Original Article

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Paediatrics Section

Impact of Screen Time and Occurrence of Autism Spectrum Disorder among Toddlers in Field Practice Area at Tertiary Care Medical College of Southern India: A Cross-sectional Study

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ABSTRACT

Introduction: Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder with multiple causative factors and various symptoms, including impaired social communication, repetitive behaviour and restricted interests. It has a significant impact on early childhood, manifesting as poor schooling and social interaction, which later continues to hamper adult productivity. Increased screen time is one of the important predisposing factors for ASD in toddlers and there is a lack of studies regarding the screening of ASDs in Southern India, especially in rural areas.

Aim: To evaluate the impact of screen time exposure on the occurrence of ASD in toddlers.

Materials and Methods: This cross-sectional study was conducted from July 2022 to January 2024 in the Department of Paediatrics at Sri Siddhartha Medical College and Research Hospital, Tumkur, Karnataka, Southern India. A total of 600 toddlers aged between 16 and 30 months, visiting the Outpatient Department (OPD), camps, Anganwadi centres and Montessoris from urban and rural areas of Tumkur, were included, provided that informed consent was obtained from their parents. All were assessed using pretested questionnaires regarding screen media use and the Modified Checklist for Autism in Toddlers, Revised (M-CHAT-R) questionnaire. The Chi-square test, Spearman's rank correlation coefficient and Analysis of Variance (ANOVA) test were used for statistical analysis.

Results: In total, 600 children from both urban and rural communities were assessed using the M-CHAT-R screening tool. Of these, six screened positive. Toddlers with positive screens (M-CHAT-R Score >2) had a significantly higher mean age (29.17±1.33 months) compared to those with negative screens (M-CHAT-R Score ≤2) (22.17±4.07 months), p-value <0.001. The gender distribution in the present study revealed a male-to-female ratio of 1.1:1. However, a significant gender disparity was observed among participants screening positive for ASD, with a male predominance (n=5, 0.83%) and a male-to-female ratio of 5:1 (p-value=0.07). A significant correlation between screen time and ASD was observed (r=0.124, p-value <0.001).

Conclusion: Early intervention and education for parents/caregivers should be provided to prevent harmful effects, as screen time is a predisposing factor in toddlers.

Keywords: Attention span, Digital media, Media exposure, Neurodevelopmental disorder

INTRODUCTION

According to the Diagnostic and Statistical Manual of Mental Illnesses V (DSM-V), ASD is a neurodevelopmental disorder characterised by disturbances in social communication and interaction, associated with repetitive behaviours and restrictions in the range of interests [1]. The Modified Checklist for Autism in Toddlers Revised (M-CHAT-R) is an ASD screening tool that is simple and inexpensive to use. It is intended for children aged 16-30 months and has a sensitivity of 91% and specificity of 95.5 [2].

The prevalence of ASD has been increasing globally and early identification could improve the quality of life [3]. A systematic review update on the global prevalence of autism states that approximately 1 in 100 children are diagnosed with ASD worldwide [3]. The prevalence of ASD in India ranges from 0.74% to 1.68% (1 in every 68 children) [4]. According to 2020 estimates from the CDC's (Centres for Disease Control and Prevention, USA) Autism and Developmental Disabilities Monitoring (ADDM) Network, 1 in every 36 children (2.8% of eight-year-old children) has been identified with ASD [5]. ASD is 3.8 times more prevalent in males (4.3%) than in females (1.1%) [5]. The etiology of ASD is uncertain, but environmental and genetic factors are associated with the disorder. Genetic factors have been recognised as primary causes of aberrant brain development and are considered major contributors [6]. Regardless of the mechanism, research indicates that hereditary variables, influenced by environmental circumstances, combine to cause the majority of ASD [7].

Recent studies have found a link between screen time media and the development of ASD, which also harms the developmental domains of toddlers, especially in cognition [8,9]. The American Academy of Paediatrics recommends that screen time should be nil for children under 18 months of age [10]. All generations use electronic gadgets, leading to increased screen time in this era of digitalisation. Quarantine during the COVID-19 pandemic has further increased screen time due to home isolation and fewer social gatherings. Since the COVID-19 pandemic, parents of toddlers have reported a significant increase in their children's screen time [11].

Due to limited research on the impact of screen time and the occurrence of ASD using M-CHAT-R score questionnaires following the COVID-19 pandemic, the present study was conducted to examine the association between screen time and ASD in toddlers. The present study, which focuses on screen time and ASD, aimed to fill the gap by examining the impact of screen media use and its effects on toddlers by calculating the amount of screen time and the risk of developing ASD using M-CHAT-R score questionnaires.

Hence, the present study was conducted to evaluate the impact of screen time exposure on the occurrence of ASD in toddlers.

MATERIALS AND METHODS

The present cross-sectional study was conducted in the Department of Paediatrics at Sri Siddhartha Medical College and Research Hospital, a tertiary care hospital, in the rural and urban areas of Tumkur, Karnataka, Southern India, over a period of 18 months, from July 2022 to January 2024. The study protocol received ethical approval from the Institutional Ethics Committee (IEC) (ref no: SSMC/MED/IEC-93/July-2022). Informed written consent was obtained from parents.

Inclusion criteria: All consecutive children aged 16 to 30 months and their caregivers (parents or guardians) visiting the OPD of Paediatrics, camps, Anganwadi centres and Montessoris were included. A total of 600 participants were selected after meeting the inclusion criteria.

Exclusion criteria: Children with already confirmed ASD, neurodegenerative disorders, neurological deficits, visual impairments, or hearing impairments were excluded from the study.

Sample size calculation: Taking the prevalence of autism to be 0.19% and estimating the expected proportion with a 0.39% absolute precision and a 95% confidence interval, the minimum sample required is 479 [12]. The formula for the same is as follows:

$$n=\frac{Z^2(1-\alpha/2)*PQ}{d^2}$$

Where,

$Z^2(1-\alpha/2)=1.96$(95% CI)

P=(0.19%) Expected prevalence based on study [12]

Q=1-P

d=0.39% (Margin of error)

Minimum required sample=479

Due to feasibility of cases, a total of 600 samples have been included in the study.

Study Procedure

The parents or guardians of the children who meet the inclusion criteria are asked to fill out the M-CHAT-R questionnaire screening tool, which contains 20 items that rely on the parents' or guardians' observations of their children [2]. Permission to use the M-CHAT-R scale in this study has been granted by its developer.

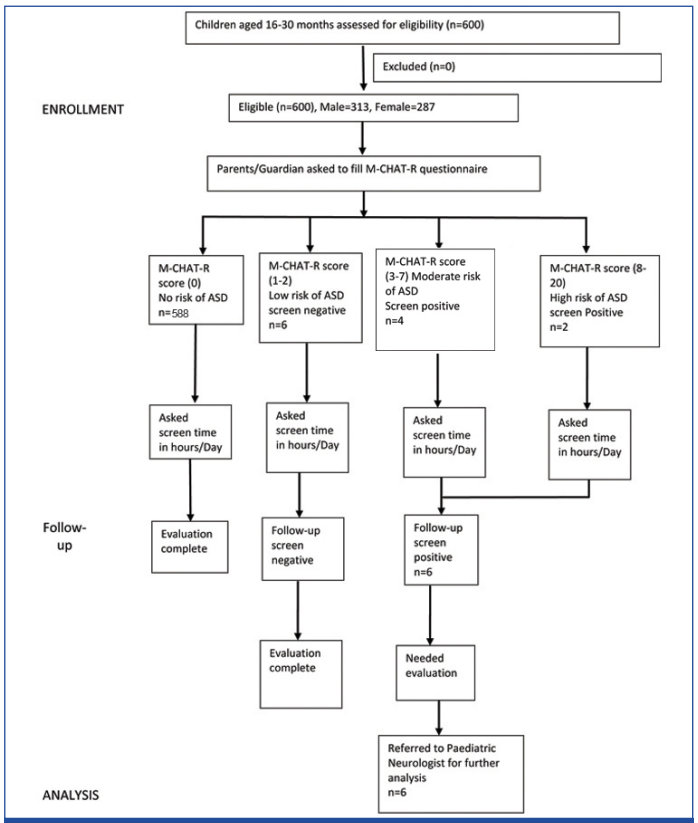
Parents respond to a series of questions. Each "no" response earns 1 point, while for items 2, 5 and 12, the scoring is reversed (meaning that a "yes" earns 1 point instead). The points are then accumulated to obtain a total score. This total score is further classified into the following categories: 0-2 (low risk of ASD), 3-7 (moderate risk of ASD) and 8-20 (high risk of ASD). A complete physical examination, including a neurological evaluation, is conducted for children who screen positive. They are then referred to a paediatric neurologist for further evaluation and intervention.

STATISTICAL ANALYSIS

The Statistical Package for Social Sciences (SPSS) software version 22.0 was used to analyse the data. Categorical data were represented in the form of frequencies and proportions. The association between categorical variables was tested using the Chi-square test. Continuous data were represented as means and standard deviations. The correlation between gadget usage hours and M-CHAT-R scores was calculated using Spearman's rank correlation coefficient. An ANOVA test was applied to assess the significant differences in mean hours of gadget use between screen-positive and screen-negative toddlers. A p-value of less than 0.05 was considered statistically significant.

RESULTS

In the present study, 600 eligible toddlers were screened to investigate the impact of screen media use on toddlers and its effects on the risk of developing ASD, utilising the M-CHAT-R score [Table/Fig-1]. The present study employed the M-CHAT-R scale, validated for toddlers aged 16-30 months. Therefore, the present study included 600 toddlers aged 16-30 months, with a mean age of 22.24±4.11 months, the majority of whom were in the age group of 16-20 months. Most of the toddlers were male, with 313 (52.2%), resulting in a male-to-female ratio of 1.1:1. The majority of the toddlers resided in urban areas, totaling 351 (58.5%) [Table/Fig-2].



[Table/Fig-1]: Study flowchart.

Variables	Category	n (%)
Age (in months)	16-20	240 (40.0)
	>20-25	198 (33.0)
	>25-30	162 (27.0)
Mean age±SD		22.24±4.11
Sex	Male	313 (52.2)
	Female	287 (47.8)
Residence	Rural	249 (41.5)
	Urban	351 (58.5)

[Table/Fig-2]: Characteristics of the study participants (children and parent/caregivers).

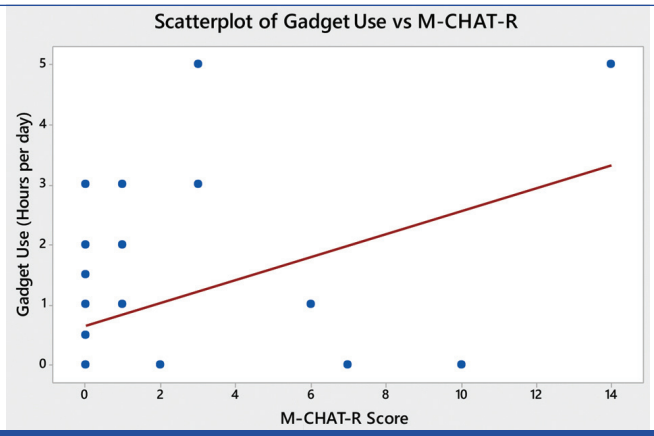
The median hours of gadget use were 0.50 hours, with an interquartile range of (0.0-1.0). Gadget usage was prevalent among 289 (48.2%) of the toddlers in the present study. According to the M-CHAT-R Score, 588 (98.0%) of the toddlers had no risk of developing ASD, 6 (1.0%) were classified as low risk, 4 (0.7%) as moderate risk and 2 (0.3%) as high risk [Table/Fig-3].

Outcome variables		n (%)
Gadget use (in hours) per day	0.0-0.49	244 (40.7)
	0.50-1.00	289 (48.2)
	>1.0	67 (11.2)
M-CHAT-R score	No-risk (0)	588 (98.0)
	Low-risk (1-2)	6 (1.0)
	Moderate-risk (3-7)	4 (0.7)
	High-risk (8-20)	2 (0.3)

[Table/Fig-3]: Distribution by gadget usage and M-CHAT-R score.

The authors found a statistically significant correlation between the number of gadget usage hours and M-CHAT-R scores (r=0.124;

p<0.001) [Table/Fig-4]. Out of a sample of 600 toddlers, 6 (1%) tested positive using the M-CHAT-R screening tool. The mean age of these six toddlers was 29.17 months, with a standard deviation of ±1.33 months [Table/Fig-5]. The present study indicated that the prevalence of ASD was higher among male toddlers than among females. The prevalence of ASD in males was 5 (1.6%), while in females it was only 1 (0.3%), although the difference was not statistically significant (p=0.127) [Table/Fig-6].



[Table/Fig-4]: Correlation between of gadget usage hours for moderate, high M-CHAT-R Score.

DISCUSSION

The present study results showed that six toddlers who screened positive with an M-CHAT-R score greater than 2 (moderate risk, n=4 and high risk, n=2) spend approximately 2.3 hours per day viewing screens and are at high risk of developing ASD. The present study primarily focused on the association between the duration of gadget use and the occurrence of ASD in toddlers. These findings indicate that an increase in the duration of gadget use correlates with a higher risk of scoring high on the M-CHAT-R scale. Several studies, including those by Dikkala VP et al., Heffler KF and Oestreicher LM, have observed the impact of increased screen time duration on developmental outcomes in toddlers [9,13]. Madigan S et al., demonstrated that children who spent more time on screens showed lower performance on the Ages and Stages Questionnaire (ASQ) {t(1500)=9.45; p<0.001}, indicating potential developmental delays [14].

In the present study, the authors observed a slight male preponderance, with 52.17% males compared to 47.83% females in the enrolled study sample. Other studies have also reported a similar male preponderance, such as 52.5% males in Dikkala VP et al., Pune and a male percentage in Elasbbagh M et al., [9,15].

In the present study, both rural and urban toddlers had a maximum screen time of 5 hours per day, which contradicts the study conducted by Ilamparithi P and Selvakumar P in Tamil Nadu, which showed increased screen time in urban boys (6.59±1.24 hours per day) associated with behavioural problems [16].

Case number	1	2	3	4	5	6
Age (in months)	27	28	30	30	30	30
Gender	F	M	M	M	M	M
Urban/Rural	R	U	U	U	U	U
Parents' education (12th standard)	Father	Uneducated	Father	Father, mother	Father, mother	Father, mother
Socioeconomic status (as per modified Kuppuswamy scale)	Lower middle class-3	Lower middle class-3	Lower middle class-3	Lower middle class-3	Lower middle class-3	Upper middle class-2
M-CHAT-R Quessionaries filled by parents/guardian	Mother	Mother	Mother	Mother	Mother	Mother
Availability of electronic gadgets (Smart phone, Tablets, Laptops, Television, Smart watch)	Smart Phone	No	Smart Phone, Television	No	Smart Phone	Smart phone, Television
Screen time in hours per day	4-5	No	5	No	1	3
Ease of availability of electronic gadgets to toddlers in home	Yes	No	Yes	No	No	Yes
Parental awareness of ill-effects of increased screen time	No	No	No	Yes	Yes	Yes
MCHAT-R score {0-2 (low-risk of ASD), 3-7 (moderate-risk of ASD) and 8-20 (high-risk of ASD)}	3	7	14	10	6	3

[Table/Fig-5]: Characteristics of the screened positive study participants (children and parents/caregivers).

M-CHAT-R score	Sex		Total n (%)	Chi-square, p-value
	Male n (%)	Female n (%)		
No-risk (0)	307 (98.1%)	281 (97.9%)	588 (98.0%)	5.700, 0.127
Low-risk (1-2)	1 (0.3%)	5 (1.7%)	6 (1.0%)	
Moderate-risk (3-7)	3 (1.0%)	1 (0.3%)	4 (0.7%)	
High-risk (8-20)	2 (0.6%)	0 (0.0%)	2 (0.3%)	
Total	313 (100.0%)	287 (100.0%)	600 (100.0%)	

[Table/Fig-6]: Distribution of M-CHAT-R Score as per gender.

A statistically significant association was observed between gadget usage hours and M-CHAT-R scores. The mean gadget usage hours were 2.25±2.22 and 2.50±3.54, respectively, in the moderate and high-risk categories of ASD (p<0.001) [Table/Fig-7].

M-CHAT-R score	N	Mean	Std. Deviation		
No-risk (0)	588	0.63	0.63	17.643	<0.001
Low-risk (1-2)	6	1.67	1.03		
Moderate-risk (3-7)	4	2.25	2.22		
High-risk (8-20)	2	2.50	3.54		
Total	600	0.66	0.69		

[Table/Fig-7]: M-CHAT-R-Score and gadget usage in hours per day.
*ANOVA

In the present study, 33% of the toddlers used smartphones and 33% used multiple devices (television, tablet). In contrast, the percentages were about 72.2% for smartphone users and 44.7% for multiple device users in the study by Dikkala VP et al., Pune, while 75% of toddlers used television in the study by Vandewater EA et al., New York [9,17].

In the present study, the age of early exposure to screen time was 56% (n=234) for toddlers aged 16-24 months and 68% (n=122) for toddlers aged 25-30 months. In another study conducted by Dikkala VP et al., Pune, the figures were 32.5% for those under one year old and 67.5% for the 13-24 month age group [9].

In the present study, 33.34% of toddlers with 5 hours of daily screen time scored between 10 and 14 on the M-CHAT-R and were considered to be at high risk for ASD. This is lower compared to a recent study by Dikkala VP et al., Pune, which reported that 53% of toddlers aged 9 to 36 months with more than 4 hours of screen time per day were at high risk for developing ASD. Similarly, a survey by Heffler KF and Oestreicher LM reported that increased exposure to screen time was associated with ASD-like symptoms as early as 12 months of age [13].

The present study reported language delays in all six screened-positive cases (n=6), regardless of their screen time. This finding

contradicts a study by Hermawati D et al., which reported language delays and short attention spans in infants under two years with less than three hours of screen time. In that study, toddlers with over three hours of screen time exhibited language delays, short attention spans and hyperactivity [18].

Limitation(s)

The present study was a cross-sectional observational study; therefore, the authors could not observe long-term consequences, such as detailed developmental cognitive delays, in affected toddlers. Informant recall bias is another possible limitation of the present study.

CONCLUSION(S)

Early detection of ASD is crucial, as signs can emerge as early as 12 months. Consequently, regular screening of toddlers, coupled with parental and caregiver counselling and education on the potential harms of screen media, is essential for timely identification and intervention. Regular screening of toddlers, along with parental and caregiver counselling and education on the potential harms of screen media, is essential for timely identification and intervention.

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