

Original Research Article

Effect of parental education on screen exposure, development and socio-emotional outcomes in early childhood: a prospective comparative interventional study

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ABSTRACT

Background: Early childhood screen exposure may displace developmentally important activities and caregiver-child interaction. This study evaluated the effect of structured parental education on screen exposure and developmental and socio-emotional outcomes among children aged 9-18 months.

Methods: This prospective comparative interventional study included 176 children enrolled at 9 months of age and followed prospectively until 18 months. Caregivers in intervention group received structured education regarding appropriate screen use, parental media practices, responsive parenting, and alternative age-appropriate activities, with periodic reinforcement. The comparison group received routine care. Screen exposure, anthropometric parameters, developmental outcomes using ages and stages questionnaire, third edition (ASQ-3), and socio-emotional outcomes using ages and stages questionnaire: social-emotional, second edition (ASQ:SE-2) were assessed at baseline at 9 months of age and reassessed at 18 months following intervention.

Results: Total screen exposure decreased by 5.85 minutes/day in intervention group and increased by 24.15 minutes/day in comparison group (between-group difference: -30.00 min/day; 95% CI: -34.37 to -25.63; $p < 0.001$). Mobile screen exposure was reduced by 23.52 min/day more in intervention group (95% CI: -26.45 to -20.59; $p < 0.001$). Intervention group demonstrated significantly greater improvements in all ASQ-3 domains (all $p < 0.05$). ASQ:SE-2 scores also showed greater reduction in intervention group (between-group difference: -5.23; 95% CI: -6.25 to -4.21; $p < 0.001$). No significant between-group differences were observed in anthropometric outcomes.

Conclusions: Structured parental education with periodic reinforcement was associated with reduced screen exposure and more favourable developmental and socio-emotional outcomes. Caregiver-focused screen-time counselling may be beneficial in routine pediatric services.

Keywords: Screen exposure, Parental education, Child development, Socio-emotional development, Early childhood

INTRODUCTION

The rapid proliferation of digital media has fundamentally transformed early childhood environments, with screen-based devices such as smartphones, televisions, and tablets becoming

increasingly ubiquitous even in infancy.^{1,2} Screen exposure, defined as the duration spent on passive screen-based activities, has increased substantially across pediatric age groups and is now recognized as a significant public health concern.^{3,4} Recent global estimates indicate that a substantial proportion of children under 5 years exceed World Health Organization (WHO)

recommended limits for screen exposure, with exposure often beginning within the first year of life.^{1,5} This early and excessive exposure has raised concerns regarding its potential impact on children's physical health, development, and behaviour.^{2,6}

Excessive screen exposure in early childhood is associated with a wide spectrum of adverse outcomes affecting physical, cognitive and psychosocial domains.^{4,7} Systematic reviews and meta-analyses have demonstrated that increased screen exposure is linked to childhood obesity, reduced physical activity, poor sleep quality, and visual strain.⁷⁻⁹ Importantly, screen exposure may also displace developmentally important activities, including physical play, sleep, and caregiver-child interaction, which are critical during the early years of rapid brain development.^{2,10} Evidence suggests that prolonged screen exposure is associated with delayed language development, impaired executive functioning, attention deficits, behavioural dysregulation, anxiety, depressive symptoms, and poorer socio-emotional outcomes.¹¹⁻¹⁷

Parental behaviour is a key determinant of screen exposure in young children, influencing both the duration and context of media use.^{13,18} Studies have shown that parental screen habits, lack of awareness regarding guidelines, and the use of screens as behavioural tools (such as feeding or soothing) significantly contribute to excessive exposure.^{13,19} Parental practices may therefore represent an important and potentially modifiable target for interventions aimed at reducing screen exposure during early childhood. Parental knowledge gaps, permissive parenting practices, and poor adherence to media-use recommendations are consistently associated with greater screen exposure among young children, particularly in developing countries.¹⁹⁻²¹

Despite clear recommendations from global organizations such as WHO and the American Academy of Pediatrics advocating minimal or no screen exposure in early years, adherence remains suboptimal, particularly in low- and middle-income countries.^{1,3} Routine pediatric and immunization visits provide an opportunity to deliver brief, caregiver-focused interventions that can be integrated into existing healthcare services. Because parental media practices are modifiable, caregiver-directed educational interventions during routine well-child visits may represent an effective and scalable strategy for promoting healthy digital media habits in early childhood.

Although observational studies have consistently demonstrated associations between excessive screen exposure and adverse developmental outcomes, evidence evaluating structured parental educational interventions remains limited, particularly in low- and middle-income countries.²⁰⁻²² Furthermore, only a few studies from India have assessed both developmental and socio-emotional outcomes alongside screen-time reduction using validated tools such as the ASQ-3 and ASQ:SE-2.²⁰⁻²⁵ However,

limited evidence is available on effectiveness of structured caregiver education in reducing screen exposure over time and its potential effects on developmental and socio-emotional outcomes during early childhood.

In this context, the present prospective comparative interventional study was undertaken to evaluate the effectiveness of a structured parental educational intervention in reducing screen exposure among children enrolled at 9 months of age and prospectively followed for nine months. The primary outcome was the change in mean daily screen exposure from 9 to 18 months of age, while secondary outcomes included changes in developmental performance and socio-emotional and behavioural outcomes. Developmental and socio-emotional outcomes were assessed using the ASQ-3 and ASQ:SE-2, and compared between the intervention and comparison groups. By evaluating a structured caregiver-focused educational intervention with repeated reinforcement over nine months, this study aimed to assess a practical approach to promoting healthier media practices during a critical period of early childhood development in an Indian tertiary care setting.

METHODS

Study design and setting

This prospective comparative interventional study was conducted in the Department of Pediatrics, Hind Institute of Medical Sciences, Mau, Ataria, Sitapur, Uttar Pradesh, India, over 18 months from August 2024 to January 2026. The study protocol was approved by the Institutional Human Ethics Committee of Hind Institute of Medical Sciences (Approval No. IHEC-HIMSA/MD/MS-23/RD-38/07-24, dated 24 July 2024). Written informed consent was obtained from the parents or legal guardians of all participating children before enrolment. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

Study participants

Healthy children aged 9 months attending the Immunization and Well-Baby Clinic for measles-rubella (MR) vaccination were screened for eligibility.

Inclusion criteria

Children were eligible if they were born at term, were appropriate for gestational age with a birth weight >2500 g, and were accompanied by a primary caregiver willing to participate throughout the study period.

Exclusion criteria

Children were excluded if they had weight-for-age or weight-for-length below -2 standard deviations according to the WHO growth standards, congenital malformations,

developmental delay, cerebral palsy, syndromic disorders, visual or hearing impairment, or acute or chronic systemic illness. Children whose caregivers did not have access to screen-based devices (television, smartphone, tablet, laptop, desktop computer, or video game device) were also excluded.

Sample size

The sample size was calculated using the single-population proportion formula based on a reported prevalence of excessive screen exposure of 88.7% among children aged 15-18 months from a previous Indian study by Meena et al.²⁶ A 95% confidence level and an absolute precision of 5% were assumed. The minimum required sample size was 160 participants. Equal allocation of participants to the educational intervention and comparison groups was planned before participant enrollment. Considering an anticipated 10% attrition, the final sample size was increased to 176 participants, with 88 children included in each study group.

Study groups

After enrolment and confirmation of eligibility, the 176 children were allocated equally to an educational intervention group (Group E; n=88) and a comparison group (Group C; n=88) using alternate assignment, a non-random allocation method. Group E received the structured parental educational intervention described below, whereas Group C received routine child-health advice without structured counselling aimed at reducing screen exposure.

Baseline assessment

At enrollment, baseline information was collected using a predesigned structured proforma by the principal investigator. Data collected included demographic characteristics, caregiver education, place of residence, socioeconomic status according to the Modified Kuppuswamy scale, household ownership of televisions, smartphones, tablets, laptops, and computers, age at first screen exposure, average daily screen exposure, weekly frequency of screen exposure, caregiver screen exposure, and parental media-use practices including screen use during meals, entertainment, and caregiver-child interactions.²⁷ Anthropometric measurements were obtained using standardized techniques.

Developmental assessment was performed using the ASQ-3, whereas socio-emotional assessment was performed using the ASQ:SE-2.^{28,29} The Hindi versions of these instruments have been validated for use in Indian children.²²

Higher ASQ-3 scores indicate better developmental performance, whereas higher ASQ:SE-2 scores indicate greater socio-emotional and behavioural concerns.²²

Educational intervention

Parents in the educational intervention group received a structured 30-minute face-to-face counselling session conducted by the principal investigator in either Hindi or English at the time of enrollment. The counselling was delivered using predesigned, structured educational content and was individualized to the caregiver's understanding and concerns.

The intervention focused on reducing children's screen exposure, limiting parental screen use, encouraging responsive parenting practices, promoting interactive parent-child play, and replacing screen-based activities with age-appropriate developmental stimulation. Caregivers were also educated regarding the World Health Organization recommendations for screen exposure in young children and practical strategies for implementing healthy media-use practices at home.

At the end of the session, each caregiver received a printed educational pamphlet summarizing the key counselling messages. To reinforce the intervention and encourage adherence, monthly telephone counselling was provided for nine consecutive months. During each monthly contact, caregivers were reminded about recommended screen-time practices, difficulties in implementing the recommendations were discussed, and additional practical guidance was provided.

Comparison group

Parents in the comparison group received routine counselling regarding nutrition, immunization, and general child safety according to institutional practice. If caregivers requested information regarding screen use, they were informed about the recommended screen-time guidelines. Monthly telephone calls were made to remind caregivers to maintain the screen-time diary and reinforce routine child health advice; however, no structured counselling specifically aimed at reducing children's screen exposure was provided.

Screen-exposure assessment and follow-up

Caregivers in both groups maintained a standardized weekly screen-time record throughout the study period. Information regarding the child's screen exposure was recorded for the relevant days of the week, and average daily screen exposure was calculated. Screen exposure included television and smartphone/mobile-device use, consistent with the study data collection procedure.

Participants were followed prospectively for nine months, from 9 months to 18 months of age. At the end of follow-up, anthropometric measurements, average daily screen exposure, developmental assessment using ASQ-3, and socio-emotional and behavioural assessment using ASQ:SE-2 were repeated using the same standardized procedures employed at enrolment. Significant illnesses

or hospital admissions occurring during the follow-up period were also documented.

Outcome measures

The primary outcome of the study was the change in mean daily screen exposure, expressed in minutes per day, from baseline at 9 months to completion of the nine-month follow-up at 18 months. Secondary outcomes included changes in developmental performance, assessed using the ASQ-3, and changes in socio-emotional and behavioural outcomes, assessed using the ASQ:SE-2. Outcome assessments were performed at baseline (9 months of age) and repeated at the end of follow-up (18 months of age), and changes from baseline were compared between the educational intervention and comparison groups.

Statistical analysis

Data were entered into Microsoft excel 2023 and analyzed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Categorical variables were expressed as frequencies and percentages, whereas continuous variables were summarized as mean $\pm$ SD. Normality of continuous variables was assessed using the Kolmogorov-Smirnov test. Categorical variables were compared between groups using the chi-square test, while continuous variables were compared using the independent-samples *t*-test. Within-group changes from baseline to follow-up were assessed using the paired *t* test. Between-group differences in change from baseline to follow-up were assessed using Welch's independent-samples *t* test. A two-tailed $p < 0.05$ was considered statistically significant.

RESULTS

Baseline socio-demographic characteristics were comparable between the educational intervention and comparison groups. No statistically significant differences were observed with respect to gender, place of residence, parental education, or socioeconomic status (all $p > 0.05$), suggesting that the groups were similar with respect to the measured baseline socio-demographic characteristics (Table 1).

Baseline anthropometric characteristics, screen exposure, developmental scores, and socio-emotional scores were comparable between the educational intervention and comparison groups at enrolment. No statistically significant differences were observed in anthropometric measurements, mean daily mobile, television, or total screen exposure, ASQ-3 developmental domain scores, or ASQ:SE-2 socio-emotional scores (all $p > 0.05$), suggesting no statistically significant baseline differences in the measured anthropometric, screen-exposure, developmental, or the socio-emotional variables (Table 2).

At 18 months of age, anthropometric measurements remained comparable between the educational intervention and comparison groups, with no statistically significant differences in weight, length, head circumference, mid-upper arm circumference, or body mass index (all $p > 0.05$) (Table 3). However, children in the educational intervention group had significantly lower mean daily mobile screen exposure, television screen exposure, and total screen exposure than those in the comparison group (all $p < 0.05$) (Table 3). Mean total screen exposure was 55.23 $\pm$ 16.04 minutes/day in the intervention group compared with 85.06 $\pm$ 22.94 minutes/day in the comparison group, representing 29.83 minutes/day lower total screen exposure in the intervention group at 18 months (Table 3).

The educational intervention group also demonstrated significantly higher scores across all ASQ-3 developmental domains, including language, gross motor, fine motor, personal-social, and adaptive skills, along with significantly lower ASQ:SE-2 socio-emotional scores, indicating fewer behavioural concerns (all $p < 0.001$) (Table 3). The magnitude of improvement from 9 to 18 months was greater in the intervention group across all five ASQ-3 domains.

Within-group comparisons demonstrated significant changes in both groups between enrolment (9 months) and follow-up (18 months). Expected age-related increases were observed in all anthropometric parameters, while body mass index decreased significantly in both groups (all $p < 0.001$) (Table 4). In the educational intervention group, mean daily mobile screen exposure and total screen exposure decreased significantly, whereas television screen exposure showed a modest increase (all $p < 0.001$) (Table 4). In contrast, the comparison group demonstrated significant increases in mobile, television, and total screen exposure over the follow-up period (all $p < 0.001$) (Table 4). Developmental scores increased significantly across all ASQ-3 domains in both groups, while ASQ:SE-2 scores decreased significantly in both groups. However, the magnitude of change was greater in the educational intervention group across all developmental and socio-emotional outcomes (Table 4).

Compared with the comparison group, the educational intervention group demonstrated significantly greater reductions in mobile screen exposure (between-group difference: -23.52 minutes/day; 95% CI: -26.45 to -20.59; $p < 0.001$) and total screen exposure (-30.00 minutes/day; 95% CI: -34.37 to -25.63; $p < 0.001$) (Table 5). The increase in television screen exposure was also significantly smaller in the intervention group (-6.48 minutes/day; 95% CI: -9.93 to -3.03; $p < 0.001$) (Table 5). The intervention group showed significantly greater gains across all ASQ-3 domains, including language, gross motor, fine motor, personal-social, and adaptive domains (between-group differences ranging from 7.50 to 8.86 points; all $p < 0.001$) (Table 5). Additionally, the reduction

in ASQ:SE-2 scores was significantly greater in the intervention group (-5.23 points; 95% CI: -6.25 to -4.21;

$p < 0.001$), indicating a greater reduction in socio-emotional and behavioural concerns (Table 5).

Table 1: Baseline socio-demographic characteristics of educational intervention and comparison groups, (n=176)*.

Variables	Category	Educational group, (n=88) (%)	Comparison group, (n=88) (%)	χ^2	P value
Gender	Male	44 (50.0)	42 (47.7)	0.73	0.393
	Female	44 (50.0)	46 (52.3)		
Residence	Rural	70 (79.5)	72 (81.8)	0.76	0.383
	Urban	18 (20.5)	16 (18.2)		
Father's education	Illiterate	5 (5.7)	6 (6.8)	3.57	0.614
	Primary	22 (25.0)	28 (31.8)		
	High school	41 (46.6)	31 (35.2)		
	Intermediate	3 (3.4)	6 (6.8)		
	Graduate	15 (17.0)	16 (18.2)		
	Postgraduate	2 (2.3)	1 (1.1)		
Mother's education	Illiterate	4 (4.5)	5 (5.7)	0.65	0.986
	Primary	26 (29.5)	28 (31.8)		
	High school	37 (42.1)	32 (36.4)		
	Intermediate	7 (8.0)	8 (9.1)		
	Graduate	13 (14.8)	14 (15.9)		
	Postgraduate	1 (1.1)	1 (1.1)		
Socioeconomic status	Lower	1 (1.1)	0 (0.0)	1.65	0.800
	Upper lower	3 (3.4)	4 (4.5)		
	Lower middle	58 (65.9)	55 (62.5)		
	Upper middle	17 (19.3)	17 (19.3)		
	Upper	9 (10.2)	12 (13.6)		

*Data are presented as number (%); χ^2 =Chi-square test; $p < 0.05$ was considered significant.

Table 2: Comparison of baseline anthropometric characteristics, screen exposure, developmental scores, and socio-emotional scores between the educational intervention and comparison groups at enrollment (9 months of age), (n=176).*

Parameters	Group E (n=88), mean (SD)	Group C, (n=88), mean (SD)	T value	P value
Weight (kg)	9.03 (0.86)	9.04 (0.59)	-0.090	0.928
Length (cm)	70.61 (2.37)	70.48 (2.96)	0.322	0.748
Head circumference (cm)	43.91 (1.24)	44.08 (1.02)	-0.993	0.322
Mid-upper arm circumference (cm)	12.61 (0.40)	12.67 (0.43)	-0.958	0.339
Body mass index (kg/m²)	18.18 (2.18)	18.27 (1.76)	-0.301	0.764
Mobile screen exposure (min/day)	45.34 (13.06)	45.00 (11.37)	0.184	0.854
TV screen exposure (min/day)	15.74 (10.65)	15.91 (12.40)	-0.098	0.922
Total screen exposure (min/day)	61.08 (16.11)	60.91 (16.98)	0.068	0.946
Language (ASQ-3)	33.13 (3.42)	33.18 (4.02)	-0.089	0.929
Gross motor (ASQ-3)	33.24 (3.13)	32.95 (3.91)	0.543	0.588
Fine motor (ASQ-3)	36.25 (3.15)	35.91 (3.44)	0.684	0.495
Personal-social (ASQ-3)	33.98 (3.32)	33.75 (3.88)	0.423	0.673
Adaptive (ASQ-3)	35.11 (3.47)	35.11 (3.47)	0.000	1.000
Behavioural (ASQ-SE-2)	35.17 (4.32)	35.68 (3.73)	-0.838	0.403

*ASQ-3=Ages and Stages Questionnaire, Third Edition; ASQ:SE-2=Ages and Stages Questionnaire: Social-Emotional, Second Edition; Kg=kilograms; cm=centimetres; m=metre; min=minutes; SD=standard deviation; Values are expressed as mean (SD); Independent samples t test was used for between-group comparisons; $p < 0.05$ was considered significant.

Table 3: Comparison of anthropometric characteristics, screen exposure, developmental scores, and socio-emotional scores between the educational intervention (Group E) and comparison (Group C) groups at 18 months of age, (n=176).*

Parameters	Group E, (n=88) mean (SD)	Group C, (n=88), mean (SD)	T value	P value
Weight (kg)	10.72 (0.80)	10.59 (0.44)	1.34	0.182
Length (cm)	80.81 (2.03)	80.58 (1.27)	0.89	0.375
Head circumference (cm)	46.37 (1.02)	46.19 (1.02)	1.17	0.243

Continued.

Parameters	Group E, (n=88) mean (SD)	Group C, (n=88), mean (SD)	T value	P value
Mid-upper arm circumference (cm)	13.51 (0.42)	13.41 (0.47)	1.49	0.138
BMI (kg/m ²)	16.45 (1.53)	16.32 (0.75)	0.70	0.486
Mobile screen exposure (min/day)	33.92 (9.48)	57.10 (9.88)	-15.91	<0.001
TV screen exposure (min/day)	21.31 (12.61)	27.95 (19.72)	-2.66	0.009
Total screen exposure (min/day)	55.23 (16.04)	85.06 (22.94)	-10.01	<0.001
Language (ASQ-3)	51.19 (3.71)	42.44 (3.94)	15.16	<0.001
Gross motor (ASQ-3)	51.59 (3.68)	42.50 (3.87)	16.01	<0.001
Fine motor (ASQ-3)	52.39 (3.12)	44.55 (3.99)	14.55	<0.001
Personal-social (ASQ-3)	51.82 (3.65)	42.73 (4.00)	15.77	<0.001
Adaptive (ASQ-3)	52.61 (3.47)	43.92 (4.18)	15.04	<0.001
Behavioural (ASQ-SE-2)	21.19 (2.94)	26.93 (3.59)	-11.62	<0.001

*ASQ-3=Ages and Stages Questionnaire, Third Edition; ASQ:SE-2=Ages and Stages Questionnaire: Social-Emotional, Second Edition; Kg=kilograms; cm=centimetres; m=metre; min=minutes; SD, SD=standard deviation; Values are presented as mean (SD); Between-group comparisons used the independent-samples t test; p<0.05 was considered significant; Higher ASQ-3 and lower ASQ:SE-2 scores indicate better outcomes.

Table 4: Within-group comparison of anthropometric characteristics, screen exposure, developmental scores, and socio-emotional scores at enrolment (9 months) and follow-up (18 months) in the educational intervention and comparison groups, (n=176).*

Parameters	Educational intervention group, (n=88)				Comparison group, (n=88)			
	9-month, mean (SD)	18-month, mean (SD)	T value	P value	9-month, mean (SD)	18-month, mean (SD)	T value	P value
Weight (kg)	9.03 (0.86)	10.72 (0.80)	29.57	<0.001	9.04 (0.59)	10.59 (0.44)	44.93	<0.001
Length (cm)	70.61 (2.37)	80.81 (2.03)	49.45	<0.001	70.48 (2.96)	80.58 (1.27)	41.77	<0.001
Head circumference (cm)	43.91 (1.24)	46.37 (1.02)	57.45	<0.001	44.08 (1.02)	46.19 (1.02)	87.33	<0.001
Mid-upper arm circumference (cm)	12.61 (0.40)	13.51 (0.42)	25.92	<0.001	12.67 (0.43)	13.41 (0.47)	40.41	<0.001
BMI (kg/m ²)	18.18 (2.18)	16.45 (1.53)	11.39	<0.001	18.27 (1.76)	16.32 (0.75)	13.77	<0.001
Mobile screen exposure (min/day)	45.34 (13.06)	33.92 (9.48)	-9.92	<0.001	45.0 (11.37)	57.10 (9.88)	12.95	<0.001
Television screen exposure (min/day)	15.74 (10.65)	21.31 (12.61)	5.68	<0.001	15.91 (12.40)	27.95 (19.72)	8.34	<0.001
Total screen exposure (min/day)	61.08 (16.11)	55.23 (16.04)	-3.97	<0.001	60.91 (16.98)	85.06 (22.94)	14.63	<0.001
Language (ASQ-3)	33.13 (3.42)	51.19 (3.71)	52.08	<0.001	33.18 (4.02)	42.44 (3.94)	39.22	<0.001
Gross motor (ASQ-3)	33.24 (3.13)	51.59 (3.68)	66.33	<0.001	32.95 (3.91)	42.50 (3.87)	42.74	<0.001
Fine motor (ASQ-3)	36.25 (3.15)	52.39 (3.12)	38.62	<0.001	35.91 (3.44)	44.55 (3.99)	32.63	<0.001
Personal-social (ASQ-3)	33.98 (3.32)	51.82 (3.65)	48.41	<0.001	33.75 (3.88)	42.73 (4.00)	41.52	<0.001
Adaptive (ASQ-3)	35.11 (3.47)	52.61 (3.47)	48.42	<0.001	35.11 (3.47)	43.92 (4.18)	38.52	<0.001
Socio-emotional score (ASQ:SE-2)	35.17 (4.32)	21.19 (2.94)	-30.50	<0.001	35.68 (3.73)	26.93 (3.59)	-37.70	<0.001

*Values are presented as mean (SD); Kg=kilograms; cm=centimetres; m=metre; min=minutes; SD=standard deviation; Within-group comparisons between 9 and 18 months used the paired t-test; p<0.05 was considered significant; Higher ASQ-3 and lower ASQ:SE-2 scores indicate better outcomes.

Table 5: Between-group comparison of changes in screen exposure, developmental, and socio-emotional scores from 9 to 18 months, (n=176).*

Outcomes	Group E, mean change	Group C, mean change	Between-group difference	95% CI for difference	P value
Mobile screen exposure (minutes/day)	-11.42	+12.10	-23.52	-26.45 to -20.59	<0.001
TV screen exposure (minutes/day)	+5.57	+12.05	-6.48	-9.93 to -3.03	<0.001

Continued.

Outcomes	Group E, mean change	Group C, mean change	Between-group difference	95% CI for difference	P value
Total screen exposure (minutes/day)	-5.85	+24.15	-30.00	-34.37 to -25.63	<0.001
Language (ASQ-3)	+18.07	+9.26	+8.81	+7.98 to +9.64	<0.001
Gross motor (ASQ-3)	+18.35	+9.55	+8.80	+8.10 to +9.50	<0.001
Fine motor (ASQ-3)	+16.14	+8.64	+7.50	+6.52 to +8.48	<0.001
Personal-social (ASQ-3)	+17.84	+8.98	+8.86	+8.01 to +9.71	<0.001
Adaptive (ASQ-3)	+17.50	+8.81	+8.69	+7.85 to +9.53	<0.001
ASQ:SE-2	-13.98	-8.75	-5.23	-6.25 to -4.21	<0.001

*Mean change=18-month value-9-month value; between-group difference=Group E-Group C; Negative values indicate greater reduction in Group E, while positive values indicate greater improvement; For ASQ-3, positive changes indicate improved developmental scores; for ASQ:SE-2, negative changes indicate improved socio-emotional/behavioural scores; 95% CI=95% confidence interval; ASQ-3=Ages and Stages Questionnaire, Third Edition; ASQ:SE-2=Ages and Stages Questionnaire: Social-Emotional, Second Edition; Between-group comparisons used Welch's independent-samples t test; $p<0.05$ was considered significant.

DISCUSSION

The present prospective comparative interventional study evaluated the effect of structured parental education on screen exposure and developmental and socio-emotional outcomes among children followed from 9 to 18 months of age. The principal findings were that the intervention was associated with a significantly greater reduction in mobile and total screen exposure, along with greater improvements across all five ASQ-3 domains and a greater reduction in ASQ:SE-2 scores. No significant between-group differences were observed in anthropometric parameters at 18 months.

The most important finding was the change in screen exposure. Total screen exposure decreased by 5.85 minutes/day in the intervention group but increased by 24.15 minutes/day in the comparison group, giving a between-group difference in change of 30.00 minutes/day (95% CI: -34.37 to -25.63; $p<0.001$). Mobile screen exposure decreased by 11.42 minutes/day in the intervention group but increased by 12.10 minutes/day in the comparison group. These findings support the role of caregiver-focused education in modifying screen-use practices during early childhood, when children's media exposure is substantially influenced by parental behaviour.^{20,21} This is particularly relevant in the Indian context, where sociodemographic characteristics have been shown to influence screen-time practices among children and adolescents.^{24,26,30} Poonia et al similarly reported significant reductions in total and mobile screen exposure following focused parental education among children aged 9-10 months.²² Evidence from systematic reviews also suggests that parental education, behavioural strategies, and repeated reinforcement are among the useful approaches for reducing children's screen exposure.²³⁻²⁵ In contrast, Alkalash et al demonstrated persistent gaps in parental knowledge and practices regarding screen-time regulation, highlighting the importance of structured counselling.²¹

Television exposure increased in both groups, although the increase was significantly smaller in the intervention group. A similar pattern was observed by Poonia et al.²² This could represent some substitution of mobile-device

use with television viewing; however, because co-viewing and the quality of television interaction were not directly assessed, this interpretation remains speculative. Nevertheless, the overall reduction in total screen exposure indicates a favourable change in the primary behavioural outcome.

The intervention group demonstrated significantly greater improvement across all ASQ-3 domains. Between-group differences in change were 8.81 points for language, 8.80 points for gross motor, 7.50 points for fine motor, 8.86 points for personal-social, and 8.69 points for adaptive development (all $p<0.001$). These findings are consistent with the concept that excessive screen exposure may displace developmentally important activities, including reciprocal communication, interactive play, exploration, and caregiver-child engagement.^{4,7-9} Poonia et al also reported greater improvement in selected ASQ-3 domains following parental education, particularly fine motor and adaptive domains.²² The greater magnitude of developmental change observed in the present study may partly reflect the longer nine-month follow-up and repeated monthly reinforcement compared with the six-month follow-up in their study. However, normal developmental maturation between 9 and 18 months contributes substantially to improvement in both groups; therefore, the findings should be interpreted as a greater change associated with the intervention rather than definitive evidence that reduced screen exposure alone caused developmental improvement.

The intervention group also showed a significantly greater reduction in ASQ:SE-2 scores than the comparison group (between-group difference: -5.23; 95% CI: -6.25 to -4.21; $p<0.001$), indicating fewer socio-emotional and behavioural concerns. This finding is consistent with Poonia et al who reported significantly greater improvement in behavioural scores following parental education, and with Lin et al who demonstrated beneficial effects of parental education on psychosocial adaptation.^{20,22} The findings are biologically plausible because reducing screen exposure may provide greater opportunities for face-to-face communication, shared play, and responsive caregiver interaction. However,

these potential mediating behaviors were not directly measured in the present study.

No significant between-group differences were observed in weight, length, head circumference, mid-upper arm circumference, or BMI. This may reflect the multifactorial determinants of growth during infancy, including nutritional, sociodemographic, and lifestyle factors such as complementary feeding practices and determinants of overweight and obesity.³⁰⁻³³ Previous intervention studies have primarily demonstrated effects on screen-related and behavioural outcomes rather than consistent anthropometric changes.²³⁻²⁵

Strengths

The study has several strengths, including its focus on children at an early age when screen-use habits are being established, a structured caregiver-focused intervention with monthly reinforcement, nine months of prospective follow-up, and simultaneous assessment of developmental and socio-emotional outcomes using ASQ-3 and ASQ:SE-2.

Limitations

Limitations include reliance on caregiver-reported screen exposure, limited assessment of exposure across digital devices, and absence of objective measures of parental screen use, parent-child interaction, physical activity, sleep, and dietary practices. The predominantly rural and lower socioeconomic study population may limit generalizability. Furthermore, because participants were not randomly allocated, selection bias and residual confounding cannot be excluded. The study also did not directly assess whether increased parent-child interaction mediated the observed developmental and socio-emotional outcomes.

Overall, the findings suggest that structured parental education with reinforcement may be a feasible strategy for reducing screen exposure and may be accompanied by more favourable developmental and socio-emotional outcomes in early childhood. Incorporating brief screen-time counselling into routine immunization and well-child visits could provide a practical opportunity for promoting healthier media-use practices. Larger multicentre studies with objective screen-time assessment and measurement of parent-child interaction, physical activity, sleep, and dietary behaviour are warranted to confirm these findings and clarify the mechanisms involved.

CONCLUSION

Structured parental education with periodic reinforcement was associated with a significant reduction in mobile and total screen exposure among children aged 9-18 months. The intervention group also demonstrated greater improvements across all domains of developmental

functioning and greater reduction in socio-emotional and behavioural concerns compared with the comparison group. No significant differences were observed in anthropometric outcomes, suggesting that short-term screen-focused interventions may primarily influence behavioural and developmental outcomes rather than physical growth. These findings support the incorporation of brief, structured screen-time counselling and caregiver guidance into routine pediatric and well-child services. Larger multicentre studies with longer follow-up and objective assessment of screen exposure are needed to determine the sustainability of these benefits and further clarify the relationship between reduced screen exposure, caregiver practices, and child development.

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REFERENCES

1. World Health Organization. Guidelines on physical activity, sedentary behaviour and sleep for children under 5 years of age. 2019. Available at: <https://www.who.int/publications/i/item/9789241550536>. Accessed on 12 April 2026.
2. Radesky JS, Christakis DA. Increased screen time: implications for early childhood development and behavior. *Pediatr Clin.* 2016;63(5):827-39.
3. McArthur BA, Tough S, Madigan S. Screen time and developmental and behavioral outcomes for preschool children. *Pediatr Res.* 2022;91(6):1616-21.
4. Stiglic N, Viner RM. Effects of screentime on the health and well-being of children and adolescents: a systematic review of reviews. *BMJ Open.* 2019;9(1):e023191.
5. Madigan S, McArthur BA, Anhorn C, Eirich R, Christakis DA. Associations between screen use and child language skills: a systematic review and meta-analysis. *JAMA Pediatr.* 2020;174(7):665-75.
6. Domingues-Montanari S. Clinical and psychological effects of excessive screen time on children. *J Paediat Child Health.* 2017;53(4):333-8.
7. Mallawaarachchi S, Burley J, Mavilidi M, Howard SJ, Straker L, Kervin L, et al. Early childhood screen use contexts and cognitive and psychosocial outcomes: A systematic review and meta-analysis. *JAMA Pediatr.* 2024;178(10):1017-26.
8. Janssen X, Martin A, Hughes AR, Hill CM, Kotronoulas G, Hesketh KR. Associations of screen time, sedentary time and physical activity with sleep in under 5s: A systematic review and meta-analysis. *Sleep Med Rev.* 2020;49:101226.
9. Wu Y, Xi X, Zhang C, Jiang J, Ye S. Effect of intervention on screen time in preschoolers: a systematic review and meta-analysis of randomized controlled trials. *BMC Public Health.* 2025;25(1):2724.

10. Barr R, Kirkorian H, Radesky J, Coyne S, Nichols D, Blanchfield O, et al. Beyond screen time: A synergistic approach to a more comprehensive assessment of family media exposure during early childhood. *Front Psychol.* 2020;11:1283.
11. Massaroni V, Delle Donne V, Marra C, Arcangeli V, Chieffo DP. The relationship between language and technology: how screen time affects language development in early life-a systematic review. *Brain Sci.* 2023;14(1):27.
12. Bal M, Kara Aydemir AG, Tepetaş Cengiz GŞ, Altındağ A. Examining the relationship between language development, executive function, and screen time: A systematic review. *PLoS One.* 2024;19(12):e0314540.
13. Duch H, Fisher EM, Ensari I, Harrington A. Screen time use in children under 3 years old: a systematic review of correlates. *Int J Behavioral Nutr Physical Activity.* 2013;10(1):102.
14. Gomes MI, Sousa H, Lousada M, Figueiredo D. Factors Contributing to Screen Exposure in Preschool Children and Its Associated Outcomes: A Systematic Review. *Child: Care Health Development.* 2026;52(2):e70241.
15. Männikkö N, Machado-Rodrigues AM, Padez C, Barata C, Rodrigues D. Device-specific and contextual patterns of screen use: links to emotional and behavioral outcomes in early childhood. *Children Youth Services Rev.* 2026;108862.
16. Muppalla SK, Vuppapapati S, Pulliahgaru AR, Sreenivasulu H, Kumar Muppalla S. Effects of excessive screen time on child development: an updated review and strategies for management. *Cureus.* 2023;15(6):1.
17. Qu G, Hu W, Meng J, Wang X, Su W, Liu H, et al. Association between screen time and developmental and behavioral problems among children in the United States: evidence from 2018 to 2020 NSCH. *J Psychiat Res.* 2023;161:140-9.
18. Xu H, Wen LM, Rissel C. Associations of parental influences with physical activity and screen time among young children: a systematic review. *J Obesity.* 2015;2015(1):546925.
19. Bhutani P, Varghese LA, Bajaj G, Bhutani C, Khan F, Menon GR, et al. Analysis of parental beliefs and practices leading to excessive screen time in early childhood. *BMJ Paediat Open.* 2025;9(1):e003488.
20. Lin YM, Kuo SY, Chang YK, Lin PC, Lin YK, Lee PH, et al. Effects of parental education on screen time, sleep disturbances, and psychosocial adaptation among Asian preschoolers: a randomized controlled study. *J Pediat Nursing.* 2021;56:e27-34.
21. Alkalash SH, Alshamrani FA, Alharthi SA, Alzubaidi MA, Alqarehi RM, Bazaid AA, et al. Parents' knowledge on, attitude toward, and practice of screen time exposure regulation of their children under six years of age in Western region, Saudi Arabia. *Cureus.* 2023;15(11):1.
22. Poonia Y, Khalil S, Meena P, Shah D, Gupta P. Parental education for limiting screen time in early childhood: a randomized controlled trial. *Indian Pediatrics.* 2024;61(1):32-8.
23. Raj D, Zulkefli NA, Minhat HS, Ahmad N. Parental intervention strategies to reduce screen time among preschool-aged children: A systematic review. *Malaysian J Med Health Sci.* 2022;18(6):295-304.
24. Jones A, Armstrong B, Weaver RG, Parker H, von Klinggraeff L, Beets MW. Identifying effective intervention strategies to reduce children's screen time: a systematic review and meta-analysis. *Int J Behavioral Nutr Physical Act.* 2021;18(1):126.
25. Rico-González M, Holsbrekken E, Martín-Moya R, Ardigo LP. Interventions for reducing screen time of preschoolers: A systematic review of randomized controlled trials. *J Primary Care Comm Heal.* 2025;16:21501319241306699.
26. Meena P, Gupta P, Shah D. Screen time in Indian children by 15-18 months of age. *Indian Pediatrics.* 2020;57(11):1033-6.
27. Saleem SM, Jan SS. Modified Kuppaswamy socioeconomic scale updated for the year 2021. *Indian J Forensic Community Med.* 2021;8(1):1-3.
28. ASQ-3. Ages and Stages. 2015. Available at: <https://agesandstages.com/products-pricing/asq3/>. Accessed on 23 July 2026.
29. ASQ:SE-2 social-emotional development guide. Ages and Stages. 2016. Available at: <https://agesandstages.com/resource/asqse-2-social-emotional-development-guide/>. Accessed on 23 July 2026.
30. Rathoria E, Bansal U, Rathoria R, Gupta NB, Biswas SK. Impact of Sociodemographic Factors on Screen Time Use Among Early Adolescents. *Child Today.* 2022;3(3):5-9.
31. Singh A, Rathoria E, Singh SK, Rathoria R, Yadav SK, Bansal U. Prevalence of overweight and obesity, and associations with socio-demographic and etiological factors. *Int J Contemp Pediatr.* 2024;11(10):1400-5.
32. Rathoria E, Rathoria R, Bansal U, Agarwal A. Prevalence of overweight and obesity in adolescents from eastern Uttar Pradesh. *Int J Sci Res.* 2021;10(1):49-51.
33. Fatima S, Bansal U, Suryavanshi P, Rathoria E. Complementary feeding practices in India and improvement strategies. *International J Sci Res.* 2021;10(3):29-32.

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