

Asian Resonance

Effects of Mobile Radiation on Sleep Pattern

Abstract

In recent years, the extensive use of mobile phones has led to exposure of humans to radio frequency electromagnetic fields (RF EMFs). This paper reveals that the exposure to EMFs from mobile phones prior to sleep affects the sleep pattern. A biological explanation for an association between exposure to RF EMF and disturbed sleep pattern can be hypothesised on the ground that the electromagnetic field exposure suppresses melatonin excretion by pineal gland.

Keywords: Electromagnetic field, sleep pattern, melatonin, National Sleep Foundation, quality sleep, REM, mobile usage.

Introduction

The National Sleep Foundation in 2011, published statistics of a survey revealing that more than half (60%) of the respondents experience lack of quality sleep every night. Quality sleep is a deep sleep that allows one to have enough REM (rapid eye movement). Almost everyone surveyed, 95% uses some type of electronic device like a television, computer, video game or mobile phone at least a few nights a week within the hour before bed.

Electromagnetic devices produce electromagnetic fields (EMFs). EMFs can cause sleep loss through suppressing the production of melatonin in the body. Melatonin is a hormone produced by pineal gland. Melatonin plays an important role in the regulation of sleep cycles. Some studies are beginning to reveal that a disruption in melatonin production not only impacts sleep, but that it may also lead to possible long term health issues.

Studies led by Charles Graham, physiologist at the Midwest Research Institute in Kansas City, indicated that cell phone radiations imbalance the hormones including estrogen, testosterone and melatonin. Melatonin is produced almost 90 minutes after we fall asleep. When this hormone is inhibited by radiations, it leads to sleep disorders.

In a study carried out by researchers in Wayne State University School of Medicine in Detroit, Michigan in collaboration with researchers in Sweden, it was found that cell phone usage for a substantial period of three hours or more immediately prior to bed time disrupts sleep patterns.

A study conducted on Japanese adolescents, showed a significant correlation between cell phone use after lights out and sleep disturbances such as short sleep duration, low sleep quality and excessive daytime sleepiness, as well as symptoms of insomnia. Sleep displacements appear to be at a higher level among children and adolescents than in other age groups.

Objective of the Study

The study is designed with the objective of finding correlation, if any, between mobile usage duration before going to bed and sleep pattern.

Review of Literature

There exists a relationship between average hours of sleep and technology use before bedtime. Children who used their phone at bedtime reported approximately 1 hour less of sleep than those who did not.¹ The EMR emitted by the mobile antennas used at the base stations affects the cell structure of the living beings.²

Exposure to electromagnetic waves can break DNA chains, damage proteins, even increase the blood brain barrier permeability, disturb sleep, and cause fatigue, memory and concentration problems. Thus, neural, hormonal and psychosocial development is affected.³ Residents exposed to electromagnetic radiation from telecommunication towers suffer insomnia. In addition, they noted other non-specific health symptoms. These symptoms include headache, giddiness, loss of memory, mental slowness, reduced reaction time and mood swing.⁴



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Use of mobile phones during normal sleeping hours may contribute to day time sleepiness.⁵

Radiations from cell phone base station affect the adrenal glands. These glands stimulate the production of adrenaline and cortisol. Excess adrenaline causes insomnia.⁶

Radio frequency electromagnetic field (RF EMF) before sleep alters brain activity that affects sleep.⁷

Most of the reported effects of electromagnetic radiation of mobile phones on central nervous system demonstrate dose response relationship. This means that small doses of EMR may not cause health problems. But larger doses can produce health symptoms upon reaching a certain threshold level.⁸

Methodology

The present observational study was conducted in the month of April 2018, on the volunteers among first and second year medical students of Jawaharlal Nehru Medical College, Aligarh Muslim University, Aligarh. The volunteers filled a questionnaire comprising of questions related to their mobile usage duration before going to bed and their sleep pattern. Questions related to sleep pattern were measured using Pittsburgh Sleep Quality Index (PSQI). Chi square test was used for statistical analysis. Sample size of the study is 300.

Hypothesis

For chi square test, Null hypothesis: There is no association between mobile usage duration before going to bed and time taken to fall asleep.

Alternate hypothesis: There is an association between mobile usage duration before going to bed and time taken to fall asleep

Observations

Observed Frequency Table

Time taken to fall asleep \ Mobile usage duration before going to bed	<15 minutes	Between 15 minutes to 30 minutes	Between 30 minutes to 1 hour	>1 hour	Total
Between 15 minutes to 30 minutes	40	31	9	20	82
Between 30 minutes to 1 hour	37	21	13	33	119
>1 hour	31	16	15	34	99
Total	108	68	37	87	300

Expected Frequency Table

Time taken to fall asleep \ Mobile usage duration before going to bed	<15 minutes	Between 15 minutes to 30 minutes	Between 30 minutes to 1 hour	>1 hour	Total
Between 15 minutes to 30 minutes	29.52	18.58	10.11	23.78	82
Between 30 minutes to 1 hour	42.84	26.97	14.67	34.51	119
>1 hour	35.64	22.44	12.21	28.71	99
Total	108	68	37	87	300

Calculation of chi square (χ^2) value

Observed value (O)	Expected value (E)	(O-E)	(O-E) ²	(O-E) ² /E
40	29.52	10.48	109.83	3.720
37	42.84	-5.84	34.10	0.795
31	35.64	-4.64	21.52	0.603
31	18.58	12.42	154.25	8.301
21	26.97	-5.97	35.64	1.321
16	22.44	-6.44	41.47	1.848
9	10.11	-1.11	1.23	0.121
13	14.67	-1.67	2.78	0.189

15	12.21	2.79	7.78	0.637
20	23.78	-3.78	14.28	0.600
33	34.51	-1.51	2.28	0.066
34	28.71	5.29	27.98	0.974

Total 19.175

Degree of freedom = 6

Level of significance was set at 0.05

Critical value of χ^2 at level of significance 0.05 for 6 degree of freedom is 12.592Calculated value of χ^2 is 19.175**Result**

Since the calculated value of χ^2 (19.175) > critical (table) value of χ^2 (12.592) at level of significance 0.05 for 6 degree of freedom, therefore the null hypothesis is rejected and the alternate hypothesis is accepted.

This result establishes a correlation between mobile usage duration before going to bed and sleep pattern.

As the mobile usage duration increases (from 15 minutes to >1 hour), there is a relevant increase (from <15 minutes to >1 hour) in the time to get asleep.

Conclusion

A statistically significant association is observed between the duration of mobile usage before going to bed and the time taken to fall asleep.

Hence, it is concluded that the individuals who use their mobile phones for long durations before going to bed experience disrupted sleep pattern.

Suggestions

Long term exposure to electromagnetic radiation emitting gadgets like mobile phones should be avoided. There should be a minimum usage of mobile phones just before going to bed so that one can experience a sound sleep.

Future Scope

Further detailed study can be conducted by using control groups whose mobile usage can be tracked via a custom made app. Further collaboration with neuroscientists can be done to improve understanding at the biochemical level. A collaboration with radiologists and the engineering and RnD teams of cell phone companies can be done to reduce the intensity of electromagnetic radiation that disrupt the biochemical processes in the human body without any significant reduction in the performance of the mobile devices themselves.

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