

Original Article

SLEEP DEPRIVATION AMONG MEDICAL STUDENTS IN MALAYSIA

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ABSTRACT

Adequate sleep is crucial to achieve optimal brain's ability to learn and remember. Sleep deprivation adversely affects the brain and cognitive functions and a major source of morbidity. Sleep deprivation is associated with increased risks of hypertension, diabetes, obesity, ischaemic heart disease, stroke, motor vehicle accidents and medical errors. Lack of sleep can be due to lifestyle habits and sleep disorders. This study aimed to investigate the prevalence, related factors and effects of sleep deprivation among medical students in Malaysia. A questionnaire comprising of demographic detail, sleep pattern, sleep behaviour and effects of sleep deprivation was distributed through Google Form. A total of 164 (20.7% male and 79.3% female) medical students age 19 to 26 years old from 13 public and private medical schools in Malaysia answered the questionnaire. All statistical analyses were conducted by using the Statistical Package for Social Science (SPSS) version 24. 65% of respondents perceived they are sleep deprived, 43.9% had insomnia and 34% had parasomnia. The two main factors of sleep deprivation are due to studying or doing homework followed by usage of electronic devices before sleep. Among the sleep deprived medical students there is no relationship between sleep deprivation with gender and the average hours of sleep. Sleep deprivation also results in hindered academic performance. These results strongly support further investigation of the important aspect of medical students' life such as factors that affect the ability to concentrate as well as different aspects in learning and neuropsychology. More parameters can be used including biological markers to analyse the association in order to get precise results.

INTRODUCTION

Sleep deprivation, also known as insufficient sleep or sleeplessness, is the condition of not having enough sleep. It can be either chronic or acute and may vary widely in severity. A chronic sleep-restricted state adversely affects the brain and cognitive function. Sleep deprivation (SD) is a major source of morbidity with widespread health effects including increased risks of hypertension, diabetes, obesity, heart attack, and stroke and many sleep deprivation behaviour that brings together vehicle accidents and medical errors and is therefore an urgent topic of investigation [1].

The clinical study of sleep deprivation is studied based on several tests including performing a face/non-face categorization psychomotor vigilance task (PVT) and electroencephalogram (EEG). Lack of sleep can be due to lifestyle habits and sleep disorders. It is not a secret that a good night's sleep makes people feel better. Sleep gives your body time to rest and recharge, and also be crucial to the brain's ability to learn and remember. During sleep, while the body rests, the brain is busy processing information from the day and forming memories. Hence, if sleep is

deprived, it will disrupt the learning centre and impair the memory process to input new learning skills. Therefore, early diagnosis of sleep disorders is essential to prevent detrimental effects on health.

Specific objectives of this study were to determine the prevalence, factors and effects of sleep deprivation among medical students in Malaysia.

Types of sleep pattern

The nature of sleep difficulty varies greatly between people. Medical students are considered a population that is particularly prone to sleep-related problems. Based on the article by Krystal AD (2005) insomnia is a sleep disorder that regularly affects millions of people worldwide. Someone with insomnia finds it difficult to fall asleep or stay asleep. The Symptoms of insomnia may include difficulty falling asleep, trouble staying asleep, and not feeling restored by sleep [2]. Although it has not been clear that it is possible to identify distinct subtypes of patients by symptom or that distinguishing symptom type affects the course of clinical treatment. This is the classification of insomnia by duration most commonly involves

three categories. The first categories are transient which is no more than a few days. Then, the short-term which up to 3 weeks and the last categories are the long-term which is more than 3 weeks. Insomnia also can be classified into symptom type. There are three symptom categories, first is the difficulty of falling asleep, trouble staying asleep and not feeling restored by sleep [2]. There are several ways that insomnia can be classified that are potentially useful in clinical practice. The main reason for distinguishing insomnia for identifying the associated conditions so that those associated conditions can be treated easily.

Another sleep pattern is parasomnia. Parasomnias are a group of sleep disorders characterized by abnormal, unpleasant motor verbal or behavioural events that occur during sleep or wake to sleep transitions [3]. Parasomnias can occur during non-rapid eye movement (NREM) and rapid eye movement (REM) stages of sleep and are more commonly seen in children than in the adult population. Parasomnias are a group of sleep disorders that are characterized by abnormal, unpleasant motor, verbal or behavioural events that occur during sleep or wake to sleep transitions. Parasomnias can be grouped by the type of behaviours seen or based on the sleep stage from which they occur. The most common non-rapid eye movement parasomnias include somnambulism, confessional arousals, and night terrors. Rapid eye movement parasomnias, particularly rapid eye movement sleep behaviours disorder, have been studied more extensively [4]. Usually, the patient with rapid eye movement behaviours disorder will present with abnormal behaviours during rapid eye movement sleep. In conclusion, it is crucial to understand the characteristics of various parasomnias and their association with medical and sleep-related disorders. Parasomnias are distressful and can disrupt the lifestyle of the patients and others. It is also crucial to reassure the patients and discuss in detail their sleep history and follow the possible diagnostic approach for a complete evaluation.

The relationship of learning process and sleep

Sleep helps learning and memory in two distinct ways. First, a sleep-deprived person cannot focus optimally and therefore cannot learn efficiently. Second, sleep itself has a role in the consolidation of memory, which is essential for learning new information. Although the exact mechanism is not known, learning and memory are often described in terms of three functions. Acquisition refers to the introduction of new information into the brain. Consolidation represents the processes by which a memory becomes stable. Recall refers to the ability to access the information (whether consciously or unconsciously) after it has been stored.

Ellenbogen JM, Payne JD and Stickgold R. (2006) study the role of sleep in learning and memory formation in two ways. The first approach looks at the different stages of sleep (and changes in their duration) in response to learning a variety of new tasks. The second approach examines how sleep

deprivation affects learning. Sleep deprivation can be total (no sleep allowed), partial (either early or late sleep is deprived), or selective (specific stages of sleep are deprived) [5].

The earliest sleep and memory research focused on declarative memory, which is the knowledge of fact-based information, or “what” we know. For example, the capital of France, or what you had for dinner last night. In one research study, individuals engaged in an intensive language course were observed to have an increase in rapid eye movement sleep or REM sleep. This is a stage of sleep in which dreaming occurs most frequently. Scientists hypothesized that REM sleep played an essential role in the acquisition of learned material. Further studies have suggested that REM sleep seems to be involved in declarative memory processes if the information is complex and emotionally charged, but probably not if the information is simple and emotionally neutral.

This study has also focused on sleep and its role in procedural memory which is remembering “how” to do something. For example, riding a bicycle or playing the piano. REM sleep seems to play a critical role in the consolidation of procedural memory. Other aspects of sleep also play a role; motor learning seems to depend on the amount of lighter stages of sleep, while certain types of visual learning seem to depend on the amount and timing of both deep, slow-wave sleep (SWS) and REM sleep.

This study also focuses on the impact that a lack of adequate sleep has on learning and memory. When we are sleep deprived, our focus, attention, and vigilance drift, making it more difficult to receive information. Without adequate sleep and rest, overworked neurons can no longer function to coordinate information properly, and we lose our ability to access previously learned information. Besides, our interpretation of events may be affected. We lose our ability to make sound decisions because we can no longer accurately assess the situation, plan accordingly, and choose the correct behaviour.

METHODOLOGY

Study design

This study is a descriptive and qualitative study to:

- a) The general effect of sleep deprivation among medical students.
- b) The main sleep complains among medical students.
- c) The factor of sleep deprivation among medical students. For example, up late studying, extra-curricular activities, video game addiction, and more.
- d) The effect of sleep deprivation among medical students. For example, weak immune system, short-term memory, unstable emotion, and more.

Sample

Sample population were medical students from universities including UniSHAMS, UniSZA, UM,

UPM, UKM, UiTM and more.

Study period

Research was done in a month, including discussion on how the research will be conducted, medical students on answering questions, data collection from questionnaires, getting result from SPSS, and report writing.

Research tools and materials

Questionnaire:

Consist of 4 different section: Section A: Demographic detail, Section B: Sleep pattern, Section C: Sleep Behaviour, Section D: Effects of Sleep Deprivation.

Data collection

Questionnaire through Google Form. Link of Google Form was sent through WhatsApp. In data analysis, Applied Chi-Square model and Pearson's Correlation to determine the association. All statistical analyses were conducted by using the Statistical Package for Social Science (SPSS) version 24.

RESULTS

A total of 164 medical students (20.7% male and 79.3% female) were recruited in the study. The

demographic data is tabulated in Table 1. The age ranged from 19 to 26 years old with the majority of the participants being 20 years old (77.4%). Most of the participants were single (98.8%) as compared to the married participants (1.2%). Participants were varied from private and public universities in Malaysia. The results covering section B-D was shown in Table 2, 3 & 4.

For descriptive analysis, there is no relationship between sleep deprivation when coming to college and average hours of sleep. But there is a relationship and significant association between sleep-deprived when coming to college and academic performance hindered, and stress interferes ability to fall asleep.

No association was found between gender and sleep deprivation when coming to college.

Results of the Pearson correlation indicated that there was a significant positive association between the results scored on the Academic performance hindered and Stress interferes ability to fall asleep. Results of the Pearson correlation indicated that there was a significant weak negative correlation between the results scored on the sleep-deprived when coming to college and Stress interferes ability to fall asleep.

Table 1: Demographic data of participants (n=164).

Demographic detail	Frequency	Percentages (%)
Gender		
Male	34	20.7
Female	130	79.3
Marital status		
Single	162	98.8
Married	2	1.2
Age (years)		
19	3	1.8
20	127	77.4
21	17	10.4
22	8	4.9
24	3	1.8
25	2	1.2
26	4	2.4
University		
UM	8	4.9
UKM	6	3.7
UPM	8	4.9
UNIMAS	16	9.8
UITM	36	22.0
UIA	1	0.6
MSU	8	4.9
USIM	9	5.5
UNISHAMS	39	23.8
UNISZA	20	12.2
UNIKL	6	3.7
UNHAS	2	1.2
USM	5	3.0

Table 2. Sleep pattern analysis.

Characteristics	Frequency	Percentage (%)
SLEEP DEPRIVED WHEN COMING TO COLLEGE		
Yes	107	65.2
No	57	34.8
SLEEP NEEDED TO FUNCTION WELL IN THE NEXT DAY (HOURS)		
< 3 hours	2	1.2
4 - 6 hours	97	59.1
7 - 9 hours	61	37.2
> 9 hours	4	2.4
HARD TO STAY AWAKE AND TO FOCUSED IN CLASS		
Yes	143	87.2
No	21	12.8
AVERAGE HOURS OF SLEEP (HOURS)		
< 3 hours	11	6.7
4 - 6 hours	126	76.8
15.27 - 9 hours	25	15.2
> 9 hours	2	1.2
LESS ENERGY AND MOTIVATION		
Yes	46	28.0
No	3	1.8
Sometimes/depends	115	70.1
NEGATIVE MOODS AND BEHAVIORAL CHANGES		
Yes	126	76.8
No	38	23.2

DISCUSSION

In this study, about 56.1% (92) of medical students did not experience insomnia while others, about 15.9% (26) students have difficulty sleeping due to mind disturbance when trying to sleep. This result was supported by a study mentioned that up to 60% of students suffer from poor sleep quality and 7.7% are having insomnia [6]. The hours of students sleep also lead to the quality to function well on the next day, based on the result of this study, 59.1% (97) students need 4 to 6 hours of sleep to function well and suffered from morning tiredness and only 1.2% of students need less than 3 hours. In another study, 31% of all students suffered from morning tiredness after having enough sleeping hours [7].

This study found a significant discrepancy between sleep deprivation and the effects on human functioning among medical students in terms of alertness and academic performance. The sleeping hours needed for a student to function well also interfere with the student ability to sleep through the night. Overall, the result in this research highlights more on the effect of sleep deprivation.

Sleep disturbances in undergraduate medical students are of particular interest because of the known relationship between sleep and mental health and the concern that the academic demands of medical training can cause significant stress [8]. Any additional undiagnosed sleep problem can presumably exacerbate mental

Table 3: Sleep Behaviour Analysis.

Characteristic	Frequency	Percent (%)
Main Sleep Complaints		
Trouble falling asleep	45	27.4
Trouble remaining sleep	34	20.7
Excessive sleepiness during the day	39	36.0
Snoring	7	4.3
Unwanted behaviours during sleep	19	11.6
Breathing		
I have been told that I snore loudly	10	6.1
I sweat a great deal at night	8	4.9
I sleep in normal breathing	121	73.8
I have been told that I stop breathing while asleep?	3	1.8
I have been told that I snore only when sleeping on my back	2	1.2
I awaken at night choking or gasping for air	2	1.2
I have trouble breathing when flat on my back	1	0.6
I have trouble breathing with my nose	7	4.3
I have morning headaches	10	6.1
Parasomnias		
I act on my dreams while asleep	14	8.5
I have frequent nightmares	19	11.6
I talk in my sleep	21	12.8
I have sleep walked as an adult	1	0.6
I did not experience parasomias at all	109	66.5
Insomnia		
I have trouble falling asleep	16	9.8
Thoughts start racing through my mind when I try to fall asleep	26	15.9
I have trouble remaining asleep	7	4.3
I awaken frequently during the night	14	8.5
I have difficulty returning to sleep if I awaken during the night	9	5.5
I did not experience insomnia	92	56.1

Table 4: Effect of sleep deprivation.

Characteristic	Frequency	Percent
ACADEMIC PERFORMANCE HINDERED		
Yes	21	12.8
No	38	23.2
Sometimes/depends	105	64.0
OTHER FACTORS DEMINISH QUALITY AND QUANTITY OF SLEEP		
Not tired at night, a "night owl"	12	7.3
Up late studying / doing homework	41	25.0
Out with friends / socializing	13	7.9
Involvement in extra-curricular activities (clubs/work/sorority/team sports/etc.)	13	7.9
Uncomfortable sleeping environment	27	16.5
Usage of electronic devices before sleep (mobile phones/laptops/mp3/etc.)	31	18.9
Medical conditions (depression/sleep apnoea)	9	5.5
Video game addiction	7	4.3
I don't feel that my sleep quality/quantity is diminished	11	6.7
STRESS INTERFERES ABILITY TO FALL ASLEEP		
Not often (1 - 2 days a week)	109	66.5
Somewhat often (2 - 3 days a week)	34	20.7
Often (3 - 4 days a week)	17	10.4
Very often (at least 5 days a week)	4	2.4

stress in these students with potential long-term consequences for both individual's health and the overall performance of the health care system. Sleep disturbance could be either a cause, symptom or comorbidity with stress or with a psychiatric disorder [9]. Stress may cause many sleep difficulties, such as restless sleep, mid-sleep awakening and waking up too early. Medical students are subject to high levels of stress and work hard to increase and maintain their grade point average (GPA) at the expense of sleep [10].

This study also found that another factor that diminishes the quality and quantity of sleep is the usage of electronic devices before sleep with 18.9% about 31 medical students. A study in America found that 72% person bring cell phones into their bedroom and use them when trying to sleep and 28% person leave their phones before sleep [11]. Based on research done on medical students, 38.9% of the 36

students attending the same school schedule had a poor sleep quality according to the Pittsburgh Sleep Quality Index (PSQI) through the questionnaire [12]. A correlation between sleep onset, sleep irregularity and sleep length can be identified together with academic performance. Despite staying up for academic purposes, it disrupts the quality of sleep-wake cycle where it does not only increase fatigue and sleepiness but also worsens cognitive performance. This study is supported by recent research proving that poor quality of sleep is due to students afraid of missing out hence they are reported to assess technology use before sleep, technology use during sleep and social media use for both academic and non-academic purposes [13]. Students need to have a normal sleep cycle and this act can be done by researchers or higher authority to teach the students how to effectively manage sleep can improve their well-being.

Sleep deprivation will lead to a weak immune system by modifies various components of the immune system [14]. One of them is a decrease in cytokine levels. In a normal night-time sleeping habit, there will be an increase of cytokines and melatonin and decrease of cortisol. Cytokines affect the growth of all blood cells and other cells that help the body's immune and inflammation responses. They also help to boost anti-cancer activity by sending signals that can help make abnormal cells die and normal cells live longer.

Sleep deprivation has a great impact on the cardiovascular system. The sleep duration is an independent predictor for morbidity and mortality of the cardiovascular disease [15]. Cardiovascular disease is a non-communicable disease and is defined as a condition that involved narrowing or blocking blood vessels which may lead to heart attack, angina or stroke. According to Department of Statistic of Malaysia, cardiovascular diseases have been the leading cause of death in Malaysian since the early 1980s until today [16]. A few studies suggested that sleep deprivation has been related to a great risk of myocardial infarction and heart failure [17-18]. Sleep deprivation can also increase the sympathetic outflow to the heart or periphery through increasing catecholamine level, coronary vasomotor tone, blood pressure and heart rate, thus alter the balance between demand and supply of oxygen [19-20]. Hence, some studies rules out as blood pressure is significant to lead to hypertension that will deduce in high afterload pressure, exacerbating cell death and increase the risk to have cardiovascular disease [21-22].

Sleep deprivation was also found to be associated with mood deficit especially those that trigger an emotional response. Sleep was actually has a role in regulating emotional brain-states [23]. A study found out sleep deprivation associated with reduced functional connectivity between the amygdala and the medial prefrontal cortex (mPFC). A study found that reflecting sleep deprivation can induced disruption of top-down control of emotion as it was claimed to reduce prefrontal-amygdala functional connectivity [24]. Sleep deprivation can lead to serious changes in mood states and their regulation [25-27].

Sleep deprivation can also lead to obesity. Insufficient sleep is a possible cause of weight gain and obesity and have been researched by many scientific works of literature [28]. Sleep and obesity association has proved that insufficient sleep will increase the food intake during the night. In addition, short sleep duration, poor sleep quality, and late bedtimes are all associated with excess food intake, poor diet quality, and obesity in the modern obesogenic environment. Those people also not prefer to do some exercises during the day that increase the risk to become obese. A study found that fatigue and tiredness of sleep deprivation people, they tend to cut their physical activity and increase sedentary behaviour [29].

Sleep deprivation will increase the risk to have diabetes. Sleep duration of either 6 hours or less or 9 hours or more was associated with increased

prevalence of diabetes or glucose intolerance, compared with 7 to 8 hours of sleep per night, adjusted any confounders [30]. According to another study, sleep loss contributes to the development of insulin resistance and type 2 diabetes through multiple pathways, including a deleterious effect on glucose homeostasis, increased inflammation, and adversely affecting appetite regulation, leading to increased food intake, weight gain, and ultimately obesity [31].

In summary, research on the effect of sleep deprivation is significant because many people have different side effects of sleeping deprivation depending on their reasons. There has been much research and discussion conducted on these opinions of these community that are sleep deprived, including their factors, culture, sleep cycle behaviour resulting in conflicts with an impaired learning skill. Most of the research found was on the medical students and their components in academic performances.

CONCLUSION

This results strongly support further investigation of the important aspect of medical students' life such as, sleep deprivation since coming to the university, sleep needed to function well, average hours of sleep per night and sleep behaviour and main sleep complaints. These could encompass the ability to concentrate as well as different aspects in learning and neuropsychological. In the future study, it is demanded to include more parameters. Biological marker such as cortisol level detection can be implemented as one of the tools of precise indicator of measurement sleep deprivation. Further investigation should focus and study also to other subgroups that have more psychological dysfunction, the nature of dysfunction and associated risk and protective factors. The improvement in the sleep variables may lead to sleep problems such as insomnia, parasomnia and breathing problem during sleep and a better life quality, which should be assessed in future studies.

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