

To Study the Effect of Excessive Daytime Sleepiness on Critical Fusion Frequency in Medical Students

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Abstract

Background: Sleep is a physiological process essential for life. Sleep loss leads excessive daytime sleepiness (EDS) which leads to many like complications like impaired memory and cognition, decreased work performance, increased chances of vehicular accidents etc .The Critical Flicker Fusion (CFF) test provides an index of central nervous system activity or cortical arousal which measures arousal and alertness. Thus, this study is carried out with aim of deciphering the effect of Excessive daytime sleepiness on Critical fusion frequency in medical students

Objective: To compare ESS and CFF between normal and daytime sleepiness group and correlate EDS with CFF.

Material and methods: This is a descriptive cross sectional study carried out in 124 undergraduate medical students in the age group of 18-25 yrs at Sri Devaraj Urs medical college ,Kolar. Institutional ethical clearance was obtained. Epworth Sleepiness Scale (ESS) questionnaire was administered to assess daytime sleepiness and CFF was measured using CFF M1 Model instrument and the frequency was measured from the recorded data using Sweepgen software.

Results: Excessive daytime sleepiness is seen among 25% of the subjects. CFF was significantly ($p=0.001$) decreased in daytime sleepiness group compared to normal group. ESS shows weak negative correlation with CFF in daytime sleepiness group.

Conclusion:

CFF an index of cortical arousal and alertness decreased with excessive daytime sleepiness group compared to normal deciphering that sleepiness leads to decreased cortical arousal and alertness and increases mental fatigue.

Keywords: Excessive Daytime Sleepiness (EDS), Critical fusion frequency (CFF), cognitive function, cortical arousal, alertness

I. Introduction

Sleep is a physiological process essential for life. It is considered to be important to body restitution, like energy conservation, thermoregulation, and tissue recovery. In addition, sleep is essential for cognitive performance, especially memory consolidation. The quality of life can be disrupted due to many different reasons one important cause may be due to sleep loss. In certain jobs, due to increase in working hours the people face sleep restriction especially in some professions like health care, security and transportation which require working at night. In such fields, the effect of sleep deprivation (SD) on performance is crucial. Furthermore, people tend to stretch their capacity and compromise their nightly sleep, thus becoming chronically sleep deprived (1). These conditions impair the quality and quantity of nocturnal sleep and share a common symptom - Excessive daytime sleepiness (EDS). Thus EDS is a symptom and not a disease/disorder by itself. Thus, EDS is characterized by persistent daytime sleepiness even after adequate quantity of night sleep, which may be due to disturbances in sleep like snoring, sleep apnoea, restless leg movements etc., which compels the individual to nap repeatedly during daytime. This leads to many complications like impaired memory and cognition, decreased work performance, increased chances of vehicular accidents etc. (2) Studies done in sleep deprived medical professionals revealed a reduced capacity to perform intellectually demanding or non-stimulating tasks, especially among doctors with less professional experience. Similarly, medical students were also subjected to huge academic stress, work load, shift postings and performance pressure making them prone to EDS. As per medical students, there is scarce information in the literature on the potential consequences of excessive daytime somnolence (3).

The Critical Flicker Fusion (CFF) test provides an index of central nervous system activity or cortical arousal which measures arousal and alertness (4). The CFF is widely used in the study of human behaviour, since it can be administered quickly and easily, and it is commonly applied to study the fatigue. Because fatigue is associated with decreased arousal, it might seem reasonable to assume that CFF

provides a measure of its effect (5). Despite the importance of these facts, little is to be found in the literature regarding effect of daytime excessive drowsiness on cognitive function in medical students.

Thus, this study is carried out with aim of deciphering the effect of Excessive daytime Sleepiness on Critical fusion frequency in medical students.

II. Objectives

1. To determine the Excessive daytime sleepiness in medical students using Epworth Sleepiness Scale
2. To determine critical flickering fusion frequency in medical students
3. To compare Epworth sleepiness score with critical flicker fusion frequency in medical students
4. To correlate Excessive daytime sleepiness with critical flicker fusion frequency in medical students

III. Material And Methods

This is a descriptive cross sectional study carried out in undergraduate medical students in Sri Devaraj Urs medical college, Kolar. The study population consists of total 124 subjects including both males and females in the age group of 18-25years. Institutional ethical clearance was obtained. Subjects with history of sleep disorders, neurological and endocrine disorders, and ophthalmic disorders was excluded from the study. The data was collected by self-administering the questionnaire to the students which consist of two parts. First part recorded the demographic information including age, sex, religion, education. Second part was Epworth Sleepiness Scale (ESS) which is one of the most reliable scales for evaluating Sleepiness. The questionnaire asks the subjects to rate his /her probability of falling asleep on a scale from 0-3 for different eight situations. These scores of eight questions are added together to obtain a single number. A number in the 0-9 range is considered to be normal while the numbers between 10 and 11 are border and 12- 14 range indicate that expert medical advice should be sought.

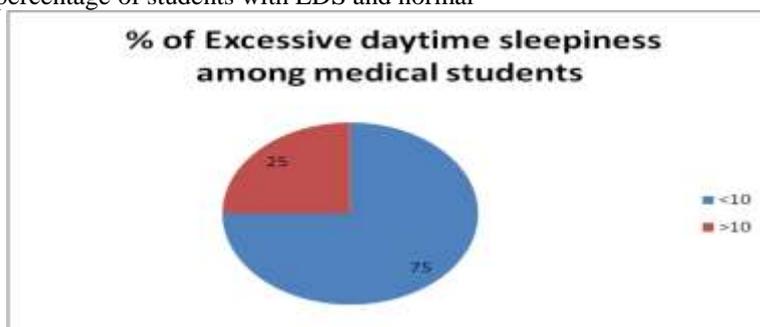
CFF was measured using in house built LED based CFF M1 Model instrument. CFF M1 model instrument has 2 components. One component has a flickering light source placed in a board of white background (to provide central field stimulation). Light source is presented separately to the individual eye by covering the other eye. A monochromatic light, red light (light emitting diode) with wave length 630nm is used as it is perceived for longer time in the retina. There is no delay period for switching on as the light source is designed so that the on period and off period are kept equal. Second component is a variable frequency square wave oscillator which can give oscillations in the range of 10-80 hertz with an accuracy of 0.5 hertz. To measure CFF, examination room is partially illuminated; subject is able to sit comfortably and presented with a red light source at a distance of 25-30cms. Frequency of oscillations is gradually increased. Subject is instructed to respond when the flickering light source appears as a single fused light and that particular frequency is critical flicker fusion frequency (CFF). The frequency was measured from the recorded data using Sweepgen software. CFF was measured in right and left eye separately and average of two frequencies will be considered as final CFF value for that subject.

IV. Statistical analysis

SPSS17.0 was used for the statistical analyses. All continuous variables are expressed as mean \pm standard deviation. Mann Whitney U test was applied to compare the ESS scores. Independent t test was done to compare CFF in normal & EDS groups. Pearson's correlation test was done to determine the relationship between ESS & CFF in normal and EDS group & P <0.05 is considering statistically significant.

V. Results

Values are expressed as mean \pm SD. The p-value is of independent t-test where p, 0.05 is significant. Figure 1 shows the percentage of students with EDS and normal



In total of 124 subjects were enrolled; 91 were normal and 32 were having excessive daytime sleepiness. Comparison of mean values of age and CFF were given in table no 1. there was a significant decrease in CFF among daytime sleepiness group compared to normal but age was comparable between both the groups.

(Figure 2) A Mann Whitney U test was conducted to determine whether there was a difference in the score of normal (ESS <10) & daytime sleepiness (ESS>10). From this data it can be concluded that there was a significantly higher score in daytime sleepiness group compared to normal group (U=19.5, z=-8.333, p<0.000).

Figure 2: Comparison of ESS among normal and excessive daytime sleepiness groups

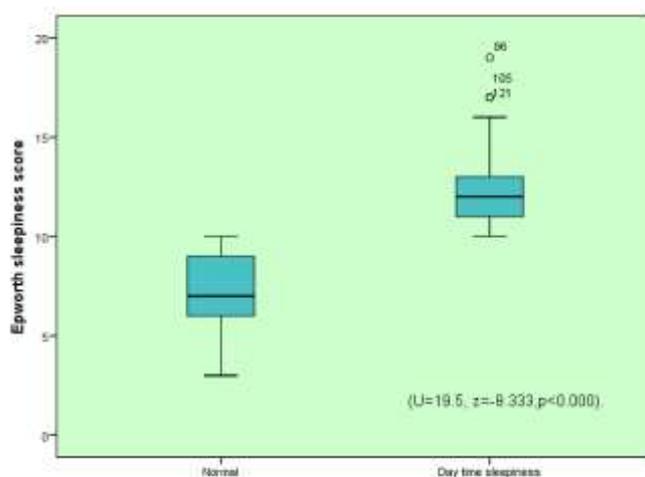


Table 1: independent t test of age and critical fusion frequency among normal and daytime sleepiness group.

Sl.no	parameters	Normal (ESS <10) N=91	Daytime sleepiness (ESS>10) N=32	P value	t value	df
1	Age	19.21±1.10	19.09±0.85	0.593	0.536	(121,69)
2	Critical flicker frequency threshold	29.43±3.42	25.82±3.22	0.001	5.203	(121,57)

Table 2 shows that there was a weak negative correlation between ESSs and CFF in daytime sleepiness group but statistically non significant. In normal individuals CFF does not show correlation with ESS.

Table 2: Pearson' s correlation between ESS and CFF in normal and EDS groups.

Parameter	Normal		Excessive Daytime Sleepiness	
	r	p	r	P
CFF	0.049	0.641	-0.064	0.727

Discussion

The present study is conducted to assess the effect of daytime sleepiness on CFF among medical students. This study was conducted in 124 medical students whose age was matched in normal (75%) and daytime sleepiness group (25%). The mean CFF is significantly decreased in daytime sleepiness group compared to normal group.

In our study sleepiness assessed by Epworth sleepiness score was seen in 25% of the medical students. Our results are consistent with other study which also showed that 37% of the medical students reported daytime sleepiness.(6) One study reported that medical students showed more sleep problems compared to non medical students. This may be because of long duration and high intensity study, away from home, night shifts, peer pressure, addiction to smart phones which delay the onset of sleep which results in excessive daytime sleepiness.(7) Since sleep is essential for the life, Sleep deprivation may affect both physical and psychological well being of the subject. Psychologically, inadequate sleep can affect cognitive functioning and has been linked to reduced short-term memory, decreased learning ability, poor productivity, and decreased motor performance.(1) Studies have shown that students suffering from excessive daytime sleepiness lose interest in lectures and thereby lag behind in their academics.(8)

CFF is an objective which is an index of central nervous activity or cortical arousal which measures alertness and mental fatigue. (4) Many previous studies showed that sleep deprivation leads to decreased academic performance but most of the studies assessed the cognitive function based on their academic performance.(6,7,8) However data with respect to the ESS and CFF among medical students is less. Hence, the present study is done to see the effect of daytime sleepiness on CFF among medical students.

In the present study, CFF was significantly decreased in daytime sleepiness group compared to the normal group individuals showing that sleepiness affects their cortical activation and alertness. Daytime sleepiness as a consequence of sleep deprivation affects their concentration and alertness during lectures which also affects their academic performance. (8)Studies have shown that consolidation of memory takes place during sleep. One of the most important theories regarding sleep has its role in the consolidation of recently acquired memories. Studies analyzed by Rauchs et al. showed that all four long-term memory systems (procedural memory, perceptual representation system, semantic and episodic memory) need either non-rapid eye movement (NREM) or rapid eye movement (REM) sleep or need both sleep stages to consolidate memories. Cognitive competences such as consolidation and encoding of memories are very important in higher education, especially for medical education, because medical students need to retain a substantial amount of complex factual knowledge within short period of time. (7) So sleep deprivation affects the cognitive function which impairs the academic performance of the students.

In our study CFF is negatively correlated with the daytime sleepiness score. This showed that daytime sleepiness leads to decreased cortical arousal and alertness of the subject which leads to the disturbance in cognitive functions like concentration, learning and memory. (4) Since sleepiness interferes with the regulation of vigilance, one may assume that a disturbance of this basic dynamic variable causes deficiencies in information processing which in turn reduce the capacity for learning and memory.(9)

Limitation

Sample size is less. We would not assess the sleep quality and academic performance.

VI. Conclusion

The present study showed high prevalence of daytime sleepiness among medical students. The analysis between daytime sleepiness and CFF shows a significant relationship. Therefore medical students should be educated regarding the importance of sleep for their academic performance and also to inculcate sleep hygiene to overcome the sleep deprivation.

Acknowledgement: All the students who participated in this study.

Conflicts of interest: NIL

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