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Original Research Article

Impact of Daily Screen Exposure on Sleep Patterns and Language Milestones in Early Childhood

Unnati Shah[1], Tamannaben Ninama[2], Hardik R. Chauhan[3], Ashwin R. Dangi[4]

[1]Associate Professor, Department of Pediatrics, SAL Institute of Medical Sciences and SAL Hospital, Ahmedabad, Gujarat, India

[2]Assistant Professor, Department of Pediatrics, Dr. M. K. Shah Medical College & Research Center, Ahmedabad, Gujarat, India

[3]Assistant Professor, Department of Pediatrics, SAL Institute of Medical Sciences and SAL Hospital, Ahmedabad, Gujarat, India

[4]Professor and Head, Department of Pediatrics, SAL Institute of Medical Sciences and SAL Hospital, Ahmedabad, Gujarat, India

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Corresponding author: Dr. Hardik R. Chauhan

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Abstract

Background: Excessive screen exposure during early childhood has emerged as an important public health concern due to its potential effects on sleep, cognition, and language development. Increased use of digital devices among young children may interfere with parent-child interaction and developmental milestone achievement.

Aim: To assess the correlation between excessive daily screen time, sleep disruptions, and language development milestones in children with emphasis on screen content, sleep patterns, and socioeconomic factors.

Materials and Methods: A cross-sectional observational study was conducted among 150 children aged up to 6 years. Data regarding daily screen exposure, type of screen content, sleep patterns, socioeconomic status, and language development milestones were collected using a structured questionnaire and developmental assessment tools. Statistical analysis was performed using SPSS software version 25.0. Associations were evaluated using Chi-square test, Student's t-test, and Pearson's correlation coefficient with $p<0.05$ considered statistically significant.

Results: Children with screen exposure greater than 4 hours/day demonstrated the lowest language development scores, whereas children with less than 2 hours/day screen exposure showed significantly better language performance. Older children exhibited higher average daily screen time compared with younger age groups. Excessive screen exposure was also associated with sleep disturbances including delayed sleep onset and reduced sleep duration. Socioeconomic factors influenced both screen exposure patterns and language outcomes.

Conclusion: Excessive daily screen time was significantly associated with poorer language development and sleep disturbances among children. Limiting screen exposure and promoting healthy sleep habits and parental interaction may contribute to improved developmental outcomes during early childhood.

Keywords: Screen time, Language development, Sleep disturbances, Children.

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Introduction

Language development is one of the most important milestones of early childhood and forms the foundation for later academic performance, social communication, emotional regulation, and cognitive growth. The early years of life are considered a sensitive period for acquiring vocabulary, receptive language, expressive language, and conversational skills. During this period, children learn language mainly through face-to-face interaction, shared attention, play, storytelling, and responsive communication with caregivers. Any environmental factor that reduces these interactions may influence the pace and quality of language development [1]. In recent years, screen exposure has become increasingly common among young children due to the widespread availability of smartphones, tablets, television, and digital media platforms. Although digital devices may provide entertainment and, in some cases, educational exposure, excessive screen

time during early childhood has raised concerns regarding delayed speech, reduced vocabulary, poor attention, and impaired social communication. Studies have suggested that increased screen exposure, particularly when started at an early age and used for longer durations, may be associated with poorer language outcomes in young children [2]. The relationship between screen time and language development is complex and depends not only on the total duration of screen exposure but also on the type of content viewed, the child's age, the presence or absence of caregiver interaction, and the overall home environment.

Passive screen viewing, non-educational content, fast-paced videos, and unsupervised mobile phone use may provide limited opportunities for meaningful language learning. In contrast, age-appropriate educational content watched with caregiver involvement may offer better developmental value because interaction helps the child understand, repeat, and apply language in real-life contexts [3].

One important mechanism through which screen time may affect language development is the displacement of parent-child verbal interaction. Children acquire language most effectively through reciprocal communication, including adult words, child vocalizations, turn-taking, gestures, and shared responses. Excessive screen exposure may reduce the amount of adult speech heard by the child and may decrease opportunities for back-and-forth conversation. Recent longitudinal evidence has shown that greater screen time between 12 and 36 months is associated with fewer adult words, fewer child vocalizations, and reduced conversational turns, suggesting that screen exposure may replace language-rich interaction during a critical developmental period [4].

Sleep is another important factor that may mediate or modify the association between screen time and language development. Adequate sleep supports memory consolidation, attention, emotional regulation, and neurodevelopment, all of which are essential for learning and communication. Excessive screen use, especially in the evening or before bedtime, has been associated with shorter sleep duration, delayed sleep onset, night waking, and poorer sleep quality in young children. Sleep disruption may further affect daytime alertness, attention span, and the child's ability to engage in meaningful verbal interaction and learning [5].

The effect of screen exposure on sleep may be related to multiple mechanisms, including exposure to stimulating content, emotional arousal, displacement of bedtime routines, and light exposure from digital devices. Toddlers and preschool children are particularly vulnerable because they are still developing self-regulation and regular sleep-wake patterns. When excessive screen time coexists with irregular sleep, the combined effect may contribute to delayed language milestones, reduced attention, and poorer cognitive performance [6].

Socioeconomic factors also play a significant role in shaping screen use patterns, sleep routines, and language development. Children from lower socioeconomic backgrounds may have greater exposure to background television, shared digital devices, crowded living conditions, inconsistent bedtime routines, and fewer language-enriching resources such as books and structured learning activities. Parental education, occupation, family income, and home literacy environment may influence both the quantity and quality of child-directed communication. Therefore, socioeconomic status should be considered an important contextual factor when evaluating the association between screen time and developmental outcomes [7].

The content of screen exposure is equally important in understanding developmental impact. Educational, slow-paced, age-appropriate programs may have different effects compared with entertainment-based, violent, fast-paced, or adult-directed content. Similarly, co-viewing with parents may reduce potential harm by converting screen exposure into an interactive learning experience. When caregivers discuss the content, name objects, ask questions, and relate screen events to real life, children may benefit more than when they watch screens alone [8].

By the age of six years, children are expected to demonstrate more advanced language abilities, including sentence formation, narrative skills, comprehension, vocabulary growth, and social communication. Delays in these milestones may affect school readiness, peer interaction, and academic learning. Identifying modifiable risk factors such as excessive screen time, poor sleep patterns, and limited caregiver interaction is therefore essential for early prevention and intervention [9].

Although several studies have examined screen time and child development, there remains a need to evaluate the combined influence of screen duration, screen content, sleep patterns, and socioeconomic factors on language development milestones. Understanding these associations may help parents, clinicians, and educators promote healthier digital habits, better sleep routines, and language-rich home environments.

Therefore, the present study was undertaken to assess the correlation between excessive daily screen time, sleep disruptions, and language development milestones in young children, with

specific emphasis on screen content, sleep patterns, and socioeconomic determinants [10].

Materials and Methods

The present cross-sectional observational study was conducted to assess the correlation between excessive daily screen time, sleep disruptions, and language development milestones among children aged up to 6 years. The study was carried out in the Department of Pediatrics in collaboration with the Department of Child Development and Behavioral Sciences over a period of one year.

A total sample size of 150 children aged between 0 and 6 years attending the pediatric outpatient department and well-child clinics were included in the study. Children were selected using a convenience sampling method after obtaining informed consent from parents or caregivers. Children with known neurological disorders, hearing impairment, developmental disorders such as autism spectrum disorder, congenital anomalies affecting speech, or severe chronic systemic illnesses were excluded from the study.

Data collection was performed using a structured and pre-validated questionnaire administered to parents or primary caregivers. Information regarding demographic profile, duration of daily screen exposure, type of screen device used, content viewed, parental supervision during screen exposure, sleep duration, bedtime routines, and socioeconomic status was recorded. Screen time included exposure to television, smartphones, tablets, laptops, and other digital devices. Excessive screen time was assessed according to age-specific recommendations for children.

Language development milestones were evaluated using age-appropriate developmental assessment tools and clinical screening methods focusing on receptive language, expressive language, vocabulary acquisition, sentence formation, response to commands, and social communication skills. Children demonstrating delayed speech, reduced vocabulary, impaired communication skills, or delayed milestone achievement compared with age norms were categorized as having language developmental delay.

Sleep patterns were assessed based on average nightly sleep duration, frequency of night awakenings, delayed sleep onset, irregular sleep routines, and daytime sleepiness. Socioeconomic status of the family was assessed using modified Kuppuswamy socioeconomic classification considering parental education, occupation, and monthly family income.

All collected data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) software version 25.0. Descriptive statistics such as mean, standard deviation, frequency, and percentage were calculated. The association between screen time, sleep disturbances, socioeconomic variables, and language development outcomes was analyzed using Chi-square test and Student's t-test wherever appropriate. Correlation analysis was performed using Pearson's correlation coefficient. A p-value of less than 0.05 was considered statistically significant.

The study protocol was reviewed and approved by the Institutional Ethics Committee prior to commencement of the study. Written informed consent was obtained from the parents or guardians of all participating children. Confidentiality of participant information was maintained throughout the study, and all procedures were conducted in accordance with ethical principles for human research.

Results

Table 1 shows the demographic characteristics of the study population comprising 150 participants. Among them, 82 (54.7%) were males and 68 (45.3%) were females. The majority of participants belonged to the middle socioeconomic group accounting for 69 (46.0%) children, followed by the low socioeconomic group with 54 (36.0%) participants, while 27 (18.0%) children belonged to the high socioeconomic group.

Table 2 depicts the association between daily screen time and language development scores. Children with screen exposure less than 2 hours/day demonstrated the highest language development scores with a mean of 84.3±9.4. Participants with screen exposure between 2–4 hours/day had moderate language scores of 75.8±10.1, whereas children with screen exposure greater than 4 hours/day exhibited the lowest language development scores of 67.2±11.3. The reduction in language development scores with increasing screen time was found to be statistically significant ($p<0.05$).

Discussion

The present study evaluated the association between excessive daily screen time, sleep disruptions, and language development among children up to 6 years of age. The findings demonstrated that increased screen exposure was significantly associated with poorer language development scores. Children with screen exposure of less than 2 hours/day demonstrated the highest language scores, whereas children exposed to screens for more than 4 hours/day exhibited the lowest language development scores. The results also revealed that older children demonstrated

greater screen exposure compared with younger age groups. These findings suggest that excessive screen use may adversely influence communication skills, language acquisition, and developmental milestones during early childhood.

Table 1: Demographic characteristics of the study population

Characteristic	Number (%)
Total participants	150 (100)
Gender distribution	
Male	82 (54.7)
Female	68 (45.3)
Socioeconomic status	
Low	54 (36.0)
Middle	69 (46.0)
High	27 (18.0)

Table 2: Screen time and language development scores

Screen time category	Language development score (Mean±SD)
<2 h/day	84.3±9.4
2–4 h/day	75.8±10.1
>4 h/day	67.2±11.3

One of the primary explanations for delayed language development associated with excessive screen exposure is the reduction in parent-child interaction. Language acquisition in early childhood depends heavily on responsive verbal communication, eye contact, social interaction, and active engagement with caregivers. Excessive screen exposure may displace opportunities for meaningful communication and interactive learning experiences. McArthur et al. reported that prolonged daily screen exposure was significantly associated with expressive language delays and reduced vocabulary development among preschool children [11]. Their findings support the present study, where children exposed to greater than 4 hours/day of screen time demonstrated considerably lower language development scores.

The present study also demonstrated increased average daily screen exposure with advancing age groups. Older children showed significantly greater screen time compared with younger children. Similar findings were observed by Tamana et al., who reported that increasing age was associated with higher digital media exposure due to greater accessibility to smartphones, television, and online educational platforms [12]. The authors further emphasized that prolonged screen use in older children may negatively affect cognitive engagement and communication patterns, thereby influencing language development outcomes. Sleep disturbances are considered another important mechanism through which screen exposure may affect child development. Excessive screen time, particularly before bedtime, may delay sleep onset, reduce sleep duration, and impair sleep quality due to overstimulation and blue light exposure. Poor sleep may subsequently interfere with memory consolidation, attention, learning ability, and verbal processing. Cheung et al. observed that children with prolonged screen exposure demonstrated shorter sleep duration and poorer sleep quality, which were significantly associated with developmental and behavioral difficulties [13]. These observations correlate with the findings of the present study, where excessive screen exposure and disrupted sleep patterns were associated with poorer language development scores.

Socioeconomic factors also influence screen exposure habits and developmental outcomes. In the present study, the majority of participants belonged to middle and low socioeconomic groups. Family environment, parental education, availability of learning resources, and parental supervision play important roles in regulating children's screen exposure and communication opportunities. Higher screen exposure in households with reduced parental interaction may contribute to delayed language milestones. Radesky et al. highlighted that unsupervised mobile media use and background television exposure may reduce caregiver-child verbal engagement, thereby negatively influencing social and language development [14]. The authors stressed the importance of parental involvement and interactive communication during early childhood. The quality and type of screen content also contribute significantly to developmental outcomes. Educational content viewed under parental supervision may have less harmful effects compared with passive exposure to entertainment media. However, prolonged passive viewing may reduce opportunities for imaginative play, peer interaction, and conversational learning. Madigan et al. demonstrated that excessive screen exposure during early childhood was consistently associated with poorer cognitive and language outcomes in longitudinal follow-up studies [15]. Their findings

closely resemble the observations of the present study where increasing screen time was associated with progressive decline in language development scores. The present study emphasizes the importance of regulating screen exposure during early childhood and encouraging healthier lifestyle habits including adequate sleep, parental interaction, reading activities, and supervised educational media use. Early identification of excessive screen habits and language delays may help healthcare professionals and caregivers implement timely interventions to improve developmental outcomes. However, the present study was limited by its cross-sectional design and reliance on parent-reported screen exposure patterns. Further longitudinal studies with objective assessment methods are recommended to better understand the long-term effects of screen exposure on child development.

Conclusion

The present study demonstrated a significant association between excessive daily screen time and poorer language development scores among children. Children with higher screen exposure exhibited lower language development scores and greater sleep disturbances compared with those with limited screen use. Increasing age was associated with higher average screen exposure. Socioeconomic and environmental factors also influenced screen habits and developmental outcomes. The findings highlight the importance of limiting excessive screen exposure, promoting healthy sleep patterns, and encouraging parent-child interaction to support optimal language development during early childhood.

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