



Digital screen exposure and sleep disturbances among 3- 13 year old children in India: A hospital based cross sectional study

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ABSTRACT

Introduction

Early childhood is a crucial period that sets the foundation for lifelong health and well-being. With the proliferation of smartphones, tablets, computers, and interactive learning devices, today's children are exposed to digital media at a much earlier age and for extended periods of time. Screen usage by children have huge impact on health-related issues, particularly on sleep pattern, which in turn has many adverse emotional, cognition related consequences.

Methodology:

This hospital based cross sectional study was conducted in Chhattisgarh Institute of Medical Sciences (CIMS), Bilaspur (C.G.) India, among children of age group from 3 to 13 years. Which included 200 sample size with objective to assess screen time and effect on sleep pattern. Pre-designed, pretested, semi-structured questionnaire were administered to parents/caretaker, and face-to-face interview was conducted. Sleep disturbance scale was used to assess sleep disorder. Data was analysed; Chi-square test applied with a significance level of $p < 0.05$.

Result:

This study included 54% boys and 46% girls. The mean screen time of study subjects was 121.55 minutes (~ 2 hrs) and prevalence of sleep disorder was found to be 32%. When comparing screen time and sleep disturbance, having higher mean screen time (145.31 ± 75.73) was significantly associated with sleep disturbance ($p = 0.002$).

Conclusion

The results underscore a concerning link between excessive screen time and sleep related issues, necessitating awareness and proactive measures to address screen usage and its effects on children's health and well-being.

Key words: Screen time, Sleep Disturbance

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INTRODUCTION

Screen time refers to the time spent using devices that have screens, including televisions, smartphones, tablets, computers, and other learning devices, has become an integral part of modern childhood.¹ The COVID-19* pandemic resulted in exponential rise in online learning and movement limitations, causing more time to spent in front of screens for education, entertainment, and social interaction. While this has aided in preserving a sense of normality, it has resulted in screen time exceeding the suggested two hours daily.² Children who spend excessive time in front of screens are at an increased risk of experiencing sleep disturbances, including difficulty falling asleep and reduced sleep duration. Light is one of the factors which affects sleep-wake cycle. Photosensitive cells of retina (rods and cones) respond to light, absence of light at nighttime leads to enhanced melatonin secretion, which, in turn induces feeling of sleepiness. Screen use, particularly before bedtime, delaying release of melatonin, increasing sleep onset and disrupting circadian rhythm. Screen use has been associated with poor quality sleep.³ Sleep disturbances due to screen were associated with increased daytime sleepiness, difficulty concentrating, and mood changes, all of which can negatively affect academic performance and overall well-being.⁴ As young children are foundation of healthy society, the long-term negative effects of excessive screen use on physical and mental health are of increasing concern. Existing studies demonstrated an association between screen time and sleep disturbances in children; there is paucity of data from our state regarding adverse effects of screen use among paediatrics population. This highlights a significant knowledge gap. hence, this cross-sectional study was designed to assess effect of screen time over sleep pattern, with aim of facilitating early interventions and promoting healthy screen practices that may ultimately impact the well-being and productivity of future generations.

Material and method: This was a hospital-based cross-sectional study conducted in Chhattisgarh Institute of Medical Sciences (CIMS), Bilaspur among paediatric population of age group 3 to 13

years, with the objective to determine screen time and impact on sleep pattern. Purposive sampling was employed to select participants based on the inclusion and exclusion criteria. Data collection was done for one year after clearance from ethical committee, from October 2023 to October 2024.

Inclusion Criteria: 1. Paediatric population attending CIMS Hospital. 2. Children aged between 3 and 13 years.

Exclusion Criteria: 1. Children with a diagnosed case of insomnia. 2. Seriously ill patients requiring intensive medical care.

The sample size has been calculated based on the following parameters: Prevalence rate: 50%, Margin of error: 7%, Confidence level: 95%. Using the formula: $n = z^2 pq/L^2$, A minimum of 200 participants were required for this study. Ethical approval was obtained from the institutional ethical committee of CIMS, Bilaspur (C.G.). Participants and their guardians were informed about the purpose of the study, and informed consent was taken before their participation. This study used the pre-designed, pretested semi-structured and structured proforma to collect information on socio demographic profile of study subjects, questionnaire on screen time to assess the duration and patterns of screen exposure, Sleep Disturbance Scale for Children (SDSC)* to evaluate sleep disturbances, it was validated tool to assess sleep disturbances.⁵ Screen time included all devices having screen (Television, mobile, computer/laptop, tablets) and included total time of screen use every day by children. After obtaining parental consent, the questionnaire was administered to parents/caretaker, and face-to-face interview was conducted. Collected data was compiled and entered into Microsoft Excel for analysis. Findings, conclusions, summary, and recommendations were formulated for further dissemination.

* COVID -19 - Corona Virus Disease 2019, SDSC - Sleep Disturbance Scale for Children

Results:

In the present study, a total of 200 children with age group 3 to 13 years were included. The mean age was 6.87 ± 2.83 years and a male

preponderance was observed (54%). More than half the participants were from the age group of 3 to 6 years (54.5%), followed by 7 to 9 years (25.5%) and 10 to 13 (20%). Majority of the children were in primary class (69.5%), followed by middle school (9.5%) and 8% were taking non-

formal education. As per modified BG Prasad socioeconomic scale,⁶ most of the (35%) study subjects belonged from class IV (35%), followed by class III (23.5%) and least belonged from class V (5%). (Table 1)

Table 1. Demographic profile of study subjects

Gender	Frequency (n)	Percentage (%)
Boys	108	54
Girls	92	46
Age		
3 to 6 years	109	54.5
7 to 9 years	51	25.5
10 to 13 years	40	20
Mean $\pm$ SD	6.87 $\pm$ 2.83	
Parents Occupation		
Both employed	33	16.5
Single parent employed	167	83.5
Child's Education		
Primary	139	69.5
Middle	19	9.5
Non formal education (Anganwadi)	16	8
Not Applicable	26	13
Socioeconomic status		
Class I ($\geq$ 9130)	31	15.5
Class II (4565 to 9129)	42	21
Class III (2739 to 4564)	47	23.5
Class IV (1369 to 2738)	70	35
Class V (< 1369)	10	5

Mobile phones were predominant screen device used by children. The mean daily screen time was 121.55 minutes, with a standard deviation of

76.47 minutes. Majority of children (72%) were supervised by caretaker while using screen devices. (Table 2 and 3)

Table 2. Types of screen devices used by study subjects

Screen devices Used	Frequency (n)	Percentage (%)
Mobile	200	100
Television	167	83.5

** Categories are not mutually exclusive; One subject can use one or more screen devices.*

Table 3. Mean screen time of study subjects and caretaker (N = 200)

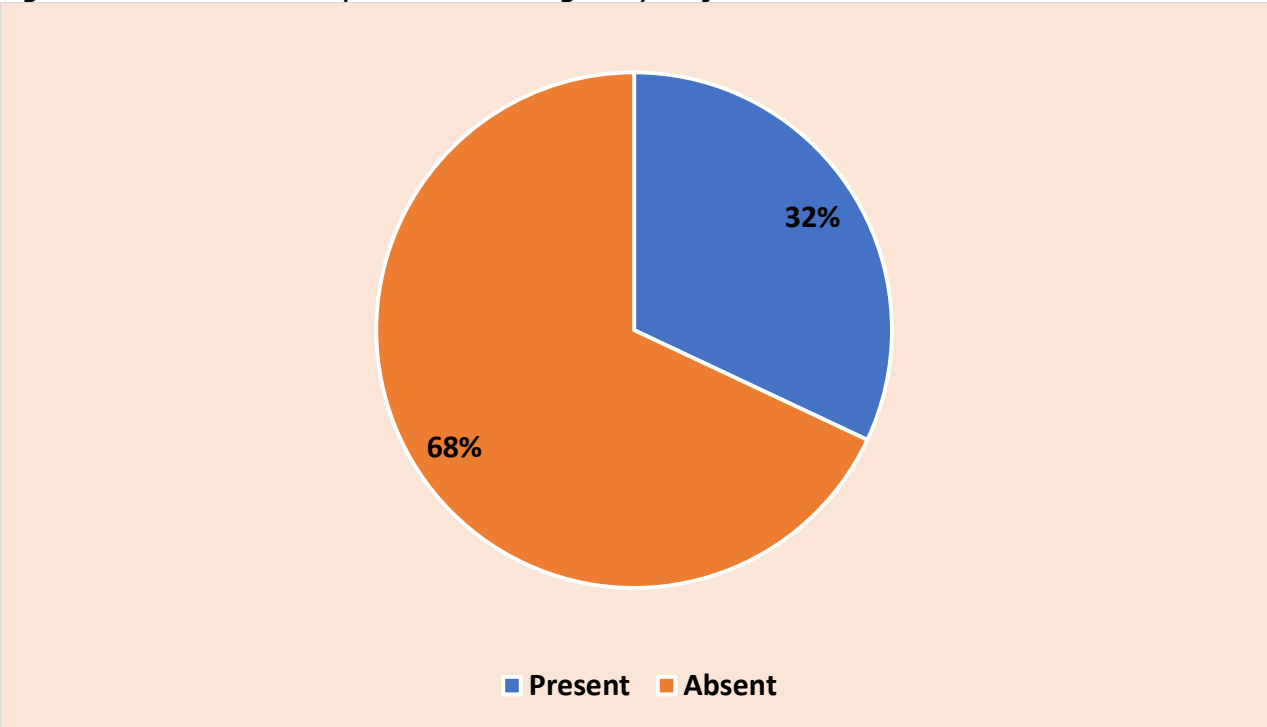
Variable	Mean	Standard deviation
Screen time for study subjects (in minutes)	121.55	76.47

Screen time for caretaker	89.62	64.41
Supervision by adults while watching screen devices		
Supervision by Adults	Frequency (n)	Percentage (%)
Yes	144	72
No	56	28

Children across three age groups (3-6 years, 7-9 years, and 10-13 years) had an average sleep time of 9.04 ± 0.90 hours, with younger children (3-6 years) having mean duration 9.17 hours, followed by 8.93 hours for children aged 7-9 years, and

8.81 hours for those aged 10-13 years. Based on a study by Bruni et al. cut-off score of 39 was used to define sleep disorders. Sleep disorders were prevalent in 32% of subjects⁵. (Figure 1)

Figure 1. Prevalence of sleep disorders among study subjects based on SDSC



Among various domains of sleep disturbances, disorders of initiating and maintaining sleep (61%) was prevalent, indicating significant sleep

difficulties for many children. Sleep breathing disorders (26%) and excessive somnolence (26%) were moderately common. (Table 4)

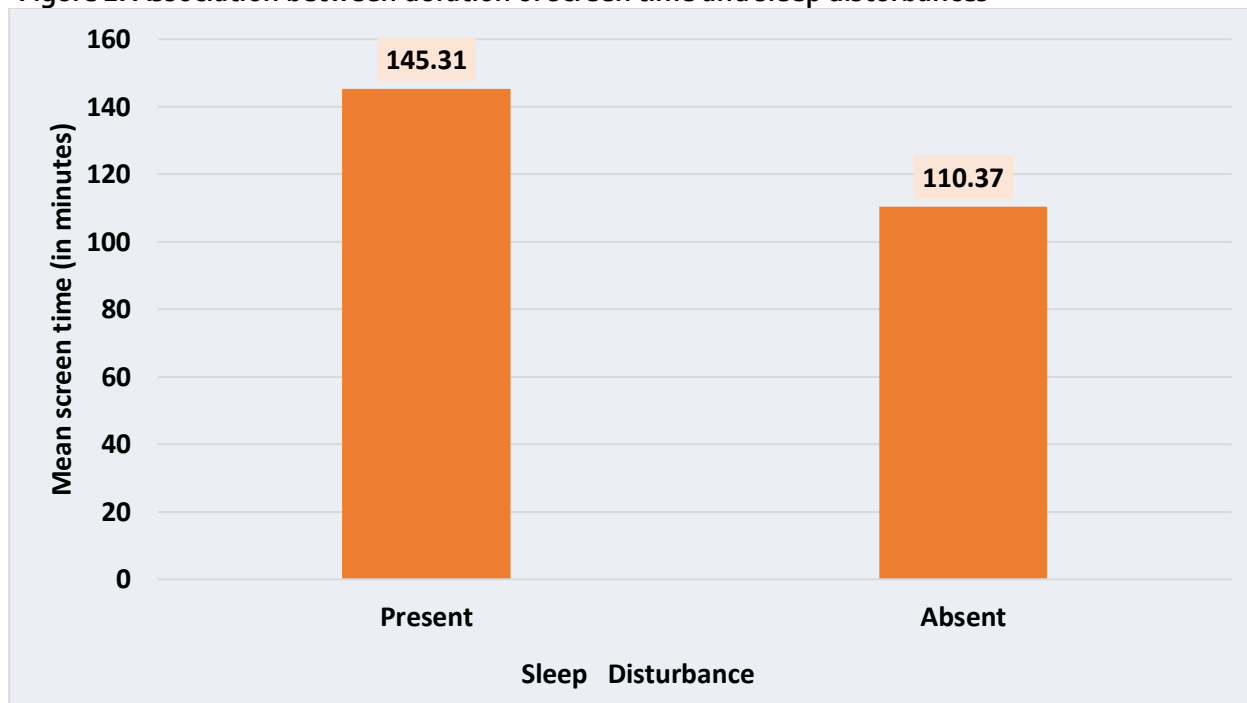
Table 4. Descriptive statistics for Sleep Disturbance Scale for Children

SDSC Scales	Problem present (%)	Absent (%)
Disorders of Initiating and Maintaining Sleep (score >10)	122 (61)	78 (39)
Sleep Breathing Disorders (score > 4)	52 (26)	148 (74)
Disorders of Arousal (score > 4)	46 (23)	154 (77)
Sleep-wake Transition Disorder (score > 9)	34 (17)	166 (83)
Sleep Hyperhidrosis (score > 3)	45 (22.5)	155 (77.5)
Disorders of Excessive Somnolence (score > 8)	52 (26)	148 (74)

The mean screen time for study subjects with sleep disturbance was 145.31 minutes as compared to 110.37 minutes in study subjects without sleep disturbance. The difference

between the two group was statistically significant ($p = 0.002$) with screen time being higher in study subjects with sleep disorder. (Figure 2)

Figure 2. Association between duration of screen time and sleep disturbances



Girls (33.7%) subjects outnumbered than boys (30.6%) for sleep disorders. However, the association between gender and sleep disorder was not statistically significant ($p = 0.63$). A higher proportion of study subjects with sleep disorders were in the age group of 7 to 9 years

(49%) as compared to other age groups. The association between age and sleep disorders was statistically significant ($p = 0.009$). It can be seen that 32.3% of study subjects with sleep disorders were in class I SES as compared to 3.1% of study subjects in class V SES. (Table 5)

Table 5. Association between socio-demographic variables and sleep disturbances

Gender	Sleep disturbance		χ ² , p-value*
	Present n (%)	Absent n (%)	
Boys	33 (30.6)	75 (69.4)	0.22, 0.63
Girls	31 (33.7)	61 (66.3)	
Age			
3 to 6 years	27 (24.8)	82 (75.2)	9.48, 0.009
7 to 9 years	25 (49)	26 (51)	
10 to 13 years	12 (30)	28 (70)	
Socioeconomic Status			
Class I	10 (32.3)	21 (67.7)	5.32, 0.26
Class II	19 (29.7)	23 (16.9)	
Class III	15 (23.4)	32 (23.5)	
Class IV	18 (28.1)	52 (38.2)	
Class V	02 (3.1)	08 (5.9)	



DISCUSSION

This study has been undertaken to estimate the screen time and impact of screen use on sleep patterns of paediatric age (3 to 13 years). The mean screen time for study subjects was 121.55 ± 76.47 minutes per day, which was similar to study findings of Kaur N et al. and Määttä et al., suggesting a consistent pattern of digital screen exposure among children across different areas.^{7,8} Time of screen exposure exceeds recommendation of Indian Academy of Paediatrics among young population (<5 yrs).⁹ Relatively high standard deviation of screen time suggestive of considerable variability in usage pattern, accessibility of device and may be due to parental supervision. In our study, digital media was predominantly used for entertainment purpose, rather than educational, with mobile phones and television being the most commonly used screen devices, this is consistent with another research, indicating a major shift of recreational digital media exposure in younger population.¹⁰ The present study observed a gradual decline in the average sleep duration with increasing age. Overall mean duration of 9.04 hours is comparable to that reported by Yoo et al., raising concerns regarding sleep curtailment in children.¹¹ The study revealed, children with sleep disorders exhibited a significantly higher mean screen time. This finding supports the underlying mechanism; blue light emission from screens suppressing melatonin secretion, increased cognitive and

emotional arousal which delays sleep onset. This observation is consistent with another literature.¹³ Our study found that sleep disturbances were higher in 7 to 9 years age group, which was in contrast with findings of Parent J et al. in which regardless of age group, sleep disturbances associated with higher screen time. This difference between two studies could be due several factors as different study population characteristics, patterns of screen exposure and due to bias in parental reporting. In our setting early access to mobile and television to keep child engaged may contribute to increased vulnerability to sleep disruption. Limitations of this study include, we couldn't assess effect of caffeinated products and screen devices used before going to sleep, a few studies determine for same.^{14,15,16} Reliance on parent – reported data, which may introduce recall bias. Cross - sectional design limits causal inference. Future studies should consider longitudinal study designs for better understanding of causality. Despite these limitations, study provides valuable baseline data for further research.

Conclusion

Overall, the present study highlights a concerning association between increased screen time and sleep-disturbances. The findings emphasize the urgent need for enhanced and targeted intervention to address regulated screen use and promote healthy sleep patterns in paediatric population.

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