Original Research Article

Bedtime Electronic Device Usage and Daytime Sleepiness among Medical Students: A Cross-sectional Study

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ABSTRACT

Introduction: In the 21st century, the use of digital devices has become a daily affair. This has led to excessive daytime sleepiness, which is also prevalent among medical students. However, there is a gap in awareness regarding the association between the use of digital devices and their impact on sleep.

Aim: This study aimed to determine the prevalence of daytime sleepiness among medical students and the awareness of the association between daytime sleepiness and the use of digital devices.

Study design: A cross-sectional analytical study

Methodology: This study was conducted at a private medical university among medical students. Purposive sampling was done to enroll respondents. A questionnaire was distributed online using Google forms to undergraduate students. The data was statistically analysed using Epi Info version 7.2.5.0 the statistical test conducted was the chi-square test and Fisher's exact test. The frequency and percentage were then analysed.

Results: A total of 123 students responded to the survey. In this study, 39.84% respondents reported of having excessive daytime sleepiness, with a mean score for the Epworth Sleepiness Scale (ESS) scale at 9.49 (SD ± 3.85). When considering the level of awareness, Chinese ethnicity had a high level of awareness than the other groups of ethnicities. There was no statistically significant association between the demographic characteristics and daytime sleepiness and awareness levels among the respondents.

Conclusion: This study showed that there was a higher prevalence of excessive daytime sleepiness than in other populations. However, most of the respondents did not have a negative impact on their work and social life.

Keywords: Awareness, Bedtime Electronic Device Usage, Daytime Sleepiness.

1. INTRODUCTION

Sleep is an important physiological need of every individual to achieve a healthy lifestyle. Sleep is vital for various reasons such as dealing with stress the entire day, preventing exhaustion, conserving energy, and for body and mind healing [1]. The sleep-wake cycle regulates the phenomena of drowsiness, which is characterised by a strong desire to sleep [1]. Extreme drowsiness refers to a strong desire to sleep in settings requiring a person to be up and alert during the day [2]. Sleep issues affect over one-third of the adult population, and this ratio is significantly greater among the student population due to their unique lifestyle [3]. Carter et al. found that using media devices before bedtime was associated with poor sleep quality and increased daytime sleepiness in a recent meta-analysis [4]. This is especially the case in the bedroom, which has become a media-rich environment in many homes. The smartphone, in particular, has made it convenient to use at least one sort of electronic gadget in bed because of its accessibility, portability, and connectivity [5]. Even in 2011, the National Sleep Foundation's 2011 Sleep in America poll found that 95% of respondents used electronic devices within the hour before bedtime at least a few evenings a week [6]. Several studies have shown that using cellphones for a lengthy period has resulted in reduced sleeping hours, weariness, later rising timings, insomnia, etc [7-9]. A study conducted in Malaysia in 2009 with medical students showed that daytime sleepiness was present in 35.5% of the respondents [10], and a study done in Brazil in 2022 compared technology and daytime sleepiness and showed daytime sleepiness in 34% of the respondents [11].

There is a considerable effect on circadian rhythm in those students as a result of continuous usage of mobile phones, particularly at night, which has a detrimental impact on sleep quality. The use of gadgets with light-emitting diode (LED) backlight screens before the night has been demonstrated to have a deleterious impact on sleep and circadian rhythm [12]. The blue region of the visible spectrum of light is abundant in light emitted from mobile phone screens. The retinal ganglion cells that contain melanopsin are highly stimulated by this type of light. The activation of those cells reduces tiredness by inhibiting melatonin release from the pineal gland. Normal sleep-wake cycles are disrupted, sleep is postponed, and melatonin secretion is reduced when people use cell phones, especially at night [1]. In comparison to the general population and other students, medical students are more likely to suffer from sleep disturbances [13]. This outcome was most likely attributable to medical students' unique lifestyles, which included late-night studying, irregular sleep, and chronic weariness, especially during exam season [1]. The use of LED backlight gadgets before bedtime had a negative effect on sleep and circadian rhythm in people, as demonstrated in a study [12]. According to the findings of the study done by Rafique et al, respondents who used the cell phone for at least 30 minutes after the lights had been turned off (without a blue light filter) had a strong positive link with poor sleep quality, daytime sleepiness, sleep disruptions, and increased sleep latency [14]. Wearers of a blue light shield worn two hours before sleep had dramatically reduced sleep latency compared to controls in interventional research [15].

Another interesting finding found from the study was that keeping the phone close to the pillow while asleep produced higher sleep latency, sleep disruptions, and daytime tiredness. This is due to the vibrations from notifications and messages, heat generated by charging phones, and radiofrequency electromagnetic field (RF-EMF) radiation from the mobile phone. Electroencephalogram (EEG) alterations in Rapid eye movement (REM) and non-REM sleep can be caused by RF-EMF exposure [16]. These RF-EMFs can pass through the skull and into the brain, resulting in neuronal hyper-excitability and a variety of sleep disorders [17].

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There have been many pieces of research done regarding sleep quality in the International Community [7-11]. However, there is a lack of sufficient research on the association between the use of electronic devices before bedtime and daytime sleepiness, and awareness of this condition. Also, the studies done regarding this are very limited when considering the medical students in Malaysia. This study aimed to determine the prevalence of daytime sleepiness among medical students in a private medical university and the awareness of the association between daytime sleepiness and the use of digital devices.

2. MATERIAL AND METHODS

2.1 STUDY DESIGN AND SETTING

This cross-sectional study was conducted from May 2022 to July 2022 in a private medical university in Malaysia. The respondents involved in the study were undergraduate students from MBBS programs.

2.2 STUDY INSTRUMENT

The study was done via a questionnaire distributed online via Google forms. The questionnaire included the following sections: (1) Demographic details (Batch, International or Local students, Ethnicity, etc.), (2) Questions regarding the participant's usage of digital devices and variable factors (Number of devices, how long they use devices before sleep, Hours of sleep they obtain, etc.), (3) Daytime Sleepiness, and (4) the awareness of respondents about the relationship between sleep and use of screens. Daytime sleepiness was measured by using the validated questionnaire "Epworth Sleepiness Scale", which is authored by Johns MW, and distributed by "Mapi Research Trust, through eProvide platform".

2.3 SAMPLE SIZE AND SAMPLING

Sample size was calculated using Epi Info Version 7.2.5.0. The Population size was 800. Based on a previous study done in Malaysia, medical students showed daytime sleepiness of 35.5% [10]. Hence, expected frequency was considered at 35.5%. The acceptable margin of error was considered as 8%, design effect as 1.0 and 1 cluster. Hence, at a confidence level, the calculated cluster size was 117 respondents. The final sample size required was 130 respondents after taking into consideration of 10% non-response rate.

All students from the study university who were enrolled in MBBS studies from Semester 1 to Semester 10 were eligible. The sampling was done by purposive sampling, in which whoever willing to participate by responding to the questionnaire is considered as a member of the sample group. The inclusion criteria for the sample were undergraduate medical students, both International and Local students. Students from other programme and all Academic and Non-academic members were excluded from the study.

2.5 DATA ANALYSIS

Data was analysed using Epi info version 7.2.5. The independent variables used in this study were age, gender, ethnicity, nationality, semester of study, BMI, coffee and energy drinks, exercise, and hours of sleep. The dependent variables for this study were the

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prevalence of daytime sleepiness and the awareness of the association between bedtime electronic device use and daytime sleepiness among medical students. The association between the prevalence and the knowledge and awareness was assessed with inferential statistics. The significant level (p-value) was set up at 0.05 with a 95% confidence interval.

The ESS scores were split into two categories with scores <11 as normal daytime sleepiness, and scores ≥11 as excessive daytime sleepiness. The scoring for the questions of awareness was done as 1 for agree, and 2 for those who responded as neutral or disagree, and the total was taken. Then, they were categorized into two based on a mean split, with respondents less than a mean having relatively better awareness and above mean having relatively lower awareness.

3. RESULTS

Table 1 reports the demographic characteristics of the respondents. Among the 123 respondents, 37.40% were male and 62.60% were female. The age was split into two categories as ≤ 22 years, which had 62.60% respondents and >22 years, which had 37.40% respondents. The ethnicity was under 4 categories, which had 8.94% Malay, 32.52% Chinese, 36.59% Indian, and 21.95% others. The respondents were also categorized based on their semester of study, which had Pre-Clinical years (Semester 1 to 4) and Clinical Years (Semester 6-10), and there were 2.20% respondents from Pre-clinical years, and 87.80% respondents from Clinical years. Among the respondents, 9.76% were underweight, 56.91% respondents were normal weight, 24.39% respondents were overweight, 6.50% respondents were obese, and 2.44% respondents were extremely obese. 3.25% respondents had underlying Health conditions which impact their sleep, and 0.81% participant had taken medication to help with their sleep (Table 1).

Table 1. Sociodemographic characteristics of respondents (n = 123)

Variable	Frequency (%)
Age	
≤ 22 years	77 (62.60)
>22 years	46 (37.40)
Gender	
Male	46 (37.40)
Female	77 (62.60)
Ethnicity	
Malay	11 (8.94)
Chinese	40 (32.52)
Indian	45 (36.59)
Others*	27 (21.95)
Nationality	
Malaysian	102 (82.93)
International	21 (17.07)
Study year	
Pre-clinical years	15 (12.20)
Clinical years	108 (87.80)
BMI	
<18.5 (Underweight)	12 (9.76)
18.5 - 24.9 (Normal)	70 (56.91)
25 - 29.9 (Overweight)	30 (24.39)
30 - 34.9 (Obese)	8 (6.50)

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35 - 39.9 (Extremely Obese)	3 (2.44)
Health condition	
Yes	4 (3.25)
No	119 (96.75)
Medication to sleep	
Yes	1 (0.81)
No	122 (99.19)

** Sri Lankans, and others.*

ESS score was considered as ≥11 as having excessive daytime sleepiness, and <11 as having normal daytime sleepiness. Among the respondents, 39.84% respondents had excessive daytime sleepiness, and 60.16% of the respondents had normal daytime sleepiness. The mean score was 9.49 (SD ± 3.85) and median and mode was 10. The total score for the ESS scale ranged from 1-17.

There was no significant association between daytime sleepiness and age, gender, ethnicity, nationality, study year, and BMI. Among the respondents who consumed coffee to any level, 40.63% had excessive daytime sleepiness, and among the respondents who did not consume coffee, 37.04% had excessive daytime sleepiness. Hence, those who consumed coffee had more prevalence for excessive daytime sleepiness.

There is positive association between Use of digital devices and sleeping less than 6-8 hours and daytime sleepiness (OR 1.75). They are 1.75 times more likely to have excessive daytime sleepiness compared to those who sleep for 6-8 hours. However, there is no statistical significance between gender and daytime sleepiness (P= 0.36) (Table 2).

Table 2. Association between respondents' demographic characteristics and daytime sleepiness. (n=123)

Variable	Excessive daytime sleepiness	Normal Daytime sleepiness	Odds Ratio	95% Confidence Interval	Statistical Tests (Chi-Square test)	P
Age						
≤22 years	30 (38.96)	47 (61.04)	Reference			
>22 years	19 (41.30)	27 (58.70)	1.10	0.52-2.32	0.06	0.79
Gender						
Male	15 (32.61)	31 (67.39)	Reference			
Female	34 (44.16)	43 (55.84)	1.63	0.76-3.5	1.60	0.21
Ethnicity						
Malay	6 (54.55)	5 (45.45)	Reference			
Chinese	16 (40.00)	24 (60.00)	0.55	0.14-2.13	0.11*	0.74*
Indian	18 (40.00)	27 (60.00)	0.55	0.14-2.09	0.76*	0.50*
Others	9 (33.33)	18 (66.67)	0.41	0.09-1.74	1.47*	0.28*
Nationality						
International	9 (42.86)	12 (57.14)	Reference			
Malaysian	40 (39.84)	62 (60.78)	0.86	0.33-2.23	0.09	0.76

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Study year						
Pre-clinical year	6 (40.00)	9 (60.00)	Reference			
Clinical year	43 (39.81)	65 (60.19)	0.99	0.32-2.98	0.0002	0.99
BMI						
18.5-24.9 (Normal)	25 (35.71)	45 (64.29)	Reference			
<18.5 (underweight)	6 (50.00)	6 (50.00)	1.80	0.52-6.17	0.88*	0.36*
25-29.9 (overweight)	12 (40.00)	18 (60.00)	1.20	0.49-2.89	0.17	0.68
30 – 34.9 (Obese)	4 (50.00)	4 (50.00)	1.80	0.41-7.82	0.62*	0.46*
35 – 39.9 (Extremely obese)	2 (66.67)	1 (33.33)	3.60	0.31-41.70	1.18*	0.55*
Hours of sleep at night time						
6-8 hours	17 (32.69)	35 (67.31)	Reference			
Less than 2 hours	0 (0)	1 (100)	0.00	Undefined	0.48*	1.00*
2-4 hours	2 (66.67)	1 (33.33)	4.12	0.35-48.65	1.45*	0.27*
4-6 hours	29 (43.94)	37 (56.06)	1.61	0.76-3.43	1.55	0.21
More than 8 hours	1 (100)	0 (0)	Undefined	Undefined	1.98*	0.34*
Use of digital devices immediately before sleep						
Devices are used	48 (39.67)	73 (60.33)	Reference			
Devices are not used	1 (50.00)	1 (50.00)	1.52	0.09-24.90	0.087*	1.00*
Use of digital devices with lack of sufficient sleep						
Sleeps 6-8 hours or more	4 (28.57)	10 (71.43)	Reference			
Uses digital devices and less than 6-8 hours of sleep	45 (41.28)	64 (58.72)	1.75	0.51-5.95	0.84	0.36
Based on hours of use of digital devices per day						
6-10 hours	11 (31.43)	24 (68.57)	Reference			
< 2 hours	2 (50.0)	2 (50.0)	2.18	0.27-17.57	0.56*	0.59
2-6 hours	29 (42.03)	40 (57.97)	1.58	0.67-3.73	1.10	0.29
10-14 hours	6 (46.15)	7 (53.85)	1.87	0.51-6.88	0.89*	0.49*
> 14 hours	1 (50)	1 (50)	2.18	0.12-38.18	0.29*	1.00*
Based on coffee & energy drink consumption level						
2-3 drinks per week	14 (53.85)	12 (46.15)	Reference			
Do not consume	10 (37.04)	17 (62.96)	0.50	0.17-1.51	1.51	0.22
Less than once	6 (26.09)	17 (73.91)	0.30	0.90-1.01	3.89	0.04

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a week						
One drink per week	5 (62.50)	3 (37.50)	1.43	0.28-7.26	0.18*	1.00*
Once daily	8 (30.77)	18 (69.23)	0.38	0.12-1.19	2.84	0.09
Twice daily	2 (33.33)	4 (66.67)	0.43	0.06-2.77	0.82*	0.65*
More than two per day	4 (57.14)	3 (42.86)	1.14	0.21-6.16	0.02*	1.00
Based on level of exercise						
3-4 days a week	12 (38.71)	19 (61.29)	Reference			
None	12 (42.86)	16 (57.14)	1.19	0.42-3.36	0.10	0.75
Once a week	23 (38.98)	36 (61.02)	1.01	0.41-2.47	0.0006	0.98
6-7 days a week	2 (40.00)	3 (60.00)	1.05	0.15-7.27	0.003*	1.00*
Based on level of awareness.						
High awareness	24 (39.34)	37 (60.66)	Reference			
Low awareness	25 (40.32)	37 (59.68)	1.042	0.51-2.14	0.012	0.92

**Fisher's Exact test.*

Table 3 shows the responses each participant gave with regard to the 13 items that were asked relevant to awareness.

Table 3. Respondents' responses relevant to the awareness questions (n=123).

Questions	**Agree n (%)**	**Neutral n (%)**	**Disagree n (%)**
The electronic devices emit a blue light, which affect our sleep quality and patterns.	103 (83.74)	18 (14.63)	2 (1.62)
There are blue light filters, night time modes, eye comfort etc which can be used to reduce the impact of blue light rays.	100 (81.3)	23 (18.7)	0 (0)
Spectacles and contact lenses can have blue-light filters to help reduce the blue light emissions.	83 (67.48)	35 (28.45)	5 (4.06)
Use of digital devices before bedtime will decrease your alertness at morning.	71 (57.72)	43 (34.96)	9 (7.32)
You should stop using electronic devices at least 30 minutes before bedtime.	93 (75.61)	27 (21.95)	3 (2.44)
Daytime sleepiness is due to poor sleep quality at night.	94 (76.42)	22 (17.89)	7 (5.69)
Engaging in stimulant activities like gaming on electronic devices can contribute to daytime sleepiness.	87 (70.73)	27 (21.95)	9 (7.32)
The recommended average sleep time is 6-8 hours per day.	106 (86.18)	16 (13.01)	1 (0.81)

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I am not getting sufficient sleep due to engaging in non-academic activities at night.	43 (34.96)	51 (41.46)	29 (23.58)
I am not getting sufficient sleep due to engaging in studies and other university related work.	70 (56.91)	50 (40.65%)	3 (2.44)
Sleep deprivation can lead to cognitive complications such as decreased information processing, working memory, inhibitory control and problem solving.	110 (89.43)	12 (9.76)	1 (0.81)
Sleep deprivation can contribute to depression.	90 (73.17)	25 (20.33)	8 (6.50)
Sleep deprivation can lead to an increased appetite for high caloric food.	75 (60.98)	38 (30.89)	10 (8.13)

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Table 4 reports the respondents' awareness level, which shows a mean of 16.86 (SD±2.91). 50.4% of respondents had a less level of awareness, and 49.6% of respondents had a high level of awareness. There was no significant association between the demographic characteristics of the respondents and awareness level (Table 4).

Table 4. Association between respondent's demographic characteristics and the Level of Awareness.

Variable	High Aware	Less Aware	Odds Ratio	95% Confidence Interval (CI)	Statistical tests (Chi-Square Test)	P
	n (%)	n (%)				
Age						
>22 years	22 (47.83)	24 (52.17)	Reference			
≤ 22 years	39 (50.65)	38 (49.35)	1.120	0.539- 2.326	0.092	0.762
Gender						
Female	22 (47.83)	24 (52.17)	Reference			
Male	39 (50.65)	38 (49.35)	1.120	0.539- 2.326	0.092	0.762
Ethnicity						
Malay	5 (45.45)	6 (54.55)	Reference			
Chinese	24 (60)	16 (40)	1.800	0.469- 6.908	0.744*	0.498*
Indian	21 (46.67)	24 (53.33)	1.050	0.280- 3.944	0.005	0.942
Others	11 (40.74)	16 (59.26)	0.825	0.201- 3.391	0.071*	1.000*
Nationality						
International	11 (52.38)	10 (47.62)	Reference			
Malaysian	50 (49.02)	52 (50.98)	0.874	0.341- 2.238	0.079	0.779
Study year						
Pre-clinical year	7 (46.67)	8 (53.33)	Reference			
Clinical year	54 (50)	54 (50)	1.143	0.387- 3.373	0.059	0.809

**Fisher's Exact test.*

Table 5 shows the responses obtained for the questionnaire about behaviour that we considered might be important contributors to daytime sleepiness. In this study, most respondents had 3 devices (49.59%), followed by respondents who owned 4 devices (25.21%). Also, it showed that the majority of the respondents sleep 4-6 hours, which was less than the recommended time of 6-8 hours. Furthermore, only a small number of respondents checked their phones during sleep regularly (7.32%) (Table 5).

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Table 5. Mobile phone usage among respondents (n=123)

No	Item	n(%)
1	**How many Electronic Devices do you own?**	
	1	3 (2.44)
	2	28 (22.76)
	3	61 (49.59)
	4 or more	31 (25.21)
2	**How many hours do you sleep at night on average?**	
	2-4 hours	3 (2.44)
	4-6 hours	66 (53.68)
	6-8 hours	52 (42.28)
	Less than 2 hours	1 (0.81)
	More than 8 hours	1 (0.81)
3	**How often do you get up during sleep to check your phone?**	
	Always	2 (1.63)
	Often	7 (5.69)
	Sometimes	22 (17.89)
	Rarely	49 (39.84)
	Never	43 (34.96)

Table 6 shows the methods that the respondents used to overcome daytime sleepiness, and also how they were able to determine the level of impact of daytime sleepiness on their life.

Table 6. The activities to overcome daytime sleepiness, and the impact of daytime sleepiness on the respondents' life (n=123)

No	Items	n (%)
1	**Caffeine/ energy drink intake**	
	Do not drink coffee and energy drinks	27 (21.95)
	Less than once a week	23 (18.70)
	One can a week	8 (6.50)
	Two-three cans a week	26 (21.14)
	One can a day	26 (21.14)
	Two cans a day	6 (4.88)
	More than two cans a day	7 (5.69)
2	**Sport activities**	
	None	28 (22.76)
	Once a week	59 (47.97)
	3-4 days a week	31 (25.20)
	6-7 days a week	5 (4.07)

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3	**Satisfied with their level of attention during lecture**	
	Yes	49 (39.84)
	No	74 (60.16)
4	**Excessive daytime sleepiness has a negative impact on work and social life**	
	Yes	47 (38.21)
	No	76 (61.79)

Figure 1 shows the activities that the respondents engage in immediately before they sleep. Based on this, most respondents show a preference to use digital devices to access social media and other online websites.

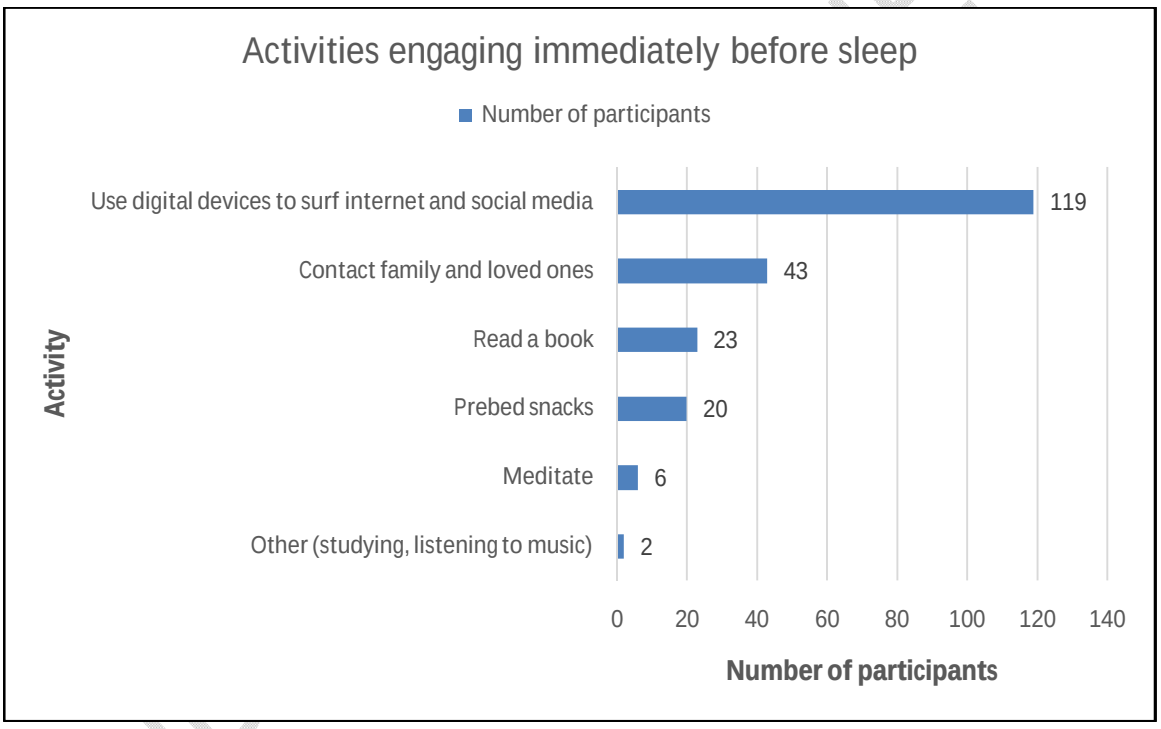

Figure 1. Activities respondents engage in immediately before sleep (multiple options were selected) (n=123)

Figure 2 shows the activities that the respondents engage in when they sleep less than 6-8 hours per day. The responses showed that students would either spend the time mostly either studying or else engaging in other activities to help overcome their stress via entertainment etc.

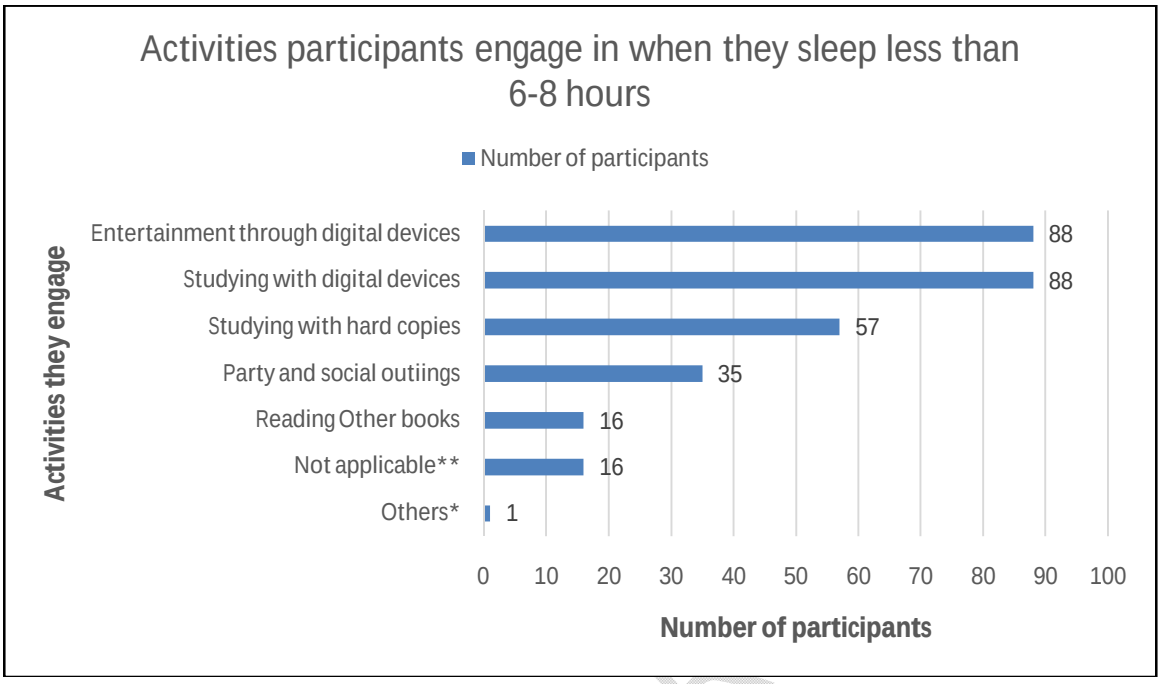

Figure 2. Activities respondents engage in when they sleep less than 6-8 hours (n=123)
***Sleeps 6-8 hours a day.*
**Cleaning, exercises, eating snacks etc.*

Figure 3 shows the products used by students to help overcome their daytime sleepiness, where respondents were able to select multiple options. Based on the chart, most of the respondents find that the consumption of coffee and energy drinks helps overcome their daytime sleepiness, followed by eating foods and snacks.

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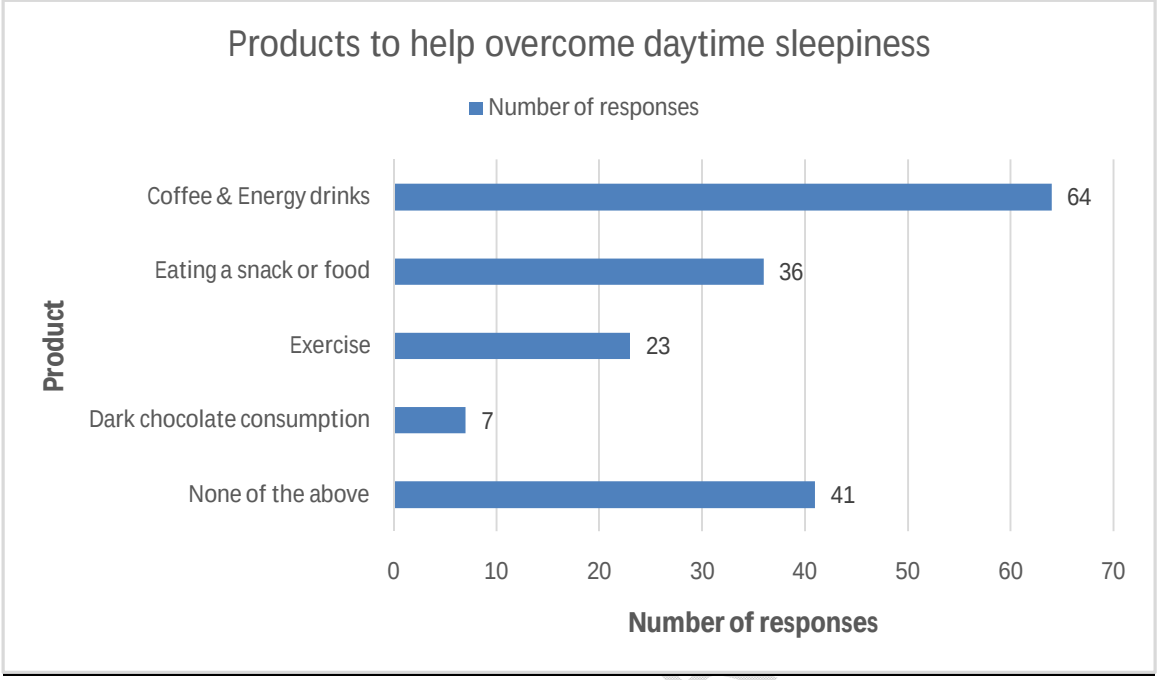

Figure 3. Products used by the respondents to help overcome daytime sleepiness (n=123)

4. DISCUSSION

This cross-sectional study was conducted to assess the awareness of the association between daytime sleepiness and the use of digital devices before sleep, among medical students at a private medical university in Malaysia. The prevalence of excessive daytime sleepiness among medical students, and their awareness about how the use of digital devices is contributing to their daytime sleepiness. In the present world, most students have access to digital devices which they use for various purposes including education and entertainment. Previous research has shown that there is an impact between the use of digital devices before bed, and a decrease in sleep quality [1, 3]. Hence, this study aimed to determine the extent of daytime sleepiness and the awareness of the association between digital devices and daytime sleepiness among medical students.

The findings showed that there was excessive daytime sleepiness was reported in 39.84% of the respondents, with 60.16 % having normal daytime sleepiness. These findings showed that there is an increase in respondents with excessive daytime sleepiness when compared to other similar studies [10,11]. Furthermore, 38.21% of respondents agreed that they have daytime sleepiness at a level that brings a negative impact on their work and social life, while 61.79% respondents did not have a negative impact. Hence, a small amount of 1.63% of the respondents had excessive daytime sleepiness, but they did not have it at a level that will have a negative impact on their work and social life. When considering the excessive daytime sleepiness about B.M.I. value of the participant, we saw a trend of increase in the number of respondents with excessive daytime sleepiness with an increase in the B.M.I. which was similar to the findings of other researchers conducted regarding obesity and daytime sleepiness and sleep quality [18].

The findings showed that most students use digital devices before sleep. Due to the increase in the level of use of digital devices among medical students, there is an increase in the risk of symptoms associated with Computer Vision Syndrome [19], and hence, it is necessary to spread awareness regarding this to identify and manage it early. Based on a

study, the use of digital devices for more than 6 hours a day can lead to a majority of the population (57.4%) having Computer Vision Syndrome, and since about 40% of our respondents use devices for more than 6 hours, there is increased risk and necessity for spreading awareness.

Furthermore, the findings of this study showed that most respondents prefer the consumption of coffee and energy drinks, and other snacks to overcome their daytime sleepiness. This can lead to an increase in the risk of nutrition-based diseases like Diabetes Mellitus and other related issues. An article showing the relationship between energy drinks and obesity [20], can indicate similar reasons for the consumption of such products. In this study, there is an increase in Excessive Daytime sleepiness among the respondents who consumed coffee than those who did not, and this is similar to another research done in India [21]. A research article related to Caffeine consumption showed that caffeine is mostly consumed by people who are having sleep disturbances and also excessive daytime sleepiness, and it further stated that Caffeinated products may have a disruptive effect on sleep, and is also becoming more prevalent among children and adolescents [22].

The number of respondents who used electronic devices before bed and those who suffered from excessive daytime sleepiness are similar prevalence in this study. Hence, the use of phones in the pre-bed or during bedtime can lead to excessive daytime sleepiness. Similar studies have shown this data, where they have shown sleep quality has decreased due to the use of digital devices at pre-bed and bedtimes, and lead to sleep disturbances [23, 24].

The findings of this study revealed that there was no significant pattern of variation in awareness regarding the use of digital devices, and the prevalence of daytime sleepiness. Hence, it is suitable to consider that even though they may be aware of such criteria, they rarely implement them into action. Furthermore, other studies showed that there was a lack of knowledge on side effects, which can contribute to complications such as daytime sleepiness [25].

This study has some limitations. Due to the time limitation, the researchers were unable to recruit all the students in the study institution. The response rate of the preclinical year students was 12.20%, which was relatively low when compared to the clinical year responses, which was 87.80%. Also, since a cross-sectional study was conducted, there was no ability to measure the changes that happened over time. The study was also done within only one private university in Malaysia, and as such we are unable to consider students from other regions, public medical universities, and other private universities.

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5. CONCLUSION

The prevalence of daytime sleepiness among respondents in this study was 39.84. It was considered to be a moderate level, however, there was no association with their awareness level. Next, the data collected showed that there is no statistically significant association between age, gender, ethnicity, nationality, study year, BMI, usage of digital devices and sleeping less than 6-8 hours, and daytime sleepiness.

ETHICAL APPROVAL AND CONSENT

The use of the Epworth Sleepiness Scale was authorized by the Mapi Research Trust, which owns the licence for its distribution. Respondents to this study were obtained by voluntary participation. Informed consent forms detailing the important and relevant particulars of the study were provided to the respondents. No incentives were given to encourage participation, nor were the respondents coerced or forced into taking part in this study. This research was approved by the Research Ethics Committee of the Faculty of Medicine, Manipal University College Malaysia, Melaka, Malaysia.

RECOMMENDATION

Based on the findings of our study, the implementation of intervention techniques that can help promote the quality of sleep of students to reduce their daytime sleepiness is recommended. Furthermore, this research showed that there was no significant variation in the level of daytime sleepiness based on their level of awareness, which brings about the need for more studies into why those who have a relatively higher level of awareness also show the same levels of daytime sleepiness as those who had relatively lower levels of awareness. Since the study setting was restricted to only one private university, future studies should be conducted by recruiting respondents from public universities. This would help to determine a more representative result.

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