MMSL
Military Medical Science Letters
Since 1925

Mil. Med. Sci. Lett. (Voj. Zdrav. Listy) 2023, 92(3), 259-271
ISSN 0372-7025 (Print)
ISSN 2571-113X (Online)
DOI: 10.31482/mmsl.2022.048

ORIGINAL ARTICLE

IMPACT OF SCREEN EXPOSURE ON LANGUAGE DEVELOPMENT AMONG TODDLERS AND PRESCHOOLERS IN NINEVEH PROVINCE

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Received 29th June 2022.
Accepted 13th October 2022.
Published 1st September 2023.

Summary

Background: There is a marked use of technology by children in our societies, particularly during the last 2decades, which may be associated with limitation of their milestones developments including speech.

Objectives: To determine the association between screen exposure and speech development delay among toddlers and preschoolers, to clarify the correlation linking the visioning of the screen and the input - data – of the child and his(her) mother, and to identify the impact of screen withdrawal on the possible enhancement of speech.

Material and Methods: This descriptive cross-sectional study enrolled children (n=237) who had a history of delay in speech or complete loss of the ability to speak as a chief complaint. The age ranged from 12–60 months categorized into two groups: toddlers and preschoolers. All cases had programmed medical visits to the private clinics of psychiatry in Nineveh Province, Iraq. Data were obtained from interview questionnaire reports including; digital device type, first exposure age, spent time, and child-maternal parameters. Follow-up for 6months was done beyond the departure of those media.

Results: This study involved 47 (19.8%) toddlers, and 190 (80.2%) preschoolers with an inclination toward males. Children with speech postponement were spotted in around 225 (94.9%), while the others had complete loss of the ability to speak. In both sets, a considerable association between speech delay and screen viewing was shown, impressively those who commenced screen exposure at less than twenty-four months of age and consumed ≥4hr per day for screens visioning. Six –months after quitting these devices, there is speech improvement was recognized in 36.7% of cases.

Conclusions: Positive associations were noticed between the first exposure age and high frequency of screen spent time and speech delays in children, especially toddlers. This work recommends an instantaneous parent's and researchers' consciousness, besides that from health consultants, on the acceptable usage of screen's visioning time in consonance with children to support healthy development in digital life.

Key words: Toddlers; screen viewing; preschooler; speech delays

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Introduction

There is an overwhelming increase in the time that children spend in front of digital devices in parallel to the rapid development of instantly accessible and portable technology like digital tablets and smartphones. Moreover, the significant fast development of packages of learning, electronic games, and educational involvement lead to growth in the opportunities to use such electronic devices by kids (1). Therefore, the use of such devices became the target of children in doing schoolwork, chatting with friends, and playing games, besides surfing the internet (2).

The rise in the spend time using such devices by young children leads to an increase in the concern about the influence of these devices on their health. Depending on the extent of the use, several studies have discussed whether the effect of screen use on children's development can be negative or positive (3). They found a positive relation between screen use and academic and cognitive skills but a negative correlation with psychological and social development like social isolation, depression and loneliness (3, 4).

It is widely understood that the child's brain continues to develop rapidly through the beginning few years of life (5). Several observations address the influence of screen media on the language development of young children, a critical time of brain development, building secure relationships, and establishing health behaviors (4, 5, 6). It has been suggested that excessive screen viewing is an unhealthy habit associated with limitations in the challenges for creativity and development of perfect sensory and motor performance (7, 8).

Recently studies reported that early exposure to screening can induce anatomical brain damage (Figures 1), particularly the frontal lobe with subsequent loss of verbal ability and cognitive skills (9-12).

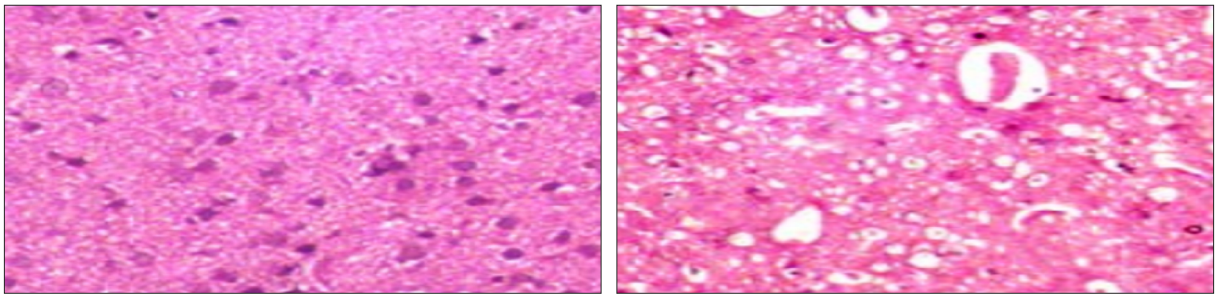

Figure 1. Brain tissue of a rat. A; Control animal with normal tissue histology. B; Glial cell loss and vacuoles after long exposure to smartphone radiofrequency. (H&E; ×40) (10).

The preschool and early school ages are pivotal periods for the acquisition of social competencies and correlated performances in association with social adjustment (16). So, the transition period from preschool to elementary school is a critical developmental period as it contains the expected acquirement of pro-social abilities that are important for successful social and emotional performance (13-16).

In Iraq, during the periods of wars, lockdowns and shuttered schools, many parents saw the vastly increasing time that kids were spending on screens, those who used to focus their free time on biking and playing football, now spends nearly all of their day on screens. This increase in screen users was associated with an increase in delayed speech development in Iraqi kids, mainly those younger than 5 years old (17).

So, the lifestyle of Iraqi children was the dominant force for the use of screens including traditional ones (such as televisions, and video games) beside the recent ones (such as smartphones, digital tablets and personal computers) and became their "whole life", especially in younger ages. To our knowledge, this is the first study on the effects of screen viewing on children in Iraq.

Therefore, this study aims to determine the association between screen exposure and speech development delay among toddlers and preschoolers, to clarify the correlation linking the visioning of the screen and the input

- data – of the child and his(her) mother, and to identify the impact of screen withdrawal on the possible enhancement of speech.

Material and methods

During two years (January 2019 to January 2021), a descriptive cross-sectional study was done on 237 children presented with a history of speech delays/complete loss of the ability to speak (with confirmation by the linguistic specialist's diagnosis) who had programmed visits to the private psychiatric health clinics in Nineveh Province/ Iraq. The age ranged from 12–60 months. The children were divided into two groups: The first group -of toddlers (12-36 months old), and the second group -of preschoolers (37-60 months old) depending on the American Psychiatric Association (APA), the diagnosis of children (18).

After obtaining the ethical approval from the Ethical Committee of the College of Medicine, Ninevah University, Iraq, we analyzed data obtained from the questionnaire that was collected from the parents during interviews, this questionnaire include identifying of child's age in months (12-60), gender, firstborn status, the presence of siblings, orphan status, and daycare. In addition to the recording of some maternal biological and demographic parameters such as the level of maternal education, maternal employment beside the characteristics of child–maternal interaction. Furthermore, the questionnaire includes questions on the child's behavior and psychological factors including that concerned with the child's sociable status, child's attention, features of hyperactivity, features of aggressiveness, presence of sleep problems, and appetite status.

Cases that had anatomical causes for their speech problems (as any congenital abnormalities or pathological conditions involving the tongue) were excluded. The children who were diagnosed as mentally retarded or with hearing loss were also excluded from this work.

To define children's access to screen media, parents were asked about the presence of screen devices in the home including televisions, and handheld screens (tablets/smartphones, video consoles, and personal computers).

The present work enrolled identification of the age of the first exposure of the child to the screen and the reports were divided into two parts: age of the first exposure of fewer than 24 months, and age of the first exposure of equal /more than 24months old (19, 20).

In addition, an estimation of the time that daily spent by the child exposed to screen was done, and the reports were classified into: less than 4 hours/day, and equal /more than 4 hours/day.

Finally, to detect the effect of withdrawal of screen viewing (for all media for 6 months) on delayed speech development in children, the records of parents were obtained and analysed.

Statistical analyses: Conducting of the statistical investigation was achieved using the SPSS -statistical package for Social Sciences - at version 18.0 for Windows, Chicago, IL, USA. Chi-square tests were used to analyze the descriptive data. Student t-tests and spearman correlation were used to analyze the association between screen viewing and various child-maternal characteristics. The p-values of less than or equal to 0.05 were considered statistically significant.

Results

The interpretations of the observations of the current work were presented as follows:

1. Children characteristics:

This study included data from 237 children in the age range from 12 to 60 months, the mean±standard deviation(SD), was 49.4±13.2, respectively. All cases were divided into two groups according to their age toddlers 47 (19.8%), with a mean±SD was 19.2±6.8 and 190 (80.2%) at preschools with a mean±SD was 50.6±8.3. Males constituted 184 (77.6%) with the proportion of females to males as 1.0 to 3.74 (Table 1).

Table 1. Selected children demographic characteristics.

	Total	Toddlers	Preschoolers
Enrolled subject **no.(%)**	237(100%)	47(19.8%)	190 (80.2%)
Age (Months) (mean±SD)	49.4±13.2*	19.2± 6.8*	50.6±8.3*
Gender (M/F) no.(%)	184 (77.6%)/53 (32.4%)	31(16.8%)/16(30.2%)	153(83.2)/37(69.8%)

*The P-value is underlined when less than 0.05, (independent t -test)

Speech delays were noticed in about 94% of all children, while a history of complete inability to speak was shown in 12 children (0.05%).

2. Digital device type

The most common digital screen that kids engaged with was the television, with 210 (89%) children. Kids interacted with a tablet/ smartphone, a video console, and personal computers (PC) were180 (75.9%), 53 (22.4%), and 27 (0.1%) respectively. All toddlers who show interactions with TV while playing with a tablet/smartphone and a video console were identified in 15 (31.9%), and 3 (0.04%) respectively. No toddler had ever used a PC.

3. Correlates of screen time for toddlers:

The baseline correlation between the toddler's age of the first exposure to the screen and the child-maternal characteristics was summarized in Table 2. In summary, those who were exposed to a screen at age of <24 months were 39 (82.9%) toddlers. There were significant associations between speech delay and the age of first exposure to the screen (*P*= 0.02).

Table 2. The correlation between the age of first exposure to screen and child-maternal characteristics in toddlers.

Variables		Exposure age ≥ 24 months N=8	Exposure age < 24months N=39	P-value
Child factors				
Gender, no. (%)				0.4
	Female	2 (25.0%)	14 (35.9%)	
	Male	6 (75.0%)	25 (64.1%)	
Presence of siblings, no. (%)				0.4
	No	-	4 (10.3%)	
	Yes	8 (100.0%)	35 (89.7%)	
Day care, no. (%)				0.3
	No	6 (75.0%)	26 (66.7%)	
	Yes	2 (25.0%)	13 (33.3%)	
First born, no. (%)				0.3
	No	8(100.0%)	33 (84.6%)	
	Yes	-	6 (15.4%)	
Chief complain, no. (%)				0.02*
	Speech delay	6 (75.0%)	39 (100.0%)	
	No speech	2 (25.0%)	-	

Variables		Exposure age ≥ 24 months N=8	Exposure age < 24months N=39	P-value
Maternal factors				
Maternal interaction during exposure, no. (%)				0.1
	No	7 (87.5%)	23 (59.0%)	
	Yes	1 (12.5%)	16 (41.0%)	
Maternal education level, no. (%)				0.1
	<College	1 (12.5%)	15 (38.5%)	
	≥College	7 (87.5%)	24 (61.5%)	
Maternal employment, no. (%)				0.1
	No	8 (100.0%)	29 (74.4%)	
	Yes	-	10 (25.6%)	
Behavior factors				
Hostile, no. (%)				-
	No	8 (100.0%)	39 (100.0%)	
	Yes	-	-	
None sociable, no. (%)				0.1
	No	6 (75.0%)	37 (94.9%)	
	Yes	2 (25.0%)	2 (5.1%)	
Poor concentration, no. (%)				0.5
	No	8 (100.0%)	36 (92.3%)	
	Yes	-	3 (7.7%)	
Poor sleep, no. (%)				0.5
	No	8 (100.0%)	36 (92.3%)	
	Yes	-	3 (7.7%)	
Hyperactive, no. (%)				0.1
	No	8 (100.0%)	31 (79.5%)	
	Yes	-	8 (20.5%)	

*The P-value is underlined when less than 0.05, (independent t -test)

The association between the time spent per day on viewing screens and child-maternal variables was shown in Table 3. Significant associations were revealed between speech delays and the time spent viewing/hour (P=0.01).

Table 3. The correlation between the time spent by toddler to screens and child-maternal parameters.

Variables		Exposure time < 4hrs/day. N=34	Exposure time ≥ 4hrs/day. N=13	P-value
Child factors				
Gender, no. (%)				0.2
	Female	13 (38.2%)	3 (23.1%)	
	Male	21 (61.8%)	10 (76.9%)	
Presence of siblings, no. (%)				0.2
	No	4 (11.8%)	-	
	Yes	30 (88.2%)	13 (100.0%)	

Variables		Exposure time < 4hrs/day. N=34	Exposure time ≥ 4hrs/day. N=13	P-value
Child factors				
Day care, no. (%)				0.1
	No	21 (61.8%)	11 (84.6%)	
	Yes	13 (38.2%)	2 (15.4%)	
First born status, no. (%)				0.1
	No	28 (82.4%)	13 (100.0%)	
	Yes	6 (17.6%)	-	
Chief complain, no. (%)				0.01*
	Speech delay	34 (100%)	11 (84.6%)	
	No speech	-	2 (15.4%)	
Maternal factors				
Maternal interaction during exposure, no. (%)				0.001*
	No	17 (50.0%)	13 (100.0%)	
	Yes	17 (50%)	-	
Maternal education level, no. (%)				0.001*
	<College	16 (47.1%)	-	
	≥College	18 (52.9%)	13 (100.0%)	
Maternal employment, no. (%)				0.5
	No	27 (79.4%)	10 (76.9%)	
	Yes	7 (20.6%)	3 (23.1%)	
Behavior factors				
Hostile, no. (%)				-
	No	34(100.0%)	13 (100.0%)	
	Yes	-	-	
None sociable, no. (%)				0.3
	No	32 (94.1%)	11 (86.6%)	
	Yes	2 (5.9%)	2 (15.4%)	
Poor concentration, no. (%)				0.01*
	No	34 (100.0%)	10 (76.9%)	
	Yes	-	3 (23.1%)	
Poor sleep, no. (%)				0.1
	No	33 (97.1%)	11 (84.6%)	
	Yes	1 (2.9%)	2 (15.4%)	
Hyperactive, no. (%)				0.6
	No	28 (82.4%)	11 (84.6%)	
	Yes	6 (17.6%)	2 (15.4%)	

*The P-value is underlined when less than 0.05, (independent t -test)

In addition, a strong association between the daily time spent by toddlers on viewing screens and maternal education as well as child-maternal interaction during exposure with (p=0.001), and (p=0.001) respectively.

Several behavior alterations were recorded in about 18 (38.2%) of toddlers as summarized in Table 3. A poor concentration was significantly identified in those who spent more hours of daily time viewing screens (p=0.01).

Table 4. The correlation between the age of first exposure to screen and child- maternal characteristics in preschoolers.

Variables		Exposure age ≥ 24 months N=67	Exposure age < 24months N=123	P-value
Child factors				
Gender, no. (%)				0.09
	Female	17 (25.4%)	20 (16.3%)	
	Male	50 (74.6%)	103 (83.7%)	
Presence of siblings, no. (%)				0.05*
	No	6 (9.0%)	3 (2.4%)	
	Yes	61 (91.0%)	120 (97.6%)	
Orphan, no. (%)				0.01*
	No	62 (92.5%)	98 (79.7%)	
	Yes	5 (7.5%)	25 (20.3%)	
Day care, no. (%)				0.008*
	No	10 (14.9%)	39 (31.7%)	
	Yes	57 (85.1%)	84 (68.3%)	
First born status, no. (%)				0.05*
	No	61 (91.0%)	120 (97.6%)	
	Yes	6 (9.0%)	3 (2.4%)	
Chief complain, no. (%)				0.01*
	Speech delay	67 (100.0%)	113 (91.9%)	
	No speech	-	10 (8.1%)	
Maternal interaction during exposure, no. (%)				0.3
	No	14 (20.9%)	31 (25.2%)	
	Yes	53 (79.1%)	92 (74.8%)	
Maternal employment, no. (%)				0.2
	No	47 (70.1%)	80 (65.0%)	
	Yes	20 (29.9%)	43 (35.0%)	
Maternal education level, no. (%)				0.2
	<College	51 (76.1%)	86 (69.9%)	
	≥College	16 (23.9%)	37 (30.1%)	
Behavior factors				
Hostile, no. (%)				0.1
	No	57 (85.1%)	113 (91.9%)	
	Yes	10 (14.9%)	10 (8.1%)	
None sociable, no. (%)				0.4
	No	57 (85.1%)	102 (82.9%)	
	Yes	10 (14.9%)	21 (17.1%)	
Poor concentration, no. (%)				0.3
	No	61 (91.0%)	114 (92.7%)	
	Yes	6 (9.0%)	9 (7.3%)	
Poor sleep, no. (%)				0.5
	No	59 (88.1%)	107 (87.0%)	
	Yes	8 (11.9%)	16 (13.0%)	

Variables		Exposure age ≥ 24 months N=67	Exposure age < 24months N=123	P-value
Behavior factors				
Hyperactive, no. (%)				0.05*
	No	58 (86.6%)	93 (75.6%)	
	Yes	9 (13.4%)	30 (24.4%)	

*The P-value is underlined when less than 0.05, (independent t -test)

4. Correlates of screen time for preschoolers:

The associations between the age of the first exposure to a screen and the time spent in viewing the screen to child-maternal variables are summarized in Table 4 and Table 5, respectively. In summary, the preschoolers who had a history of the first time of exposure to a screen at age of <24 months old were123 (64.7%).

Table 5. The correlation between the time spent by preschoolers in exposure to screens and child-maternal parameters.

Variables		Exposure time spent ≥ 4hrs/day N=137	Exposure time spent < 4hrs/day N=53	P-value
Child factors				
Gender, no. (%)				0.1
	Female	24 (17.5%)	13 (24.5%)	
	Male	113 (82.5%)	40 (75.5%)	
Presence of siblings, no. (%)				0.5
	No	130 (94.9%)	51 (96.2%)	
	Yes	7 (5.1%)	2 (3.8%)	
Orphan, no. (%)				0.3
	No	117 (85.4%)	43 (81.1%)	
	Yes	20 (14.6%)	10 (18.9%)	
Day care, no. (%)				0.08*
	No	31 (22.6%)	18 (34.0%)	
	Yes	106 (77.4%)	35 (66.0%)	
First born status, no. (%)				0.5
	No	130 (94.9%)	51 (96.2%)	
	Yes	7 (5.1%)	2 (3.8%)	
Chief complain, no. (%)				0.03*
	Speech delay	127 (92.7%)	53 (100.0%)	
	No speech	10 (7.3%)	-	
Maternal interaction during exposure, no. (%)				0.005*
	No	25 (18.2%)	20 (37.7%)	
	Yes	112 (81.8%)	33 (62.3%)	
Maternal employment, no. (%)				0.07*
	No	87 (63.5%)	40 (75.5%)	
	Yes	50 (36.5%)	13 (24.5%)	

Variables		Exposure time spent ≥ 4hrs/day N=137	Exposure time spent < 4hrs/day N=53	P-value
Child factors				
Maternal education level, no. (%)				0.009*
	< College	106 (77.4%)	31 (58.5%)	
	≥College	31 (22.6%)	22 (41.5%)	
Behavior factors				
Hostile, no. (%)				0.2
	No	121 (88.3%)	49 (92.5%)	
	Yes	16 (11.7%)	4 (7.5%)	
None sociable, no. (%)				0.007*
	No	121 (88.3%)	38 (71.7%)	
	Yes	16 (11.7%)	15 (28.3%)	
Poor concentration, no. (%)				0.006*
	No	122 (89.1%)	53 (100.0%)	
	Yes	15 (10.9%)	-	
Poor sleep, no. (%)				0.1
	No	117 (85.4%)	49 (92.5%)	
	Yes	20 (14.6%)	4 (7.5%)	
Hyperactive , no. (%)				0.001*
	No	98 (71.5%)	53 (100.0%)	
	Yes	39 (28.5%)	-	

*The P-value is underlined when less than 0.05, (independent t -test)

A significant association was seen between the history of speech delays and the age of first exposure to a screen as well as the number of hours spent viewing screens with (p=0.01), and (p=0.03), respectively.

Moreover, this study showed strong associations between the high number of hours spent on viewing screens and the high maternal educational level as well as with the absence of child-maternal interaction during exposure (p=0.001), and (p=0.001) respectively.

Several behavioral changes were recorded in about 89(46.8%) children. All of them were hostile, and hyperactive while one-third were non-sociable, and they were also complaining of poor concentration and poor sleep.

5. Correlates screen time departure for speech delay:

The withdrawal of the screen viewing of all media from children's access for 6 months was associated with speech improvement in about 19 (40.4%) toddlers and 58 (30.5%) preschooler children, as summarized in Table 6 and Table 7.

Table 6. The improvement in speech in toddlers after withdrawal of screens media.

Toddler speech improvement	Age of first Exposure ≥24 months No. (mean ± SD)	Age of first Exposure <24 months No. (mean ± SD)	Time spent viewing/day ≥4hrs/day No. (mean ± SD)	Time spent viewing/day <4hrs/day No. (mean ± SD)
No	3(28.3±5.8) *	25(17.6±3.8) *	5(5.4±0.9) *	23(1.7±0.8) *
Yes	5(29.2±4.4) *	14(17.1±3.6) *	8(7.6±1.7) *	11(2.4±0.8) *

*Descriptive statistics (mean ± SD)

Table 7. The improvement in Speech in preschoolers after withdrawal of screens media.

Preschoolers speech improvement	Age of first Exposure ≥24 months No. (mean ± SD)	Age of first Exposure <24 months No. (mean ± SD)	Time spent viewing/day ≥4hrs/day No. (mean ± SD)	Time spent viewing/day <4hrs/day No. (mean ± SD)
No	47(46.5± 11.4) *	85(16,5± 3.6) *	98(6.4± 1.3) *	34(1.8± 0.9) *
Yes	20(54.2± 8.3) *	38(17.3± 3.7) *	39(11.8± 4.7) *	19(2.8± 1.2) *

*Descriptive statistics (mean ± SD)

Discussion

Exposure to screens is globally increasing as well as the concerns about its effect on young children (21), and as utmost kids began practicing screen devices in their first year of life, various delays in the developmental milestones started to rise especially speech delays (22), therefore, it was crucial to investigate whether there is a contribution of screen exposure on the delaying in the speech in young ages.

In this study, we focused on toddlers and preschooler children, the critical age group for normal brain evolution and subsequent language development (23). As a measure of screen exposure, this study relied on the parental report via interview, similar to several studies (24, 25). The research identified significant associations between speech delays and the young age of first exposure to a screen (<24 months old) as well as the high frequency of time spent viewing it (≥ 4 hour/day) in both groups, similar to those of Martinot *et al*., who reported that young children diagnosed as speech delays watch screens earlier and with the higher frequency than normal children (24). This is explained by perhaps mothers actively persuading their children to use electronic screens as a convoy to keep them occupied so they can work freely, subsequently leading to a delay in a child's ability to form words (6, 26). These results more consistently matched the study of the Pediatrics American Academy (6), while the high frequency of daily exposure to the screen (≥4 hrs/day) was more pronounced in preschoolers, not surprising because television screen time remained constant over the whole age groups, but handheld screen time increased with age (26). Besides, toddlers extensively depend on their parents to access the screen devices and other activities, in diversity to preschooler children who can further easily access screen media and make choices on their daily activities (19). Our conclusions were consistent with prior studies (17, 24, 27, 28).

The present study reveals that high levels of exposure to a screen (≥ 4hour/day) are strongly associated with low levels of child-maternal interaction, and a high level of maternal education (29). Overall, it is not shocking that these children will develop speech delays more than others because speech development typically takes place in the three-dimensional real world through child interaction with parents and family, face to face, rather than in a two-dimensional digital world that does not provide these rich occasions for the learning (30).

In the present sample, super-connected children (early age of exposure to screens and more time spent engaging with digital devices), acquired behavioral problems in both groups. We noticed that sustained exposure to screens in toddlers was linked positively with poor concentration, probably because massive exposure to screens occurs during critical periods of toddlers' brain development (12), while in preschoolers it correlated more with poor concentration, hyperactivity, and non-sociable status, Christakis et al., reported similar results in recent work (31).

The most frequently utilized screen device that still contributes to the highest viewing time among children in Nineveh Province was television, this finding were in line with the study conducted by Al-Dulaimy *et al*. (17). However, Chen *et al*., utilized handheld devices in 19 (40.4%) toddlers (32).

The study also revealed sleep problems among children in both groups, These findings were similar to Lund *et al*. (33). Authors hypothesized that several pathways are included in the action of screen devices on sleep. Firstly, by reducing sleep duration by delaying naptime and bedtime via the use of these screen devices (32). Secondly, psychologically stimulating through the viewed content leads to delayed sleep or interruptions of nighttime sleep (34). Thirdly, by an interruption in the sleep-wake cycle through the exposure to the bright light of screen devices

before sleep by suppressing the release of the hormone melatonin (34), the onset of nighttime sleepiness may be postponed due to the increasing alertness caused by bright light.

Other behavior changes were also linked to screen viewing. Preliminary childhood is a period of remarkable development in the cognitive and behavioral entity. Cognitive expertise that aid children to comprehend and process information, collaborating with their environment, and use logic to apprehend mathematical and scientific phenomena are garnered throughout this time (35). Some areas of the cerebral cortex which are responsible for cognition and behavior are among the areas that are vulnerable to insults during early childhood (36).

Globally, the pediatric societies endorsed limiting screen employment among preschoolers and emphasize congruous parental mediation to offset the disadvantageous effects of screen. However, poor adherence to these guidelines with a declining trend (29, 37, 38).

A recent study by John *et al*. reported that exposure to adult-directed television early in life, as well as high background television exposure, has negative correlations with the child's executive functioning and cognitive development (35).

Christakis *et al.* suggested that the auditory and visual over-stimulation may prime children to expect similar fast-paced activities in daily life, and can lead to inattention (31).

In conclusion, this study recognized the positive associations between the child's age of first exposure to screen high frequency of screen spent time on speech delays in children, especially toddlers. Early attention from mothers and fathers, health specialists, instructors, and researchers on the correct optimal employ of screen viewing time in accordance to a child's age, is endorsed to achieve healthy child development in this digital World.

Limitations of the work included the lack of a control group which can help in the evaluation of whether the frequency of speech delays indeed raised in young children due to early and excessive screen viewing; however, children's follow-up after departure from screens gave some strength to the findings. The second limitation includes that the data (regarding screen exposure) was estimated from parents might not be reliable; however, the question on screen time focused on "yesterday" in an attempt to improve validity.

Despite these limitations, the results of the current work have some implications if replicated in future studies. First, we found that super-connected children (<24 months old exposure to screens and ≥ 4hrs/day spent time engaging with digital devices) were more likely associated with delayed speech. Second, it is the first study in Iraq to investigate the impression of screen viewing exposure on speech development; therefore, offered guidelines for limiting screen use in young children (12- 60 months old).

Further, this study provides evidence for a substantial association between longer screen viewing and behavior problems among young children. Further studies are warranted to confirm these findings.

Acknowledgements

The authors are thankful for all children (with their parents) who contributed their data to this work. Appreciations are presented for Professor. Dr Ghada A. Taqa, Department of Dental Basic Science, College of Dentistry, University of Mosul/Mosul, Iraq for her comments.

Conflict of interest

The authors declare no conflict of interest concerned in the present study.

Adherence to Ethical Standards

The study was approved by the medical research ethics committee/College of Medicine/ Ninevah University with approval letter UON/COM/MREC/2019 (90).

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