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Original Research Article

Effects of Long Working Hours on the Cognitive Functions of Interns

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Abstract:

Objective: The study helped to assess the correlation between the cognitive functions of interns after long working hours and lack of sleep. It also assessed the effect of excess daytime sleepiness on cognitive functions.

Methodology: A cross-sectional study of 50 interns, aged 23-25 years was taken. They were given 2 questionnaires: firstly, the Chalder Fatigue Scale, a self-reported scale of fatigue severity over 3 months, and Epworth Sleepiness Score which is a self-reported scale of daytime sleepiness. Afterwards, 4 tests were given to assess the cognitive functions. 1. Reaction Time Test 2. Stroop Test 3. Trail Making Test 4. Rey Auditory Verbal Test

Results: The correlation between excessive daytime sleepiness and cognitive function, as by the Epworth Sleepiness Scale (ESS), was positive but statistically insignificant. The Stroop Test also showed an insignificant p-value, suggesting sleep deprivation may not significantly impact cognitive performance. However, sleep-deprived individuals had significantly higher reaction times during the incongruent trial, suggesting a decline in cognitive function related to selective attention and executive functions. Trail Making Test (TMT) A and B showed decreased results post-night shift, but the p-values were insignificant. Rey Auditory Verbal Test yielded significant results emphasizing the potential impact of sleep deprivation on cognitive function among medical interns.

Conclusion: Our findings highlight the potential impact of sleep deprivation on cognitive function among medical interns. Although the correlations were not statistically significant in some cases, sleep deprivation still showed trends toward decreased cognitive performance.

Keywords: Sleep, Cognitive Function Tests, Chalder Fatigue Scale, Epworth Sleepiness Scale.

Introduction

Henry Ward Beecher quoted, 'To array a man's will against his sickness is the supreme art of medicine'. This art lies in the hands of budding doctors /residents/interns. What could be the most tragic thing in the world other than a sick doctor!! Long-hour work shifts are equivalent to finding interns battling a shut-eye in the emergency room. Heroic working hours is a new routine for doctors but it in turn can affect patient safety. Doctors who stay with patients all day and night are more prone to make serious diagnostic mistakes than those scheduled to work for less consecutive hours.

Cognitive functions refer to mental abilities like learning, thinking, reasoning, remembering, problem-solving, and attention. Hence, cognitive impairment affects mental functioning and leads to degraded social skills and poor quality of life. Sleep deprivation causes burnout, spoils the mood, and negatively affects cognitive function; extended shifts and sleep deprivation in residents have been associated with impairment in attention and psychomotor vigilance, working memory, cognitive processing, balance, fine motor skills, verbal and numeric skills, visuomotor performance, and response inhibition [1].

There have been links between sleep deprivation and errors in electrocardiogram interpretation and impairment in determining significant changes in monitored variables such as blood pressure, heart rate, and gas flow rate!!! [2] It is fairly said that 'invest in rest 'as sleep is the golden chain that binds humans and health together. It is time to strike the right balance by minimizing resident hours and maximizing patient safety and care Hence, medical residents and interns should be allowed to maintain a desirable balance between working and resting hours for appropriate cognitive functioning and benefits!

Aims and Objectives:

1. To assess the correlation between the cognitive functions of interns after long working hours and lack of sleep.
2. To assess the effect of excessive daytime sleepiness on cognitive functions.

Materials and Methods

After institutional Ethics committee approval, a cross-sectional study was conducted on 50 MBBS Interns in the age group of 23-25 years. Written informed consent was obtained from participants who were involved in the study voluntarily. There was no potential risk to the subjects in this study as there were no interventions involved.

Inclusion Criteria:

1. MBBS Interns/Residents who have worked night shifts or excessively long shifts.
2. Those who have given written informed consent.
3. Those who are familiar with the use of laptops and well-versed with the English language.

Exclusion Criteria:

1. Those who are not giving written informed consent.
2. Those who are taking any medication.
3. Any history of major physical/mental illness.
4. Any history of neuromuscular/neurological/ psychological disorder/head trauma.
5. Any history of substance abuse, smoking, or alcohol abuse.

Cognitive function tests were assessed using the following tests

1. Simple Reaction Time
2. Rey Auditory Verbal Learning Test
3. Trail making Test
4. Stroop test

Sleep duration was assessed by using the scales like Chalder Fatigue Scale (ANNEXURE -A) and Epworth Sleepiness Scale (ANNEXURE -B) to check the performance of interns and residents after long working hours.

Methodology:

The interns were given prior information regarding the nature of the study and those who were willing to participate were asked to come for a single contact session. On the study day, written informed consent was taken from each participant. The study was conducted in a quiet isolated room with adequate light. Subjects were asked to sit in the natural sitting comfortable position. Each subject was tested individually. Subjects were given a case record form in which detailed history was recorded.

The following methods were used in data collection:

A) The following 2 questionnaires were used:

1. Chalder Fatigue Scale:

Chalder fatigue scale (CSF) is a self-reported scale that measures fatigue severity over the past 3 months. CSF was originally perceived as comprising two subscales that evaluate fatigue in the physical and mental domains. It consists of 11 questions that are based on subjective conditions, either in extreme clinical cases or in routine day-to-day functioning. Scoring is done with "Likert Style" using 0,1,2,3 as appropriate numbers to answer the questions. Higher scores indicate greater fatigue. Questions 1 - 7 are based on physical fatigue and 8 - 11 on mental fatigue [3].

ANNEXURE A has been used as the Chalder Fatigue Scale [4].

2. Epworth Sleepiness Score:

The Epworth Sleepiness Scale is widely used in the field of sleep medicine as a subjective measure of one's daytime sleepiness. The test is a list of eight self-rated items, in which participants rate the tendency to become sleepy on a scale of 0, no chance of dozing, to 3, high chance of dozing. When the participant finished the test, we added up the values of the responses. The total score was evaluated on a scale of 0 to 24. The score-wise interpretation was as follows: 0-7: It is unlikely that you are abnormally sleepy, 8-9: You have an average amount of daytime sleepiness. 10-15: You may be excessively sleepy depending on the situation. You may want to consider seeking medical attention, 16-24: You are excessively sleepy and should consider seeking medical attention [5].

ANNEXURE B has been used to perform the Epworth Sleepiness Score [6].

B) Following tests to assess the cognitive functions:

1. Reaction Time Test

It provides assessments of motor and mental response speeds, as well as measures of movement time, response accuracy, and impulsivity. Reaction Time was assessed with the visual help of Digital Reaction Time Apparatus (made in Ambala). The subject was asked to sit in front of the apparatus. There were three light bulbs: red, yellow, and blue, all having the same luminescence and each had its respective button equidistant from the center button.

Each time we switched on a bulb, the subject was asked to respond by keeping the index finger of the dominant hand on the center button and by pressing the corresponding light button as soon as possible. The task was to respond to the visual stimulus the fastest. The Reaction time was displayed on our side in the digital format and hence, the speed at which the brain can process visual information was assessed [7].

2. Stroop Color and Word Test (SCWT):

It is a neuropsychological test extensively used to assess the ability to inhibit cognitive interference that occurs when the processing of a specific stimulus feature impedes the simultaneous processing of a second stimulus attribute, well known as the Stroop effect [8]. We used PsychoPy Demo Software version 1.83.01 which runs a digital demonstration of the Stroop effect. Colors-word task in which subjects were shown names of colors printed in conflicting ink colors (e.g., the word "red" in blue ink) and were asked to name the color of the ink rather than the word. Subjects were instructed to press the laptop keys assigned for a particular color. Instructions are as follows; Keys to press Left, Down, and right and for color red, green, and blue accordingly. After the end of the test, the Reaction time for the given responses and the number of errors made were recorded. This component measures mental flexibility and the ability to inhibit a dominant response as well as provides a measure of the individual's ability to inhibit stimulus-bound responses and deal with inference [9].

3. Trail Making Test:

The trial-making test (TMT) is a short neuropsychological test used for screening cognitive impairment. This is a pen-and-paper test. It was conducted in two parts; both parts of the Trail Making Test consist of 25 circles distributed over a sheet of paper. In Part A, the circles are numbered 1 – 25, and the subject was instructed to draw lines to connect the numbers in ascending order. In Part B, the circles include both numbers (1 – 13) and letters (A – L); as in Part A, the subject was instructed to connect the circles, this time including a new sequence of a number followed by a letter in ascending order.

The subject is asked to complete the test as quickly as possible without lifting the pen from the paper. The subject was timed as he or she connected the "trail." If the subject made an error, it was pointed out immediately and the subject was allowed to correct it. The errors in the test are not noted separately to affect the score on the test but the total time taken included the correction of the errors. It is unnecessary to continue the test if the subject has not completed both parts after five minutes have elapsed [10].

Scoring is as follows: results for both TMT A and B are reported as the number of seconds required to complete the task; therefore, higher scores reveal greater impairment.

Trail Name	Average	Deficient	Rule of Thumb
Trail A	29 seconds	>78 seconds	Most in 1minute 30 seconds
Trail B	75 seconds	>273 seconds	Most in 3 minutes

ANNEXURE C has been used to perform the Trail Making Test [11].

4. Rey Auditory Verbal Learning Test: It is a well-recognized measure of a person's ability to encode, combine, store, and recover verbal information in different stages of immediate memory. Therefore, the effect of interference stimulus, delayed memory, and recognition are evaluated with this assessment tool [12].

The examiner reads aloud a list of 15 words at the rate of one per second and loud and clear. The participant was then asked to repeat all words from the list that he/she could remember. The participants were instructed that the order of words is not important. This procedure is carried out a total of five times and after each trial recall is recorded. The five recall trials are summed into one score (Trial 1-5).

The examiner then presented a second interference list of 15 words, allowing the participant only one attempt to recall this new list. Immediately following this, the participant was asked to remember as many words as possible from the first list (Short recall). After a 20-minute delay, the participant was again asked to recall as many words as possible from the first list (Long recall).

The participant was then read a recognition trial of 30 words containing the 15 words from list A and 15 distractor words (out of which 10 were phonetically like target words) and asked to indicate whether each word was from the first list [13]. The total scores for trials (1-5), short recall, long recall, and the number of correct responses in the recognition test were analyzed. The RAVLT has proven useful in evaluating verbal learning and memory, including proactive inhibition, retroactive inhibition, retention, encoding versus retrieval, and subjective organization [14].

LIST A (Drum, Curtain, Bell, Coffee, School, Parent, Moon, Garden, Hat, Farmer, Nose, Turkey, Color, House, River) LIST B (Desk, Ranger, Bird, Shoe, Doll, Mirror, Nail, Sailor, Stove, Heart, Mountain, Desert, Glasses, Towel, Cloud) Recognition trial (Thumb, Drum, Nose, Choose, Color, Garden, Summer, River, Coffee, Monkey, Parent, Moon, Money, Turkey, House, Hat, Cheer, School, Curtain, Chat, Wrong, Keychain, Foreigner, Farmer, Mat, Lagoon, Hotel, Bell, Light, Field) Scores based on the number of words recalled at particular intervals. Total scores for trials 1-5, short recall, long recall, and the number of correct responses in the recognition test were analyzed. One point for each correct answer.

Results

Table 1: Sleep duration distribution according to Gender

			Sleep Duration in hours per day			Total	Fisher's Exact Test P value	Conclusion
			4 to 6	6 to 8	8 to 10			
Gender	Female	Count	4	17	1	22	0.695	Insignificant Association
		Percentage	18.2%	77.3%	4.5%	100.0%		
	Male	Count	6	20	3	29		
		Percentage	20.7%	69.0%	10.3%	100.0%		
Total		Count	10	37	4	51		
		Percentage	19.6%	72.5%	7.8%	100.0%		

Inference: The above table correlates gender with sleep duration in hours per day. Both females and males have been divided into 3 categories based on their average daily sleep duration; which are 4-6hrs, 6-8hrs and 8-10 hrs.10 (19.6%) of them slept for 4-6hrs, 37 (72.5%) of them slept for 6 to 8hrs and 4 (7.8%) of them slept for 8-10 hrs. On calculating, the P value was found to be 0.695 and there was insignificant association between the two.

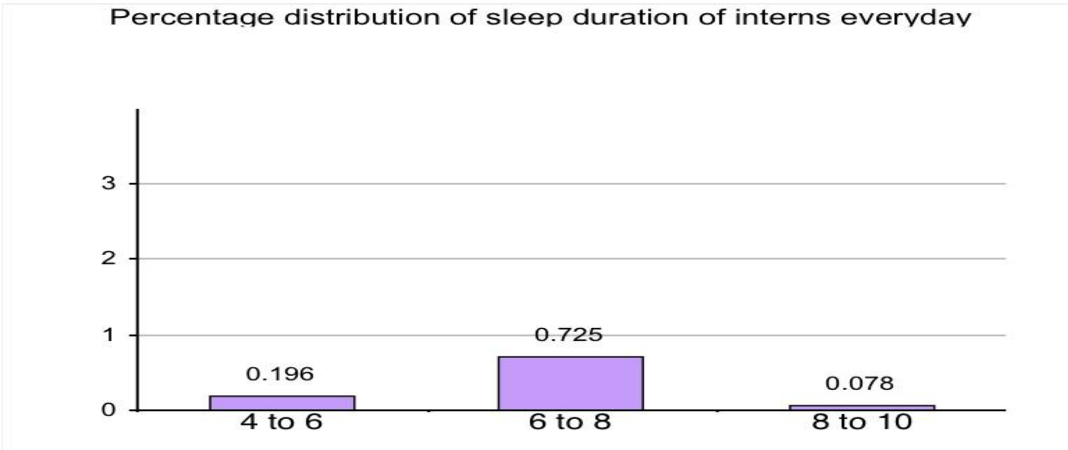


Figure 1:

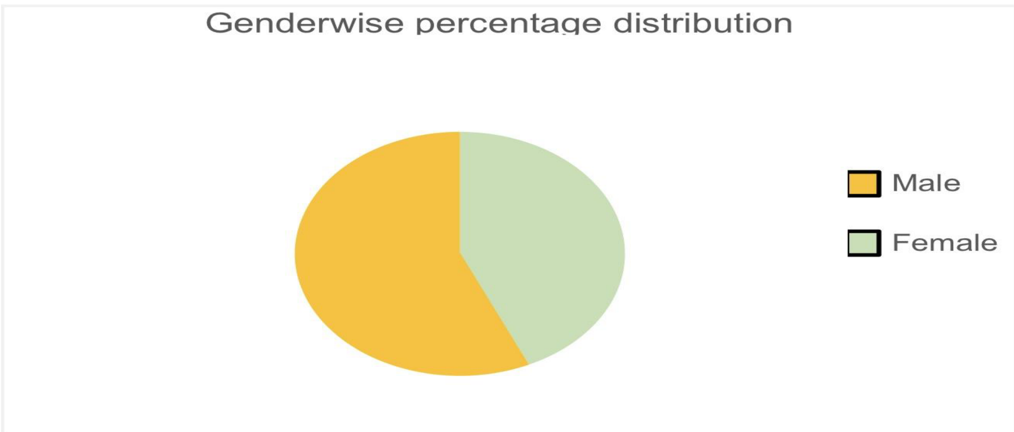


Figure 2:

Table 2: Correlation between the cognitive function of interns after long working hours and lack of sleep

Cognitive Function		STROOP TIME	TMTTIME A	TMTTIMEB	REACTION TIME	AVERAGE RAVLT
CFSCORE	Pearson's Correlation	-0.169	-0.029	-0.133	-0.106	-0.129
	Significance (p-value)	0.235	0.842	0.352	0.460	0.365
EPROSCORE	Pearson's Correlation	0.160	0.041	0.060	-0.182	0.123
	Significance (p-value)	0.262	0.775	0.676	0.201	0.392

Inference: The above table correlates the fatigue and sleepiness scores measured by the Chalder Fatigue scale and Epworth's Sleepiness scale respectively with the Stroop time, Trail making test time, the Reaction time, and Rey Auditory Verbal Learning Test time.

Conclusion

1) There is a negative correlation with respect to the Cognition function of interns after long working hours (CFSCORE) which implies as the fatigue increases the time taken to complete the test will start decreasing.

2) There is a positive correlation with respect to the Cognition function of interns due to lack of sleep (EPROSCORE) which implies due to excessive daytime sleepiness, the time taken to complete the test increases except with the Reaction time which is negatively correlated.

However, there is no significant relation between the cognitive function of interns after long working hours and lack of sleep.

Table 3:

The effect of excessive daytime sleepiness on cognitive function: Using Analysis of Variance (ANOVA)							
1)EPRO Score							
Hypothesis: There is no significant difference in mean time spent on the completion of tasks due to the effect of excessive daytime sleepiness							
ANOVA							
		Sum of Squares	**Df**	**Mean Square**	**F**	**value**	**Conclusion**
Stroop Time	Between Groups	65.973	3	21.991	0.965	0.417	Insignificant
	Within Groups	1070.904	47	22.785			
	Total	1136.877	50				
TMTTIMEA	Between Groups	5.180	3	1.727	0.021	0.996	Insignificant
	Within Groups	3894.365	47	82.859			
	Total	3899.545	50				
TMTTIMEB	Between Groups	966.378	3	322.126	0.788	0.507	Insignificant
	Within Groups	19209.734	47	408.718			
	Total	20176.112	50				
Reaction Time	Between Groups	73450.739	3	24483.580	2.527	0.069	Insignificant
	Within Groups	455404.594	47	9689.459			
	Total	528855.333	50				
Average RAVLT	Between Groups	23.106	3	7.702	4.256	0.009*	Significant
	Within Groups	85.045	47	1.809			
	Total	108.150	50				
*P value < 0.05 indicates significance							

Inference: In the above table, ANOVA has been used to correlate Stroop time, Trail making time, Reaction time, and Average RAVLT within and between the groups. A Significant P value of 0.009 has been obtained by correlating the RAVLT between and within the groups.

Table 4:

Post HOC Analysis					
Average RAVLT		**Mean Difference**	**Standard Error**	**P value**	**Conclusion**
Average daytime sleepiness	excessively sleepy	-0.89	0.63	0.49	Insignificant
	over sleepy consider medical	2.21	1.06	0.18	Insignificant
	Unlikely abnormally sleepy	0.44	0.54	0.84	Insignificant
excessively sleepy	Average daytime sleepiness	0.89	0.63	0.49	Insignificant
	over sleepy consider medical	3	1.03	0.02*	Significant
	Unlikely abnormally sleepy	1.33	0.47	0.035*	Significant
over sleepy consider medical	Average daytime sleepiness	-2.21	1.06	0.18	Insignificant
	excessively sleepy	-3.09	1.03	0.02*	Significant
	Unlikely abnormally sleepy	-1.77	0.98	0.29	Insignificant
Unlikely abnormally sleepy	Average daytime sleepiness	-0.44	0.54	0.84	Insignificant
	excessively sleepy	-1.33	0.47	0.035*	Significant
	over sleepy consider medical	1.77	0.98	0.29	Insignificant
*P value < 0.05 indicates significance					

Inference: With the help of Post HOC Analysis, the average RAVLT has been calculated.

A significant P value of 0.02 has been obtained in the 'over sleepy consider medical' category under the excessively sleepy type, also 0.035 in the 'unlikely abnormally sleepy' category under the excessively sleepy type.

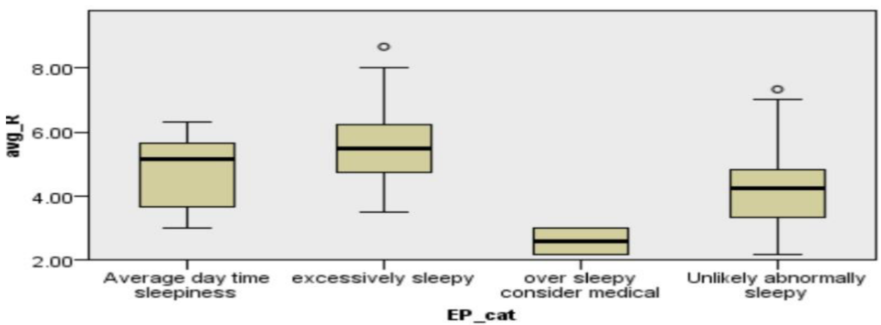
In the 'excessively sleepy' category under over sleepy considered medical type, the P value was obtained as 0.02; which is significant.

In the 'excessively sleepy' category under the unlikely abnormally sleepy type, the P value was obtained as 0.035; which is significant.

Conclusion: There is no significant difference in mean time spent in the completion of tasks due to lack of sleep in all the tests except the significance is observed among Rey Auditory Verbal Learning Test which implies the mean time spent in completing this task is different among those who are not sleepy and those who are over sleepy.

The POST HOC Analysis indicate that the mean time spent in completing the Rey Auditory Verbal Learning Test is significantly different among the people who are over sleepy and requires medical condition and excessively sleepy also among those who are excessively sleepy and unlikely you be abnormally sleepy.

Independent-Samples Kruskal-Wallis Test



Total N	51
Test Statistic	11.049
Degrees of Freedom	3
Asymptotic Sig. (2-sided test)	.011

1. The test statistic is adjusted for ties.

Figure 3:

Discussion

In today's hustle and bustle, we often compromise on our sleep to meet the demands. Resident doctors are among those healthcare providers who face high levels of stress, time restraints, lack of nutrition, and lack of sleep. Night shift duty affects sleep which in turn affects efficiency and decision-making. Sleep is now considered a new frontier in performance enhancement [15]. In the present study, we have evaluated the effects of lack of sleep on the cognitive functions of interns who work endlessly for long duration of hours without any rest at the hospital.

The sleep duration was divided into 3 groups: 4 to 6 hrs., 6 to 8 hrs., and 8 to 10 hrs. per day. Out of the 51 interns, 22 were females and 29 were males and their association in hours per day with the sleep duration was found to be insignificant. Opposite results were reported in a study by Michele Ferrara et al which showed that one night of sleep deprivation alters economic behavior in a gender-sensitive way, they further mentioned that after sleep deprivation females make less risky choices than men [16].

Chalder fatigue scale ascertains tiredness amongst the working population, according to our results, there is a negative correlation between the Chalder fatigue scale with respect to the cognitive function of interns after long working hours, this implies that as the fatigue increases the time taken to complete the test will start decreasing. No studies are available to support our results.

Although sleep deprivation and mental fatigue are two distinguishable conditions, they often occur together in real life, especially among occupations requiring overnight on-call, extended shift, and shift work.

Epworth sleepiness scale assesses daytime sleepiness. We found a positive correlation between the Epworth sleepiness scale and cognitive functions, which means as the Epworth sleepiness score increases the time taken to complete the test increases except the reaction time. Reaction time is negatively associated with the Epworth sleepiness score. However, there is no significant relation between cognitive functions and excess daytime sleepiness due to shift duty or long working hours.

Further analysis with Post Hoc, we found that the Rey Auditory Verbal Learning test shows significant results in which the mean time spent in completing the task is different among those who are not sleepy and those who are over sleepy. The POST HOC Analysis indicate that the mean time spent in completing the Rey Auditory Verbal Learning Test is significantly different among the people who are over sleepy and requires medical condition and excessively sleepy also among those who are excessively sleepy and unlikely you be abnormally sleepy. A study by Yehia Z. Alami et al Concurred with similar results, they explained that daytime sleepiness leads to poor physical composite but, they also noticed, an insignificant effect on the mental aspect [17]. Khullar et al, concluded the results same as our study, with no significant association between sleep duration and the results of the Stroop test [18]. Basil Anderson et al, concluded that in adolescents, subjective sleepiness causes a decrease in selected executive functions and not sleep duration [19]. As per Mittal A & Dixit T, Occupations like armed forces and medicine put in more than 24 hours of service at a stretch which slowed their response time but there was no change in executive functions, which implies that decision-making and judgment ability are preserved [20]. Our results are also concurring with the results of Ibrahim Aliya et al, that doctors worked in different departments for more than 24 hrs. Consecutively in the preceding week and most had high ESS scores but no statistical significance was observed further, all doctors showed heightened daytime sleepiness [21]. Purim KS et al researched Sleep deprivation and drowsiness of medical residents and medical students; wherein they found an insignificant correlation [22].

Sleep deprivation and compensating it with the next day, daytime sleepiness is not a healthy practice. Many studies showed the results obverse to that of ours. A study by Daniah Bondagii et al concluded that resident physicians working in Saudi Arabia have an increased risk of anxiety and depression due to long working hours [23]. Similar results were found by Paola Guraieb-chahin et al, which state that chronic sleep deprivation causes an alteration in selective attention, working memory, processing speed, and inhibition [24]. El Hangouche AJ et al showed that poor sleep quality excessive daytime sleepiness and psychological distress are highly prevalent in medical students and poor sleep quality and low academic performance are significantly associated [25].

Naveen Aalasyam et al observed a negative correlation between sleep latency and spatial memory whereas a positive correlation was observed between sleep latency and verbal memory. Thus, the study provides research evidence for loss of sleep causing profound impairment in cognitive performance [26]. Yehia Z. Alami et al, reported that resident doctors suffered from daytime sleepiness and it significantly affected several aspects of their quality of life including physical function, health, body pain, and general health [27]. Reaction time correlation with lack of sleep due to long working hours was found to be insignificant in our study, but in a Research study by Dr. Jeetendra Yogi et al, the Effect of sleep deprivation on audio-visual reaction time in resident doctors, the audio-visual reaction time was increased significantly at the end of 24 hr. duty period as compared to the start of the duty [28].

Uppal et al mentioned that there is a significant increase in the Pittsburg Sleep Quality Index (PSQI) scoring and neurocognitive tests. Although no statistically significant association was obtained between the two, Trail-making test-A took significantly more time during the sleep-deprived phase than during the non-sleep-deprived phase. The Trail-making test-B also showed greater time to complete the trial by the participants in sleep sleep-deprived phase as compared to the non-sleep-deprived phase score. The ratio of Trail making test B score to Trail making test A score was also significantly increased during sleep deprived phase [29].

S P Drummond et al used functional MRI to find out the effects of sleep deprivation on cerebral activation. They found Prefrontal cortex (PFC) was more responsive after sleep deprivation. Increased subjective sleepiness in sleep-deprived subjects correlated significantly with activation of the prefrontal cortex. The temporal lobe was active after normal sleep, but not after sleep deprivation. In contrast, the parietal lobe was not activated after normal sleep but was activated after sleep deprivation. Hence, they proved that better free recall in sleep-deprived subjects was associated with greater parietal lobe activation. These findings show that there are dynamic, compensatory changes in cerebral activation during verbal learning after sleep deprivation and implicate the PFC and parietal lobes in this compensation [30]. For verbal learning and divided attention, Increased activation is seen in the bilateral prefrontal cortex and parietal lobes after total sleep deprivation.

Increased sleepiness after Total Sleep Deprivation was correlated with increased activation in specific regions of the prefrontal cortex and lower levels of memory impairment were correlated with increased activation in specific regions of the parietal lobes. Significantly decreased activation in the bilateral prefrontal cortex and parietal lobes was noted with arithmetic tasks. It was hypothesized, based on this and other data, that there is an adaptive cerebral response during cognitive performance following Total Sleep Deprivation having specific patterns of adaptations for specific cognitive functions performed [31].

The theories about the underlying effects of sleep deprivation on the central nervous system (CNS) can be divided into two main approaches. The first one, known as the “prefrontal vulnerability hypothesis” states that lack of sleep impairs executive functions, the cognitive process mediated by the prefrontal cortex [32]. The second, known as the “unstable state hypothesis”, postulates that performance due to sleep deprivation is increasingly variable due to the influence of sleep-initiating mechanisms on the endogenous capacity to maintain attention and alertness, thereby creating an unstable state that fluctuates within a second and that cannot be characterized as either fully awake or sleep [33].

Conclusion

Sleep is considered a vital and organized sequence of events that follows a regular cyclic program each night to ensure that the human body can recover and perform at its optimum. Being a vital component of a healthy lifestyle, consequences of Sleep Deprivation are evident in the overall behaviour, and considerable social, financial, and health-related costs, in large measure because it leads to impaired cognitive performance due to increasing proclivity to sleep and instability of waking neurobehavioral functions.

However, our study showed that the lack of sleep or excessive daytime sleepiness does not affect the cognitive performance of interns significantly. It may be because of increased activation in specific regions of the prefrontal cortex and parietal lobes as proved in other studies. We hypothesize an adaptive, potentially compensatory cerebral response during cognitive performance following sleep deprivation with a specific pattern of adaptation depending on the specific cognitive processes performed. Many questions arise before the full nature and extent of this adaptive response can be known. Detailed research is required to answer these questions, which will provide insight into the plasticity of the brain and perhaps the functions of sleep itself.

Implications: Lack of sleep is detrimental to humans. There is an important link between sleep and cognitive processing as sleep plays an important role in consolidating different types of memory and contributes to insightful thinking. The role of appropriate sleep in an intern’s life is directly related to his/her cognitive functioning.

To enhance patient care and safety and to produce healthy doctors for the future, it is extremely salient for interns/residents to have an appropriate work-life balance. Hence, by conducting this research we found a relationship between cognitive functions and long working hours for sleep-deprived interns. Let’s all hope for a brighter future in medicine with a healthy lifestyle!

Limitation: As the small sample size is the limitation of our study, future work with a larger sample size will be more effective in generalizing the results.

Author's Contributions: All the authors have equally participated in the research study and preparation of the manuscript.

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