Submitted: 20 January, 2023 Accepted: 19 April, 2023 Published: 03 September, 2023 DOI:10.22514/jocpd.2023.060

ORIGINAL RESEARCH

Journal of Clinical Pediatric Dentistry

The association of screen time with intake of potentially cariogenic food and oral health of school children aged 8–14 years—a cross-sectional study

Neetu Garg[1,*], Amit Khatri[1], Namita Kalra[1], Rishi Tyagi[1]

[1]Department of Paedodontics and Preventive Dentistry, University College of Medical Sciences and GTBH, 110095 Delhi, India

***Correspondence**
akhatri@ucms.ac.in
(Neetu Garg)

Abstract

This study aimed to test the hypothesis that excessive screen time can affect the oral health of school children. In this observational cross-sectional study conducted in four schools in Delhi, National Capital Region (NCR), India, 497 school children aged 8–14 years were included. Convenience sampling was used to select schools. Data were extracted from a questionnaire pertaining to screen time and dietary habits, which was distributed to the school children during their first planned school visit. Seven days later, on their second school visit, the children were clinically examined by a calibrated examiner (κ = 0.9) for dental caries, plaque and gingival health using the following indices: Decayed, Missing, Filled teeth (DMFT)/decayed, extracted, filled teeth (deft), Silness-Loe plaque index (PI) and Loe-Silness gingival index (GI), respectively. Overall, 88.7% of the participants exhibited screen time of $\geq$2 h with maximum frequency for smartphones (93%), followed by television (84.7%). Significantly higher DMFT/deft values (3.20 $\pm$ 0.68 *vs.* 2.45 $\pm$ 0.35, p = 0.001), PI (1.04 $\pm$ 0.21 *vs.* 0.33 $\pm$ 0.10, $p < 0.001$) and GI (1.45 $\pm$ 0.34 *vs.* 0.12 $\pm$ 0.04, $p < 0.001$) were observed in those with screen time $\geq$2 h as compared to those with screen time <2 h. Data underwent statistical analysis with a significance threshold of $p < 0.05$. Excessive screen time can influence the eating patterns of children and contribute to higher DMFT, GI and PI.

Keywords

Screen time; Oral health; Dental caries; Dental plaque

1. Introduction

Advances in broadcast media and interactive screen technologies herald a new age of digital generation which is defined by their digital technology competence [1]. Children and adolescents in this generation have increased exposure to both traditional fixed devices such as televisions and laptops and interactive media devices such as smartphones and electronic tablets, resulting in longer screen times. Screen time is defined as the time spent watching any type of screen [2].

Despite facilitating increased access to information and learning amongst children, the widespread use of these devices is detrimental to their health. The associated unhealthy lifestyle, sedentary behaviour, irregular meals, snacking, junk food habits and a lack of sleep can lead to various physiological and/or psychological health issues [3]. The American Academy of Pediatrics recommends that the screen time of children and adolescents should be limited to no more than 2 h/day [4].

The inadequate dietary habits associated with excessive screen time, such as consumption of energy-dense high-fat-high-sugar foods and beverages and reduced consumption of fruit and vegetables, apart from other metabolic disorders, can also lead to a higher prevalence of dental caries and increased plaque accumulation [4, 5]. In addition, the unhealthy lifestyle constituting excess screen viewing might influence oral health behaviours such as tooth brushing frequency, routine dental check-ups and oral hygiene [6].

Screen time might affect snacking through different pathways such as longer working hours for parents, rendering less time for supervision, ignoring the harmful effects of low-quality diet and catering to readily available options such as mobile devices to engage them and junk food to feed them [7–10]. The food industry employs persuasive strategies through advertising to associate non-nutritive food products with children's well-being, happiness and health [11]. Furthermore, food advertisements expose children to energy-dense, nutrient-poor products and trigger their consumption [12, 13].

Oral health problems are significant issues that impact not only children's dental health but also their psychosocial well-being, including dental pain, anxiety and missed school days. These implications can go beyond affecting individuals and families (for example, stress) to health care resources used to provide treatment [14].

Although there appears to be an important relationship between excessive screen time and oral health, it has not been

extensively studied. The correlation between television and unhealthy dietary habits and food preferences in terms of fast food, soda and refined grains has already been established [4, 15]; however, its association with dental caries, gingival health and plaque accumulation remains unclear. Moreover, very few studies have revealed a similar relationship for computers, smartphones and the internet. The claimed correlation between screen time along with the associated sedentary lifestyle and oral health of children is not yet well established [15]. With this background, in this study, we aimed to test the hypothesis that excessive screen time can affect the oral health of school children.

2. Materials and methods

2.1 Study design and setting

This was an observational cross-sectional study conducted in various schools in Delhi, National Capital Region (NCR), India, from July 2021 to January 2022. The study commenced when most of the private schools were either shut down or were ensuing an online teaching-learning programme induced by the impact of the COVID-19 pandemic. Consequently, convenience sampling was used to recruit four public (government) schools out of all schools in NCR. The present study was carried out in adherence to the guidelines of the Strengthening the Reporting of Observational Studies (STROBE) statement [16].

2.2 Sample size

Assuming 37.7% [15] of the children had <2 h of screen time per day and alpha = 5% and beta = 90%, a sample size of 320 participants was needed. Convenience sampling was done to select four schools in NCR, including 80 students from each school. To account for clustering within schools and districts, a design effect of 1.5 was applied. Therefore, the final sample size was 320 × 1.5, *i.e.*, 480. The number of children included in the study was 497, which was slightly greater than the sample size. There were no dropouts.

2.3 Participants

School children aged 8–14 years from grades third to eighth who were cooperative and cognitively able to answer the questionnaire were included in the study. Children were required to possess at least one smartphone, television, laptop, tablet, computer or video game device. Parents, family members and guardians were to be familiar with the colloquial language and possess the ability to comprehend and answer the questionnaire. Children with specific medical illnesses, special needs or a lack of cognitive ability were excluded.

2.4 Variables

Screen time was considered the primary exposure variable (independent variable) and was defined as the time for which the child watches any type of screen [2]. Data were extracted using a questionnaire. Parents tracked and reported their children's total screen time, which included television, smartphones, computers, laptops, videogames and any other screen device, for 1 week using an application on digital media or a timer. The responses ranged from 0 to 24 h of screen time. For assessment, the values were converted to <2 h or ≥2 h as per the recommendation of the American Academy of Pediatrics to limit the screen time of children and adolescents to no more than 2 h/day [4].

The primary outcome variables (dependent variables) included caries experience, plaque status and gingival health. The indices used were Decayed, Missing and Filled teeth (DMFT)/decayed, extracted and filled teeth (deft) for caries [17], Silness-Loe plaque index (PI) for plaque [18] and Loe-Silness gingival index (GI) for gingival health [19]. The American Dental Association (ADA) class III clinical examination of school children was performed by a single examiner to avoid inter-examiner variance using natural light and Community Periodontal Index World Health Organization (CPI WHO) probe (WHO 2013) [15].

Potential confounders were cariogenic diet, sugar intake, oral hygiene habits and socioeconomic status. Specific questions regarding the consumption of sweets, chocolates, biscuits, chips, salty snacks, packaged sweetened juices and soft drinks, donuts and other junk foods while watching screen devices were included in the questionnaire and considered cariogenic. This was based on their densities of refined sugar or other simple carbohydrates and/or previously reported associations with caries [20]. Bias was social desirability as participants were included in the study.

2.5 Data sources/measurement

A self-administered, pre-validated, closed-ended questionnaire was distributed to children during their first planned school visit. The questionnaire was formulated in English, translated into the local language (Hindi) and again back-translated to English to evaluate linguistic validity. The questionnaire was pre-tested, and reliability was measured for internal consistency using Cronbach's alpha (0.794), split half and Spearman's brown test.

The questionnaire comprised three parts. The first part included demographic, medical, height, weight and parental socioeconomic status questions. The second part enquired about the children's screen time and device type. The third part assessed diet, including the consumption of cariogenic food while watching screens, snacking frequency and related dietary behaviours of screen-watching youngsters. The questionnaire also included questions related to the influence of advertising on the purchase of unhealthy and cariogenic food and drinks and oral hygiene items such as toothpaste, floss and mouth rinse by the parents and children. To evaluate the effect of screen time on oral health behaviour, questions regarding tooth brushing and dental visits were included.

The parents were told to return the questionnaire after 7 days. On the second school visit after 7 days, the children were clinically examined for dental caries, plaque and gingival health.

2.6 Calibration and pilot study

The calibration of the principal investigator was performed by an experienced research head with thorough knowledge of

the subject. The examiner determined how consistently she could apply the diagnostic criteria by examining a group of approximately 25 subjects twice, on successive days, or with a time interval of at least 30 min between examinations. These subjects were selected to represent the full scope of the conditions expected to be evaluated in the study. A kappa statistic was applied to test intra-examiner reliability, and a value of 0.9 indicated a perfect agreement. To allow detection and correction of this tendency, the examiner performed duplicate examinations on 5–10% of the sample in the actual survey. A pilot study was conducted with 25 participants to verify the feasibility and accessibility of the study.

The examiner was assisted by an alert and cooperative recording clerk to note the numbers and letters and an organising clerk to maintain a constant flow of subjects and sterile instruments to the examiner, enter descriptive information and check the finished records for accuracy and completeness.

2.7 Statistical analysis

The data were analysed using SPSS version 27.0 (Statistical Package for Social Sciences, IBM Corp., Armonk, NY, USA). Descriptive statistics were applied, and categorical data were presented as proportions and percentages while continuous data were presented as mean and standard deviation. The chi-square test was used to compare categorical variables, and the *t*-test and Analysis of Variance (ANOVA), followed by a *post hoc* Least Significant Difference (LSD) test, were used to compare continuous variables. Simple logistic regression analysis was applied, and the odds ratio (OR) was calculated for the association between different variables. The significance threshold was set at $p < 0.05$.

3. Results

The study included 497 students with a mean age of 11.02 ± 2.0 years. Males accounted for 50.7% (n = 252), and females 49.3% (n = 245) of the study population. Most of the study participants belonged to the upper middle class (42.3%), followed by lower middle class (38.6%), upper lower class (17.1%) and upper class (2%). Overall, 441 (88.7%) children exhibited a screen time of ≥2 h. The mean frequency of digital device usage in children was found to be the highest for smartphones (93%), followed by television (84.7%).

Table 1 presents the association of screen time with respect to demographic variables, screen devices and play activity. Age exhibited a significant association with screen time, inferring that children in the older age range (11–14 years) were more captivated by screens ($p = 0.014$). However, no significant association was observed with respect to gender or socioeconomic status. Of all screen devices used by children, smartphone usage was found to be the highest, followed by television. Overall, 91.7% of the children watching television and 91.1% of those using smartphones had a screen time of ≥2 h. Additionally, children with a screen time of ≥2 h presented with fewer average play activities with friends on both weekdays (2.30 ± 1.36 *vs.* 2.38 ± 1.29 h) and weekends (1.62 ± 1.09 *vs.* 1.70 ± 0.87 h) than their counterparts, although the difference was not statistically significant. The chi-square test and *t*-test were used.

Table 2 demonstrates the association between screen time and clinical variables. Children with a screen time of ≥2 h exhibited significantly higher DMFT/deft values (3.20 ± 0.68 *vs.* 2.45 ± 0.35, $p = 0.001$), PI (1.04 ± 0.21 *vs.* 0.33 ± 0.10, $p < 0.001$) and GI (1.45 ± 0.34 *vs.* 0.12 ± 0.04, $p < 0.001$) than those with a screen time of <2 h, and the difference was statistically significant. Additionally, children with a screen time of ≥2 h had significantly more unfilled cavities (92.6%). Overall, 89.5% of the children who brushed only once a day had a screen time of ≥2 h. The probability of experiencing oral pain (and visiting a dentist) was also higher among children with a screen time of ≥2 h, and the difference was statistically significant ($p < 0.001$).

Table 3 presents the food habits of children. There was an increased likelihood of snacking (87.2% *vs.* 12.2%, $p = 0.024$), buying (92.1% *vs.* 7.6%, $p = 0.001$) and consuming foods such as chips, chocolates and packaged juices alongside screen devices (93.5% *vs.* 6.1%, $p = 0.001$) and food pouching while watching screens (95.4% *vs.* 4.6%, $p = 0.001$) in the study population. The variables pertaining to parental behaviour such as buying food requested by children (95.4% *vs.* 4.3%, $p = 0.025$) and buying under the influence of advertisements (94.2% *vs.* 5.4%, $p = 0.001$) were also significantly associated with a screen time of ≥2 h ($p = 0.001$). Simple logistic regression analysis was performed, and the OR was calculated for the association between different variables.

Table 4 shows the association between screen time, eating cariogenic food while viewing screens and oral health parameters. *Post hoc* comparisons showed that the mean DMFT/deft index score was the highest among children with a screen time of ≥2 h and eating cariogenic food while viewing screens (2.21 ± 1.52) than among children with a screen time of ≥2 h and not eating cariogenic food while viewing screens (1.81 ± 1.44) and those with a screen time of <2 h whether (1.29 ± 1.49) or not (1.18 ± 1.92) consuming cariogenic food, with a significant difference among the four groups ($p < 0.001$).

The mean PI score was significantly higher among children with a screen time of ≥2 h and eating cariogenic food while viewing screens (1.02 ± 0.47) than among children with a screen time of ≥2 h and not eating cariogenic food while viewing screens (0.91 ± 0.46) and those with a screen time of <2 h whether (0.67 ± 0.29) or not (0.74 ± 0.36) consuming cariogenic food, with a significant difference among the four groups ($p < 0.001$). Similarly, the mean GI score was significantly higher among children with a screen time of ≥2 h and eating cariogenic food while viewing screens (1.08 ± 0.37) than among children with a screen time of ≥2 h and not eating cariogenic food while viewing screens (0.98 ± 0.36) and those with a screen time of <2 h whether (0.83 ± 0.28) or (0.92 ± 0.35) consuming cariogenic food, with a significant difference among the four groups ($p < 0.001$).

4. Discussion

Over the past few decades, the growth of digital media has led to both enormous promises and substantial concerns regarding children's development [1]. Previous studies have

TABLE 1. Association of screen time with demographic variables, devices used and playing activity.

Parameter	Category	Screen time		*p*-value
		<2 h	≥2 h	
Age				
	8–10 yr	33 (15.6%)	178 (84.4%)	0.014*
	11–14 yr	23 (8.0%)	263 (92.0%)	
Gender				
	Male	30 (11.9%)	222 (88.1%)	0.604
	Female	27 (11.0%)	218 (89.0%)	
Socioeconomic status				
	2 (upper lower)	8 (9.4%)	77 (90.6%)	6.428
	3 (lower middle)	18 (9.4%)	174 (90.6%)	
	4 (upper middle)	28 (13.3%)	182 (86.7%)	
	5 (upper class)	3 (30.0%)	7 (70.0%)	
Devices				
	Television	35 (8.3%)	386 (91.7%)	<0.001*
	Smart phone	41 (8.9%)	421 (91.1%)	<0.001*
	Cellar phone	14 (7.6%)	171 (92.4%)	0.056
	Tablet	1 (1.9%)	53 (98.1%)	0.020*
	Console	2 (3.3%)	59 (96.7%)	0.031*
	Computer/Laptop	4 (2.4%)	115 (96.6%)	0.001*
Chi-square test; * indicates significant difference at $p \leq 0.05$.				
		Mean ± SD		
Playing with friends on weekdays (no of hours)	-	2.38 ± 1.29	2.30 ± 1.36	0.706
Playing with friends on weekends (no of hours)	-	1.70 ± 0.87	1.62 ± 1.09	0.608

*Independent t test; * indicates significant difference at $p \leq 0.05$. SD: standard deviation.*

TABLE 2. Association of screen time with clinical variables.

Variable	Category	Screen time <2 h	Screen time ≥2 h	*p*-value
		Mean ± SD		
DMFT/deft	-	2.45 ± 0.35	3.20 ± 0.68	0.001*
PI	-	0.33 ± 0.10	1.04 ± 0.21	<0.001*
GI	-	0.12 ± 0.04	1.45 ± 0.34	<0.001*
Independent *t* test; * indicates significant difference at $p \leq 0.05$.				
		N (%)		
Dental caries	-	29 (7.4%)	363 (92.6%)	<0.001*
H/o of dental pain	-	11 (4.8%)	218 (95.2%)	<0.001*
Visit to a dentist	-	6 (3.5%)	164 (96.5%)	<0.001*
Brushing frequency	1	35 (10.5%)	298 (89.5%)	<0.001*
	≥2	22 (13.4%)	142 (86.6%)	<0.001*

*Chi-square test; * indicates significant difference at $p \leq 0.05$. DMFT: Decayed, Missing, Filled teeth; PI: plaque index; GI: gingival index; SD: standard deviation.*

TABLE 3. Association of screen time with snacking habits.

Variable	Screen time		*p*-value	OR
	<2 h	≥2 h		
Daytime snacking	21 (12.2%)	150 (87.2%)	0.024*	2.30
Watch advertisements	28 (7.2%)	361 (92.6%)	0.002*	3.50
Child buys cariogenic food seen in advertisements	28 (7.6%)	339 (92.1%)	0.001*	3.50
Child buys packaged drinks	22 (6.5%)	315 (93.2%)	0.033*	2.50
Child eats cariogenic food while watching screens	17 (6.1%)	259 (93.5%)	0.001*	2.50
Child eats healthy foods	106 (52.0%)	98 (48.0%)	0.521	0.09
Child asks for cariogenic food seen in advertisements	26 (7.8%)	307 (91.9%)	0.001*	3.36
Parent buys cariogenic food requested by child	13 (4.3%)	291 (95.4%)	0.025*	2.59
Parent buys food seen in advertisements	14 (5.4%)	242 (94.2%)	0.001*	5.60
Parent buys packaged drinks seen in advertisements	10 (4.2%)	229 (95.4%)	0.350	2.30
Food pouching in children	15 (4.6%)	308 (95.4%)	0.001*	1.26

*Chi-square test; * indicates significant difference at $p \leq 0.05$; OR: odds ratio.*

TABLE 4. Association of screen time combined with eating cariogenic food while viewing screens with oral health parameters.

Variable	Group	Mean	SD	*p* value
DMFT				
	ST <2—Eating Cariogenic food (1)	$1.29^{a,b}$	1.49	<0.001*
	ST <2—Not eating cariogenic food (2)	1.18^{a}	1.92	
	ST ≥2—Eating Cariogenic food (3)	2.21^{c}	1.52	
	ST ≥2—Not eating cariogenic food (4)	1.81^{b}	1.44	
PI				
	ST <2—Eating Cariogenic food (1)	0.67^{a}	0.29	<0.001*
	ST <2—Not eating cariogenic food (2)	0.74^{a}	0.36	
	ST ≥2—Eating Cariogenic food (3)	1.02^{b}	0.47	
	ST ≥2—Not eating cariogenic food (4)	0.91^{c}	0.46	
GI				
	ST <2—Eating Cariogenic food (1)	0.83^{a}	0.28	0.001*
	ST <2—Not eating cariogenic food (2)	0.92^{a}	0.35	
	ST ≥2—Eating Cariogenic food (3)	1.08^{b}	0.37	
	ST ≥2—Not eating cariogenic food (4)	0.98^{a}	0.36	

*One-way ANOVA test; Post hoc LSD test; * indicates significant difference at $p \leq 0.05$; ST <2: Screen time of less than 2 hours; ST ≥2: Screen time of greater than or equal to 2 hours; Different superscript letters in a column indicate significant difference. DMFT: Decayed, Missing, Filled teeth; PI: plaque index; GI: gingival index; SD: standard deviation.*

demonstrated the detrimental effects of excessive screen time on obesity, metabolic syndrome, sleep disorders, cardiovascular diseases and even chronic non-communicable diseases (CNCDs) such as dental caries [4, 15, 21].

This study included 8–14-year-old children and early adolescents. Cognitive development in healthy children is nearly complete by the age of 6 years [22]. The increasing independence to seek care, daily habits and food choices in childhood and adolescence lays a foundation for habits in adulthood [23]. The age range of 8–14 years in this study was determined considering all these factors. A previous similar study included a study population with a mean age 11.7 years [24]. In our study, 88.7% of the study population had a screen time of ≥2 h. The number of hours of screen viewing per day was higher on weekends, although the difference was not statistically significant. A previous study on similar research also reported an overall prevalence of high screen time [25].

In the present study, the mean frequency of digital device usage in children was the highest for smartphones (93%), followed by television (84.7%). Previous studies have also highlighted the accentuated use of smartphones, especially in children who are more skilled [26]. This can be attributed to the decreasing cost, ease of application and portability, screen size, multiple applications and interactive ability, especially

due to the commencement of the study during the COVID-19 pandemic [27]. Solitary viewing by children is mostly achieved using mobile screen media devices. Therefore, the daily screen time of traditional media such as television has decreased [26].

This study demonstrated a strong association between daily screen time and outcomes. School children with a screen time of ≥2 h were more likely to consume cariogenic food and have higher caries experience and GI and PI scores. Additionally, a higher screen time resulted in buying and consuming cariogenic food and packaged drinks seen in advertisements, children asking for cariogenic food, parents buying the same for them and compromised oral health-related behaviours such as tooth brushing habits. Children's viewing habits are shaped by a media landscape that emphasises foods rich in fat, sugar and salt, which are linked to obesity, dental caries and other degenerative conditions [11]. In previous studies, food advertising on television has been criticised for its possible involvement in promoting poor dietary choices among young people, leading to an increased chance of dental caries [28].

Zhu *et al*. [29] surveyed children and adolescents for their junk food consumption and reported that 32%, 27% and 37% ate biscuits, coke and comparable beverages, respectively, more than once a day. "Junk food" information came primarily from television commercials [29]. Advertisers profit from children's impact on their parents' purchasing patterns because they are future consumers [11]. In their study, McNeal *et al*. [30] found a steady increase in the percentage of parents whose purchasing decisions were swayed by the advertising of their children's products [30]. Children's eating habits are being influenced by powerful marketing methods, including the use of fun, live actions, music and other emotional cues. More than 95% of the food commercials on children's favourite television channels are about cariogenic foods influencing their dental health [31].

AlSaffan *et al*. [12] performed a content analysis of commercials and inferred the targeted advertising employed by internet platforms such as YouTube, considering an individual's previous browsing history to be a primary factor in the type of advertisements the individual is exposed to [12]. The user account which frequently accessed children's videos had significantly greater food and beverage advertisements high in sugar and fats [13]. Fruit, vegetables and protein-rich foods such as meat, fish, poultry, beans, nuts, eggs and dairy products were rarely advertised, whereas candy was the most commonly advertised food [32].

Screen time length has been linked to a greater frequency of intake of energy-dense, micronutrient-poor items such as sugar-sweetened soft drinks, snacks and chocolates [15]. A previous study investigated the relationship between the amount of time spent viewing television and children's eating habits and suggested a significant correlation between the amount of time that youngsters spend watching television and the amount of time they spend drinking soft beverages [33].

In the present study, a daily screen time of ≥2 h was found to be significantly associated with higher DMFT/deft scores (3.20 ± 0.68 *vs.* 2.45 ± 0.35), GI (1.45 ± 0.34 *vs.* 0.12 ± 0.04) and PI (1.04 ± 0.21 *vs.* 0.33 ± 0.10) scores. Likewise, previous studies have observed that youngsters who viewed various forms of screens while eating meals presented a higher DMFT score and poor periodontal health [6, 34].

The present study also evaluated food pouching and reported a statistically significant correlation between increased screen time and food pouching in children. Children and adolescents tend to become involved in digital media and lose consciousness of their current activity, which, in this case, is eating/chewing [35]. Food pouching in the vestibule for longer hours can lead to sticking of the food to the newly erupted tooth surfaces that already have less mineralisation (mixed dentition period), increased plaque, bleeding gums and higher acid formation, leading to dental decay [36, 37]. Hence, the present study's results are justified. Dietary habits affect the formation and maintenance of plaque biofilm, either by serving as a direct source of nutrients or by influencing the environment [38]. Plaque build-up may be prevented by eating foods with a natural texture, such as fruits and vegetables, whereas foods with a softer consistency may encourage plaque formation [39].

In the present study, children with a screen time of ≥2 h exhibited an inclination towards lower brushing frequency and presented a greater history of dental pain than children with lesser screen time. This corroborates the findings of a previous study which states that problematic internet users are likely to possess lower brushing frequency, poor oral health and experience oral symptoms. Problematic internet use could lead not only to mental health issues but also to issues related to health-related quality of life (HRQOL) in the adolescent population [40]. Additionally, engaging in addictive activities such as internet is associated with poor self-care, difficulties in performing daily routines and decreased HRQOL in adolescents and young adults [41].

Certain limitations of this study need to be considered. First, non-probability convenience sampling was applied as schools were not functioning, which might have affected the representativeness of the sample. Second, due to the cross-sectional nature of the study, a causal relationship between screen time and the occurrence of oral conditions could not be established. Therefore, further longitudinal studies are needed to establish causality.

By educating parents and guardians about the significance of limiting screen time and incorporating wholesome snack and meal patterns into their oral hygiene routines, dentists can be at the forefront of promoting excellent nutrition and habits for both general and dental health. At the community level, dentists can contribute to school health programmes by incorporating teacher's training and child-parent counselling in various capacities to make them aware of the findings and consequences.

5. Conclusions

The study shows that children and adolescents who spend two or more hours daily viewing screen devices may develop an inclination toward consuming junk food, acidic food and pouching food in the oral vestibule. As a result, they may experience higher levels of DMFT, GI and PI. Educating parents and schools about the mechanisms behind the negative effects of excessive screen time on oral health is crucial to formulating

targeted parental control plans and promoting healthy eating habits in children. Proper information transfer can help prevent dental issues and improve overall health outcomes for children.

ABBREVIATIONS

NCR, National Capital Region; DMFT, decayed missing filled teeth; deft, decayed, exfoliated due to caries, filled; CPI WHO, Community periodontal index, World Health Organization; STROBE, Strengthening the Reporting of Observational studies in Epidemiology; GI, Gingival index; PI, plaque index; ADA, American Dental Association.

AVAILABILITY OF DATA AND MATERIALS

The data are contained within this article.

AUTHOR CONTRIBUTIONS

NG—Principal investigator who conducted the research and collected, evaluated, and analysed data; AK—Conception and designing of the study, proof read the document and led the writing; NK—Supervised the research and led the writing; RT—Supervised the research and led the writing.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was approved by Scientific Ethics Committee of the University College of Medical Sciences and GTB Hospital, Delhi, India (IEC-HR/2020/PG/46/77-R1). Written informed consent was obtained from parents or guardians. Verbal assent for children aged 7–12 years and written assent for children 12–14 years were obtained.

ACKNOWLEDGMENT

We would like to express our gratitude to all 8–14-year-old school children, their parents and the school authorities. We would also like to thank our statisticians Shilpi Singh and Mahesh Khairnar for their valuable contribution.

FUNDING

This research received no external funding.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

[1] Beatty C, Egan SM. Screen time in early childhood: a review of prevalence, evidence and guidelines. An Leanhb Óg. 2020; 13: 17–31.

[2] AAP COUNCIL ON COMMUNICATIONS AND MEDIA. Media use in school-aged children and adolescents. Pediatrics. 2016; 138: e20162592.

[3] Mark AE, Boyce WF, Janssen I. Television viewing, computer use and total screen time in Canadian youth. Paediatrics & Child Health. 2006; 11: 595–599.

[4] Bomfim RA, Frias AC, Cascaes AM, Mazzilli LE, Souza LB, Carrer FC, *et al*. Sedentary behavior, unhealthy food consumption and dental caries in 12-year-old school children: a population-based study. Brazilian Oral Research. 2021; 35: e041.

[5] Al-Zahrani MS, Borawski EA, Bissada NF. Poor overall diet quality as a possible contributor to calculus formation. Oral Health and Preventive Dentistry. 2004; 2: 345–349.

[6] Olczak-Kowalczyk D, Tomczyk J, Gozdowski D, Kaczmarek U. Excessive computer use as an oral health risk behaviour in 18-year-old youths from Poland: a cross-sectional study. Clinical and Experimental Dental Research. 2019; 5: 284–293.

[7] Taveras EM, Sandora TJ, Shih M, Ross-Degnan D, Goldmann DA, Gillman MW. The association of television and video viewing with fast food intake by preschool-age children. Obesity. 2006; 14: 2034–2041.

[8] Falbe J, Willett WC, Rosner B, Gortmaker SL, Sonneville KR, Field AE. Longitudinal relations of television, electronic games, and digital versatile discs with changes in diet in adolescents. The American Journal of Clinical Nutrition. 2014; 100: 1173–1181.

[9] Mollborn S, Limburg A, Pace J, Fomby P. Family socioeconomic status and children's screen time. Journal of Marriage and Family. 2022; 84: 1129–1151.

[10] Pérez-Farinós N, Villar-Villalba C, López Sobaler AM, Dal Re Saavedra MÁ, Aparicio A, Santos Sanz S, *et al*. The relationship between hours of sleep, screen time and frequency of food and drink consumption in Spain in the 2011 and 2013 ALADINO: a cross-sectional study. BMC Public Health. 2017; 17: 33.

[11] Kelly B, Halford JCG, Boyland EJ, Chapman K, Bautista-Castaño I, Berg C, *et al*. Television food advertising to children: a global perspective. American Journal of Public Health. 2010; 100: 1730–1736.

[12] AlSaffan A, AlDayel E, AlZamami M, Satout A, AlMotairi Y, Pani S. A content analysis of food and beverage advertisements associated with Arabic children's videos on the internet and its relation to dental health. Saudi Journal of Oral Sciences. 2017; 4: 96.

[13] Morgan M, Fairchild R, Phillips A, Stewart K, Hunter L. A content analysis of children's television advertising: focus on food and oral health. Public Health Nutrition. 2009; 12: 748–755.

[14] Al-Mazyad M, Flannigan N, Burnside G, Higham S, Boyland E. Food advertisements on UK television popular with children: a content analysis in relation to dental health. British Dental Journal. 2017; 222: 171–176.

[15] Silva RDNMT, Duarte DA, Oliveira AMG. The influence of television on the food habits of schoolchildren and its association with dental caries. Clinical and Experimental Dental Research. 2020; 6: 24–32.

[16] von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP; STROBE Initiative. The strengthening the reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies. Journal of Clinical Epidemiology. 2008; 61: 344–9.

[17] Klein H, Palmer CE, Knutson JW. Studies on dental caries: I. Dental status and dental needs of elementary school children. Public Health Reports. 1938; 53: 751–765.

[18] Silness J, Löe H. Periodontal disease in pregnancy II. Correlation between oral hygiene and periodontal condition. Acta Odontologica Scandinavica. 1964; 22: 121–135.

[19] Löe H, Silness J. Periodontal disease in pregnancy I. Prevalence and severity. Acta Odontologica Scandinavica. 1963; 21: 533–551.

[20] Dreher IL, Herrmann R, Ferreira FM, Casagrande L, Lenzi TL. Can schoolchildren substitute mothers' reports of cariogenic foods consumption? Pesquisa Brasileira em Odontopediatria e Clínica Integrada. 2021; 21: e0228.

[21] Carra MC, Schmitt A, Thomas F, Danchin N, Pannier B, Bouchard P. Sleep disorders and oral health: a cross-sectional study. Clinical Oral Investigations. 2017; 21: 975–983.

[22] Alberga AS, Sigal RJ, Goldfield G, Prud' homme D, Kenny GP. Overweight and obese teenagers: why is adolescence a critical period? Pediatric Obesity. 2012; 7: 261–273.

[23] American Academy of Pediatric Dentistry. Adolescent oral health care. The reference manual of pediatric dentistry. Pediatric Dentistry. 2021: 267–76.

[24] Boynton-Jarrett R, Thomas TN, Peterson KE, Wiecha J, Sobol AM, Gortmaker SL. Impact of television viewing patterns on fruit and

vegetable consumption among adolescents. Pediatrics. 2003; 112: 1321–1326.
[25] Wang H, Zhong J, Hu R, Fiona B, Yu M, Du H. Prevalence of high screen time and associated factors among students: a cross-sectional study in Zhejiang, China. BMJ Open. 2018; 8: e021493.
[26] Paudel S, Jancey J, Subedi N, Leavy J. Correlates of mobile screen media use among children aged 0–8: a systematic review. BMJ Open. 2017; 7: e014585.
[27] Serra G, Lo Scalzo L, Giuffrè M, Ferrara P, Corsello G. Smartphone use and addiction during the coronavirus disease 2019 (COVID-19) pandemic: cohort study on 184 Italian children and adolescents. Italian Journal of Pediatrics. 2021; 47: 150.
[28] Bahuguna R, Jain A, Suryavanshi D, Chauhan H, Khan SA, Thakur R. Influence of television advertising on behavior of children across socioeconomic backgrounds. The Journal of Contemporary Dental Practice. 2017; 18: 52–56.
[29] Zhu SP, Ding YJ, Lu XF, Wang HW, Yang M, Wang JX, Chao XD, Zhao Z. Study on factors related to top 10 junk food consumption at 8 to 16 years of age, in Haidian district of Beijing. Zhonghua Liu Xing Bing Xue Za Zhi. 2008; 29: 757–762. (In Chinese)
[30] McNeal JU, Yeh C. Development of consumer behavior patterns among Chinese children. Journal of Consumer Marketing. 1997; 14: 45–59.
[31] Pine KJ, Nash A. Dear Santa: the effects of television advertising on young children. International Journal of Behavioral Development. 2002; 26: 529–539.
[32] Utter J, Scragg R, Schaaf D. Associations between television viewing and consumption of commonly advertised foods among New Zealand children and young adolescents. Public Health Nutrition. 2006; 9: 606–612.
[33] Arikan D, Bekar P. Children's eating habits and obesity while watching television. Iranian Journal of Pediatrics. 2017; 27: 1–6.
[34] Rodd HD, Patel V. Content analysis of children's television advertising in relation to dental health. British Dental Journal. 2005; 199: 710–712.
[35] Stevenson RD, Allaire JH. The development of normal feeding and swallowing. Pediatric Clinics of North America. 1991; 38: 1439–1453.
[36] Linke HB, Birkenfeld L. Clearance and metabolism of starch foods in the oral cavity. Annals of Nutrition and Metabolism. 1999; 43: 131–139.
[37] Kashket S, Yaskell T, Murphy JE. Delayed effect of wheat starch in foods on the intraoral demineralization of enamel. Caries Research. 1994; 28: 291–296.
[38] Bowden GHW, Li YH. Nutritional influences on biofilm development. Advances in Dental Research. 1997; 11: 81–99.
[39] Newman HN. Diet, attrition, plaque and dental disease. British Dental Journal. 1974; 136: 491–497.
[40] Park S, Lee JH. Associations of internet use with oral hygiene based on national youth risk behavior survey. Journal of the Korean Academy of Child and Adolescent Psychiatry. 2018; 29: 26–30.
[41] Tran BX, Huong LT, Hinh ND, Nguyen LH, Le BN, Nong VM, *et al*. A study on the influence of internet addiction and online interpersonal influences on health-related quality of life in young Vietnamese. BMC Public Health. 2017; 17: 138.

How to cite this article: Neetu Garg, Amit Khatri, Namita Kalra, Rishi Tyagi. The association of screen time with intake of potentially cariogenic food and oral health of school children aged 8–14 years—a cross-sectional study. Journal of Clinical Pediatric Dentistry. 2023; 47(5): 116-123. doi: 10.22514/jocpd.2023.060.