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Relationship between Neurocognitive Functions of Sleep Deprived Versus Non-Sleep Deprived Adolescents of Nagpur

Dr. Aswini A. Rathod
MBBS, MD, Physiology, Govt. Medical Collage, Nagpur, India
Dr. Manoj Pawar
MBBS, DNB, Chest Medicine, Govt. Medical Collage, Nagpur, India

Abstract:
Rationale: Adequate sleep is very important for healthy & happy life and also for optimum performance. Deprivation of sleep as in medical students during examination is characterized by increasing lapsing, cognitive slowing, memory impairment, decrease in vigilance, sustained attention. Also affect ability to make a split-second decision. Objective: To study the effect of one night sleep deprivation on neurocognitive performance of subjects in the morning of the following day. Methods: 30 healthy male, medical college students of 24-26 years of age group were selected who were preparing for PG Medical entrance examination. Selected participants were studied twice. Depending upon duration of sleep, study was divided into two parts:First part of the study was performed in the next morning following the adequate sleep at night (ASDN=>7) Hrs. Neuro-cognitive test & Reaction time were measured. Results: Neurocognitive function test score (MMSE) of subjects exposed to sleep deprivation [28.73+0.98] was not significantly changed [28.9±0.96](p=0.1340). Mean Auditory reaction time of subjects exposed to sleep deprivation [186.6± 4.76 ms] was significantly more [166.63+ 4.81ms] (p =0.005). Mean visual reaction time of subjects exposed to sleep deprivation [245.83±20.28ms] was significantly more [188.26±5.40ms] (p =0.005).
Conclusion: We found a strong effect of time awake on reaction time suggesting that cognitive functions such as RT are more vulnerable to be affected by sleep deprivation rather than the other neurocognitive functions.

1. Introduction

Adequate sleep is very important for healthy & happy life and also for optimum performance. Deprivation of sleep as in medical students during examination is characterized by increasing lapsing, cognitive slowing, memory impairment, decrease in vigilance, sustained attention. Also affect ability to make a split-second decision. Total sleep deprivation has been shown to negatively affect many physiological, psychological, cognitive& behaviorial measures within the body.
Neuro-cognitive test performed by physican includes numbers of questions, which gives a score at the end. Most common test used in called as mini-mental status examination (MMSE) / Folestein test.

2. Objective

To study the effect of one night sleep deprivation on neurocognitive performance of subjects in the morning of the following day.

3. Methods

Study is carried out at Department of physiology, Government medical college, Nagpur. 30 healthy male, medical college students of 24-26 years of age group were selected who were preparing for PG Medical entrance examination. Selected participants were studied twice. Depending upon duration of sleep, study was divided into two parts-
First part of the study was performed in the next morning following the adequate sleep at night (ASDN=>7 Hrs. Neuro-cognitive test & Reaction time were measured. Participants remained awake up to 3am at that night under constant observation. During sleep deprivation period, participants spent their time by reading book up to 3am. They were restricted from taking caffeine, tea or other stimulants. Second part of the study was performed in the next morning at the same time period(7-8am) & neurocognitive testing & reaction time measured.

EXCLUSION CRITERIA: Insomnia, obstructive sleep apnea, Visual & hearing defects were excluded.
Only male were included in the study in order to assure that the findings following sleep deprivation were not affected from gender differences. All participants gave consent after explaining the non-invasive technique to them.

NEURO-COGNITIVE TEST:

- Following 30 point MMSE test is used-
- QUESTIONAIRE USED:
  - ➢ APPEARANCE:
    - → Exhausted or not ?
    - → General level of comfort
  - ➢ ORIENTATION:
    - → Participant's name, age, gender ?
    - → The place where participant reside, type of building, city, state or place they are currently in ?
    - → Time, date, season ?
  - ➢ ATTENTION SPAN:
    - → Audio–visual Reaction time = ___ in m sec
  - ➢ RECENT AND PAST MEMORY:
    - → Questions related to recent places, persons and events in the personal life?
    - → questions related to participant's childhood, school?
    - → 5 items were presented, participants are then asked to repeat them and recall them after 5 minutes.
  - ➢ JUDGEMENT:
    - → If you found a driver's license on the ground, what would you do ?
    - → If police officer approached you from behind in a car with light flashing, what would you do?

Category	Possible points
Orientation to time	5
Orientation to place	5
Registration	3
Attention	5
Repetition, recall	4
Complex commands	6
Language	2

•Score Interpretation

>25/30 = Normal

21-25/30 = Mild

10-20/30 = Moderate

<9/30 = Severe

Figure 1

- REACTION TIME: The apparatus used in this study was portable research reaction timer,which can measure Visual Reaction Time (VRT) and Auditory Reaction Time (ART).

4. Results

1.Neurocognitive function test score (MMSE) of subjects exposed to sleep deprivation [28.73+0.98] was not significantly changed [28.9±0.96](p=0.1340)

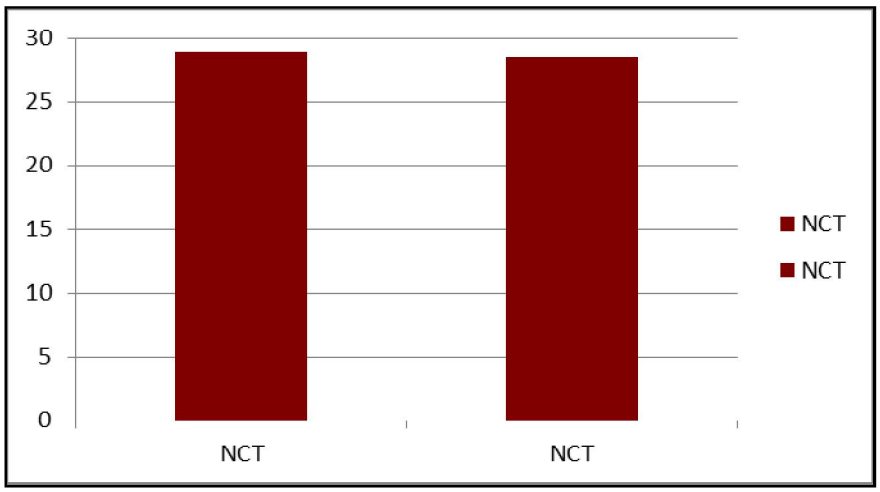

Figure 2

2. Mean Auditory reaction time of subjects exposed to sleep deprivation [186.6± 4.76 ms] was significantly more [166.63+ 4.81ms] (p =0.005).
3. Mean visual reaction time of subjects exposed to sleep deprivation [245.83±20.28ms] was significantly more [188.26±5.40ms] (p =0.005).

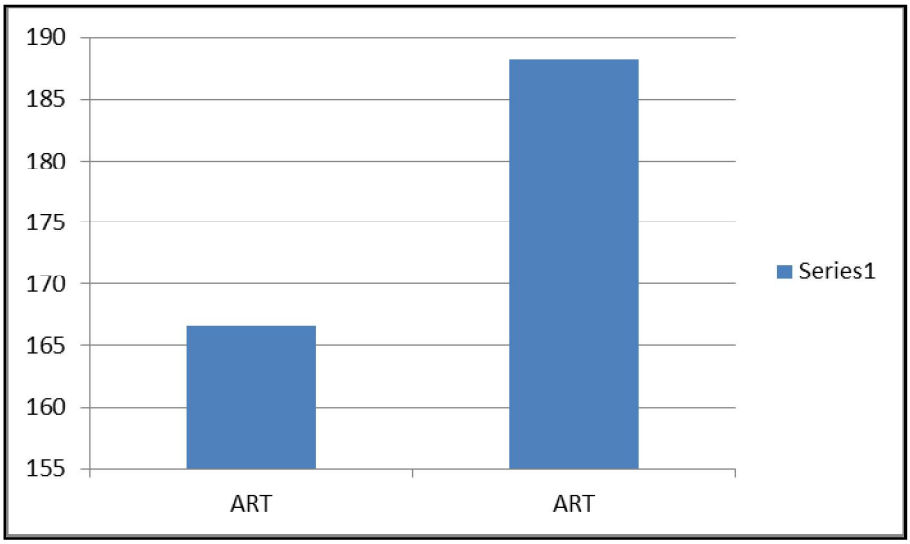

Figure 3

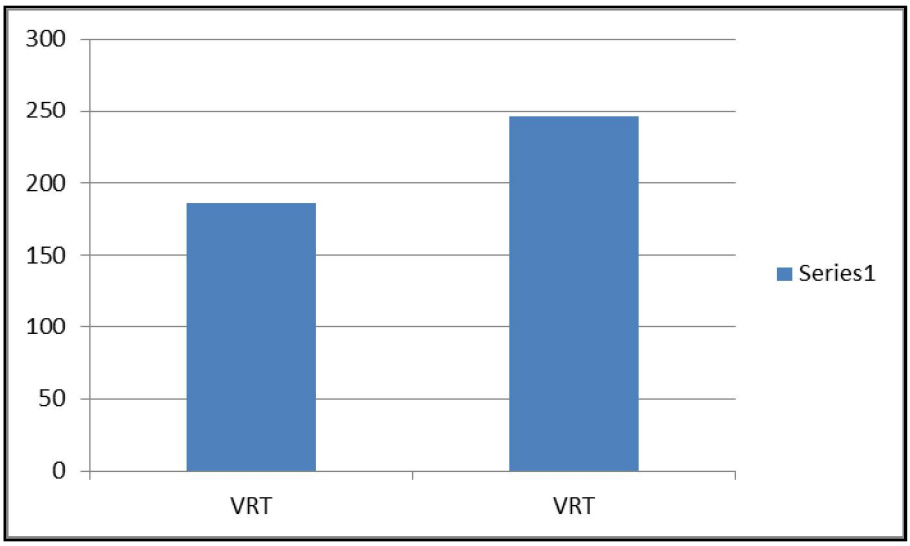

Figure 4

5. Discussion

Sleep deprivation affect ability to make split-second decisions, according to a recent study in the journal SLEEP. Participants selected were preparing for PG entrance examination. Medical PG entrance examinations have multiple choice questions where candidate need to take a split-second decision about the correct answer out of four options.

In the present study, there was no significant decrease in neurocognitive functions due to one night sleep deprivation. This finding is consistent with study of Bartle, Sun, Thompson, Light, McCool, Heatson (1988), that acute sleep deprivation of less than 4 hours alters mood state but does not change performance in test situations in which concentration, clear thinking, and problem solving are important.

Adequate sleep is essential for peak performance of those competitive examination students which need more cognitive functions (motor perceptual skills) and some unwillingly events (e.g. jetlag or anxiety) in which sleep is disturbed prior to an examination event can impair the student's performance.

We found a strong effect of time awake on reaction time. The idea that executive function tasks are particularly sensitive to sleep deprivation stems from the finding that the frontal lobe is highly responsive to sleep loss. Additional studies involving more subjects, a more controlled environment, and/or a different variety of cognitive and physical tests are required in order to make conclusive assumptions about a larger population conclusively

6. Conclusion

We found a strong effect of time awake on reaction time suggesting that cognitive functions such as RT are more vulnerable to be affected by sleep deprivation rather than the other neurocognitive functions.

7. References

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