared with students who were overweight, underweight, and normal weight. On the other side, in a previous study, overweight among young adults was affected by sleep disturbances [30]. Consistent with our findings, a meta-analysis examined the relationship between short sleep duration and obesity at different ages revealed that there was a consistent increase in the risk of obesity among adults who sleep shorter

duration [31]. Another retrospective cohort study that included 21,469 individuals aged 20 years or older revealed that compared with those who slept 7 h, the individuals who slept ≤ 5 h per night were more likely to experience increased weight and to become obese [32].

Students with pass GPA had the highest sleep duration and students with a good GPA had the lowest sleep duration. Opposite to our findings, a study that included medical university students found that sleep duration was significantly longer in the “excellent” GPA group [33]. This might be explained that students with pass GPAs are less motivated to enhance their academic achievement and thus their sleep

duration could be longer. In addition, consistent with our findings, a study that included 1845 college students found that students who got more sleep before school had higher grades [34]. These results might be explained by the fact that academic achievement is more affected by sleep quality rather than sleep duration. Sleeping longer hours does not necessarily indicate having good sleep quality [35].

In our study, 20.4 % of the students reported sleep latency of more than 30 min. A study of university students found that 26% of the students reported longer sleep latency (≥ 30 min) [8]. In another study that included 2230 undergraduate students, 48.6% of the students reported sleep latency of more than 30 min [1]. Another study found that 36.2% of the students reported having a sleep latency of more than 30 min [26]. Compared with previous studies of university students, the students in our sample had lower sleep latency. It is apparent that there are various outcomes from different countries. Most previous research investigated sleep outcomes and how these outcomes might affect students' academic performance. On the other hand, it is important to explain these outcomes in relation to differences in education systems, as countries worldwide have variant education systems that could have different effects on students' sleep habits. In Jordan, most undergraduate schools start classes early in the morning and finish late. In addition, undergraduate studies in Jordan have intensified schedules with mostly 18 credit hours per semester that depend on on-campus teaching. Therefore, it is essential to consider differences in education systems as they might contribute to these controversies.

We found that students who used media devices before sleep had longer sleep latency and had difficulties to fall asleep. Similarly, it was found that frequent use of media devices was associated with an increased risk of sleep disturbances [16]. In addition, using media devices before sleep among youth was associated with delayed bedtime, increased sleep latency, and increased nighttime awakening [36]. Light exposure from media devices such as cell phones affects sleep by influencing melatonin secretion in the body. Exposure to light suppresses the secretion of melatonin and result in a delay in the onset of sleep [18].

In the current study, differences in these sleep problems in relation to smoking were found only in sleep latency; current smokers reported longer sleep latency than none or former smokers. Our results were consistent with previous studies which found that compared with students who reported never smoking, current smokers have long sleep latency [1, 8]. Nicotine is a nervous system stimulant that increases heart rate and alertness which results in a delay in sleep onset [37].

The results of the current study showed that there were statistically significant differences in sleep latency according to students' academic performance measured by GPA. Students with a very good GPA had the highest sleep latency than other groups of students, while students with a weak

GPA had the lowest sleep latency. On the contrary, another study found a significant difference between excellent and average academic performance groups. Students with average academic performance had longer sleep latency time compared with the excellent group [35]. However, another study found no differences in sleep latency in regard to university students' academic performance [25]. More studies are needed to understand differences in students' academic performance relative to sleep latency.

Finally, gender did not show any differences in these sleep problems. This could be explained that academic life and its responsibilities might not have an impact that shows differences in sleep problems between male and female students. On the other hand, it could also be explained that physiological and psychological differences between male and female students do not appear in these specific sleep problems. Further studies are still required to help understand these patterns.

Limitations

This study is not without limitations. First, the single measure used was based on self-reporting sleep habits, which affected the accuracy of reporting sleep problems. The lack of examining these problems with further questionnaires, such as sleep diary, restricted the findings too. Second, there could be some confounding variables that might influence the relationship between academic performance and sleep problems, such as the level of motivation the student could have. Third, this was a cross-sectional study; thus, causality cannot be inferred. Lastly, this study did not examine the effects of specific next-day events, such as exams or deadlines that would also have been important factors to examine in this population.

Conclusions

University students commonly in Jordan suffer from poor sleep quality, delayed sleep latency, and short sleep duration. Specifically, the significant increase in these sleep problems was found among students with lower-income, smokers, physically inactive students, and students who used media devices before sleep.

Implications

The outcomes of this study have important contributions to youth health behaviors. Supporting and funding intervention programs that focus on healthy lifestyles, such as improving physical activity, controlling tobacco, and reducing screen time are essential public health interventions. These public

health interventions can also apply health promotion approaches, such as healthy sleep education. This could eventually improve the physical and mental health of young adults.

Funding information The fund was obtained from the Deanship for Scientific Research-The University of Jordan.

Compliance with ethical standards Institutional Review Board (IRB) approval was obtained received from The Research Ethical Committee at The University of Jordan. Informed consent was obtained from students who agreed to participate in the study. The consent form illustrated stated study purpose the purpose of the study, clearly identified that participation in the study was voluntary and that students had affirmed the right to withdraw from the study any time.

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

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