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Sleep quality and attention of senior high school students

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ABSTRACT

Background: A successful learning process can be influenced by an individual's attention level that can affect his/her concentration level and memory capacity. Some psychological and neurological aspects contribute to the attention level. If an individual experiences attention disorder, he/she can be difficult to learn and work efficiently. One of factors that may affect the individual's attention is sleeping quality. A sufficient sleeping quality plays an important role in an individual's development and daily activities.

Objective: This study aims to analyse relationships between the sleeping quality and the attention of students to improve their learning performances.

Methods: This study was an observational analysis study with a cross-sectional design that involved 87 senior high school students. The inclusion criteria of this study were male/female students between 14 to 19 years old who were willing to be respondents by signing informed consent form. Its exclusion criteria were male/female students who were experiencing brain-related injuries and who were on medical treatment causing drowsiness such as influenza drugs, cough syrups and sleeping pills. This study was conducted for four months. The data were collected by interviews and questionnaires including identity data, educational level, Pittsburgh Sleep Quality Index valuation and digit span tests. The samples were collected with a consecutive non-random sampling method. Its data analysis was conducted by applying SPSS V.21 through Chi-Square statistical test with a significance level of 0.05.

Results: Of the 87 respondents, 50.6% were females and 35.6% were 15 years old. The majority of them were at class X (10th grade). Also, 52.9% of them had low sleeping quality and 74% of them suffered bad attention. Based on the Chi-Square test, the relationship between the sleeping quality and the attention level was not significant with p value of 0.938.

Conclusion: There was no a significant relationship between the sleeping quality and the attention levels on the senior high school students.

Latar Belakang: *Keberhasilan suatu proses pembelajaran berkaitan dengan tingkat perhatian yang akan mempengaruhi tingkat konsentrasi dan daya ingat seseorang. Berbagai aspek psikologis dan neurologis terlibat dalam proses perhatian ini. Jika seseorang mengalami gangguan perhatian, maka akan sulit bagi orang tersebut untuk belajar dan mengerjakan hal-hal baru secara efisien. Salah satu faktor yang dapat mempengaruhi daya perhatian seseorang adalah kualitas tidur. Kualitas tidur yang baik memainkan peran penting dalam perkembangan dan aktivitas seseorang sehari-hari.*

Tujuan: *Penelitian ini bertujuan untuk menganalisis hubungan kualitas tidur dan perhatian siswa agar dapat diperoleh peningkatan prestasi belajarnya.*
Metode: *Metode yang digunakan dalam penelitian ini adalah studi analisis observasional dengan desain potong lintang yang melibatkan 87 siswa SMA. Kriteria inklusi penelitian ini adalah siswa/siswi berusia antara 14 sampai 19 tahun, bersedia dilibatkan dalam penelitian ini sebagai responden dengan menandatangani formulir informed consent. Kriteria eksklusi adalah siswa/siswi yang sedang menjalani pengobatan yang menyebabkan kantuk seperti obat influenza, sirup obat batuk, dan obat tidur, serta mereka yang mengalami cedera pada otak. Penelitian ini dilakukan selama 4 bulan. Data yang diperlukan dikumpulkan melalui wawancara dan kuesioner yang mencakup data identitas, tingkat pendidikan, penilaian Pittsburgh Sleep Quality Index, dan tes rentang digit. Sampel diambil dengan metode consecutive non-random sampling. Analisis data dilakukan dengan menggunakan SPSS V.21 melalui uji statistik Chi-Square dengan taraf signifikansi 0,05.*
Hasil: *Dari 87 subjek, 50,6% adalah perempuan, 35,6% subjek berusia 15 tahun, saat ini duduk di kelas X, 52,9% adalah siswa dengan kualitas tidur rendah dan 74% mengalami perhatian yang buruk. Berdasarkan uji Chi-Square didapatkan bahwa kualitas tidur tidak berhubungan secara signifikan dengan tingkat perhatian dengan nilai p 0,938.*
Kesimpulan: *Tidak ada hubungan signifikan antara kualitas tidur dengan tingkat perhatian pada siswa SMA.*

INTRODUCTION

Attention is one of the most important aspects of an individual's cognitive function. It can be defined as an effort of mind to consciously focus on an object in order to understand it.[1] A number of psychological and neurological aspects are involved in the attention process. It is a small component of stage of an individual's memory during his/her thinking process. When an individual experiences attention disruption, he/she will difficult to learn and work on new objects that require attention.[2] It will affect his/her concentration level. In a previous study in Surakarta, it was revealed that 48.25% of teenagers suffered low concentration capacity, and 10.86% of them had low attention levels.[3] Furthermore, the attention is vital for students to perform their learning activities and to increase their memory capacity. When they are learning in school, they will face numerous materials that require them to think not only on a visual manner but also in a complex manner which highly requires prime attention.[4]

There are various factor that may affect an individual's attention level such as head trauma, stress factor, sleep quality and drug use. Sleep quality is one of the most influential factor of an individual's ability to maintain his/her attention level.[5] A cross-sectional study conducted by Surbakti et al. in Medan City found that only 54.8% of their respondents who had sufficient sleep quality.[6] Low sleep quality on students are correlated with their busy activities in academic and non-academicals activities or other types of activities that can reduce their sleep time. In addition, social factors like electronic devices in bedrooms (such as television, gadgets and computer), habits (such as coffee consumption and smoking) and other factors (such as stress, anxiety and depression) can affect the sleep quality.[7-9]

Sleep can be described as a condition when an individual is unconscious, but he/she can be interrupted by providing sensory stimulation or any other types of stimulations. There are stages in a sleep, starting from light sleep to high quality sleep; these are expected to rejuvenate an individual's condition, which enables him/her to perform normal activities and to balance his/her central nerve system. Factors that may affect his/her ability to achieve sufficient quality of sleep are sleep duration, sleep onset, sleep disorders, drug consumption and sleeping habit. These will not only affect his/her emotional development but also relate with his/her cognitive, learning and attention functions.[7-10]

The low sleep quality and quantity among teenagers can impact their academic performances mostly by lowering their motivation to participate at school, lowering awareness and concentration levels, affecting their emotional level and causing concerning levels of sadness. Insufficient sleep quantity and low sleep quality can cause both physical

and psychological imbalances of an individual. Natural sensory stimulation such as sound, light and certain types of movements may affect levels of sleep initiation and quality. If the teenagers have low sleep quality and quantity, they will experience heavy drowsiness and lower attention levels during the day. Sleeping pattern disorders such as excessive amount of sleep will contribute to negative impacts such as low learning performances, cognitive function, and mood.[8,11,12]

Some previous studies concluded that there was a relationship between sleep quality and attention levels.[11,13] However, another study also concluded that there was no a significant relationship between sleep quality and attention levels.[6] Concerning the studies that were not in line and the importance of students' attention for their study, the authors aim to study further on the relationship between the sleep quality and the attention on the students.

METHODS

Research Design

This study applied an observational analytic method with a Cross-Sectional research design. It was conducted at BPK Penabur 3 Christian High school in Bandung from August to October in 2016.

Experiment Procedure

87 students were chosen as subjects of this study. Its inclusion criteria were high school students with ages of 14 to 19 years old and were willing to be participants by signing an informed consent form. Its exclusion criteria and were students with history of brain injury and were students undergoing medical treatment or drug consumption that produce drowsiness such as influenza drugs, cough syrups and sleeping pills.

The number of samples of this study were calculated by using the following formula:

$$no = \frac{Z\alpha^2 \times p \times q}{d^2}$$

n = the required optimum sample

Zα = on a significance level of 95%, the value was at 1.96

p = prevalence of 10.86%

q = prevalence of subjects not suffering from the studied phenomenon (1–p) = 0.8914

d = accuracy of measurement was predetermined at 0.05

On a corrected finite population:

$$n = \frac{n_0}{\left(1+\frac{n_0}{N}\right)}$$

N = number of students was 150

n_0 = sample size on a finite population

n = sample size required for a finite population

The final required sample size was 15% or 87 subjects. The subjects were selected by using a consecutive non-random sampling method

Data Collection

The required data were collected by interviews and questionnaires to determine socio-demographic characteristics of the subjects (age, sex, level of education). To measure the sleep quality levels, the authors applied Pittsburgh Sleep Quality Index (PSQI) consisting of 7 components. Those were subjective sleep quality, sleep latency, sleep duration, daily sleep efficiency, sleep disorders, sleeping pills consumption and daily activity dysfunction. The results were divided into two main groups, sufficient sleep quality (score ≤ 5) and low sleep quality (score > 5). To measure the attention levels, the authors applied Digit Span Test forward and backward valuation sheets consisting of 8 lines of numbers; each line was divided into section a and section b. Score for each successful line was 1, and 0 was for failed line. The attention was categorized as good when the score was ≥ 8 digits (forward) and ≥ 7 digits (backward). However, when the score was < 8 digits (forward) and < 7 digits (backward), it was categorized as low attention level.

Data Analysis

The data was descriptively presented in a form of percentage. Chi-Square test was applied to analyse the relationship between the sleep quality and the attention. The significance level of this study was 0.05.

Ethical study

This study obtained an ethical clearance letter from Research Ethical Commission of Faculty of Medicine, Universitas Trisakti, with No.58/KER-FK/VII/2016.

RESULTS

Of the 87 subjects, there were 31 subjects who are students with the age of 15 years old (35.6%) and 44 of them are females (50.6%). The majority of the subjects (33 students) were at class X (10th grade) (37.9%). Then based on the sleep quality measurement by the PSQI score calculation, 46 subjects (52.9%) had high sleep quality. However, results of the attention test showed that 64 students (74%) had low level of attention, while 26% of them had high level of attention (Table 1).

Table 1.Characteristics of the subjects (n= 87)

Characteristics	Total N (%)
Sex	
Male	43 (49.4)
Female	44 (50.,6)
Age	
14	7 (8)
15	31 (35.6)
16	26 (29.9)
17	20 (23)
18	3 (3.4)
Grade	
X	33 (37.9)
XI	26 (29.9)
XII	28 (32.2)
Sleep quality	
High	46 (52,9)
Low	41 (47.1)
Attention	
High	23 (26)
Low	64 (74)

Based on the Table 2 below, there were 31 male students with low level of attention (71.1%), which was lower than the 33 female students (75%), even though they were statistically insignificant (p=0.759). The grade levels also showed a statistically insignificant relationship (p=0.301). Most of the students (46 students) had high sleep quality (52.9%). However, of these 46 students, 34 of them (73.9%) experienced low attention level. Meanwhile, of the 41 students with low sleep quality, 30 students (73.2%) experienced low attention level. The Chi-Square test indicated statistically insignificant relationship between the sleep quality and the attention (p=0.938).

Table 2. Relationship between sex, grade and attention levels on the students (n=87

Variables	Attention Levels		p
	High (%)	Low (%)	
Sex			
Male	12 (27.9)	31 (71.1)	0.759
Female	11 (25)	33 (75)	
Grade			
X	6 (18.2)	27 (81.8)	
XI	7 (26.9)	19 (73.1)	0.301
XII	10 (35.7)	18 (64.3)	
Sleep Quality			
High	12 (26.1)	34 (73.9)	0.938
Low	11 (26.8)	30 (73.2)	

DISCUSSION

The results of this study showed that the characteristics of the subjects based on their sex and levels of education were evenly distributed. Based on the obtained data and the PSQI score, 52.9% of the students had high sleep quality. This result is higher than a result of a previous study showing 40% of subjects with high sleep quality.[3] This result is possible because the subjects involved were from different levels of education and location. A study in Argentina found that students were generally sleeping in average length of 6.48 hours.[14] Sleep is a physiological requirement for each individual as it impacts brain performance. Teenagers usually sleep between 8-10 hours each night to prevent lowered immunity and concentration levels. However, 20% of teenagers suffers rapid eye movement (REM) sleep. REM sleep is important to recover cognitive ability because this type of sleep is connected with cerebral blood stream changes, cortical activity increase, escalated oxygen consumption and epinephrine release, which assists memory storage and learning processes. During their sleeping hours, brain will filter and store every information and activity experienced on their day.[12,15-18]

Sleep quality is more important than sleep quantity. High quality of sleep is a deeply uninterrupted sleep and can be easily continued when awaken. Low sleep quality is related to several factors such as age, sex, anxiety, depression, caffeine consumption habit, busy academic and non-academic activities that reduce sleeping time.[8,19] Low sleep quality will involve higher cortices-cortical circuit roles (selective and divided attention) and higher participation level of prefrontal cortex affecting attention levels.[15] Sleep quality has impacts on physical, emotional and mental conditions. Less sleep quantity or low sleep quality can cause an individual to experience drowsiness, tiredness and emotional disorders that can also lead to inability to perform learning activities.[20] Various stressors faced by students such as new environment, educational problems or competition between students can be considered as long-term chronic stress that can lead to both physical and mental health. Students with high level of stress may experience mental illnesses such as anxiety, depression, inability to concentrate and cooperate in learning groups and low responsibility on their learning performances.[14,15,20]

In this study, the authors found that most of the subjects (74%) experienced low attention level, and only 26% of them had high level of attention. This result shows lower percentage than a previous study finding 73.5% of total subjects with high attention level.[14] Psychological

and neurological aspects that are parts of cognitive process are some factor of the attention. It is formed by a specific system that involves three areas in the brain functioned as an alerting tool, an orienting tool and an executive attention tool. The three area are the frontal and parietal cerebral cortex, the posterior area, and the cingulate anterior and prefrontal lateral cortex areas, respectively.[21] An individual with brain injury, drug consumption, low sleep quality and stress tends to have lower attention level.[6] The attention level is mostly affected by the students' interest on some presented objects and their curiosity to gain information. Media to share information and teachers' ways of giving information affect the students' attention levels.[14,15]

This study indicated that there was an insignificant relationship between sex and attention. The subjects, both males and females, were found to experience low level of attention. This result is similar to a study by Solianik R et al. stating that average conditions of attention level and memory capacity was similar enough on both males and females. Some inter-individual factors such as short-term memory capacity disorder and easily-distracted attention were mostly discovered on the females. This was because of lower cognition ability on the females and males.[22] Another study also concluded that there was a different level of attention on males and females as the males tend to focus better than the females, which eventually affect their motoric skill capacities. The motoric skills were also affected by experience, physical development, inheritance factor and an opportunity to be involved. Some instructions might be able to drive a more focused attention to improve learning outcomes.[23]

The differences of the attention levels on both sexes were also related to sleeping disorders. A study in China reported that females have high prevalence of insomnia than males. The females had longer sleep duration than the males, but their sleep quality is lower than the males. Some factors that might cause the sleep disorders were different circadian clock genes, sexual hormones, responses on stressors, behavioural patterns and demographic factor. Moreover, it might be influenced by the existence of environmental aspects such as noise exposures, pollution or habit. Piccinelli and Wilkinson mentioned that some factors of sleep disorders were age, sex, occupation, lifestyle, emotional stress and living environment.[24,25]

The increase of age can produce attention disorders that may vary in each individual. However, those are generally higher on older individuals. Individuals with older ages can experience a slight degeneration of brain function that influences their concentration. A decrease of memory capacity also happens with age. Memory degeneration can be seen after 40 years old. A trained individual will possess better level of attention than the types of stimuluses. However, the attention level will be better on a preferred stimulus, or the stimulus is considered important for them. Levels of readiness in individuals to receive stimulus can also affect their attention level. Examples of stimulus that may influence the attention are moving objects and objects with higher intensities or pressures.[26-28]

This study also revealed that there was no a significant relationship between the level of education and the attention. This might occur because the attention could be influenced by some factors such as internal motives (interests, willingness and health status) and external motives (socio-cultural factors, relationships between friends and environment). However, other studies concluded that there was a relationship between levels of education (grade) and attention of the students due to some factors such as new environmental condition, new classmates, cultural changes and new learning schedules. There are some ways to improve the attention such as time table making, scheduling, creating conducive environment and self-motivating.[10,29,30]

This study also found that there was no a significant relationship between the sleep quality and the attention. A study by Surbakti similarly concluded that there was no a significant relationship between the sleep quality and

the attention, in both orienting and executive attention.[6] This result is different with a theory mentioning that sleep deprivation can cause attention failure, lowered cognitive capacity, learning difficulties, memory processing capacity and attention on an individual. The attention process is affected by the sleep quality. When an individual is sleeping, there is a coupling process of the striatum ventral that is important to reward his/her body with dorsolateral prefrontal cortex (DLPFC) that regulates the attention. DLPFC is a part of brain that develops during childhood transition. Children who experience continuously low sleep quality will experience DLPFC development disorder which further affects their cognitive function.[5,31,32]

Learning process of a new memory into a long-term memory requires consolidation of memory and attention. The attention is formed by the existence of a response on presented stimulus towards one of senses. It will also escalate significantly when the stimulus is preferred and consciously observed. The mind will never be able to concentrate to a single object. However, if individuals understand what they see, their mind will concentrate better. Stress levels on students can cause difficulties to concentrate, lowered attention, memory degeneration and inability to solve problems. The stress will affect the attention because it causes disturbance on prefrontal cortex that plays an important role on attention building process.[33,34] In addition, breakfast habit can also improve cognitive function by channelling nutrition towards the central neural system. If glucose supply is unable to fulfil metabolic requirement, it will never be able to fulfil the same requirement on the brain. Changes of blood glucose concentration will also affect serotonin hormones and cortisol production that play important roles on cognitive behaviour process. Serotonin is a neurotransmitter that stimulates prefrontal cortex responsible for the attention, executive function and cognitive function such as mood, emotion and memory.[35-37]

Furthermore, this study has some limitations that need to be addressed such as biological factors, socio-psychological factors, environmental factors, attitudes, habits, movements and stimulation intensity factors. In addition, the schedule of this study is adjusted to the students' schedule, and the attention assessment is conducted on a different time for each student.

CONCLUSION

It could be concluded that there was no a significant relationship between the sleep quality and the attention on the senior high school students. Also, this study suggests to conduct further studies with longer time and more complete variables.

CONFLICT OF INTEREST

The authors state that there is no conflict of interest in this study.

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