ORIGINAL RESEARCH ARTICLE UHD JOURNAL OF SCIENCE AND TECHNOLOGY

Exploring the Association between Screen Time Exposure and Autism Spectrum Disorder in Preschool-aged Children in Sulaymaniyah

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ABSTRACT

Introduction: Recent research suggests that excessive screen time may influence Autism spectrum disorder (ASD)-related developmental patterns. This study examines the correlation between screen exposure and ASD symptoms in preschool-aged children. **Methods:** A cross-sectional study was conducted on children aged 2–6 years, including both formally diagnosed ASD cases and those exhibiting ASD-related symptoms. Data collection involved the use of structured face-to-face questionnaires adapted from previous research, which covered screen time duration, content type, parent-child interactions, and prevalence of ASD symptoms. Statistical analyses, including Kendall's tau-b correlation and logistic regression, were performed using IBM the Statistical Package for the Social Sciences Statistics 22. **Results:** Using Kendall's tau-b correlation and logistic regression analysis, the study found a significant positive association between screen time duration and ASD-related symptoms (P = 0.011, Exp[B] = 6.364). Children in Sulaymaniyah averaged more than 4 h of daily screen exposure, exceeding international recommendations. Parental education and household income showed moderate negative correlations with screen time, indicating that higher socioeconomic status was associated with less screen exposure. **Conclusion:** The findings indicate a significant correlation between prolonged screen exposure and ASD-related behaviors among preschool-aged children. However, due to the inclusion of both diagnosed and symptomatic cases, the results should be interpreted with caution.

Index Terms: Autism Spectrum Disorder, Screen Time, Preschool Children, Neurodevelopment, Parental

1. INTRODUCTION

Autism spectrum disorder (ASD) is a complex neurodevelopmental disorder characterized by persistent deficits in social communication and social interaction, as well as restricted and repetitive behaviors, interests, or activities. The global prevalence of ASD has risen markedly over the past two decades. According to the World Health Organization (2023), approximately 1 in 100 children worldwide is diagnosed with ASD, compared to 1 in 150 two decades ago. In some high-income countries, recent surveillance reports estimate prevalence rates as high as 1 in 36 children (CDC, 2023). This increasing incidence has prompted researchers to explore both genetic predispositions and environmental influences. Among the environmental determinants, prolonged exposure to electronic screens has emerged as a potential factor influencing neurodevelopmental patterns associated with ASD [1]. Among environmental determinants, prolonged exposure to electronic screens has emerged as a potential factor influencing neurodevelopmental patterns associated with ASD [2].

Excessive screen time has been widely documented as having adverse effects on both typically developing children and

Access this article online

DOI:10.21928/uhdjst.v9n2y2025.pp297-304

E-ISSN: 2521-4217
P-ISSN: 2521-4209

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Received: 21-09-2025 Accepted: 29-10-2025 Published: 16-11-2025

those diagnosed with ASD. These detrimental consequences range from reduced academic performance and disrupted sleep cycles to deficits in attention, social behaviors, and language acquisition [3]. Additional concerns include mood disorders and the manifestation of ASD-like symptoms [4]. Given the pervasiveness of digital technology in modern life, young children are increasingly exposed to electronic devices, often exceeding the screen time limits recommended by health organizations such as the World Health Organization (WHO, 2019) and the American Academy of Pediatrics (AAP, 2016). The AAP advises avoiding digital exposure for children under 2 years of age, while recommending a restriction of no more than 1 h daily for those aged 2–5 [4]. Similarly, the WHO suggests a maximum of 1 h/day for children aged 4–6 ([5]. Notably, children diagnosed with ASD exhibit heightened engagement with screens, including television, video games, and mobile devices [6]. A study conducted among preschoolers in China revealed a pronounced risk of ASD-like symptoms among children exposed to more than 2 h of screen time per day [7]. Additional findings reinforce the association between early digital exposure and elevated ASD-related behaviors in preschool-aged children [8].

Recent research has increasingly focused on how excessive screen exposure may contribute to the development or worsening of ASD-related behaviors in early childhood. Prolonged screen use has been associated with reduced social interaction, delayed language acquisition, and limited eye contact, features commonly observed in children with ASD [4], [8]. Moreover, early and unregulated screen exposure during critical developmental periods may interfere with sensory processing and social engagement, potentially influencing the expression of ASD-related symptoms [6]. Moreover, differences in screen content quality and duration can yield varied developmental outcomes. Higher-quality digital content has been linked to improved language skills, whereas excessive screen exposure, especially in early developmental stages, is associated with diminished language proficiency [9].

Diagnostic disparities exist across different populations, with variable prevalence rates influenced by genetic, environmental, and socioeconomic factors. While males are diagnosed more frequently, females with ASD tend to exhibit higher intellectual disabilities [10]–[13].

Piaget's theory of cognitive development underscores the importance of language acquisition and attentional responsiveness as key milestones in early childhood development [14]. Recent studies highlight the growing phenomenon of language delays and attention deficits among young children, partly attributed to excessive screen exposure. The COVID-19 pandemic further exacerbated this trend, as increased digital engagement displaced traditional parental interactions. Observational reports from childcare centers indicate a marked rise in preschoolers exhibiting language deficits and attention-related concerns post-pandemic [15], [16]

Despite mounting evidence of screen exposure influencing neurodevelopmental trajectories, research on this phenomenon remains limited, particularly within the Kurdistan Region of Iraq. This study seeks to address this gap by examining the correlation between screen time and ASD-related symptoms in children aged 2–6 in Sulaymaniyah. By analyzing screen exposure patterns and their neurodevelopmental consequences, the findings aim to contribute to informed parental strategies for managing digital engagement among young children, particularly those predisposed to ASD.

2. MATERIALS AND METHODS

2.1. Study Design and Setting

A descriptive cross-sectional study was conducted between March and July 2024 in Sulaymaniyah City, located in the Kurdistan Region of Iraq. Data collection took place in specialized child development and rehabilitation centers, including the Sulaymaniyah Autism Center and several private pediatric and psychiatric clinics that provide assessment and therapy services for children with developmental concerns.

2.2. Study Aim

The study aimed to examine the correlation between screen exposure duration and ASD-related symptoms among preschool-aged children.

2.3. Participants

Participants included children aged 2–6 years. Two categories of children were enrolled:

1. Formally diagnosed ASD cases, confirmed by pediatric or psychiatric specialists based on DSM-5 diagnostic criteria and available medical records.
2. Children exhibiting ASD-related symptoms such as language delay, poor eye contact, and repetitive behaviors, but without a formal diagnosis.

Children with other confirmed neurodevelopmental disorders (e.g., ADHD, intellectual disability, or cerebral palsy) were

excluded to minimize confounding factors. The inclusion of both diagnosed and symptomatic cases was intended to capture early behavioral patterns that may be related to excessive screen exposure, but this criterion is now explicitly stated as a study limitation.

2.4. Ethical Considerations

The study protocol was reviewed and approved by the Ethical Committee of the College of Medicine, University of Sulaimani (Approval No. 24/2024). Written informed consent was obtained from parents or legal guardians before participation.

2.5. Data Collection Instruments

Data were collected using a structured, face-to-face questionnaire developed by the researchers, based on previously validated tools from related studies. The questionnaire included three main parts:

1. Screen time assessment: Questions adapted from Wu *et al.* (2017) regarding the average duration and type of digital device use.
2. ASD symptom assessment: Selected items derived from the Childhood Autism Behavior Scale were used to identify the presence of ASD-related behaviors such as communication difficulties, social interaction deficits, and repetitive movements.
3. Family and environmental factors: Items regarding parental education, occupation, socioeconomic level, and parent-child interaction patterns.

The questionnaire was translated into Kurdish following a standard forward–backward translation process reviewed by three bilingual experts in child psychology and psychiatric nursing. A pilot test was conducted on 10 parents to ensure clarity and cultural appropriateness. Reliability testing using Cronbach's alpha ($\alpha = 0.83$) confirmed internal consistency.

2.6. Data Analysis

Data were analyzed using IBM the Statistical Package for the Social Sciences Statistics version 22. Descriptive statistics (frequency, mean, and standard deviation [SD]) were used to summarize demographic variables.

- Kendall's tau-b correlation was applied to assess the strength and direction of relationships between screen time and ASD-related symptoms.
- Binary logistic regression analysis was conducted to identify predictors of ASD-related symptom presence based on screen time duration and demographic variables.

A significance level of $P < 0.05$ was considered statistically significant.

3. RESULTS

The analysis showed that children aged 2–6 years in Sulaymaniyah spent an average of 257.3 ± 209.0 min/day on screen-based activities (approximately 4.3 h/day). This high SD indicates considerable variation in screen time among participants as illustrated in Figure 1. Overall, the average screen exposure greatly exceeds the World Health Organization's recommended limit of 1 h/day for preschool-aged children.

Categorical variables are represented as frequencies (percentages) as shown in Table 1. The study sample consisted of 73 male participants (65.8%) and 48 female participants (34.2%). The children ranged in age from 2 to 6 years, with a mean age of 4.23 years (SD = 1.21). Regarding parental education, 18 parents (24.7%) had an educational attainment below the high school level, while 55 parents (75.3%) had pursued education beyond high school. In terms of caregivers' occupations, the majority (47.9%, $n = 35$) were housewives, followed by 16.4% ($n = 12$) who worked as teachers and 35.6% ($n = 26$) engaged in other professions. Household income varied, with 8.2% ($n = 6$) of families earning below 300,000, 9.6% ($n = 7$) falling within the 300,000–500,000 income range, and the majority (82.2%, $n = 60$) reporting an income above 500,000. Regarding screen content preferences, 76.7% ($n = 56$) of children primarily engaged in entertainment and gaming, while 17.8% ($n = 13$) consumed educational content. A small proportion (5.5%, $n = 4$) reported no screen-based content consumption. Language preferences showed variability, with 37% ($n = 27$) consuming content in Kurdish, Arabic, and English, while

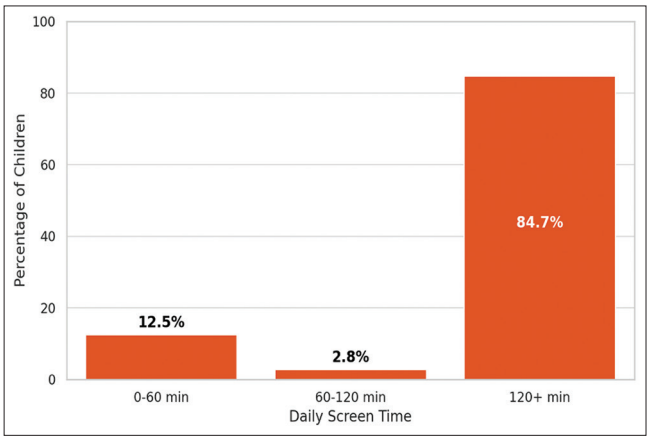

Fig. 1. Average daily screen time (min/day)

TABLE 1: Number and percentage of each category in the variables

Variables	*n* (percentage)
Gender	
Male	48 (65.8)
Female	25 (34.9)
Age	Age by year (2–6)
Parental education	
Less than high school	18 (24.7)
Higher than high school	55 (75.3)
Occupation	
Housewife	35 (47.9)
Teacher	12 (16.4)
Other	26 (35.6)
No. of children in the house	Not categorical
Household income	
<300,000	6 (8.2)
300,000–500,000	7 (9.6)
>500,000	60 (82.2)
Types of content	
Educational	13 (17.8)
Entertainment and gaming	56 (76.7)
Not using	11 (5.5)
Language of content	
Kurdish and Arabic and English	27 (37)
Only Kurdish	9 (12.3)
Only English	34 (46.6)
Not using	3 (4.1)
Screen time rule	
No	50 (68.5)
Yes	23 (31.5)
Parent-child activities	
Play	40 (54.8)
Housework	18 (24.7)
Other	15 (20.5)
Communication quality	
Poor	2 (2.7)
Fair	7 (9.6)
Average	26 (35.6)
Good	29 (39.7)
Excellent	9 (12.3)
Shared screen time	
No	33 (45.2)
Yes	40 (54.8)

12.3% (n = 9) exclusively used Kurdish. A notable 46.6% (n = 34) preferred English-language content, and 4.1% (n = 3) reported no screen-based content engagement. Screen time regulation varied among households, with 68.5% (n = 50) of parents reporting the absence of predefined screen time rules, whereas 31.5% (n = 23) adhered to structured screen time guidelines. Parent-child interaction patterns indicated that 54.8% (n = 40) of children engaged in recreational play with caregivers, while 24.7% (n = 18) assisted with household chores, and 20.5% (n = 15) participated in other activities. Communication quality assessment revealed 2.7% (n = 2) of children experienced low-quality communication, while 9.6% (n = 7) reported interactions. A larger proportion (35.6%, n = 26) experienced moderate communication quality, 39.7% (n = 29) perceived communication as good, and 12.3% (n = 9) reported excellent communication. Regarding shared screen time activities, 54.8% (n = 40) of children engaged in screen-based interactions with caregivers, while 45.2% (n = 33) did not (Table 1).

TABLE 2: Observed correlations between observed variables and screen time (n=73)

Variables	Kendall's tau-b (τb) correlation coefficient	Sig (2-tailed)
Age	−0.094	0.328
Gender	−0.129	0.251
Parental education	−0.264*	0.019
Occupation	−0.249*	0.020
No. of children in the house	0.024	0.815
Household income	−0.179	0.103
Sleep	0.034	0.732
Types of content	−0.177	0.108
Language of content	−0.165	0.120
Screen time rule	−0.058	0.607
Parent-child activities	0.201	0.059
Communication quality rate	−0.267	0.010
Shared screen time	0.030	0.789

Correlation coefficients reflect non-parametric (Kendall's tau-b) slope estimates *Correlation significant at the 0.05 level (two-tailed). **Correlation significant at the 0.001 level (two-tailed)

To evaluate the strength, direction, and significance of relations between the observed variables, Non-parametric (i.e., Kendall's tau-b) correlation analysis was used. Among the demographic and contextual factors scrutinized, several revealed noteworthy correlations with screen time. As shown in Table 2, Parental education notably exhibited a moderately negative correlation ($\tau = -0.264$, $P = 0.019$), implying a robust inverse association with screen time. Higher levels of parenteral education are linked to reduced screen time among children. Moreover, the occupation of the parents exhibited a significant negative correlation ($\tau = -0.249$, $P = 0.020$), indicating a pronounced inverse association with screen time, suggesting a negative relationship with screen time.

Further insights into these correlations, as detailed in Table 3, reinforce the importance of demographic and contextual influences in shaping screen time behaviors among young children, particularly in relation to ASD.

Logistic regression analysis was conducted to assess the association between screen time duration and ASD-related

TABLE 3: Model fit statistics from logistic regression analysis

Independent variables included in the model	−2 Log likelihood	Cox and Snell R^2	Nagelkerke R^2
Screen time duration (minutes/day), Child's age (years), Gender, Parental education level, Parental occupation, Household income, Parent-child interaction quality, Shared screen time	43.911[a]	0.313	0.520

a. Estimation terminated at iteration number 20 because the maximum iterations have been reached. The final solution cannot be found

TABLE 4: Results of fitting the logistic regression model to the data

Variables	B	Standard errors	Wald	Difference	Significant	Experience (B)
Screen time	1.851	0.728	6.465	1	0.011	6.364
Age	0.570	0.352	2.620	1	0.106	1.768
Gender	0.698	1.113	0.393	1	0.531	2.009
Parental Education level	−1.726	1.120	2.374	1	0.123	0.178
Occupation	0.593	0.593	1.001	1	0.317	1.810
No. of Children In House	−0.662	0.424	2.433	1	0.119	0.516
Household income	−2.023	0.794	6.492	1	0.011	0.132
Types of content	−1.456	1.084	1.806	1	0.179	0.233
Language of content	0.271	0.483	0.316	2	0.574	1.312
Screen time rules	0.045	1.093	0.002	1	0.967	1.046
Parent child activities	0.296	0.542	0.298	1	0.585	1.344
Communication quality rate	0.629	0.527	1.427	1	0.232	1.876
Shared screen time	−0.020	1.049	0.000	1	0.984	0.980
Constant	−0.567	4.777	0.014	1	0.905	0.567

symptoms among children aged 2–6 years (Table 4). Screen time emerged as the only statistically significant predictor of ASD-related behaviors (B = 1.851, $P = 0.011$, Exp[B] = 6.364), indicating that longer daily screen exposure markedly increased the likelihood of exhibiting ASD-related symptoms.

Other demographic and contextual factors, such as child's age, gender, parental education, and occupation, did not show a significant effect ($P > 0.05$) and were therefore excluded from further interpretation. These findings emphasize that excessive screen exposure is the main contributing factor linked to ASD-related behaviors in this sample, aligning directly with the study's objective to examine the correlation between screen time and ASD symptoms (Table 4).

4. DISCUSSION

The findings of this study indicate that children aged 2–6 years engage in screen-based activities significantly beyond the recommended daily limit of <1 h, with an average screen time of 257.27 min (4.28 h) per day. This aligns with previous research that predominantly focuses on older children and adolescents diagnosed with ASD. For instance, a study by Healy *et al.*, in Ireland, reported that 13-year-old children with ASD spend an average of 121–150 min/day watching television [17]. Similarly, another study by MacMullin *et al.*, on electronic media use among youth and young adults with ASD, found that individuals aged 6–21 years dedicate approximately 5.67 h/day to electronic device usage [18]. Despite these insights, studies exploring screen time exposure in younger children with ASD remain scarce, highlighting a critical gap in the literature. Notably, a study conducted in Qatar by Kheir *et al.*, reported that children under the age of 3 with ASD engage in screen activities for an average of 4.7 h daily [19].

Interestingly, parental reports in this study revealed no significant difference in children's screen time habits between weekdays and weekends. This finding may be attributed to the high proportion of housewives among caregivers, whose daily routines remain relatively unchanged across the week, potentially influencing children's screen exposure patterns. This null finding necessitates further investigation across larger and more diverse populations to better understand the factors shaping screen time behaviors in young children with ASD.

Existing research presents mixed results regarding weekday-weekend screen time disparities in children with ASD. A study in China suggested that weekdays tend to feature longer screen exposure compared to weekends, possibly due to reduced parent-child interaction during the workweek. In contrast, findings from Must's study indicated an opposite

trend, suggesting children with ASD spend more time on screens during weekends than weekdays [20].

In contrast to this finding, Must's study (2014) posits an opposing trend, suggesting that children with ASD exhibit increased screen time during weekends relative to weekdays. Furthermore, the research indicates that children who engage in higher levels of screen time are at an elevated risk of being diagnosed with ASD or exhibiting ASD-like symptoms, demonstrating a statistically significant correlation with a $P = 0.011$. Conversely, the data suggest that children who limit their screen time are associated with a reduced likelihood of receiving a diagnosis of ASD or ASD-like symptoms [21].

Our findings highlight several critical sociodemographic factors associated with both ASD and screen time among children aged 2–6 in Sulaymaniyah. Household income demonstrated a significant inverse relationship with ASD or ASD-like symptoms ($P = 0.011$), indicating that children from higher-income families were less likely to be diagnosed with ASD. In contrast, those from lower-income households showed a higher prevalence of ASD or related symptoms. Parental education was also significantly correlated with children's screen time ($P = 0.019$); specifically, higher parental education levels were associated with reduced screen time for their children, whereas lower educational attainment among parents corresponded to increased screen time. In addition, parental occupation emerged as a significant factor influencing screen time ($P = 0.020$). The data revealed that 47.9% of parents were housewives, 16.4% were teachers, and 35.6% held various other occupations. This suggests that the diversity in parental occupation is linked to differences in children's screen exposure. Collectively, these results underscore the complex interplay between socioeconomic status, parental characteristics, and both ASD risk and screen time in early childhood, emphasizing the need for targeted interventions considering these contextual factors.

The findings of this study provide valuable insights into the distribution of parent-child activities and communication quality among participants. Engagement in parent-child activities was categorized into three main domains: Play, Housework, and Other. Notably, most respondents (54.8%) primarily engaged in Play-related activities, suggesting that recreational interactions are the most prevalent form of engagement between parents and children. In contrast, a smaller proportion (24.7%) participated in Housework, indicating a comparatively lower parental involvement in household-related tasks with their children. In addition, 20.5% of respondents reported engagement in other activities, highlighting variability in parent-child interaction patterns. Furthermore, this study examined the perceived communication quality within the parent-child dyad, categorized into five distinct levels: Poor, Fair, Average, Good, and Excellent. The data indicate that most respondents (39.7%) perceived their communication as Good, followed by 35.6% who rated it as Average. Smaller proportions rated communication as Excellent (12.3%), Fair (9.6%), or Poor (2.7%). These results underscore the prevailing perception of adequate parent-child communication, emphasizing the need for further exploration into the factors influencing interpersonal dynamics and parental engagement in early childhood.

In our study, all participants exhibited at least one core symptom of ASD, with language delay and communication problems being the most prevalent. While previous research has consistently identified a correlation between increased screen time and more pronounced ASD symptoms, particularly in communication and language development, our findings did not establish a direct association between screen time and these specific deficits. For example, systematic reviews and cohort studies have shown that prolonged or early screen exposure is linked to a greater risk and severity of ASD symptoms, including delayed language and social difficulties. However, some studies, such as an extensive cohort analysis, found no significant association between screen time at age three and ASD diagnosis, suggesting that the timing and context of screen exposure may influence outcomes. These differences highlight the need for further research to clarify the complex relationship between screen time and ASD symptomatology in diverse populations [22], [23].

5. CONCLUSION

This study examined the correlation between ASD and screen time in children aged 2–6 years in Sulaymaniyah, revealing key insights into screen exposure patterns and their potential implications for ASD diagnosis. The findings indicate that children in this study exhibited significantly high screen time, averaging 257.27 min/day, far exceeding recommended guidelines for early childhood. The logistic regression analysis identified screen time as a significant positive predictor of ASD symptoms ($P = 0.011$, Exp[B] = 6.364), demonstrating that increased screen exposure is associated with a greater likelihood of ASD-related outcomes. In contrast, household income emerged as a negative predictor ($P = 0.011$, Exp[B] = 0.132), suggesting that higher income levels may correlate with reduced ASD risk. While other factors – including content type, parent-child interactions,

and screen time regulations – did not reach statistical significance, observed trends warrant further exploration. These findings underscore the importance of regulating screen exposure in young children, particularly those at risk for ASD, and call for larger-scale studies to refine the understanding of how socioeconomic and behavioral variables shape neurodevelopmental outcomes.

5.1. Limitations

This study faced several limitations that impacted the scope and accuracy of the findings. One of the primary challenges was the limited data on ASD prevalence in Iraq. While the global rate of ASD is approximately 1 in 100, reliable reports specific to Iraq are scarce. A previous study estimated the prevalence at 89.40/10,000, but formal diagnoses remain inconsistent due to cultural stigma and a lack of educational and professional resources on the subject. Many parents either do not seek professional help or attend inaccessible centers for data collection, reducing the number of eligible participants and ultimately limiting the sample size.

Another significant limitation was the age range of participants, restricted to 2–6 years old. While preschool-aged children frequently use phones and tablets, making them ideal subjects for assessing the impact of screen time, children younger than two are difficult to evaluate for ASD-related behavioral patterns. Although this age range provided more reliable data, it narrowed the participant pool significantly.

Furthermore, the persistent stigma surrounding psychiatric conditions in Iraq posed an additional challenge. Parents were often reluctant to discuss their child's condition openly, requiring a level of trust and comfort that was difficult to establish. In-person interviews were necessary to foster a supportive environment, but many parents only interacted with centers for drop-off and pick-up, limiting interview opportunities. The subject's sensitivity rendered voice calls ineffective, further restricting the pool of participants and complicating data collection efforts.

6. ACKNOWLEDGMENTS

We express our gratitude to all participants of the study.

7. FUNDING

No any specific funding giving to this work, and the authors did not receive any financial support for conducting the research, preparing the article, or publishing this article.

8. DATA AVAILABILITY

The data used to support the findings of this study are available on request from the corresponding authors or can be accessed.

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