

Original Research Article

Study of impact of screen exposure time on behavioural and growth parameters in urban Indian children

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ABSTRACT

Background: The American academy of paediatrics (AAP) recommends 2 hours of screen time (ST) daily for children and teenagers, with no exposure for those under 2 years old. However, research shows children often exceed these limits, leading to behavioural issues, obesity, and unhealthy eating habits. This study aimed to evaluate STs impact on behaviour, growth, and eating habits in children aged 1.5 to 8 years.

Methods: This cross sectional, observational study, conducted in the paediatric department, enrolled 401 children aged 1.5 to 8 years. Demographic details, weight, height, and BMI of the children were recorded. Parents provided information of their child's ST, screens at home, their own ST, and child's eating habits. Behavioural parameters were evaluated using the child behaviour checklist (CBCL). Internalizing and Externalizing behaviours were also recorded in which internalizing factors comprised of anxious and somatic behaviours, while externalizing factors encompassed aggression and rule-breaking behaviours. Data analysis was performed using SPSS V.23.

Results: In our study, 401 children were enrolled, comprising 233 females (58.10%) and 168 males (41.90%). Out of 401, 201 (50.12%) exceeded 2 hours of ST, while 159 (39.65%) had 1 to 2 hours, and only 41 (10.22%) had less than 1 hour. There was a strong significant association between children's ST and their internalizing ($p=0.00034$), externalizing ($p=0.009$), withdrawn ($p=0.001$), rule breaking ($p=0.03$) and aggressive ($p<0.01$) behaviour. Additionally, children weight had a positive correlation between ST and BMI ($p=0.015$).

Conclusions: Excessive ST use correlates well with higher BMIs, behavioural issues like withdrawal, somatic complaints, rule-breaking, aggression. Urgent interventions are needed to reduce ST and promote healthier lifestyles among children, involving parents, caregivers, and policymakers.

Keywords: Children, ST, BMI, Behavioural problems, Parental ST, CBCL

INTRODUCTION

In today's digitally immersive world, children are increasingly exposed to screens from a young age, raising concerns about the potential effects on their behaviour and development factors. In this digital age, parents face ongoing dilemmas about children's ST, evolving from TVs to various devices. With globalization and technological progress, now children are exposed to unrestricted and age-inappropriate digital content. These

digital platforms can deliver educational content and foster positive behaviours if used appropriately, but the inappropriate and excessive use of such devices, however, has been related to harmful consequences.^{1,2} This highlights the need for balance in managing children's exposure to digital content.

The Indian academy of paediatrics guidelines on ST and digital wellness in infants, children and adolescents group recommends that children below 2 years of age should

not be exposed to any type of screen, whereas exposure should be limited to a maximum of one hour of supervised ST per day for children 24-59 months age, and less than two hours per day for children 5-10 years age.³ The AAP council on communication and media has recommended 2 h/day as the maximum screen-time allowed for children and teenagers, and for children under 2 years, no screen-time exposure was recommended. Children using screen devices for more than this recommended time have been found to be at a higher risk for developing several serious conditions.⁴

Prior to the COVID-19 pandemic, children under 5 years old spent around 25% of their waking hours using screens. This ST can be categorized into active engagement, such as educational games and video chats, and passive activities like watching TV or scrolling through social media. During the pandemic, ST outside of online school requirements has surged, with reports indicating it increased from 0.75 hours to as much as 6.5 hours per day.^{5,6} According to a study, an estimate of 83% of children in age of 6 years and below use a screen media device in a typical day. Of these, 73% watched TV, videos, or digital video disks, 18% used computers, and 9% played video games. These numbers are higher among adolescents.⁷ Also, according to the results of a Survey of 2022, reveal that approximately 46% of urban parents in India noted their children spending 3 to 6 hours daily engaged with social media, over the top (OTT) platforms, and online gaming. Additionally, 15% of Indian parents reported their children spending over 6 hours daily watching online media content. These statistics shed light on the significant amount of time children dedicate to online activities, indicating a notable trend towards prolonged engagement with digital media among the younger demographic of Indian population.⁸

Studies indicated physiological associations, as well as a correlation between a high level of screen-time and psychosocial problems in children, the subsequent development of attention problems, and poor school performance.⁹ Almost 90% of the studies included in a systematic review indicated that increased ST is associated with adverse sleep outcomes.¹⁰ Increased ST has consistently correlated exposure with delayed acquisition of language and lower vocabulary and grammar scores.¹¹ A recent study conducted in south India region found that increasing ST was associated with increased odds of development delay in the language and communication domains.¹² Higher amounts of ST in preschoolers have also been shown to increase externalizing behaviours and psychosocial difficulties.¹³ Few studies indicate that higher ST at the age of four years is associated with lower levels of emotional understanding at the age of six years. It also reveals that having a television in a child's bedroom at the age of six years predicts lower levels of emotional understanding at eight years.¹⁴ A recent study found that TV and/or video viewing for 3 h/day at 12 months, when compared with no viewing, was modestly associated with greater autism-

like symptoms (but not autism risk), as measured by the modified checklist for autism in toddlers (M-CHAT) at 2 years. By contrast, increased parental play with children every day was significantly associated with fewer ASD-like symptoms.¹⁵

A systematic review of 30 studies identified parental ST as the most frequently studied and consistent parental influence on ST in children aged ≤ 6 years.¹⁶ High exposure to background TV is known to negatively affect language use and acquisition, cognitive development, and foundational executive function skills (i.e., attention, working memory, impulse-control) in children younger than 5 years. Background TV has also been shown to reduce the amount and quality of parent-child interaction and distract children from playing.¹⁷

The world health organization (WHO) recommends 60 minutes of daily physical activity for children aged 5-17, focusing on aerobic exercises, and muscle/bone strengthening activities three times weekly.¹⁸ Time spent in front of screens such as television, computer, or handheld devices, lack of physical activity, poor sleeping and eating habits, consumption of sugary beverages, and a sedentary lifestyle are important risk factors for overweight/obesity, and adverse cardiometabolic profile in adolescents.¹⁹⁻²¹ One longitudinal mediation analysis conducted in Canada showed that dietary patterns mediate the association between television viewing and BMI in children.²² Television viewing is inversely associated with fruit and vegetable consumption and positively associated with the consumption of energy-dense snacks and drinks, total energy intake, and fast foods.²³ Studies have found that watching television is associated with poor dietary habits in children and adolescents. Eating while at the same time sitting in front of the TV is related to terrible eating routine quality among youngsters, including successive utilization of sugar-improved drinks and food varieties high in fat and sugar.^{24,25}

Therefore, this study was conducted with an aim to assess the effect of ST exposure on behavioural parameters, growth parameters eating habits in children of age 1.5 to 8 years in Indian urban setting. Understanding these dynamics is crucial for devising informed strategies to promote healthy screen habits and optimize children's overall development in the digital age.

METHODS

This cross-sectional, observational study was conducted at Bhaktivedanta hospital and research institute, Mira Road, Thane, from December 2021 to December 2023. The study was approved by the institutional ethics committee (IEC).

In this study 401 children were recruited from paediatric department's OPD as well as IPD. Children of both the genders from age 1.5 to 8 years visiting paediatric

department were included in the study. Children with known behavioural, psychological, or neurological disorders or developmental delay, chronic systemic diseases were excluded from the study.

After obtaining parental consent for children aged 1.5 to 5 years and both verbal assent and parental consent for children aged 7 to 8 years, parents participated in interviews conducted by a paediatrician. The interviews were based on 'ST of children' questionnaire which was validated and also approved by IEC which covered various topics, including the ST of both parents and children (measured in hours per day), the number of screens in the home, the presence of screens in children's bedrooms, and the children's eating habits. Additionally, the paediatrician recorded demographic information and growth parameters, such as weight, height, and BMI. Behavioural parameters were assessed using the CBCL now called the Achenbach system of empirically based assessment which was developed by Achenbach TM, Rescorla LA. The CBCL questionnaire was assessed by child psychologist with the age-appropriate versions used: the CBCL for ages 1.5 to 5 years and the CBCL for ages 6 to 18 for older children. The child psychologist also evaluated the internalizing behaviours (e.g., anxiety and somatic complaints) and externalizing behaviours (e.g., aggression and rule-breaking) through the CBCL. The CBCL scores were analysed using a 3-point Likert scale (0 for "not at all," 1 for "sometimes," and 2 for "always"). T-scores were computed to sum the internalizing and externalizing behaviours, with a T-score below 60 indicating low risk, a score between 60 and 70 considered borderline risk, and a score above 70 indicating a high risk of developing behavioural problems.⁴¹

The BMI was categorized according to the WHO guidelines, which use BMI percentile categories for children and adolescents aged 2 to 19 years. These categories are as follows: underweight (BMI less than the 5th percentile), healthy weight (BMI between the 5th and less than the 85th percentile), overweight (BMI between the 85th and less than the 95th percentile), and obesity (BMI at or above the 95th percentile). To determine whether a child falls within the normal BMI range or is overweight, their BMI should be plotted on WHO growth chart for children, which takes age and sex into account.

The children's eating habits were categorized into forceful feeding, over eating and junk food eating. Forceful feeding which involves parents or caregivers pressuring or compelling a child to eat regardless of their hunger cues or willingness. This practice includes verbal coercion, where persistent or aggressive language is used to persuade the child to eat more than they want; physical coercion, such as spoon-feeding against their will or holding their mouth open; emotional pressure, applying tactics like guilt or fear (e.g., "If you don't eat, I'll be very upset," or "You must eat to make me happy"); and reward or punishment, offering incentives for eating or

threatening consequences for not eating (e.g., "No dessert if you don't finish your vegetables" or "You can watch TV only if you eat all your food"). The children's eating habits were also categorized as overeating behaviours, characterized by the tendency to consume excessive amounts of food while engaged in screen-based activities such as watching TV, playing video games, or using tablets and smartphones. This behaviour, influenced by several factors, can lead to various health and behavioural issues. Characteristics of overeating with ST include mindless eating, where food is consumed without attention to hunger cues or portion sizes due to distraction; frequent snacking, particularly on unhealthy, high-calorie foods; consuming larger portions as distraction leads to a lack of awareness of quantity; emotional eating, using food to cope with emotions while watching TV or using other screens; and reduced physical activity, as prolonged ST often results in a sedentary lifestyle, increasing the likelihood of overeating. Furthermore, junk eating in children refers to the frequent consumption of foods that are high in calories but low in nutritional value. These foods typically include items such as sugary snacks, candies, chips, sodas, fast food, and other processed or heavily packaged foods that offer little in terms of essential nutrients like vitamins, minerals, and fibre. The numeric data and categorical data were summarized by descriptive statistics like, n, mean, frequency count and percentage. Normality test was performed before applying any statistical test. The data was analysed by using SPSS V.23. A p value less than 0.05 was considered statistically significance.

RESULTS

Indicating statistically significant results

In our study, a total of 401 children were recruited, out of which 233 (58.10%) were males and 168 (41.90%) were females. Children under the age group of 18 to 36 months were 65 (16.21%), 36 to 60 months were 131 (32.67%), and 61 to 96 months were 205 (51.12%). Among children surveyed, 201 (50.12%) exceeded 2 hours of ST, while 159 (39.65%) fell within range of 1-2 hours. Only 41 children (10.22%) had less than 1 hour of ST (Table 1).

There was a statistically significant correlation found between children ST and their behavioural problem like somatic complaints ($p < 0.01$), withdrawn behaviour ($p = 0.001$), rule breaking behaviour ($p = 0.03$), aggressive behaviour ($p < 0.01$), however there was no significant correlation found between attention problem and ST of children ($p = 0.113$) (Table 2).

There was a strong statistically significant correlation was found between children's ST and their internalizing behaviour ($p = 0.00034$) and externalizing behaviour ($p = 0.009$) (Table 3).

Among children classified as overweight (4.49%), the average ST was 4.3 hours in comparison to average of 3.2

hours for normal weight children (87.28%), revealing a highly statistically significant positive correlation between children's ST and their weight ($p=0.015$). Furthermore, children exhibiting overeating behaviours (6.23%) had a higher average ST of 4.5 hours, indicating a statistically significant correlation between children's eating habits and their total ST ($p<0.01$), the study observed that among children aged >5 years, categorized as obese (11.71%) had a high average ST of 5.12 hours, while overweight children (10.73%) had an average ST of 4 hours and children with a normal BMI (77.56%) had

a lesser average ST of 3.77 hours. A significant positive correlation was found between BMI (among children aged >5 years old) and their total ST ($p=0.006$) (Table 4).

Among the participants, 52 children (12.97%) had their own screens, spending an average of 5.2 hours in contrast to the 349 children (87.03%) did not have their own the screen, spent an average of three hours. The study found a statistically significant association ($p<0.01$) between the children's own screens as well as their total the ST (Table 5).

Table 1: Demographic and ST details of children, (n=401).

Variables	N	Percentage (%)
Children's age distribution (in months)		
<36	65	16.21
36 to 60	131	32.67
61 to 96	205	51.12
Children's gender distribution		
Male	233	58.10
Female	168	41.90
Children's ST distribution (in hours)		
<1	41	10.22
1 to 2	159	39.65
>2	201	50.12

Table 2: Association of children screen time with their behavioural problems.

Behavioural problems	Variables	Not at all	Sometimes	Always	P value
Anxious	N	191	183	27	0.714
	%	47.63%	45.64%	6.73%	
	ST	3.38±1.88	3.25±1.61	3.19±1.49	
Withdrawn	N	352	47	2	0.001
	%	87.78%	11.72%	0.50%	
	ST	3.18±1.69	4.13±1.81	4.50±1.80	
Somatic complaints	N	134	214	53	<0.01
	%	33.42%	53.37%	13.22%	
	ST	2.50±1.27	3.51±1.74	4.50±1.82	
Attention problems	N	141	245	15	0.113
	%	35.16%	61.09%	03.74%	
	ST	3.20±1.88	3.31±1.64	4.15±1.63	
Rule breaking behaviour	N	292	108	1	0.03
	%	72.82%	26.93%	0.25%	
	ST	3.16±1.64	3.68±1.93	3.50±0.70	
Aggressive behaviour	N	60	299	42	<0.01
	%	14.96%	74.56%	10.47%	
	ST	2.65±1.16	3.30±1.74	4.26±1.96	

Table 3: Association of children screen time with their risk of developing internalizing or externalizing behaviour.

Risk	Variables	Low risk	Borderline risk	High risk	P value
Association of children's screen time and their internalizing behaviour	N	341	37	23	0.00034
	%	85.04%	9.23%	5.74%	
	ST	3.18±1.69	3.70±1.90	4.56±1.53	
Association of children's screen time and their externalizing behaviour	N	381	18	2	0.009
	%	95.01%	4.49%	0.50%	
	ST	3.26±1.73	4.36±1.55	1.50±0.70	

Table 4: Association of children screen time with their BMI and eating habits.

Association with children's total screentime	Variables	N	Percentage (%)	Mean±SD of ST (hours)	P value
Children's BMI	Normal	350	87.28	3.2±1.7	0.015
	Obese	33	8.23	2.8±1.5	
	Overweight	18	4.49	4.3±1.7	
Children's eating habits	No feeding problem	336	83.79	3.1±1.7	<0.01
	Forceful feeding	33	8.23	2.3±1.5	
	Overeating	25	6.23	4.5±1.8	
	Junk Eating	4	1.00	2.5±1.0	
Children (>5 years) BMI	Normal	159	77.56	3.77±1.84	0.006
	Obese	24	11.71	5.12±2.04	
	Overweight	22	10.73	4.045±2.18	

Table 5: Association of individual screen in children's own bedroom with their total screen time.

Variables	N	Percentage (%)	Mean±SD of ST (hours)	P value
Screen based device in children's own bedroom (No)	349	87.03	3±1.5	<0.01
Screen based device in children's own bedroom (Yes)	52	12.97	5.2±1.5	

DISCUSSION

Recent years have witnessed a surge in digital media usage in developing countries, resulting in elevated ST and sedentary behaviour among the youth.³⁹ Children under the age of 5 years, are the fastest growing user of digital media. Mobile devices are quickly becoming the preferred media choice for children because of its screen size, mobility, ability to stream content, interactive capability and decreasing costs.²⁷ According to a recent study, it was found that over 80% of the children surpassed the ST guidelines recommended by the AAP. Notably, half of the parents reported introducing ST to their children earlier than advised by the AAP. Interestingly, households with three or more devices tended to have children with higher ST. Moreover, children whose parent's frequently used smartphones were more likely to have increased screen exposure. Another notable finding was that children who had meals while watching television tended to have higher ST.²⁸ Another study concluded that 60% of the children (2 to 5 years) in India used digital media gadgets for more than 1 hour per day, which is in similar lines with the current study in which 201 (50.12%) children had a ST of more than 2 hours which is exceeding the standard recommendation by AAP (Table 1).²⁹

The American Academy of Sleep Medicine guidelines recommends that children's bedrooms should be free of any screen-based device and that children should not have access to any screen based device 30 min before bedtime.³⁰ However, in our study, a positive significant association ($p<0.01$) was found between screen based

device in children's bedroom and their ST with mean ST of 5.2 hours per day (Table 5), which is in similar lines with a study which stated that for children having TV sets in their bedroom, had a statistically significantly associated with excessive ST.³¹ Also, a similar study concluded that higher number of TV sets, smart phones, presence of TV cable, internet access at home, and child having personal gadgets were significant with ST >2 hours.³² Indeed, our findings highlight need of proactive measures aimed at curtailing screen exposure and regulating access to electronic devices for children. Such measures are crucial to safeguarding their physical and mental well-being in an increasingly digital world.

ST and unhealthy eating habits are common in young children, and evidence suggests that they frequently co-occur and are linked. A study revealed that the teens who watched more than 2 hours of ST were more obese.¹⁹ A study conducted in India reported that 29% and 18% of the children were overweight and obese, respectively who had a ST more than the international and national guidelines.³³ Similarly, in our study 4.49% children were overweight with a significant correlation ($p=0.015$) between weight and total ST of children (Table 4). Also, in our study there was a positive correlation observed between the ST of children aged >5 years and their BMI ($p=0.006$) with 11.71% of children obese and 10.7% of children overweight. (Table 4). The convergence of increased ST, unhealthy eating habits and thus increase incidence of overweight/obesity in the young children has garnered significant concern among researchers as they are interlinked. These findings align with previous studies, highlighting the urgent need for awareness

among teachers and parents and thus to mitigate these interconnected factors in children's health management.

High ST in children correlates with overeating and adopting unhealthy eating habits from advertisement and programs. ST and poor eating habits intertwine, especially in young kids, highlighting the need to recognize and address these clusters early for tailored prevention strategies. Excessive ST often accompanies low fruit/vegetable intake and high-energy snack consumption in young children.³⁵ Recent study results indicate that approximately 19% of children exhibited forceful feeding behaviour. Additionally, 20% of children displayed signs of overeating behaviour,³⁶ which is in somewhat similar lines to our study in which forceful eating, Overeating, junk eating was observed in 8.23%, 6.23%, 1% children respectively with a significant association ($p<0.01$) between eating habits and total ST of children (Table 4). High ST in children is closely linked to overeating and the adoption of unhealthy eating habits, emphasizing the critical importance of early recognition and targeted prevention strategies to promote healthier lifestyles in children.

A meta-analysis discovered a direct link between adolescent depression and screen use.³⁴ A study conducted in 2020, revealed that long-term screen use has also been connected to issues with children's social and emotional development.³⁷ In the present study a statistically significant correlation was found between children ST and their withdrawn behaviour ($p=0.001$), somatic complaints ($p<0.01$). However, in the present study we did not find any statistical relationship between children ST and their attention problem (Table 5). A study stated that greater time spent watching television/movies was associated with increased occurrences rule-breaking behaviour, which is in similar lines with the present study in which there was a positive correlation observed between children ST and their rule breaking behaviour ($p=0.03$).³⁸ The result of the study concluded that children's Prolonged leisure time spent on screen activities is associated with violent and aggressive behaviour in children and adolescents, which is in similar lines with the current study in which a positive correlation was observed between children ST and their aggressive behaviour ($p<0.01$) (Table 2).³⁹ A study conducted in China revealed that preschooler with ST of >60 min per day tend to have more behavioural problems,⁴⁰ which is in similar lines with current study in which association of children's ST with internalizing ($p=0.00034$) and externalizing behaviour ($p=0.009$) were statistically significant (Table 6). Our findings resonate with prior research, revealing notable links between children's ST and both internalizing and externalizing behaviours, emphasizing promotion of balanced screen exposure to safeguard children's mental well-being. Evidence from the current study as well as past studies around the world suggests a concerning association between ST and adverse effects on children's mental health, including withdrawn behaviour, somatic

complaints, and rule-breaking tendencies, emphasizing the need for vigilance in monitoring ST as well as its content by using parental monitoring apps available in all the gadgets today. Therefore, the balanced and supervised screen exposure can mitigate risks to children's social, emotional, and behavioural well-being while they reap the benefits from them.

Limitations of the study includes, recall or social desirability bias due to reliance of physical activity and ST relied on self-reporting. The sample mostly consisted of individuals from urban and higher socioeconomic backgrounds, limiting accuracy of generalizability to the wider population.

CONCLUSION

Reducing ST in children is a multifaceted challenge that requires a comprehensive approach involving parents, educators, and policymakers. Increasing awareness among parents about the potential negative effects of excessive ST is crucial, along with providing education programs and workshops to manage and limit usage. Promoting alternative activities, such as outdoor play, reading, hobbies, and family activities, can significantly reduce reliance on screens. Consistent and enforceable ST limits, along with modelling healthy habits by adults, are essential. Schools should incorporate screen-free periods and hands-on learning experiences to balance digital exposure. Policymakers should support legislation that limits ST in various settings and promote public health campaigns. Implementing these strategies can foster healthier screen habits and enhance the overall well-being of children in our increasingly digital world.

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