

Does Lack of Sleep Have an Impact on Short-Term Memory?

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Cognitive function is very important to humans as it is composed of our visual and auditory perception, attention, short-term memory, long-term memory, working memory, and logical reasoning. The purpose of this study was to determine if the amount of sleep a person receives has an impact on their mood and cognitive function. In this study we are closely looking at memory recall. Sleep is crucial to brain function and our overall health. Consistent lack of sleep can cause back pain, stomach pain, mood swings, diabetes, heart failure, depression, hypertension, and can negatively affect the immune system. Consistent lack of sleep can also affect the ability to stay focused and can impair judgement and logical reasoning. This study is important because if sleep does affect memory recall and mood then people might have answers as to why they are constantly forgetful and in a bad or depressed mood. This gives people a chance to make sleep a priority, so it does not affect their health and cognitive skills.

There have been multiple interesting studies regarding cognitive function and sleep. Chengyang (2016) did a study where he examined the functional connectivity of the hippocampus after restriction of sleep. The hippocampus is a part of the brain that is responsible for learning and memory, so he was basically studying whether or not sleep restriction had an effect on memory. Chengyang hypothesized that there will be altered functional connectivity in participants who received less hours of sleep. To test this, he took a group of twenty-year-old males who got between 6.5 and 8.5 hours of sleep a night. The participants were all healthy non-smoking individuals who were in good health and could not consume caffeine or alcohol. Participants were monitored using an actimetry sensor which helps track rest and active cycles. To measure cognitive function Chengyang used the DMS task which assess “attention and concentration, memory and executive function” (p. 956). A magnetic resonance imaging (MRI)

was also used to track the functional connectivity in the hippocampus. At the end of this study Chengyang found that there was “increased functional connectivity between left hippocampus and left thalamus that was significantly correlated with the decreased performance of memory task” (p. 958). A decreased performance in memory task was a result of sleep deprivation. Sleep deprivation contributes to deficits in attention and sensory processing.

A more recent study was conducted by Phan (2018) to investigate the effect sleep had on college students. He “hypothesized that sleep characteristics measured by Fitbit devices (total minutes asleep and awake count) would be associated with the memory capacity of college students” (p. 184). Phan took a group of 39 first year college students and had them wear a Fitbit device that tracked heart rate, physical activity and characteristics of sleep. The participants wore the Fitbit at all times for fourteen weeks unless they were in the shower when the device had to come off. Each week the participants were required to take a memory test and close attention was given to their sleep before, after and on the test day. Phan found that there was a “positive effect of minutes asleep on the test date and during one week prior to testing on memory capacity in college students. Although sleeps on the test date acutely affect memory, the influence of sleep on memory capacity during the week before the test date was higher than those on the test date” (p. 187). Some of the participants were split up into two separate groups based off of the time they went to sleep on test day. Results still showed that the students who went to sleep earlier had greater memory capacity than the students who went to sleep at a later time.

Another recent study done by Aidman, Jackson and Kleitman (2018) takes a look at the “effect of acute sleep deprivation on metacognitive constructs and decision making in addition to executive functions and cognitive abilities” (p. 188). They hypothesized that executive functions will suffer after sleep restriction and in early morning hours. Aidman, Jackson and Kleitman also

wanted to study metacognitive functioning, which is responsible for complex decision making, self-awareness and problem solving. They hypothesized that there will be a change in metacognitive functioning under sleep deprivation, but that it would be a minor change. Aidman, Jackson and Kleitman took thirteen army personnel who had less than 1,000mg of caffeine a day and screened them for “sleep disturbance symptoms and excessive daytime sleepiness” (p. 191). The participants were required to take a series of tests; the spatial stroop test that tests inhibitory control, predictable switching digits that tests cognitive flexibility, running letters test that tests working memory, numbers series test that tests reasoning ability, medical decision-making test that looks at short-term memory, and metacognitive function and a test that measured reaction times. Sleep patterns were measured for two weeks. In the first week, the participants kept their normal sleep schedule and then tested twice. In the second week, the participants were deprived of sleep and then tested twice as well.

Results were gathered from every test that was taken from before sleep deprivation and after. The results on the running letters test, simple reaction time, found that there was no significant improvement. The spatial stroop test and predictable switching digits test concluded that there were changes between week one and week two. Overall the study found that “circadian phase and time spent awake might independently affect cognitive performance but might interact in their effect on self-regulation and self-reflective processes” (Aidman, Jackson & Kleitman p. 198). Sleep deprivation may not have an effect on all cognitive functions but influences cognitive performance. Deprivation of sleep did affect “executive functioning and self-regulation, complex cognitive abilities” but, “metacognitive monitoring remained relatively intact” (Aidman, Jackson & Kleitman, p. 198).

For this present study we wanted to see if the amount of sleep people obtain affects their mood and short-term memory. This study could also show how the number of hours of sleep individuals have to get a night before it does start to affect mood and short-term memory. I predict that there will be a positive correlation between sleep, mood and short-term memory. The more sleep the participants receive will positively affect their mood and memory recall. To be more precise, I think that the participants will have to get seven to eight hours of sleep a night in order to see the positive correlation. Six hours or less of sleep consecutively is when participants will start to see the negative effects that deprivation of sleep can have on short-term memory and mood. I do not think that there will be a difference between men, women or age. There are many people who might think that older adults need more sleep, but I predict that all ages need the same amount of sleep in order to not see the negative affects that sleep can have on the brain and the body.

Method

Participants

The participants for this present study were recruited using the online Sona-systems program that is utilized by the psychology department at Angelo State University. There was a total of 114 students that took the survey. Ages of the participants ranged from 18 to 42 ($M = 19.52$, $SD = 2.7$). Out of all the participants 15.8% of them were males and the other 83.3% of them were female. For the race of the participants, .9% were Native American or American Indian, .9% Asian/Pacific islander, 4.4% Black or African American/ not of Hispanic origin, 47.4% White/not of Hispanic origin, 5.3% Hispanic and 5.3% Biracial.

Design

The design is correlational because none of the variables are being manipulated. The results will show if there is a relationship between the variables whether that be positive or negative relationship.

Stimuli

In the survey we used a written scenario which is the following; There once a girl named Samantha, who had a pet dog named Samson, who had a pet rat named Samuel. The rat had a pet cricket named Sam. The four of them lived in Massachusetts. They spent many days out in the wild looking for clovers. Their neighbors were best friends of the famous entertainers Will Smith and Kristen Bell. Sometimes their neighbors Rick and Roy would have cook outs on the weekend. They were from Texas and loved to BBQ. They had the biggest smoker in the state of Massachusetts and would take Sam and Samantha to every cooking tournament in the United States. They usually traveled to these tournaments during the summertime. This was the best time to travel because of the weather. On these tournaments Sam would collect rocks to bring back home to Samuel. This was used to test the participants' memory recall. We asked them basic questions and then provided them with the scenario and then more basic questions used as distractors. After the distraction questions we asked them questions about the scenario to see what they remembered.

Measures

The questionnaire used for this study consisted of the positive and negative PANAS scale which is used to measure a positive or negative affect (Watson, et al., 1988). The positive and negative PANAS scale is a self-questionnaire that has 10 positive emotions and 10 negative emotions that can be rated on a 1-5 scale in how much the participants agreed on having felt the emotion. In this case we wanted to measure how much sleep or lack thereof affected the

participants regarding their mood and emotion. The questionnaire also included simple questions like: “*what is 4x7?*” and “*what is 100 squared?*” in order to distract them from the scenario before their memory recall. We also asked demographic questions to help describe the sample group.

Procedure

Participants were recruited using Sona, which is the online recruiting tool used by the psychology department at Angelo State University. Once the students got into the Sona website and chose to take the “Fussy and Forgetful?” study they completed the online consent form and then were directed to the survey. After the survey, they read over the debriefing and were thanked for their participation. Data were collected using the online software program Qualtrics, which is a secure platform for collecting data online. The survey took 30 min or less and the students received .5 Sona credits for their psychology class. Participants received contact information for the P.I. on both the informed consent and the debriefing so if they had any questions or inquiries about the research, they would know who to contact. Participants also received contact information for the IRB if they wished to complain or had any grievances related to the research. Names, phone numbers, and email addresses were included in the contact information provided on both the consent form and the debriefing.

Results

We predicted that there will be a positive correlation between the amount of sleep, and memory recall and mood. To test our hypothesis, we used Pearson’s correlation to determine the relationship between memory recall/mood and sleep deprivation. We ran correlations for hours of sleep and a positive mood on weekdays $r(114) = .02, p = .885$, hours of sleep and a negative mood on weekdays $r(114) = -.16, p = .211$, hours of sleep and total correct answers $r(114) =$

.12, $p = .211$, hours of sleep and a positive mood on weekends $r(114) = -.12$, $p = .262$, hours of sleep and a negative mood on weekends $r(114) = -.19$, $p = .04$ and hours of sleep and total correct answers for the weekends $r(114) = .15$, $p = .103$. The Pearson's r data analysis showed that there was no significant relationship between any of the data except for the amount of sleep the participants received on the weekends and negative mood. This means that the less hours of sleep the participants received on the weekend, the more a negative mood was reported.

Discussion

We hypothesized that the participants who received less sleep would have a negative mood than the participants who received more sleep. We found that this was not really the case. Our findings concluded that the participants who received less sleep did not have a negative mood during the week, but on the weekend. I believe that our hypothesis did not match up with the results because of how we went about receiving the results. According to other research, some type of disruption to memory recall and a negative mood has also been found.

If we were to present this study again, I think that it would be important to take a larger group of participants and test them differently. In our study we only asked the participants how many hours of sleep they received and then took their word on what their mood was; which is very subjective. Perhaps for the next study it would be a good idea to ask people who are close to the participant if there was a change in the participants mood. Also, instead of just letting the participants tell us how many hours of sleep they received we should minimize or maximize that amount to truly know if they are sleep deprived. These changes would more accurately test if a negative mood is a result of sleep deprivation. I think that further research should explore not only changes in mood from sleep deprivation, but how sleep deprivation can affect the body as well.

This research is important because other researchers may see it and think that it may be something to look further into and develop their own research that helps us truly understand sleep deprivation better. This research also contributes to the scientific literature mentioned previously by going about how sleep is measured. If sleep is not manipulated by the researcher, then it would be a good idea to measure sleep on the weekdays separately from the weekends. This is because typically people get different amounts of sleep between the two because there are more things going on during the week and since our findings showed different results between the weekdays and weekends, so it may be something to further look in to.

Research regarding sleep is very important because sleep is something that many individuals take for granted and do not get enough of. If we keep doing research on sleep and the negative effects that it has then maybe people will start to put it as a priority. Sleep is a major part of basic functioning and a lot of people suffer from illnesses that could be easily fixed by just adding a little more sleep to their schedule. Sleep deprivation can alter the quality of life and not enough people are aware of that when they should be.

References

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