

Better Sleeping Quality in a Youthful Cohort Is Associated with Better Emotional Regulation, Reaction Speed and Short Term Memory Skill

Ruohan Hu

Shanghai United International School Gubei Campus, Shanghai, Shanghai 201103, China

Keywords: Sleeping Quality, Emotional State, Short-Term Memory, Stimuli.

Abstract: Sleep is an essential aspect of our life. Sleeping plays a significant role in refreshing the brain, it can remove the toxic from the brain which sustains oneself for a whole day. Tiredness, concentration problems, loss of appetite can become direct consequences of sleeping deprivation. As a team, this work decided to investigate into the correlation between sleep and these distinct aspects. In general, to conclude our researches, the analysis supported the hypothesis on the positive correlation between sleeping quality and short term memory. The correlation between sleeping quality and emotional state and reaction speed shows no significant results. Also, this work would develop further on the correlation between depression level and reaction speed to observe farther impact for emotion onto perceptual learning ability.

1 INTRODUCTION

Processes related to keeping circadian rhythm have not been given a specific suggestion of how should one maintain and evaluate its sleep cycles. Yet, there are hypotheses explaining the purpose and the importance of keeping a daily rhythm in sleeping. During the progress of sleeping, rhythm can be seen as a brain's function to disconnect the cortex from sensory input, thus achieving the effect of refreshing the brain system. Distinct neurons can perform differently when getting through REM state. A suitable example would be acetylcholine which is a neurotransmitter to help your brain keep information gathered while you are awake and regulate REM sleep. (Watson, Baghdoyan and Lydic 2010)

Researchers suggested that adequate sleep should be defined as 6–8 hours per night regularly (Chen, Wang, Jeng 2006). However, nowadays, more and more experts suggested using sleeping hours to measure how well a person sleep during the night is not accurate. If individuals wake up at night, snore, or have insomnia, though they sleep for eight hours or even more, they are still in the category of “lack of sleep”. Therefore, using sleeping quality to measure how well a person sleeps during night is a more precise way since this report would take issues as urinary frequency into consideration. An example of

the sleeping quality measurement is the Pittsburgh Sleeping Quality Index. Getting a result of 83% from the total points in PSQI tests would be seen as good.

Getting good quality sleep is significant to people's health, but there is a group of individuals who are developing a stage where they have troubles of falling asleep. Researches conducted by Mary Carskadon at Brown University suggested that “sleep requirements do not decrease between adolescence and teenagers, yet changes in circadian mechanisms make it progressively harder for teenagers to fall asleep early in the evening.” (Carskadon 2012) As a result, teenagers sleeping times sometimes cannot meet the requirements to sustain their daily activities which means that they are facing sleeping deprivation. The list of negative outcomes can be detrimental to adolescents which include inattention, poor grades, behavior problems, substance use, driving crashes, overweight, and immune system compromise. (Xu, and Wu 1986)

Thus, the main aim of this review is to introduce a more detailed way of how sleeping quality can affect adolescents' mood and learning ability. In addition, we describe depression index may appear a positive relationship with reaction speed.

Better performance of sleeping quality in a youthful cohort is associated with emotional regulation, reaction speed and short term memory skill in positive contexts.

2 GOAL AND HYPOTHESIS

There are three hypotheses of this research, all hypotheses are the correlations between sleeping quality and different aspects of living. First of all, we hypothesize better performance of one's sleeping quality results in more positive emotion. Secondly, we hypothesize better sleeping quality Amy results in quicker reaction speed of recognition. At last, we assume that better performance of somebody's sleeping quality results in better short-term memory.

By understanding the results of this study, our goal is to persuade people to take sleep more seriously since sleep deprivation would lead to harmful impacts which can easily affect youngster's mental health and learning ability. To continue, we would like to share our results in adolescence's mental health research. We received 34 participants' answers to a combined survey to test depression level. The mean of the analysis is 12.26 points which is included in the category of "mild depression" area in the marking scheme (With the standard deviation of 6.146). The maximum results of this survey is 24 points which should be categorized in the "moderate depression" area. We want to raise awareness of the mental health issue among young adults and admonish them to take care of their stress and release pressure.

3 METHOD

There are a total of 4 parts in our research process, which were a sleeping quality survey, a temporary emotional survey, a short-term memory test, and a reaction speed test.

3.1 Participants

We choose the participants from the age set of 16-26 since we want to focus on the correlation between sleep and mood as well as learning abilities among youngsters. There is no reward system in this research and we chose to use the method of "volunteering" which is a way of proactively offering work to participants. We expected to receive 160 pieces of information from forty participants, but because some of the data is incomplete, so we finally received 136 pieces of information with 34 participants. Some of the tests were done online via the internet, and some of the tests were done offline in person.

3.2 PSQI Test

The PSQI test is a sleeping quality test called Pittsburgh Sleeping Quality Index. PSQI test is a test consisting of 19 questions measuring the sleeping quality for one month. It is developed by Pittsburgh University and is highly reliable and valid in assessments of sleeping diagnostics. The test includes questions like: During the past month, how long (in minutes) has it usually taken you to fall asleep each night? Or Loud snoring? Long pauses between breaths while asleep? We delivered the test to our participants through a program and waited for their response. Based on the performance of our participants, the mark scheme would be poor (Testing points ≥ 5), the other is good (Testing points < 5).

3.3 Depression Test

Questions from the depression test are chosen from a depression survey from depression.org and mayoclinic.org which are two credible organization that devote them into depression career, depression.org is supported by the New Zealand government. The depression test consist of 20 questions that are evaluated with the marks of 0-3 points in each question while 3 points represented every time, 2 points represented most of the time, 1 point represented some of the time (or rarely) and 0 means never. An example would be: How often have you been bothered by thoughts that you would be better off dead, or of hurting yourself in some way over the last two weeks? Rate from 0-3. The marking scheme would be Depression Severity: 0-10 none, 11-21 mild, 22-32 moderate, 33-43 moderately severe, 44-60 severe.

3.4 Memory Test

According to the Wechsler Memory Scale published in 2009, a neuropsychological test that is used to assess one's general cognitive screener, logical memory, visual memory, we constructed a simplified test a simplified test to mitigate our environmental difficulty. The test includes three sections: association learning, random number quick recalling, and face-associated feature recognition (Vandekerckhove, Wang 2017).

In the first part of the quiz, a total of 18 pairs of Chinese phrases were displayed to the participants, half of the phrases were related to each other and half were not. (eg. Pants-shirts and faith-exaggeration) Participants were given 20 seconds to memorize the words and to write down the exact combination of the

word pair. There are two trails in total.

For the second part of the test, participants were required to memorize random number sequences for the given 1.5 seconds and to write them down within 3seconds. There are eight sequences with 7 numbers, one sequence with 5 numbers, one sequence with 6 numbers, one sequence with 8 numbers and one sequence with 9 numbers. (eg. 3860213)

For the final task in this test, participants needed to remember three lines of information in 15 seconds with connected faces. There were three faces in one slide matching with 3 detailed information for each face. The information included nationality, job and age. Four rounds of trails were conducted, including western male trail, asian male trail, western female trail and asian female trail.

The marking scheme for the memory test are the following. First section: 3 scores for one correct meaningful set, 6 scores for the correct memorization of meaningless sets. Second section: 1 score for the sequence with 5 numbers, 2 scores for the sequence with 6 numbers, 3 scores for sequences with 7 numbers, 4 scores for the sequence with 8 numbers, 5 scores for the sequence with 9 numbers. Third section: 1 score for one correct feature associated with the matching Eastern face, 2 scores for one correct feature associated with the matching Western faces. The test consist of 252 scores in total, participants getting scores higher than 110 would be considered performing well, while those ending up 110 scores or less would be judged as poor.

3.5 Reaction Test

The reaction test examines the reaction speed of the contestants. The participants were asked to find out

requested numbers or Chinese characters in lists of numbers. (eg. Find 6 in 23578495628985687, the real questions are more complicated) There were questions relating to shapes as well. The whole test consists of 11 questions, the researchers didn't need to calculate the exact points but to measure the time for participants to complete. If the participants exceed 160 seconds, they would be seen as poor; if the participants' calculated time is below 160 seconds, they would be seen as good.

4 RESULTS ANALYSIS

We did Pearson Correlation test, obtaining p value and r value. We also completed regression test and t test.

4.1 Pearson Correlation Analysis

According to the Table 1, correlation is significant when the p value is < 0.05. Since the correlation between sleeping quality and depression is p=0.445, and the correlation between sleeping quality and reaction time is p=0.863, unfortunately, we found no significant correlation between sleeping quality and depression, sleeping quality and reaction speed.

The P value for sleeping quality and memorizing index is 0.029, so they are related. The R value indicates whether two variables are positively or negatively related. The range of R value is between -1 to +1. The R value between sleeping quality and memorizing index is 0.374 which means that higher the sleeping quality results in higher short-memory skill.

Table 1: Pearson test correlation.

| | | Correlations | | | |
|-----------------|---------------------|-----------------|-----------------|--------------|-----------------|
| | | SleepingQuality | DepressionIndex | ReactionTime | MemorizingIndex |
| SleepingQuality | Pearson Correlation | 1 | .135 | -.031 | .374 |
| | Sig. (2-tailed) | | .445 | .863 | .029 |
| | N | 34 | 34 | 34 | 34 |
| DepressionIndex | Pearson Correlation | .135 | 1 | -.341* | -.227 |
| | Sig. (2-tailed) | .445 | | .049 | .197 |
| | N | 34 | 34 | 34 | 34 |
| ReactionTime | Pearson Correlation | -.031 | -.341* | 1 | .336 |
| | Sig. (2-tailed) | .863 | .049 | | .052 |
| | N | 34 | 34 | 34 | 34 |
| MemorizingIndex | Pearson Correlation | .374* | -.227 | .336 | 1 |
| | Sig. (2-tailed) | .029 | .197 | .052 | |
| | N | 34 | 34 | 34 | 34 |

*. Correlation is significant at the 0.05 level (2-tailed).

4.2 Regression Test

After determine the positive relationship between sleeping quality and memorizing index. The R Square

value continues indicates the correlation which sleeping quality would have contribution to at least 14% of the memory index score. This is a dominate factor.

Table 2: Regression Test of three variables.

| Model Summary ^b | | | | | |
|----------------------------|-------------------|----------|-------------------|----------------------------|---------------|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1 | .374 ^a | .140 | .113 | 31.466 | 1.405 |

a. Predictors: (Constant), SleepingQuality
 b. Dependent Variable: MemorizingIndex

The histogram of regression residual and the linear P-P plot of regression standardized residual both indicates that the residuals are in a trend of normally distribution. Therefore, the variables did not

appeared bizarre results, and it contributes to the conclusion since the variables were not abnormally affecting the hypothesis.

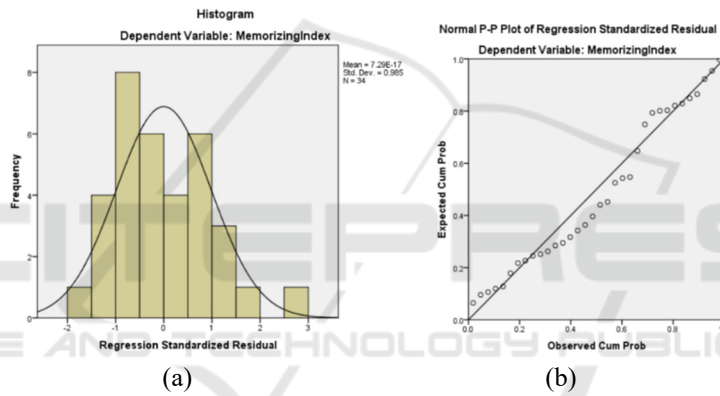


Figure 1: P-P plot of memorizing index.

4.3 T-test

In this test, we divided the participants into two groups based on their results in sleeping quality tests.

The two groups are poor (≥ 5), the other is good (< 5). We found out an implicit positive relationship between sleeping quality and memory index.

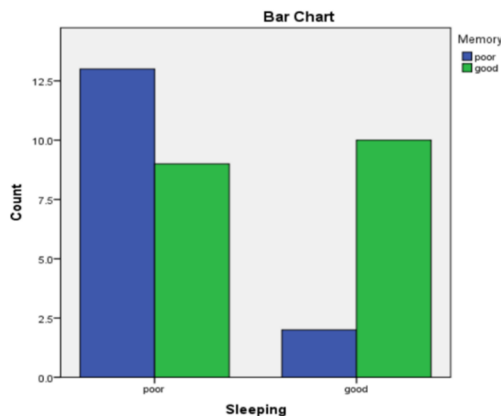


Figure 2: Bar chart of good/poor sleep division.

5 CONCLUSIONS

We created three experiments to discover the relationship between sleeping quality and three different aspects, we conclude: there is positive relationship between sleeping quality and short term memory.

We found no significant relationship between sleeping quality and emotion where the p value between them is 0.445, also the results shows there is especially weak relationship between sleep and reaction speed and the results is .886. This disproves our hypothesis. Meaning that better sleeping quality may not results in better emotion control and quicker reaction speed.

There could be possible reasons why we didn't get to our hypothesis that will be discussed in the following limitation section.

The P value shows correlation between memory test and sleeping quality is 0.029 which is below 0.05, means that there is relationships between sleep and memory. The results is successfully. Chi-square test divides the participants' sleeping quality into groups which are poor and good: the results shows for most participants: sleeping quality has a positive relationship with short term memory.

6 LIMITATION

There are plenty of limitations in these experiments that lead us to the unsatisfied conclusion.

According to a study constructed by Marie Vandekerckhove, deprivation a common symptom of and risk factor for a range of psychiatric disorders including anxiety and mood disorders. (Vandekerckhove, Wang 2017) This evidence supported our hypothesis on sleeping quality would positively relate to emotional state. However, there are mainly two reasons why we didn't get to a successful conclusion. The age group of this experiment is restricted between 16 to 26 years old. Human beings at this age are going through a tough

time in life which they have to be pressured by school works and facing troubles in their adolescences as well. A lot of participants may have feelings of depression because of other environmental factors rather solely by their sleeping quality. This variable may affect the results. In addition, the participants volunteered to be tested on the depression tests so there may appear biases. The participants knew that they were tested by the researchers, so they would answer the question as they imagine to be beneficial to the researches. Therefore, participation bias is created, it may varies the results.

There may appear two limitations in the reaction speed test. First, some of the participants finished their tests via internet. There could be problems during the tests, for instance internet lagging, communication problems etc. Thus, the time record could be different than whom finished the test offline, this could affect the results. Lastly, the reason why there appears no significant relationship, could because of the average quality of the participants are too high. Therefore, whatever the sleeping quality results they get can lead to a high score in reaction speed tests.

The emotional test and the reaction speed test are not successful, so we would like to redo these two tests in a modified notion. We would proceed this experiment offline collecting information from a more diversified age group. The ideal age group is from age 16 to age 50, this could create a more pluralistic atmosphere and hopefully reduce variables. We are not looking for older age groups since there will be a lot of factors affecting the results, like diseases and psychosis.

Based on the correlation graph, the p values between depression index and reaction speed is 0.045 which is slightly below 0.05, this could be seen as slightly significant. Thus, we would like to develop another research investigate on the correlation between depression level and reaction speed specifically. As Chai M. Tyng and his team concluded, emotional state can impact on learning and memory, we would conduct an experiment mainly focus on reaction speed and conclude a more delicate result.

Table 3: P-P plot (Tyng, Amin, Saad, Malik 2017).

| | | Correlations | | |
|-----------------|---------------------|-----------------|-----------------|--------------|
| | | SleepingQuality | DepressionIndex | ReactionTime |
| SleepingQuality | Pearson Correlation | 1 | .135 | -.031 |
| | Sig. (2-tailed) | | .445 | .863 |
| | N | 34 | 34 | 34 |
| DepressionIndex | Pearson Correlation | .135 | 1 | -.341* |
| | Sig. (2-tailed) | .445 | | .049 |
| | N | 34 | 34 | 34 |

REFERENCES

- Carskadon M.A., (2012) Sleep in Adolescents: The Perfect Storm *Pediatr Clin North Am.* 2011 Jun; 58(3): 637–647. doi: 10.1016/j.pcl.2011.03.003
- Chen M.Y., Wang E. K., Jeng Y.J.,(2006) Adequate sleep among adolescents is positively associated with health status and health-related behaviors doi: 10.1186/1471-2458-6-59
- Tyng C.M., Amin H.U., Saad M.N.M, Malik A.S.(2017) The Influences of Emotion on Learning and Memory doi: 10.3389/fpsyg.2017.01454
- Vandekerckhove M, Wang Y,L.(2017) Emotion, emotion regulation and sleep: An intimate relationship *AIMS Neurosci.* 2018; 5(1): 1–17. doi: 10.3934/Neuroscience.2018.1.1
- Watson C.J., Baghdoyan H, A. , and Lydic, R.,(2010) Neuropharmacology of Sleep and Wakefulness *Sleep Med Clin.* 2010 Dec; 5(4): 513–528. doi: 10.1016/j.jsmc.2010.08.003
- Xu, Shulian, and Zhenyun Wu. “The Construction of ‘The Clinical Memory Test.’” *Acta Psychologica Sinica*, 1986.

