



## Association between screen time and sleep patterns in preschool children: A cross-sectional observational study.

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### Abstract

#### Background

The growing prevalence of screen-based devices in early childhood raises concerns about their impact on sleep health. Preschool children are particularly vulnerable to the effects of excessive screen exposure, which may disrupt normal sleep patterns essential for healthy development.

**Objectives:** To examine the association between screen time duration and sleep patterns, including total sleep duration, sleep onset latency, and night awakenings, in preschool-aged children.

#### Methods

A cross-sectional observational study was conducted involving 100 preschool children aged 3 to 5 years. Data on daily screen time and sleep parameters were collected using a structured parental questionnaire. Sleep outcomes were compared between children with screen time  $\geq 3$  hours/day and those with  $< 3$  Hours/day. Pearson correlation analysis was performed to assess the relationship between screen time and sleep metrics.

#### Results

The mean daily screen time was  $2.7 \pm 1.1$  hours. Thirty-six percent of children had screen exposure  $\geq 3$  hours/day. The mean total sleep duration was significantly lower in children with higher screen time ( $8.7 \pm 1.1$  hours) compared to those with lower screen time ( $10.1 \pm 1.0$  hours;  $p < 0.001$ ). Delayed sleep onset and night awakenings were also more prevalent among high screen-time users ( $p < 0.01$  and  $p = 0.02$ , respectively). A moderate negative correlation was found between screen time and total sleep duration ( $r = -0.47$ ,  $p < 0.001$ ), and a positive correlation with sleep onset latency ( $r = 0.41$ ,  $p < 0.01$ ).

#### Conclusions

Excessive screen time is significantly associated with shorter sleep duration, delayed sleep onset, and increased night awakenings in preschool children. Limiting screen exposure may promote healthier sleep patterns in early childhood.

#### Recommendations

Caregivers should limit preschool children's screen time to under 3 hours daily, especially in the evening, and promote consistent bedtime routines to support healthy sleep duration and quality.

**Keywords:** Screen time, sleep duration, Preschool children, Delayed sleep onset, Night awakenings

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#### Introduction

Sleep is a fundamental biological process essential for the cognitive, emotional, and physical development of preschool-aged children. During

early childhood, the brain undergoes rapid maturation, and high-quality sleep is vital for neurodevelopment, behavior regulation, learning capacity, and immune functioning. Pediatric sleep guidelines recommend that children aged 3 to 5 years should receive 10 to 13 hours of sleep per 24-hour period, including naps, to support healthy growth and development [1].

However, in recent years, the widespread integration of digital devices—such as televisions, tablets, and smartphones—into daily routines has presented new challenges to maintaining optimal sleep health in early childhood [2]. These screen-based technologies, although often used for educational or entertainment purposes, are now recognized as potential disruptors of healthy sleep patterns, especially when used excessively or during evening hours. The mechanisms underlying these disruptions include bedtime delays due to screen engagement, reduced physical activity, increased cognitive stimulation, and suppression of melatonin by blue light emitted from screens, which together may contribute to shortened sleep duration and circadian rhythm disturbances [3].

Numerous studies have explored the relationship between screen time and sleep disturbances in school-aged children and adolescents, consistently demonstrating negative associations [4,5]. However, evidence focused specifically on preschool-aged children remains limited, particularly in developing countries where cultural media use patterns and parental awareness may differ significantly [6]. Furthermore, toddlers and young children are especially vulnerable due to their developmental sensitivity to environmental stimuli, including screen exposure [7].

Given the growing prevalence of digital device use among young children, it is essential to investigate how screen time influences sleep behaviors during this critical developmental window. This study aims to assess the association between screen exposure and sleep patterns, including total sleep duration, onset latency, and night awakenings, among preschool children aged 3 to 5 years.

## Methodology

### Study design and setting

This was a cross-sectional observational study conducted at the Department of Pediatrics, Rajiv Gandhi Institute of Medical Sciences (RIMS), Adilabad, Telangana, India. RIMS is a tertiary care teaching hospital serving urban and semi-urban

populations of Adilabad district, providing pediatric outpatient and inpatient services to a large catchment area. The institution is equipped with primary and specialty healthcare services and functions as a referral center for surrounding rural and semi-urban communities. The study was carried out over a period of three months, from August 2024 to October 2024.

### Study Population

The study included preschool children aged 3 to 5 years who either attended the pediatric outpatient department at RIMS or were enrolled in nearby preschools affiliated with the institution. The nearby preschools included:

- Government Upper Primary School, Brahmanwada, Adilabad
- Government Upper Primary School, Khanapur Street, Adilabad
- Government Upper Primary School, NGOS Colony, Adilabad

Children with known neurological, developmental, or diagnosed sleep disorders were excluded from the study to avoid potential confounding variables.

### Sample size and sampling technique

A total of 100 preschool children were recruited using a convenient sampling method. The sample size was calculated using the formula:

$$n = Z^2 * p * (1 - p) / d^2$$

Where:

$n$  = sample size

$Z$  = Z statistic for 95% confidence level (1.96)

$p$  = estimated prevalence of sleep disturbances among preschool children due to screen exposure (assumed to be 50% in the absence of prior regional data)

$d$  = precision (10%)

$$n = (1.96)^2 * 0.5 * (1 - 0.5) / (0.1)^2 = 3.84 * 0.25 / 0.01 = 96$$

After rounding up and accounting for possible non-responses or incomplete data, a final sample size of 100 was chosen.

### Bias and measures to minimize it

To minimize selection bias, children were recruited from both outpatient attendees and multiple preschools within the locality. Information bias was reduced by using a pre-validated, structured questionnaire with standardized questions. Interviewer bias was minimized by training the data



collectors on consistent interviewing techniques. Recall bias was addressed by restricting parental recall to sleep and screen exposure patterns within the preceding two weeks. The inclusion and exclusion criteria were strictly adhered to to reduce confounding effects.

### Data collection tools and procedures

Data were collected using a structured, pre-validated questionnaire administered to parents or primary caregivers. The questionnaire consisted of three sections:

#### Sociodemographic profile

Age, gender, and family structure.

#### Screen time assessment

Duration, timing, and type of device use, based on average daily exposure.

#### Sleep pattern assessment

Total sleep duration, sleep onset latency, frequency of night awakenings, and any reported sleep disturbances, based on parental observations over the preceding two weeks.

#### Operational definitions

**Excessive Screen Time:** Defined as screen exposure  $\geq 3$  hours per day.

**Delayed Sleep Onset:** Sleep initiation taking more than 30 minutes after going to bed.

**Night Awakening:** Any instance of waking after sleep onset, reported by caregivers.

### Statistical analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 26. Descriptive statistics (mean, standard deviation, and percentages) were used to summarize participant characteristics. Group comparisons (high vs. low screen time) were analyzed using independent *t*-tests and Chi-square tests. Pearson's correlation coefficient was used to assess the relationship between screen time and sleep parameters. A *p*-value  $< 0.05$  was considered statistically significant.

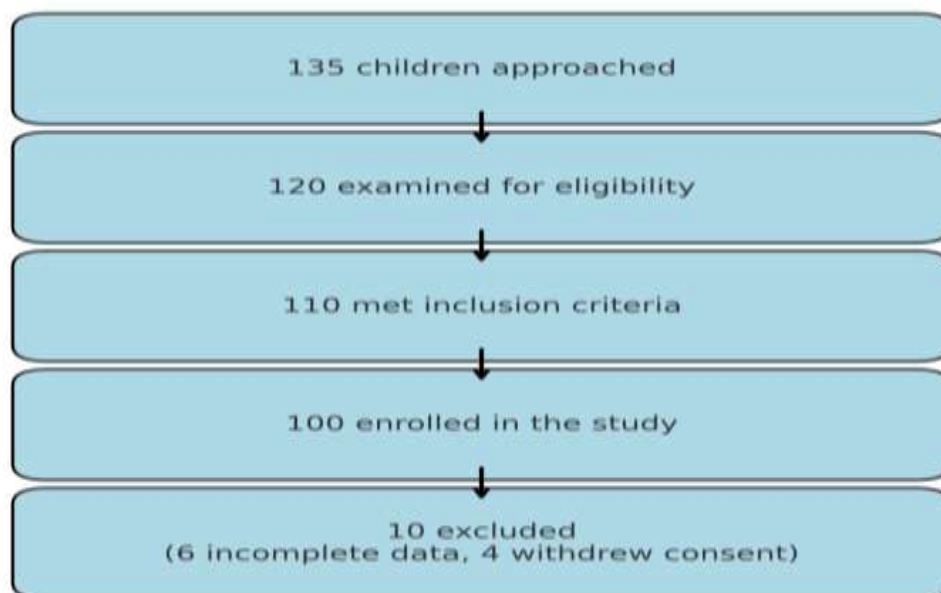
### Ethical considerations

The study was approved by the Institutional Ethics Committee of Rajiv Gandhi Institute of Medical Sciences, Adilabad. Written informed consent was obtained from the parents or legal guardians of all participants. Data confidentiality and anonymity were maintained throughout the study.

### Results

#### Participant enrollment flow

Out of 135 preschool children initially approached, 120 were examined for eligibility. Among them, 110 children met the inclusion criteria. After obtaining informed consent, 100 participants were enrolled in the study. Ten eligible participants were excluded due to incomplete questionnaires or withdrawal of parental consent. The flow of participants is shown in Figure 1.



**Figure 1. Participant flow diagram**

The mean age of the participants was  $4.1 \pm 0.6$  years, with a near-equal distribution of gender (52% male, 48% female). In terms of family structure, 72% of

children were from nuclear families and 28% from joint families. These demographic characteristics are presented in Table 1

**Table 1: Demographic characteristics of the study sample**

Variable	Value
Sample Size	100
Mean Age (years)	$4.1 \pm 0.6$
Gender - Male	52%
Gender - Female	48%
Family Type – Nuclear	72%
Family Type – Joint	28%

The average daily screen time was  $2.7 \pm 1.1$  hours, and 36% of children were reported to have daily screen exposure exceeding 3 hours (Table 2).

**Table 2: Screen time characteristics**

Screen Time Variable	Value
Mean Screen Time (hours)	$2.7 \pm 1.1$
Screen Time $\geq 3$ hours/day	36%
Screen Time $< 3$ hours/day	64%

Analysis of sleep patterns revealed that the overall mean total sleep duration was  $9.4 \pm 1.2$  hours per day. However, a significant reduction in sleep duration was observed among children with screen time  $\geq 3$  hours/day ( $8.7 \pm 1.1$  hours) compared to those with  $< 3$  Hours/day ( $10.1 \pm 1.0$  hours,  $p < 0.001$ ). Additionally, delayed sleep onset ( $> 30$  minutes after bedtime) was reported in 42% of participants, with a

notably higher prevalence in children with higher screen time (61%) compared to those with lower screen time (25%),  $p < 0.01$ . Night awakenings were reported in 34% of the cohort, more frequently in the high screen-time group (46%) compared to the low screen-time group (22%,  $p = 0.02$ ). These findings are summarized in Table 3.

**Table 3: Sleep pattern comparisons by screen time group**

Sleep Parameter	Value	<i>p</i> -value
Mean Total Sleep Duration (All Children)	9.4 ± 1.2 hours	—
Sleep Duration (≥3 hrs/day screen time)	8.7 ± 1.1 hours	< 0.001
Sleep Duration (<3 hrs/day screen time)	10.1 ± 1.0 hours	< 0.001
Delayed Sleep Onset (>30 mins)	42%	—
Delayed Sleep Onset in High Screen Time Group	61%	< 0.01
Delayed Sleep Onset in Low Screen Time Group	25%	< 0.01
Night Awakenings (All Children)	34%	—
Night Awakenings in High Screen Time Group	46%	0.02
Night Awakenings in the Low Screen Time Group	22%	0.02

Correlation analysis demonstrated a statistically significant moderate negative correlation between daily screen time and total sleep duration (Pearson's  $r = -0.47$ ,  $p < 0.001$ ). Moreover, a moderate positive

correlation was found between screen time and sleep onset latency (Pearson's  $r = 0.41$ ,  $p < 0.01$ ), as shown in **Table 4**.

**Table 4: Correlation analysis**

Parameter Correlated	Correlation Coefficient ( <i>r</i> )	<i>p</i> -value
Screen Time vs. Total Sleep Duration	-0.47	< 0.001
Screen Time vs. Sleep Onset Latency	0.41	< 0.01

## Discussion

This study explored the association between screen time and sleep patterns in preschool-aged children (3 to 5 years) and identified a significant relationship between extended screen exposure and poor sleep outcomes. Children who engaged in screen use for more than three hours daily exhibited notably shorter total sleep duration, prolonged time to fall asleep, and more frequent episodes of night awakenings compared to peers with lower screen time.

The observed average sleep duration among high screen-time users (8.7 ± 1.1 hours) was considerably lower than that of children with less screen exposure (10.1 ± 1.0 hours,  $p < 0.001$ ). These results are in line with earlier studies that have documented similar negative impacts of prolonged screen use on sleep in young children [7,8]. Several mechanisms may contribute to this effect, such as delayed bedtimes due to media engagement, increased cognitive stimulation from screen content, and the influence of

blue light on melatonin secretion, which can interfere with normal circadian rhythms [9,10].

The increased sleep latency and greater frequency of night awakenings found in our study are consistent with literature indicating that evening screen use disrupts sleep onset and sleep continuity [11,12]. One population-based study also emphasized that nighttime screen exposure has a more detrimental effect on sleep compared to usage during earlier hours of the day [13].

The study findings are supported by longitudinal research from Korea, where high smartphone use in children below 7 years was a predictor of future sleep-related difficulties [14]. Similarly, a cross-sectional analysis from China found that even toddlers showed reduced sleep quality with increased screen viewing time, underscoring the sensitivity of early childhood sleep patterns to digital media exposure [15].

The correlation analysis in this study demonstrated a moderate inverse association between screen time and total sleep duration ( $r = -0.47$ ,  $p < 0.001$ ), and a moderate positive correlation with sleep onset



latency ( $r = 0.41, p < 0.01$ ). These findings reinforce the role of screen time as a key modifiable factor in shaping healthy sleep behaviors in preschoolers.

Taken together, the study findings, when considered alongside existing literature, highlight the pressing need for parental awareness and behavioral strategies to regulate screen time in young children. Interventions at the community and healthcare levels are essential to reduce excessive screen exposure and encourage consistent bedtime routines, thereby promoting healthier sleep patterns during a critical stage of child development.

### Generalizability

The findings of this study offer valuable insights into the association between screen time and sleep patterns in preschool children; however, certain limitations affect their generalizability. As the sample was drawn from a single tertiary care center and nearby government preschools in Adilabad, the results may be most applicable to similar urban or semi-urban populations in India with comparable sociodemographic and media usage patterns. Caution should be exercised in extending these findings to children in rural areas, private schools, or other regions with differing cultural, educational, and technological exposures. Nonetheless, the consistency of our results with international studies supports the broader relevance of the observed associations, especially concerning excessive screen exposure and disrupted sleep among young children.

### Conclusion

This study highlights a significant association between excessive screen time and disrupted sleep patterns among preschool children. Children with daily screen exposure of three hours or more demonstrated reduced total sleep duration, delayed sleep onset, and more frequent night awakenings. These findings underscore the importance of regulating screen time, particularly during evening hours, to promote healthy sleep in early childhood. Given that sleep is crucial for cognitive, emotional, and physical development, pediatricians, educators, and parents must work together to establish age-appropriate guidelines for screen use. Early interventions aimed at reducing screen exposure may serve as a practical and effective strategy to enhance sleep hygiene and overall child well-being.

### Limitations

Despite the strengths of primary data collection and a focused pediatric population, this study is limited by its cross-sectional design, which restricts causal inference. Furthermore, reliance on parental reporting may introduce recall bias. Nonetheless, the results emphasize the importance of parental awareness and screen time regulation as part of routine health promotion in pediatric care.

### Recommendations

Based on the study findings, it is recommended that parents and caregivers limit screen time for preschool children to less than 3 hours per day, with particular emphasis on reducing screen exposure during the evening hours. Establishing consistent bedtime routines, encouraging screen-free periods before sleep, and promoting alternative activities such as reading or quiet play can support healthier sleep behaviors. Pediatricians and educators should provide guidance on age-appropriate screen use and sleep hygiene practices. Public health initiatives must also raise awareness about the negative impact of excessive screen time on sleep, especially during critical stages of early childhood development.

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### List of abbreviations

<b>GMC:</b>	Government Medical College
<b>SPSS:</b>	Statistical Package for the Social Sciences
<b>r:</b>	Pearson's correlation coefficient
<b>p:</b>	Probability value
<b>hrs:</b>	Hours
<b>≥:</b>	Greater than or equal to
<b>&lt;:</b>	Less than
<b>SD:</b>	Standard Deviation
<b>IEC:</b>	Institutional Ethics Committee





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## Conflicts of interest

The Author declares no conflict of interest.

## Author's contribution

PS-Concept and design of the study, results interpretation, review of literature, and preparing the first draft of the manuscript. Statistical analysis and interpretation, revision of manuscript. BK-Concept and design of the study, results interpretation, review of literature, and preparing the first draft of the manuscript. Statistical analysis and interpretation, revision of manuscript. PV-Concept and design of the study, results interpretation, review of literature, and preparing the first draft of the manuscript, revision of the manuscript.

## Data Availability

Data is available on request.

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