Is artificial light from tablets and smart phones affecting sleep pattern in youngsters?

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Abstract

Introduction and Objective: Global warming and industrialization has affected public health. Modern world has explored a popularity of hand-held digital devices. The advent of electronic devices has significantly impacted on the sleep-wake patterns because of the LED light. Good quality sleep and adequate amount of sleep are important in order to have better cognitive performance and avoid health problems and psychiatric disorders. Lack of sleep affects alertness, concentration, memory leading to later developing obesity, diabetes, heart disease, anxiety disorders, substance abuse, depression and stroke in adults and concentration problems in children. Hence the current study was designed to explore artificial light from tablets and smart phones affects sleep pattern in youngsters.

Aim: To assess the Quality, pattern and daytime sleepiness young healthy male subjects exposed to artificial light from electronic gadgets.

Materials and Method: Fifty young healthy males in the age group of 18 -25 years were included for the study. Informed consent was taken from the participants who volunteers for the study. The Quality and pattern of sleep were assessed by using Pittsburgh Sleep Quality Index (PSQI). Global PSQI score ranges from 0 to 21; the higher the score is, the worse the sleep quality. A global score equal or greater than 5 indicates poor sleep quality in the last month. Daytime sleepiness was assessed by The Epworth Sleepiness Scale (EPSS) over the last month. EPSS score equal or greater than 7 indicates daytime sleepiness.

Results: Use of smart phones at bedtime (2.08±0.45) positively correlated with global PSQI & EPSS score (r = 0.79, r = 0.8, p<0.01). On the other hand, sleep duration (6.23±0.53) was negatively correlated with global PSQI score (6.24±1.07) & EPSS score (6.64±1.39), (r_1 = -0.81, r_2 = -0.75, p<0.01).

Conclusion: Our data suggests that individuals using smart phones for a longer duration at bedtime have poor quality of sleep and increased daytime sleepiness. Sleep disturbance can be avoided by dimming the screen brightness and holding the gadget about 1 foot away from the face can stop the light from interfering with a good night's sleep.

Keywords: Sleep pattern, PSQI, EPSS, Artificial light, and Tablets.

Introduction

Sleep is an important aspect of maintaining the body's circadian rhythm. Global warming and industrialization has affected public health. Modern world has explored a popularity of hand-held digital devices. The advent of electronic devices has significantly impacted on the sleep-wake patterns because of the LED light. Melatonin, which is a hormone produced during dark, helps to regulate & promote sleep. People who do not have enough melatonin of the hormone take longer to fall asleep. The extent of the response of the circadian clock will depend on how bright the light is and how far the device is from the eyes as well as what color of light are being emitted. Sleep at night is essential for good health. Lack of sleep can affect alertness concentration memory leading to problems at study/work place. They are at much greater risk of later developing anxiety disorders, depressive illness substance abuse & on physical side they're at increased risk of poor glycemic control and diabetes so on. Lack of sleep affects alertness, concentration, memory leading to later developing anxiety disorders, depressive illness, poor quality of life and substance abuse.

Exposure to artificial light from electronics disrupts sleep pattern, causes decreased melatonin and difficulty falling asleep. It is known that decreased sleep causes anxiety disorders affecting cognition, memory, alertness & physical health.

Hence the current study was designed to assess the sleep Quality, pattern and daytime sleepiness young healthy male subjects exposed to artificial light from electronic gadgets.

Materials and Method

The study was conducted in a sample of fifty young healthy male subjects exposed to artificial light from electronic gadgets in the age group of 18-25 years. Informed consent was taken from all the participants who volunteered for the study. The study was approved by Institutional Ethical Committee.

Inclusion criteria:
1. Fifty healthy male subjects between 18 and 25 years exposed to artificial light from electronic gadgets for more than 2-3hrs a day.

Exclusion criteria:
1. History of consumption of alcohol/smoking.
2. History of depressive disorders in the past.
3. History of sleep disorders
4. Hypertension
5. Diabetes mellitus
6. History of consumption of drugs acting on CNS

Study design: The subjects were selected by a detailed history & thorough physical examination. The subjects were asked to fill the questionnaire to assess their smart phone use in day and at bedtime status.

Instrumental tools used in the study: *The Pittsburgh Sleep Quality Index (PSQI)* is an effective instrument used to measure the quality and patterns of sleep in adults. It differentiates "poor" from "good" sleep by measuring seven domains: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, and sleep disturbances, use of sleep medication, and daytime dysfunction over the last month. Scoring of the answers is based on a 0 to 3 scale, whereby 3 reflect the negative extreme on the Likert Scale. A global sum of "5"or greater indicates a "poor" sleeper. The PSQI has internal consistency and a reliability coefficient (Cronbach's alpha) of 0.83.

The Epworth Sleepiness Scale (ESS) is an effective instrument used to measure average daytime sleepiness. Numerous studies using the ESS have supported high validity and reliability with Cronbach's alpha, ranging from 0.74 to 0.88. The questionnaire asks the subjects to rate their probability of falling asleep in eight different situations. Scoring of the answers is 0-3, with 0 being "would never doze" and 3 being "high chance of dozing". A sum of 0-9 is normal, 10 & 11 borderline and 12-24 need for further evaluation.

Statistical analysis: The results were expressed as mean ± standard deviation (SD). Karl-Pearson's correlation co-efficient was used to test for significance relationships between variables. A p value of <0.05 was considered statistically significant. Statistical analysis was performed using the statistical package for social & sciences. Chi square test was applied to compare between the parameters.

Results

Sleep quality and daytime sleepiness was determined by Pittsburgh Sleep Quality Index and Epworth Sleepiness Scale in fifty healthy male subjects in the age group of 18-25 (19.56±2.23) years. Sleep quality (6.24±1.07), sleep duration (6.23±0.53) hrs, smart phone usage (2.08±0.45) hrs and daytime sleepiness (6.64±1.39), are tabulated in Table 1.

Table 1: Correlation between Smart phone usage, global and EPSS score

Smart phone usage(Hrs) (mean±sd)	Global score (mean±sd)	EPSS score (mean±sd)	r_1	r_2	p
2.08±0.45	6.24 ±1.07	6.64 ±1.39	0.79	-0.80	<0.001

r_1 = Partial Correlation variable for Global score
r_2 = Partial Correlation variable for EPSS score

Table 2: Correlation between Sleep duration, global and EPSS score

Sleep duration (Hrs) (mean±sd)	Global score (mean±sd)	EPSS score (mean±sd)	r_1	r_2	p
6.23±0.53	6.24 ±1.07	6.64 ±1.39	-0.81	-0.75	< 0.001

r_1 = Partial Correlation variable for Global score
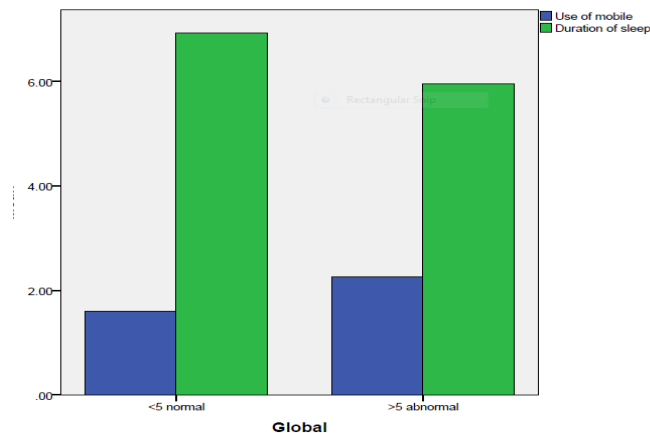r_2 = Partial Correlation variable for EPSS score

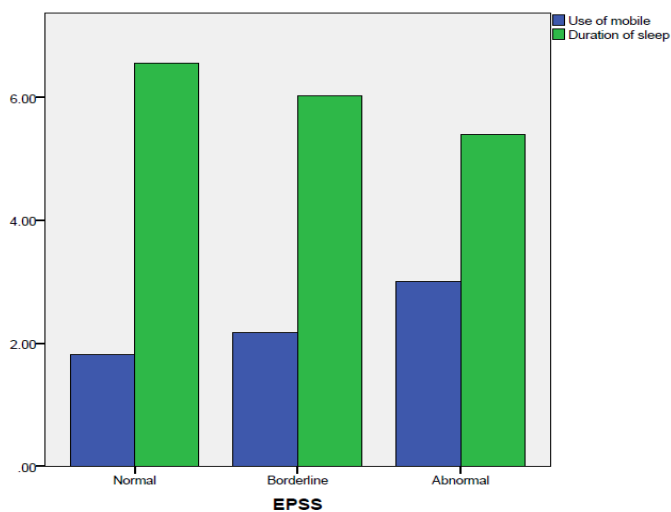**Fig. 1: Bar chart showing Global score with the use of mobile & duration of sleep**

Fig. 2: Bar chart showing EPSS with the use of mobile & duration of sleep

Discussion

In the olden days, people were exposed to greater light only during the day between sun rise and sunset. Now, with the advanced development in technology we are exposed to the artificial light from LED, LCD televisions and hand-held electronic gadgets, and we are not exposed to sufficient darkness. This creates a situation in which the internal clock which keeps up the time and the biological pace setting mechanisms of the body's circadian rhythm is altered. Data as suggested by National Sleep Foundation, documents that the significance of light in promoting wakefulness and sleep. Photoreceptors in the retina senses light and dark and these signals are carried to the brain to sense the external world and thereby aligning the body's circadian rhythm to the external day-night cycle. Circadian rhythm is regulated by suprachiasmatic nucleus (SCN), a cluster of neurons located in the hypothalamus. These signals of light and dark carried from photoreceptors helps to be alert and wakeful in the daytime and to fall asleep in the night at an appropriate time.

Melatonin, hormone produced during dark, helps to regulate & promote sleep and is responsible for sleep-wake cycles. Studies suggest that individuals lacking melatonin take longer time to fall asleep.[9-13] The response of circadian clock depends on how bright the light is, how long the individual is using and how far the device is from the eyes including the color of light are being emitted from gadgets. *Melatonin* is the most potent stimulator of sleep-wake cycle, and when its secretion is decreased there is more of wakefulness, alertness and less sleepiness in a healthy person at bed time. By evolution humans are exposed to bright firelight and sunlight yellow, orange, and red wavelengths which will not suppress the melatonin secretion as that of white and blue wavelengths of hand held smart phones does. Humans can protect melatonin secretion in the body when the sun goes down by shifting to a low-wattage bulb with yellow, orange or red light instead of bright advanced LED lights & by limited use of smart phones at bedtime.

Conclusion

Our study concludes that individuals using smart phones for a longer duration at bedtime have poor quality of sleep and increased daytime sleepiness. Sleep disturbance can be avoided by limited use of hand-held electronic gadgets, dimming the screen brightness, changing the display color from bright blue and white to less brighter yellow color and holding the smart phones and tablets about one foot away from the eyes can stop the light from interfering with the individual's good sleep at bedtime. By lifestyle modifications & relaxation techniques, such as yoga, meditation may be helpful in preparing the body to fall asleep sooner. Exercise done in the early morning, can also be helpful in reducing stress and promoting deeper sleep.

Scope of the study

Further study can be extended with the estimation of hormones.

Acknowledgements

Conflict of Interest

The authors declare no conflict of interests.

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