Assessing of Sleepiness, Insomnia and Sleep Quality among University Students: Association between Computer Use and Sleep Quality

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ABSTRACT

Purpose: To investigate associations between computer use data and sleep quality among university students.

Materials and Methods: This descriptive, cross-sectional study was performed on 312 students of Tehran University of Medical Sciences, Iran. Data was collected using Epworth Sleepiness Scale (ESS), Insomnia Severity Index (TSI), Pittsburgh Sleep Quality Index (PSQI), and a background and computer use questionnaire. Descriptive statistics, independent samples test, Univariate analysis of variance and Chi Square test were used to analyze the data.

Results: The final sample was composed of 164 (52.6%) male and 148 (47.4%) female students aged 17-30 years. The mean of assessed sleep indices were not significantly different between the male and female groups ($P = .05$). Among all the participants, 81.1% were poor sleepers (PSQI $\geq$ 5), 60.58% of them suffered from insomnia (ISI $\geq$ 8), and 49.36% of them reported sleepiness (ESS $\geq$ 10). There was a significant association between the computer work (hours/day) and ISI and PSQI indices ($P = .05$). Students who used computer between 24:00 to 2:00 had a meaningful higher ISI and PSQI indices compared to those whose computer use interval was 19:00 to 22:00. The prevalence of eye discomfort and the headache associated with computer use was significantly more common among female students. We found a significant association between the headache precededby computer use and ISI and PSQI indices ($P = .05$).

Conclusion: Poor sleep quality and insomnia were common among university students. The amount of prevalence was higher among nocturnal (24:00-2:00) computer users and those with prolonged durations of use. Also, the headache associated with computer use deteriorates the quantity and quality of sleeping.

Keywords: sleep deprivation; psychology; quality of life; diagnosis, differential; sleep initiation and maintenance disorders; physiopathology; prevalence; sleep wake disorders; epidemiology; surveys and questionnaires.

INTRODUCTION

Many studies have investigated the importance of sleeping over the years. Sleeping is, of course, one of the basic and vital needs of human beings and plays a crucial role in the maturation of the brain, especially throughout adolescence,[1-4] during which being a student can be mentioned as one of the main tasks of an individual. Many of the functions of brain such as cognition, concentration,

learning and memorizing are believed to be strongly influenced by the quality and quantity of sleeping.[5-9] These are some of the most important criteria of students' performance evaluation and many studies have shown how sleep problems and sleepiness can result in a poor school performance.[10-12]

In addition to the number of studies reporting the effects of sleep on the individuals' daily performance and well-being,[13-15] many others have mentioned the person's life-style and behaviors as key determinants of sleep quality.[16,17] Consequently, a reciprocal effect between sleep and daily performance can be concluded.

In order to clarify the biological regulation of sleeping, two main processes have been introduced: the circadian (rhythmic) regulation and the homeostatic regulation. While the circadian model refers to the clock of the brain and the role of the day and night on the sleep-wake cycles, the homeostatic regulation is defined as the need to sleep after a period of wakefulness.[18,19] Exposure to light has been discussed a lot as a factor that can interfere with the circadian regulation, which may lead to sleep disturbances.[20] Computer use, which is a fast growing trend among students, can be noted as a source of light exposure.

In order to investigate any association between computer use data and sleep quality, in this study, we evaluated the sleep conditions in students and their computer usage in terms of time, duration and eye discomfort and the headache associated with computer use.

MATERIALS AND METHODS

A descriptive, cross-sectional study was conducted, in which data on sleep quality and quantity was collected from a sample of 312 university students at Tehran University of Medical Sciences in Tehran, Capital of Iran. The participants were chosen randomly and the sample included both male (n = 164) and female students (n = 148). The demographic statistics and computer use data are shown in **Table 1**.

The participants with health problems that may interact with our results (having medical issues such as depression, hyperthyroidism or taking any medication to sleep) were excluded from this study.

The participating students were informed about the aim of the study and the methods to be used (Ethical considerations).

Questionnaires

Three questionnaires were used to examine the sleep conditions including Epworth Sleepiness Scale (ESS),[21,22]

Table 1. Demographic information and Computer use data (n = 312).

Variables	no (%)
Gender	
Male	164 (52.6)
Female	148 (47.4)
Education level	
Bachelor	98 (31.4)
Master of Science	26 (8.3)
GP	188 (60.3)
Computer use time (Mostly)	
Before 19:00	39 (12.5)
19:00-22:00	159 (50.96)
22:00-24:00	87 (27.9)
24:00- 2:00	26 (8.3)
Computer work (hours/day)	
0-2	134 (42.9)
2-4	105 (33.7)
4.1-6	48 (15.4)
> 6	25 (8.0)

Abbreviation: GP, general practitioner.

Insomnia Severity Index (ISI)[23-25] and Pittsburgh Sleep Quality Index (PSQI).[26,27] Also, a questionnaire was used to collect data about computer use.

Epworth Sleepiness Scale (ESS)

This questionnaire measures the general level of daytime sleepiness. It determines the chance of falling asleep in eight routine daily situations. Each item is rated from 0 to 3, with 0 meaning you would never doze or fall asleep in a given situation, and 3 meaning there is a very high chance that you would doze or fall asleep in that situation. The rates of all eight questions are added together and the final score is obtained. A final score in the range of 0-9 is considered to be normal while a score extending 10-24 indicates sleepiness and a sleep problem. A validate and reliable version of the questionnaire in Persian was used.[21,22]

Insomnia Severity Index (ISI)

This index is a reliable and valid instrument to assess the nature, severity and impact of insomnia. It is a 7-item self-reported questionnaire and each item is rated by a 5-point Likert scale (0 = no problem, 4 = very severe problem), yielding a total score of 0-28. The measured domains consisted of severity of sleep onset, sleep maintenance and early morning wakening problems, sleep dissatisfaction, interference of sleep difficulties with daytime functioning, noticeability of sleep problems by others, distress caused by the sleep difficulties. The total score is interpreted as follows 0-7 = No clinically significant insomnia, 8-14 = Sub threshold insomnia, 15-21 = moderate insomnia, 22-28 = severe insomnia. The

questionnaire was translated in a reliable and validate version for Persian speaking students.[23-25]

Pittsburgh Sleep Quality Index (PSQI)

PSQI is a self-rated questionnaire which measures the sleep disturbance and usual sleeping habits during the prior month. The "poor" sleep is differentiated from the "good" sleep by assessing seven domains (19 individual items): sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction. Each domain is rated from 0 to 3 in a Likert scale, whereby 3 reflect the negative extreme. The sum of the domains rates yields the global score which ranges from 0 to 21 with the cut-off point of 5, which means a global score of 5 or greater is considered as a "poor" sleep. A validate and reliable version of this questionnaire was used in this study.[26,27]

Computer Use Data

A self-reported questionnaire was used in order to provide a valid and reliable responsive means of gathering computer use information among students. Previous studies indicated that computer use characteristics are related to health problems.[28] In this study, students were asked to respond to the questions about computer use history, computer work (hours per day), computer use time, and eye discomfort and the headache associated with computer use.

Statistical Analysis

Independent samples test was used to determine the differences among means of male and female sleep related indices. The comparison between the mean of sleep related indices was performed using univariate analysis of variance based on computer use time and computer work (hours/day). Also, associations between eye discomfort and the headache associated with computer use with sleep related Indices was investigated using Chi Square Test. Statistical significance was established when $P < .05$.

Statistical Package for the Social Science (SPSS Inc, Chicago, Illinois, USA) version 17.0was used for statistical analyses.

RESULTS

Three hundred and twelve students were studied, of whom 52.6% were male and 47.4% were female with the total mean age of 22.43 ± 2.28 years (aged 17-30). The mean age of male participants (22.81 ± 2.31) was statistically different from the mean age of female participants (22.02 ± 2.17 years), ($P = .002$). However, there was no difference between the mean history of computer use of male participants (8.34 ± 3.14 years) and female participants (8.19 ± 3.65 years), ($P = .703$).

The comparison of sleep related indices based on gender is shown in the **Table 2**. The results indicate that the mean of assessed sleep indices were not significantly different between the male and female groups ($P= .05$).

The data extracted from the questionnaires were categorized in **Table 3** based on the cut off points of each index used in the study. It can be obtained from the table that about 81.1% of our study sample were poor sleepers based on the PSQI questionnaire and 60.58% of them suffered from insomnia based on the ISI index. Feeling sleepy during the day and falling asleep in routine daily situations (measured by ESS) was reported to be experienced by about 49.36% of the participants.

The comparison between the mean of the sleep related indices was performed using univariate analysis of variance based on computer use time and computer work (hours/day). The results showed that computer work (hours/day) can affect the insomnia severity and sleep quality indices. The comparison between the four groups with different duration of computer use indicated that the group with the longest duration of use (> 6 hours/day) by far developed a poorer quality of sleep. (In all comparisons $P = .05$) (**Table 4**).

The mean of ISI was higher amongst those with the longest duration of computer use (> 6 hours/day) compared to the groups who used computer for 0-2 and 2-4 hours/day. ($P = .011$ and $P = .007$, respectively). On the other hand, no significant difference was detected compared to the group who used computer for 4-6 hours/day $P = .066$) (**Table 4**).

Table 2. Comparisonof sleep related indices based on gender (n= 312).*

Indices*	Total (n = 312)	Male (n = 164)	Female (n = 148)	P Value
ESS Mean ± SD	9.61 ± 4.20	9.51 ± 3.99	9.71 ± 4.42	.674
ISI Mean ± SD	9.51 ± 5.11	9.47 ± 5.41	9.56 ± 4.76	.879
PSQI Mean ± SD	7.01 ± 3.14	7.27 ± 3.41	6.72 ± 2.79	.118

Independent Samples Test was performed.
Abbreviations: ESS, Epworth Sleepiness Scale; ISI, Insomnia Severity Index; PSQI, Pittsburgh Sleep Quality Index. SD, Standard Deviation

Table 3. Frequency of somnolence, insomnia severity and sleep quality based on gender and Computer use data (n = 312).

Variables	ESS		ISI		PSQI	
	< 10*	≥ 10*	< 8*	≥ 8*	< 5*	≥ 5*
Total	158 (50.64)	154 (49.36)	123 (39.42)	189 (60.58)	59 (18.9)	253 (81.1)
Gender						
Male (n = 164)	83 (50.61)	81 (49.39)	67 (40.85)	97 (59.14)	30 (18.29)	134 (81.71)
Female (n = 148)	75 (50.67)	73 (49.32)	55 (37.16)	93 (62.84)	29 (19.59)	119 (80.41)
Computer use time						
19:00-22:00 h (n = 39)	24 (61.54)	15 (38.46)	13 (33.33)	26 (66.67)	8 (20.51)	31 (79.47)
19:00-22:00 h (n = 159)	78 (49.06)	81 (50.94)	69 (43.39)	90 (56.61)	31 (19.50)	128 (80.50)
22:00-24:00 h (n = 87)	42 (48.27)	45 (51.73)	32 (36.78)	55 (63.22)	14 (16.09)	73 (83.91)
24:00-2:00 h (n = 26)	15 (57.69)	11 (42.31)	8 (30.77)	18 (69.23)	5 (19.23)	21 (80.77)
Computer work (hours/day)						
0-2 (n = 134)	70 (52.24)	64 (47.76)	55 (41.04)	79 (58.96)	28 (20.90)	106 (79.10)
2.1-4 (n = 105)	51 (48.57)	54 (51.43)	40 (38.09)	65 (61.91)	21 (20)	84 (80)
4.1-6 (n = 48)	24 (50)	24 (50)	21 (43.75)	27 (56.25)	8 (16.67)	40 (83.33)
> 6 (n = 25)	13 (52)	12 (48)	6 (24)	19 (76)	2 (8)	23 (92)

Abbreviation: Data are presented as number percent.
Cut-off points of sleep problem related indices: ESS: 10, ISI: 8, PSQI: 5.

Table 4. Comparison of mean of sleep related indices based on computer use time and computer work (hours/day).

Variables		ESS			ISI			PSQI		
Computer use time (I)	Computer use time (J)	Mean difference (I-J)	SE*	P Value	Mean difference (I-J)	SE	P Value	Mean difference (I-J)	SE	P Value
19 h	19-22	-0.888	0.758	.242	1	0.907	.271	0.338	0.558	.545
	22-24	-1.149	0.817	.16	0.372	0.981	.705	-0.227	0.602	.706
	24-2:00	-0.144	1.082	.894	-1.577	1.286	.221	-1.166	0.791	.142
19-22 h	22-24	-0.261	0.56	.642	-0.628	0.679	.356	-0.565	0.416	.176
	24-2:00	0.744	0.904	.411	- 2.577*	1.074	.017	- 1.504*	0.661	.024
22-24 h	24-2:00	1	0.953	.292	-1.949	1.137	.088	-0.939	0.698	.18
Computer work (I)	Computer work (J)	Mean difference (I-J)	SE*	P Value	Mean difference (I-J)	SE	P Value	Mean difference (I-J)	SE	P Value
0-2	2-4	0.28	0.552	.611	0.252	0.662	.703	-0.097	0.401	.808
	4-6	0.347	0.715	.627	-0.521	0.852	.541	-0.773	0.518	.137
	+6	-0.048	0.919	.958	- 2.829*	1.104	.011	- 2.455*	0.671	< .001
2-4	4-6	0.067	0.741	.928	-0.774	0.884	.382	-0.675	0.537	.209
	+6	-0.328	0.939	.727	- 3.081*	1.129	.007	- 2.358*	0.686	.001
4-6	+6	-0.395	1.044	.705	-2.307	1.25	.066	- 1.682*	0.76	.028

Abbreviations: SE, Standard Error.
*Univariate Analysis of Variance, The mean difference is significant at the 0.05 level.

The comparison between different times that the computer was mostly used (having four main time intervals: before 19:00, 19:00-22:00, 22:00-24:00, 24:00-2:00) demonstrated that those who used computer between 24:00-2:00 had a meaningful higher ISI and PSQI indices compared to those whose computer use interval was 19:00-22:00 ($P = .017$ and $P = .024$, respectively). No other differences were detected between the time intervals (**Table 4**).

There were two questions on the computer use questionnaire that asked about the experience of having a headache and eye discomfort amongst the computer users. The prevalence of eye discomfort and the headache associated with computer use was significantly more common among female students (**Figure**). Also, the associations between experiencing a headache or eye discomfort due to the computer use and sleep related indices were assessed and analyzed, which is shown in (**Table 5**). A significant association was found between the headache and ISI and PSQI indices ($P = .05$).

DISCUSSION

The effect of media use on the sleep is not a new issue. As using a computer is becoming an inevitable daily routine, the concern gets bigger. The findings from this study demonstrated that there is not a significant
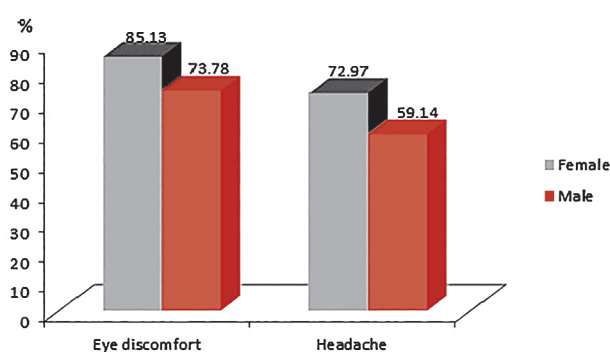
Figure 1. Reported frequency of eye discomfort and the headache associated with computer use among participants (n = 312).

Table 5. Associations between eye discomfort and headache associated with computer use with sleep related Indices (n = 312).

Variables	ESS	ISI	PSQI
	P Values		
Eye discomfort	.242	.882	.344
Headache	.278	.005	.004

difference in sleep indices based on gender. Zhang and Wing applied meta-analytic methods to investigate sex differences in the risk of insomnia among the published epidemiologic studies and a female predisposition of insomnia was confirmed.(Reference) However, cross-cultural differences in the sex-based risk of insomnia were suggested, with relatively lower female predominance in East Asian countries, as compared with Western countries. [29]

Our study indicates that those participants who used the computer between 24:00-2:00 suffered from a poorer quality of sleep and the insomnia was more severe among the mentioned group (compared to those who used the computer mostly between 19:00-22:00). In a study by Mesquita and Reimao,[17] the nighttime television and computer use and the perceived sleep quality was assessed in a group of 710 university students. It was shown that internet use between 19:00-24:00 increases the risk of poor sleep significantly. Also, in an earlier study by the same authors a notably poorer sleep quality and higher indices in the components of daytime sleepiness and sleep disorders were attained among the adolescents who used the computer during the night.[30] In consistent with these, there is another study in which 816 individuals aged 16–40 years were asked about the frequency of computer usage in their bedrooms and their sleep habits on weekdays and at weekends/days off and symptoms of insomnia. It finally indicated that the respondents who used a computer in the bedroom 'often' compared to 'rarely' rose later on weekdays and at weekends/days off, turned off the lights to go

to sleep later at weekends/days off, slept more hours at weekends/days off and had a greater discrepancy between turning off the lights to go to sleep on weekdays and at weekends/days off.[31]

Some studies assume that as the duration of media use gets longer, the sleep problems appear to be more intense. In a study by Suganuma and colleagues,[32] respondents were divided into three subgroups based on the duration of media use (< 2.5 hours of use = light users, 2.5-3.5 hours = intermediate users and >3.5 hours = heavy users). It was reported that only 29.0% of light users perceived that they had insufficient sleep compared to 53.5% of heavy users. Another study examined the association between electronic media use and sleep habits in 332 middle-school children. This study described that an evening screen time of one hour or more is associated with a higher risk of sleep problems (OR = 3.10 [1.24–7.78]), particularly going to bed late (OR = 3.4 [1.59–7.271]) and difficulty with waking up (OR = 2.15 [1.01–4.6]).[33] Similarly, we represented that the sleep quality and quantity both meaningfully decreased when the participants had spent more hours using the computer per day.

Eye discomfort and the headache are common among prolonged computer users. Our results showed that the amount of prevalence was higher among female students. This finding is consisted with previous studies.[28,34,35]

We found that the headache associated with computer use deteriorates quantity and quality of sleep. Consistently, Nakazawa and colleagues showed that the duration of daily visual display terminal (VDT) use was related to mental and sleep-related symptom score.[36]

Generally, musculoskeletal disorders, eye discomfort and a headache are common among computer users. In this study, a significant relationship was found between the headache associated with computer use and sleep problems.

Limitations and Suggestions

Longitudinal studies on larger populations are needed to reflect the effects of computer use on sleep quality more clearly. In this study, results are based on self-reported data. We suggest the use of objective measures for further studies.

CONCLUSIONS

Poor sleep quality was common among university students. The prevalence was greater among prolonged computer users. Using computer between 24:00-2:00 has a negative consequence on the quality of sleep and the insomnia severity compared to the use of computer

between 19:00-22:00. Also, the headache associated with computer use deteriorates quantity and quality of sleep.

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CONFLICT OF INTEREST

None declared.

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