The influence of sleep deprivation on short term memory and attention to details in young students

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Abstract

Many researches highlight the relationship between fatigue and performance. Sleep deprivation consists in keeping the participant awake for minimum sixteen hours. The study is focused to on highlighting the influence of 24 hours of sleep deprivation on short term memory and attention to details tasks. The participants were 74 young students, aged between 19 and 24 years old (m= 21.2; S.D.=1.63). The instrument: tachistoscope test (TAVTMB) (Schuhfried, 2006). By applying Man Whitney nonparametric test for independent groups, the research hypothesis has been confirmed (p<0.05). The findings provide psychological evidence-based data confirming the assumed hypothesis.

1. Introduction

Many research and meta-analysis studies highlight the relationship between fatigue and performance. Researchers showed that studies are different concerning the samples, the instruments and scales measuring the performances (subjective, behavioral and objective measures).

Furthermore, sleep deprivation consists in keeping the participant awake for minimum sixteen hours. Van den Berg and Neely (2006) have discovered that sleep deprivation provokes leads to a longer reaction time at subjects, omitting stimuli during a 2 hour test period. Takahashi et all (2004) studied workers who
were permitted to sleep a short period of time at work and they discovered that even if the workers believed that sleep made them more aware and alert, there was no effect on the reaction time.

Research studies concerning sleep deprivation (Federal Highway Administration, 1998; Fell and Black, 1997; Horne and Reyner, 1995; Knipling and Wang, 1995; Knipling and Wang, 1994) have shown that after 24 hours of awakening, the metabolic brain activity decreases to a significant level (up to 6% for the entire brain and up to 11% for the specific cortical area and the region of base ganglions). As for the human body, sleep deprivation leads towards body temperature loss, an increase in the functioning of the immune system, measured by white cells, and an increase in the release of growth hormones.

Sleep deprivation determines the increase in cardiac pulse. Drummond and Brown (2001), Drummond et all (2000) highlighted that without sleep, brain deteriorates and the behavior suffers the same effects.

After long periods of sleepless states, neurons start to function improperly, affecting the person’s behavior in a visible manner. Some organs, like muscles, are capable of regenerating even when the person does not sleep, as long as he or she rests. Even if the cognitive functions do not seem to be necessary in this scenario, the brain and especially the cortex are not capable to rest, remaining in a state of partial alertness. Several stages of sleep are necessary for regenerating the cortical neurons while other stages seem to be used for creating new memories and for generating new synaptic connections.

The studies finalized inside the experimental laboratory concerning sleep deprivation (Aniţei et all, 2010), the validation of a psychological test battery for driving schools (Schuhfried, Aniţei & Chraif, 2010; Aniţei, Chraif, Schuhfried, Sommer, (2011), and other research studies involving psychological tests for skills (Schuhfried, Sommer, Aniţei & Chraif, 2011; Aniţei, Schuhfried & Chraif, 2011; Schuhfried, Sommer, Aniţei & Chraif, 2010) were the scientific basement for this research.

2. Objectives and Hypothesis

2.1. Research Objectives

- To highlight the influence of 24 hours (of) sleep deprivation on short term memory and attention to details tasks;
- To show that sleeping represents a fundamental need for living in a social environment.

2.2. Hypothesis

Sleep deprivation has a statistically significant influence on short term memory and attention to details tasks measured by tachistoscopic test in young students.

3. Method

3.1. Participants

The participants were 74 young students from the Faculty of Psychology and Education Sciences, University of Bucharest, aged between 19 and 24 years old (m= 21.2; S.D.=1.63), rural and urban areas, male and female.

3.2. Instruments

- Perception tachistoscope test for time limited details in traffic (TAVTMB) (Schuhfried, 2006)
The tachistoscope test is composed of 19 image items (figure 1). The participant visualises the image of a traffic situation for a second and has to indicate the relevant objects in the image. The test measures: short term memory (1-5 seconds retrieval process) and attention to traffic details.

Fig. 1 Tachistoscope test: visual stimuli. (Schuhfried, 2006)

3.3. Experimental design

Independent variable is sleep deprivation. Dependent variables are: the number of stimuli correctly recognised (Correct answers) and Incorrect number of stimuli measured in percentiles.

4. Results

Table 1. Descriptive statistics and p-value (TAVTMB) (Schuhfried, 2006)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean (Percentile %)</th>
<th>Standard Deviation</th>
<th>Man Whitney test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Experimental Group</td>
<td>Non-experimental</td>
<td>Experimental</td>
</tr>
<tr>
<td>Correct answers</td>
<td>58.39</td>
<td>45.36</td>
<td>14.67</td>
</tr>
<tr>
<td>Incorrect number of stimuli</td>
<td>46.21</td>
<td>58.35</td>
<td>13.81</td>
</tr>
</tbody>
</table>

As it is shown in table 1 there are differences between the means of the experimental and the control group. But in order to verify that the differences are statistically significant firstly the Kolmogorov-Smirnoff test has been applied for verifying the normal distribution of the data curves of the 5 variables. Because a normal distribution was not obtained for any of the data of the 5 variables (p>0.05), the non-parametric Man Whitney test has been applied for differences between independent groups. By applying Man Whitney nonparametric test for independent groups, the research hypothesis has been confirmed (p<0.05). Therefore, the experimental group with sleep deprivation obtained statistically significant better performances than the control group at the tachistoscope test for both dependent variables: correct answers, incorrect number of stimuli. Also table 2 shows information connected to the statistical significance of the differences between the two groups. Therefore, according to the observed values of p-value for each of the 5 dependent variables (p<0.05). The research hypothesis has been confirmed. Therefore we can state that “There is a statistical significant difference between the experimental group influenced by sleep deprivation and the control group concerning short term memory and attention to details.
5. Conclusions

The findings provide psychological evidence-based data confirming the assumed hypothesis. Also, it must be mentioned that on short term, the subjects who were deprived of sleep obtain very good results compared to the ones from the control group due to the arousal the organism triggers as a defense mechanism. Previous researches in sleep deprivation on time reaction and multiple stimuli time reaction underlined and confirmed that during the driving actions when the human operator has to do multiple actions simultaneous (shifting gears, moving the rear-view mirror, processing exterior stimuli, processing interior stimuli) can be statistically significant influenced by sleep deprivation (Aniței et al. 2010; Aniței, Chraif, Vlăsceanu & Ciolacu, 2011).

The results show that there is a statistically significant difference by using Man Whitney nonparametric test for both correct answers (p <0.05) and incorrect number of stimuli (p<0.05). Following previous researches, 24 hours sleep deprivation leads to a decrease in reaction towards multiple stimuli, mentioning that the significant statistical effect can be observed when obtaining correct performances (Aniței, Chraif, Vlăsceanu & Ciolacu, 2011).

The conclusion of this research study is that short time memory, visual perception field and attention are influenced by sleep deprivation in obtaining better results for a short time. This is due to the fact that the human organism enters an activated state as a defence reaction to the sleep deprivation. However, the results of this research must be correlated with results previously obtained concerning the reaction time and the reactivity to multiple stimuli as well as the results which concern memory, visual and auditory perception, long-term motor coordination, more precisely after 30-50 minutes of exposure to different tasks which need to be achieved.

This is why, this research comes as a support for the recommendation that the psychological assessment of people must not be done only with screening tests but also with psychological tests which involve the cognitive processes on a time period of 10 minutes.

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References


