

Association of Quality of Sleep and Decreased Short Term Memory Function in Medical Students of Pelita Harapan University

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Abstract

Background: Memory is a place where information is stored from the learning process or experience. There are several types of memory , one of them is short term memory. Declining sleep quality is directly proportional to the decrease in short-term memory. Poor sleep quality is often associated with medical student due to exams or vast amount of tasks. Therefore, researcher wants to see whether there is significant correlation between sleep quality and short-term memory function in students.

Aim: To assess the association of the quality of sleep towards short term memory function of medical student of Pelita Harapan University.

Methods: This study was conducted with a cross-sectional method, with taking sample using the method of a simple random sample. A total of 90 respondents at University of Pelita Harapan were taken. Data collected sorted out according to the inclusion and exclusion criteria. Quality of sleep assessed with PSQI questionnaire while short-term memory assessed by Digit span backward test. Results processed with SPSS version 24 and tested with Chi Square.

Results: Data analyzed by Chi square test showed there are 33 students (58.9%) have poor sleep quality and short term memory function. There are also significant association between the quality of sleep and short term memory function (p value = 0.026)

Conclusion: There is significant association between the quality of sleep and short term memory function of medical student of Pelita Harapan University

Introduction

Memory is one of the most important aspect that can affect students performance in learning activities. It's definition is the process by which information obtained through learning activities or experiences, is stored and can be reused in the future.¹ Memory can be classified into three, which are short term memory, medium memory and long term memory.² Short term memory consists of a few chunks of information which will be stored in a coded form.³ Those information will be kept for a limited capacity and time. There are several factors that can affect memory, one of them is sleep quality.

Sleep is defined as the state of unconsciousness, but become aware when there is stimulus.² During sleep, the brain activity, which is an active process, will continue to run.⁴ The restoration of the body's energy is a function of sleep. This is needed by everyone to achieve optimal body condition for the next day. The need for optimal sleep duration for each person is different. It is influenced by many factors, one of them is age. For example, babies or toddlers need more sleep duration than adults. For young adults, the duration of sleep needed generally around 7 to 8 hours per day.⁵

A good sleep quality can be seen when someone has a good night's sleep or there were no distractions and difficulties during sleep until he wakes up. The quality of sleep can be assessed from several component in the Pittsburgh Sleep Quality Index (PSQI) measurement. There are seven indicators of sleep quality, which are subjective sleep quality, latency or difficulty when starting to sleep, duration, efficiency of sleep, sleep disturbances, use of sleeping pills and presence of disturbances during daytime activities.⁶

Based on the research conducted by Ajeng Hana Anjani Djajaatmadja in 2016, there was a positive correlation between poor sleep quality and decreased short term

memory in the elderly.⁷ This study shows that having a poor sleep quality tend to result to a decreased short term memory function. Another research by Weizhen Xie, Anne Berry, Cindy Lustig, Patricia Deldin and Weiwei Zhang in 2019 showed a similar result. This study had concluded that poor sleep quality was highly correlated with reduced working memory capacity in college students from University of California.⁸ However, contrary to the two previous studies, a research titled "Effects of sleep deprivation on cognitive and physical performance in university students" by Yusuf Patrick, Alice Lee, Oishik Raha, et al, which was conducted on 2017, showed that there was no correlation between sleep deprivation and cognitive performance.⁹ Negative correlation was also found in a study titled "The relationship between subjective sleep quality and cognitive performance in healthy young adults: Evidence from three empirical studies" by Zsofa Zavecz, Tamas Nagy, Adrienn Galko, Dezso Nemeth & Karolina Janacsek in 2020.¹⁰

Poor sleep quality is often associated with medical students, due to the large number of tasks or study material that has to be learned. This reason and inconsistency result among previous studies about sleep quality and short term memory function, drives the researcher to conduct a study to know whether there is a relationship between poor sleep quality and decreased short term memory function in medical students.

Materials And Method

This analytical study is an unpaired comparative analytic cross-sectional study design, which was carried out for 4 months, starting from January 2019 to April 2019. This study was conducted at the Faculty of Medicine of Pelita Harapan University. Minimum sample size estimation was calculated by a simple random sample method. The result was a total of 51 samples. Data was obtained through the filling out of the Pittsburgh Sleep Quality

Index (PSQI) questionnaire and Digit span test.

The materials used in this study include the following. Informed consent sheet, to indicate that the respondent agreed to be a sample in this study. Faculty of medicine of Pelita Harapan University demographic information as the list of sample for this study. PSQI questionnaire, which had been translated into Bahasa Indonesia, to assess respondent's sleep quality. Digit span test, to assess respondent's short term memory. Lastly, Depression, Anxiety and Stress Scales (DASS-42) questionnaire, which had been translated into Bahasa Indonesia, to determine whether the sample is under stress or not.

Faculty of Medicine of Pelita Harapan University students, class of 2016, 2017 and 2018 were taken as the subject for this study. Firstly, the researcher explained the purpose of the study and provided a DASS-42 questionnaire to determine whether the sample is stressed or not. Those who falls into the stress category were excluded from the study, while those who are not were continued to the next stage. This was because psychological conditions such as depression and anxiety may impair quality of sleep or short term memory functions. Therefore, this questionnaire made sure subjects that falls on stress or depression category was not included in this study. There were 3 aspects being monitored in this questionnaire, which are stress, depression and anxiety, that were assessed in DASS-42 questionnaire. If the subjects scored 0-14 in stress category, 0-9 in depression category and 0-7 in anxiety category, they were included in the study. A total score achieved above those range, shows that the subjects were under stress, depressed or anxiety. By this process, the researcher can filter the subjects before proceeding to the next process.

Later on, informed consent was given. After the subject agreed to participate in the study, their personal data, filled out PSQI

questionnaire and digit span test result were collected.

The total score obtained from PSQI questionnaire will give two results, which are good and poor sleep quality. A total score of < 5 indicate a good sleep quality, while ≥ 5 signify a poor sleep quality. There are 2 types of digit span test, which are forward and backward digit span test. In this study, backward digit span test was performed. It is said that short term memory performance is poor when the total score obtained < 6 , while ≥ 6 indicate a good short term memory performance.

All data that had been obtained then processed using SPSS software version 24.0 and tested with Chi square.

Results

Over 4 months of study, there were 90 students from Faculty of Medicine at Pelita Harapan University who met the inclusion and exclusion criteria. There were 39 male students (43.3%) and 51 female students (56.7%). The age varied from 18 to 25 years old and median value at the age of 19. The average body weight was 58.43 ± 8.00 , height was 165.31 ± 7.84 and body mass index was 21.28 ± 1.47 .

There were 56 students (62.2%) had poor sleep quality, while 34 students (37.8%) had good sleep quality. The result of short term memory function of the students, based on Backward digit span test, were 44 students (48.9%) had poor short term memory function and the other 46 students (51.1%) had good short term memory function.

Table 1. Subjects Characteristics

Subject Characteristics (n=90)	n
Gender	
Male	39 (43.3%)
Female	51 (56.7%)
Age (years)	
Mean ± SD	19.33 ± 1.08
Median	19
Min	18
Max	25
Weight (kg)	
Mean ± SD	58.43 ± 8.00
Median	57.50
Min	44.00
Max	87.00
Height (cm)	
Mean ± SD	165.31 ± 7.84
Median	165.0
Min	150.0
Max	192.0
Body Mass Index (BMI)	
Mean ± SD	21.28 ± 1.47
Median	21.88
Min	18.56
Max	23.60
Quality of Sleep	
Poor	56 (62.2%)
Good	34 (37.8%)
Short term memory function	
Poor	44 (48.9%)
Good	46 (51.1%)

Gender and Sleep Quality

In this study, there were 15 male and 19 female students who had good sleep quality, while there were 24 male and 32 female students with a poor sleep quality. The relationship between gender and sleep quality was insignificant because the p value obtained was 1.000 (p value >0.05).

Table 2. Association of Gender and Sleep Quality

	Quality of Sleep		Total	OR (95% CI)	P value
	Good	Poor			
Male	15 (38.5%)	24 (61.5%)	39 (100.0%)	0.950 (0.402- 2.243)	1.000
Female	19 (37.3%)	32 (62.7%)	51 (100.0%)		
Total	34 (37.8%)	56 (62.2%)	90 (100.0%)		

Gender and Short Term Memory

On table 5, there were 19 male and 27 female students had a good short term memory, while 20 male and 24 female

students had a poor short term memory. The relationship between gender and short term memory was also insignificant, as the p value was 0.854 (p value >0.05).

Table 3. Association of Gender and Short Term Memory Function

	Short Term Memory		Total	OR (95% CI)	P value
	Good	Poor			
Male	19 (48.7%)	20 (51.3%)	39 (100.0%)	1.184 (0.514- 2.728)	0.854
Female	27 (52.9%)	24 (47.1%)	51 (100.0%)		
Total	46 (51.1%)	44 (48.9%)	90 (100.0%)		

Sleep Quality and Short Term Memory

The relationship between sleep quality and short term memory function was tested with Chi square in SPSS program. The result obtained indicate that there is significant relationship between the two, as the p value was 0.026 (p value <0.05). Poor sleep quality result to a decrease in short term memory function. This can be seen through the presence of 33 students with poor sleep quality had a poor short term memory function, while there were only 11 students with good sleep quality and poor short term memory function.

Table 4. Association of Sleep Quality and Short Term Memory Function

Variable	Short Term Memory		Total	OR (95% CI)	P value
	Good	Poor			
	Quality of Sleep	23 (67.6%)			
	Good	Poor			
	23 (41.1%)	33 (58.9%)	56 (100.0%)		
Total	43 (47.8%)	47 (52.2%)	90 (100.0%)		

Discussion

This study aims to determine the association between sleep quality with a decrease in short term memory function of medical students at Pelita Harapan University. Based on the result that had been obtained, the p value was 0.026, indicating that there was a strong relationship between the two variables. There was a significant difference in total number of students who had poor short term memory function on a good sleep quality and poor sleep quality. There were 11 students (32.4%) and 33 students (58.9%) respectively.

The result obtained was in line with the research conducted by Ajeng Hana Anjani Djajaatmadja (2016) entitled "Relationship between Sleep Quality and Short-term memory in Non-dementia Elders" with p value 0.001 (p value <0.05). This study stated that disturbances in sleep result in poor sleep quality and eventually causes a decrease in short term memory function.⁷ It was supported by another study by Ady Nugroho Solikhin et al (2016) entitled "The Relationship between Sleep Duration and Short term memory of students at Darul Hikam middle school in Bandung Academic Year of 2015-2016". Analysis between the two variable had a p value of 0.042 (p value <0.05).¹¹ Similar result was also obtained by a study conducted by Ayesha Uddin (2015) entitled "Effects of Sleep on Vigilance, Short Term Memory, and Learning in College Students" with a p value of 0.008 (p < 0.05).¹²

Poor sleep quality can cause a decrease in short term memory function. This is due to the presence of neural activation in the prefrontal and parietal cortex during sleep, especially in slow-wave sleep. Neural activity affects the anterior cingulate cortex (ACC), which has an important role in regulating level of attention. According to stages of memory formation, in order for information to enter short term memory, a good attention is needed. This will allow information from sensory, auditory or visual stimulus can be forwarded from ACC to

enthorinal cortex (EC) in the hippocampus, which is a short term memory storage. Poor sleep quality interfere this process, resulting a decrease of neural activation in ACC and disturbing the function of EC. As a result, short term memory function will also decrease.^{13,14} In addition, memory storage process is said to be more efficient during sleep, therefore sleep deprivation will also affect memory function.¹⁵

Based on the discussion above, it can be concluded that there is significant association between sleep quality and a decrease in short term memory function on medical students of Pelita Harapan University.

In this study, Chi square test was also performed to test between the variable of gender and sleep quality. This test was carried out to see whether or not gender has an association with sleep quality. The p value result was 1.000 (p value > 0.05). This shows gender has insignificant relationship with one's sleep quality. However, this result was contrary from previous study by Yaqoot Fatima et al (2016), which stated that women have a greater predisposition to poor sleep quality compared to men.¹⁶

In addition to seeing the relationship of gender with sleep quality, its relation with short term memory was also seen. The p value obtained was 0.854 (p value > 0.05), so it can be concluded that there was insignificant relationship between gender and short term memory. This too, contrary to the research conducted by Dr. Selwin Gabriel et al (2016), which states that there was a meaningful relationship between the two variable. Dr. Selwin's research used Word list recall to assess short term memory function¹⁷, while this study use Backward digitspan test. The difference of measurement tool use may be the cause of different results obtained.

There were several limitations in this study. This research does not discuss other factors that might affect sleep quality or short term

memory function, such as dwelling, diet and others. Data taken on subjects was only once, therefore increasing the risk of invalid result. Therefore, further research is needed by including other confounding factors, and if possible, data collecting process could be done more than once to get a more valid result.

Conclusion

There is a significant relationship between sleep quality and short term memory function among medical students of Pelita Harapan University.

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