

Association of Screen-based Lifestyle Behaviors with caries risk profile using CAMBRA in school age children- A Cross Sectional Study.

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Background:- Screen time is the amount of time spent using digital devices such as televisions, computers, and mobile phones. Excessive screen exposure in children is associated with adverse psychological, physical, and social effects, including unhealthy dietary habits, reduced physical activity, and increased risk of dental caries. However, the relationship between screen time, diet, and oral health is still not fully understood.

Aim: This study assessed the association between screen time lifestyle Behaviors with caries risk profile using CAMBRA in school aged (3-6 years) children-A Cross Sectional Study.

Methods : A cross-sectional observational study was conducted for a duration of 3 months (December 2025–February 2026) in the Department of Paediatric & Preventive Dentistry. Fifty children aged 3–6 years were selected using convenience sampling. Screen-time data were collected through parental interviews using structured questionnaires. Clinical oral examination were performed to categorize children into low, moderate, high, and extreme caries risk groups based on CAMBRA guidelines. Dietary habits were assessed using a seven-day dietary recall.

Results: Result was analyzed using SPSS software chicago (v30.0). The findings suggest that excessive screen-based behaviors, together with unhealthy dietary habits and inadequate oral hygiene practices, are associated with an increased risk of dental caries among school-age children. These results emphasize the importance of incorporating assessment of screen time and lifestyle behaviors into routine CAMBRA-based caries risk assessment and preventive oral health programs.

Conclusion: Higher screen time, particularly during meals, is associated with increased cavitated lesions and overall caries due to unhealthy dietary habits. These results highlight the importance of parental monitoring and regulated screen use to improve diet and oral hygiene. The updated CAMBRA approach supports individualized, risk-based management combining minimally invasive restorative care with chemical therapy, with the addition of antibacterial agents to fluoride in children at high or extreme caries risk.

Keywords: CAMBRA, Dental caries, Risk assessment, Flouride therapy, High risk, Moderate risk, Low risk

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I. Introduction

The rapid advancement of digital technology has significantly increased children's exposure to screen-based devices such as televisions, smartphones, tablets, computers, and gaming consoles.¹ Screen-based lifestyle behaviors have become an integral part of daily life among school-age children, especially following the COVID-19 pandemic, leading to growing concerns regarding their impact on physical, psychological, and oral health. Increased screen time has been associated with sedentary behavior, unhealthy dietary habits, reduced physical activity, sleep disturbances, and poor oral hygiene practices, all of which may contribute to the development of dental caries²

Children engaged in prolonged screen exposure frequently consume cariogenic snacks and sugar-sweetened beverages while watching screens, often without parental supervision.³ Exposure to advertisements promoting processed and high-sugar foods further influences children's dietary preferences and eating patterns. Additionally, excessive screen use may lead to neglect of oral hygiene routines such as nighttime brushing and regular tooth cleaning practices. These behavioral changes collectively increase the risk of dental caries among children.⁴

Dental caries is a multifactorial, biofilm-mediated disease influenced by the interaction of biological, environmental, and behavioral factors. Contemporary caries management emphasizes prevention and early risk identification rather than solely restorative treatment. Caries Management by Risk Assessment (CAMBRA) is an evidence-based approach developed to assess an individual's caries risk by evaluating disease indicators,

biological risk factors, and protective factors.⁵ CAMBRA categorizes patients into low, moderate, high, or extreme caries-risk groups and guides preventive and therapeutic interventions accordingly.⁶

The CAMBRA philosophy is based on the concept of “caries balance,” where pathological factors such as cariogenic bacteria, frequent fermentable carbohydrate intake, and reduced salivary function are weighed against protective factors including fluoride exposure, adequate saliva, and antibacterial therapy.⁷

School-age children are particularly vulnerable to developing unfavorable lifestyle behaviors due to increased accessibility to digital media and changing family routines. Since screen-based behaviors can influence dietary practices, oral hygiene habits, and snacking frequency, assessing their relationship with caries risk becomes essential.⁸

Although several studies have explored the association between screen time and oral health outcomes, limited literature is available regarding the relationship between screen-based lifestyle behaviors and caries risk profiling using CAMBRA among school-age children.⁹

Therefore, the present cross-sectional study aims to evaluate the association of screen-based lifestyle behaviors with caries risk profile using CAMBRA in school-age children. Understanding this association may help in identifying modifiable behavioral risk factors and developing targeted preventive strategies to improve oral health outcomes in children.¹⁰

II. METHODOLOGY

Study Design

A cross-sectional observational study was conducted to evaluate the association between screen-based lifestyle behaviors and caries risk profile using Caries Management by Risk Assessment (CAMBRA) among school-age children.

Study Setting

The study was carried out in the Department of Pediatric and Preventive Dentistry in association with selected schools/hospital outpatient departments over a period of 3 Months.

Study Population

School-age children between 3-6 years of age was included in the study.

Sample Size

Based on the prevalence of excessive screen time among children from previous studies, the estimated sample size were taken approximately 50 participants.

Sampling Technique

Participants were selected using convenience sampling/random sampling from children reporting to the dental department or selected schools after obtaining parental consent.

Ethical Clearance

Ethical approval was obtained from the Institutional Ethical Committee before commencement of the study. Written informed consent were obtained from parents/guardians and assent were obtained from children 3-6 years of age.

Inclusion Criteria

- Children aged 3-6 years.
- Children whose parents/guardians provide informed written consent.
- Children who are cooperative for oral examination.

Exclusion Criteria

- Children with systemic diseases or special healthcare needs.
- Children undergoing orthodontic treatment.
- Children on long-term medications affecting salivary flow.
- Uncooperative children.

Data Collection Procedure

Questionnaire Assessment

A structured questionnaire was administered to parents/guardians to record:

Demographic Details were recorded like age,gender,socioeconomic status & parent education and occupation.

Screen-based Lifestyle Behaviors are

Information regarding

- Average daily screen time on weekdays and weekends
- Type of digital devices used (mobile, television, tablet, computer)
- Screen use during meals
- Frequency of snacking while using screens
- Night-time screen exposure
- Physical activity duration

Dietary Assessment :- Dietary habits was evaluated using a 7-day dietary recall method including

- Frequency of sugary snack intake
- Consumption of sugar-sweetened beverages
- Frequency of meals while watching screens
- Between-meal snacking habits

Oral Hygiene Practices were :-

Data regarding :- Frequency of tooth brushing,Night brushing habits, Use of fluoridated toothpaste, parental supervision during brushing, Use of additional oral hygiene aids.

Clinical Examination :- Clinical examination was performed by a single calibrated examiner under adequate illumination using mouth mirror and CPI probe following infection control protocols.

Examiner Calibration:-

Examiner calibration were carried out on 10% of the sample prior to the study to assess intra-examiner reliability using Cohen's Kappa statistics.

CAMBRA Caries Risk Assessment:-

Caries risk profile was assessed using the CAMBRA protocol for children aged 3-6 years and above.The following CAMBRA components will be evaluated:

Disease Indicators:-

- Existing cavitated lesions
- White spot lesions
- Restorations due to caries
- Radiographic evidence of enamel/dentin lesions (if available)

Biological Risk Factors:-

- Frequent snacking on fermentable carbohydrates
- Heavy plaque accumulation
- Deep pits and fissures
- Reduced salivary flow
- Poor oral hygiene habits

Protective Factors :- Fluoride toothpaste use,fluoride exposure,regular dental visits,adequate salivary function.

Based on the CAMBRA scoring system, children will be categorized into :- Low caries risk, Moderate caries risk, High caries risk, Extreme caries risk.

III. RESULTS

The present cross-sectional study demonstrated a significant association between screen-based lifestyle behaviors and caries risk profile assessed using the CAMBRA model among school-age children. Children with prolonged daily screen time were more frequently categorized into the moderate- and high-caries-risk groups compared to those with lower screen exposure. Increased screen time was also associated with unhealthy dietary practices, including frequent consumption of sugary snacks and sugar-sweetened beverages during screen use, irregular meal patterns, and increased snacking frequency.

Table 1: Disease Indicators in Study Participants (n = 50)

Disease Indicator	Yes (n, %)	No (n, %)
Cavities or fillings present	15 (30%)	35 (70%)
Tooth pain or sensitivity	8 (16%)	42 (84%)

White spot lesions	10 (20%)	40 (80%)
Recent dental treatment for caries	5 (10%)	45 (90%)

Figure 1: Disease Indicators in Study Participants (n = 50)

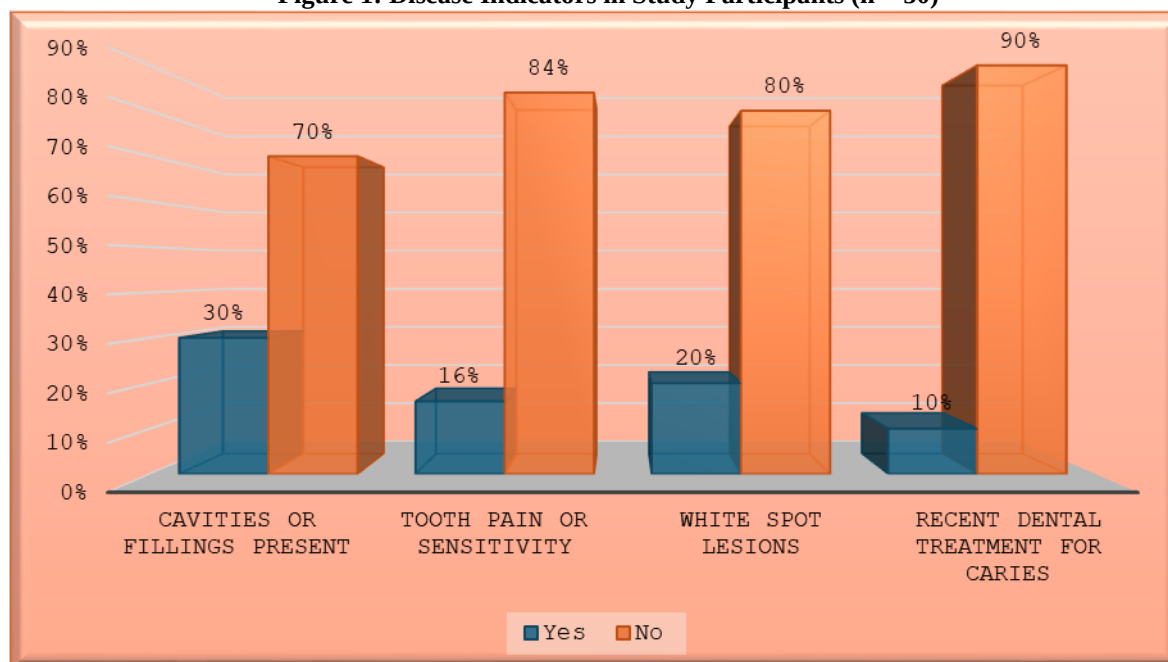


Table 1 summarizes the prevalence of disease indicators among 50 children. About 30% of children had existing cavities or fillings, 16% reported tooth pain or sensitivity, 20% had white spot lesions, and 10% had received recent treatment for caries. The presence of any disease indicator automatically classifies a child as high-risk according to CAMBRA guidelines.

Table 2: Biological / Risk Factor Scores by Screen Time Category

Risk Factor	≤2 hours/day (n=20) Mean ± SD	>2 hours/day (n=30) Mean ± SD	p-value
Screen time >2 hours/day	0.0 ± 0.0	1.0 ± 0.0	–
Snacking during screen time	0.3 ± 0.5	0.9 ± 0.3	0.000*
Sugary snacks/drinks during screen	0.2 ± 0.4	0.8 ± 0.4	0.001*
Frequent snacking (>3/day)	0.5 ± 0.5	1.2 ± 0.6	0.000*
Night-time screen use	0.1 ± 0.3	0.7 ± 0.5	0.000*
Mouth breathing	0.2 ± 0.4	0.4 ± 0.5	0.202
Total Risk Factor Score	1.3 ± 0.9	4.0 ± 1.2	0.001*

*Significant at p < 0.05

Figure 2: Biological / Risk Factor Scores by Screen Time Category

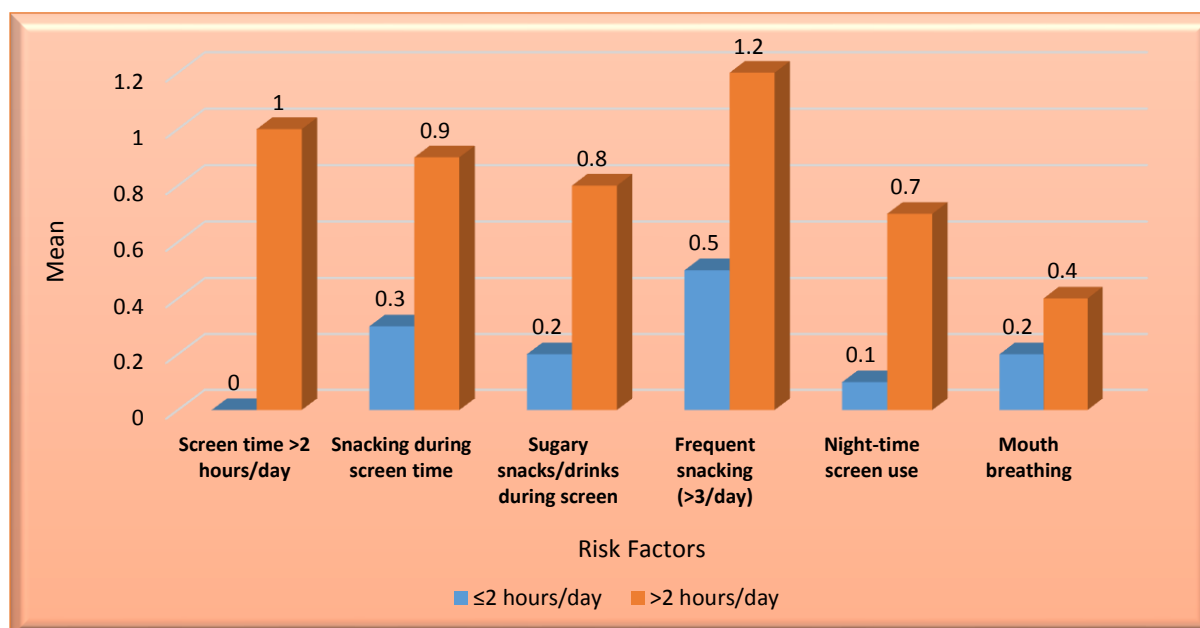
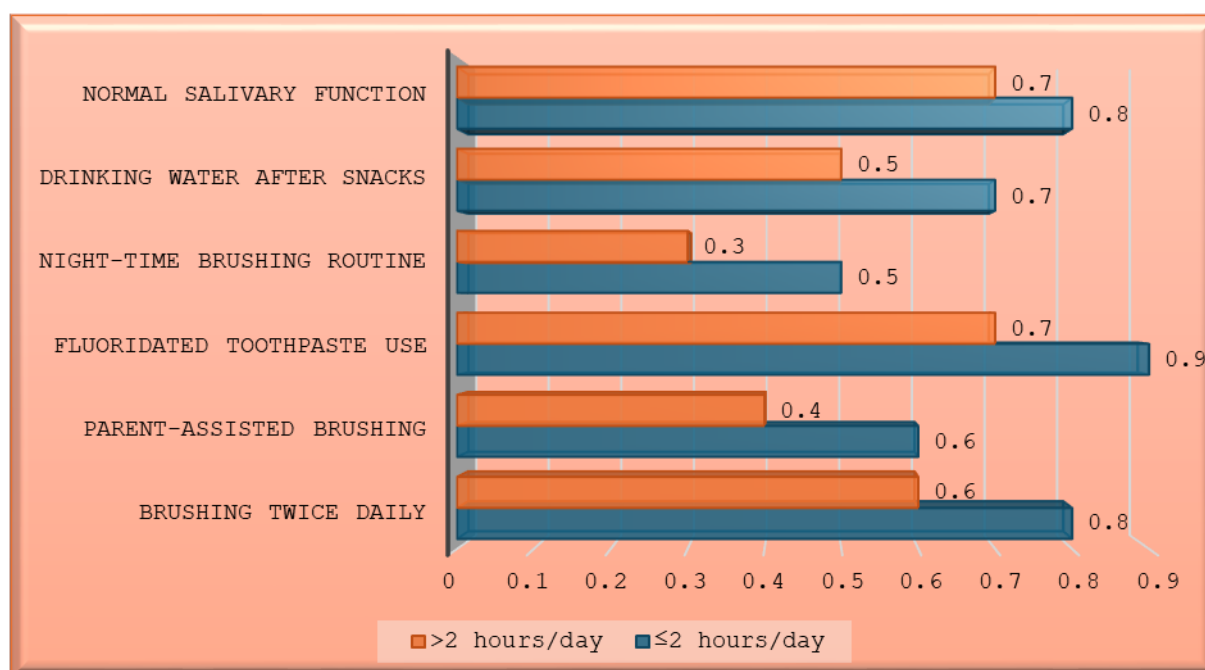


Table 2 shows the distribution of biological and behavioral risk factors based on screen time categories. Children with screen time >2 hours/day had significantly higher risk scores across most parameters, including snacking during screen use, consumption of sugary snacks/drinks, frequent snacking, and night-time screen exposure. The total risk factor score was significantly higher in children with longer screen time (4.0 ± 1.2) compared to those with ≤ 2 hours/day (1.3 ± 0.9 , $t = 8.97$, $p < 0.001$).

Table 3: Protective Factor Scores by Screen Time Category

Protective Factor	≤ 2 hours/day (n=20) Mean $\pm$ SD	>2 hours/day (n=30) Mean $\pm$ SD	t-value	p-value
Brushing twice daily	0.8 ± 0.4	0.6 ± 0.5	1.33	0.189
Parent-assisted brushing	0.6 ± 0.5	0.4 ± 0.5	1.61	0.115
Fluoridated toothpaste use	0.9 ± 0.3	0.7 ± 0.5	2.03	0.049*
Night-time brushing routine	0.5 ± 0.5	0.3 ± 0.4	1.62	0.112
Drinking water after snacks	0.7 ± 0.5	0.5 ± 0.5	1.36	0.180
Normal salivary function	0.8 ± 0.4	0.7 ± 0.4	0.83	0.411
Total Protective Score	4.3 ± 1.1	2.7 ± 1.4	4.92	0.001*

Figure 3: Protective Factor Scores by Screen Time Category



Protective factors, including brushing habits, parental supervision, use of fluoridated toothpaste, night-time brushing, drinking water after snacks, and normal salivary function, were higher among children with ≤ 2 hours/day screen exposure. The total protective score was significantly higher in the lower screen time group (4.3 ± 1.1) compared to the higher screen time group (2.7 ± 1.4 , $t = 4.92$, $p < 0.001$). Only fluoridated toothpaste use showed a borderline significant difference individually, highlighting its protective role.

Statistical Analysis:

Data was analyzed using IBM SPSS Statistics version 30. Descriptive statistics were calculated as mean $\pm$ SD for continuous variables and frequency (%) for categorical variables. Differences in total risk and protective scores between screen time groups were assessed using independent t-tests, while associations between screen time and CAMBRA risk categories were evaluated using the chi-square test. A p-value < 0.05 was considered statistically significant.

IV. Discussion:

The present study demonstrated a significant association between increased screen-based lifestyle behaviors and higher caries risk profiles assessed using CAMBRA among school-age children. Children with prolonged screen exposure were more likely to exhibit moderate- to high-risk CAMBRA scores, suggesting that excessive screen time may contribute to behaviors that increase susceptibility to dental caries. The findings are consistent with the study by Robin et al., which reported that higher screen exposure was associated with greater numbers of cavitated carious lesions and total caries, while frequent screen use during meals was associated with unhealthy dietary patterns.¹¹

Similar findings have also been reported among school children, wherein screen time of ≥ 2 hours was associated with significantly higher DMFT/deft scores, plaque scores, and gingival index scores.¹²

The relationship between screen time and caries risk may be explained by behavioral factors such as frequent snacking during screen use, irregular eating patterns, consumption of cariogenic foods and beverages, and reduced attention to oral hygiene. A systematic review by Mazarello Paes et al. reported that higher television viewing and total screen time were generally associated with increased consumption of potentially cariogenic foods, including energy-dense snacks and sugar-sweetened beverages.¹³ Similarly, Robin et al. observed a significant association between meals consumed while watching screens and cavitated carious lesions, as well as an association between higher screen time and poorer tooth-brushing practices.¹¹ In the present study, these behavioral factors may have contributed to higher CAMBRA risk scores by increasing disease indicators and reducing protective factors against dental caries. These findings suggest that a substantial proportion of the study population already exhibits early signs of dental caries, emphasizing the importance of early preventive measures (Table1).

An important strength of the present study is the use of the Caries Management by Risk Assessment (CAMBRA) model, which evaluates multiple disease indicators, risk factors, and protective factors rather than relying solely on existing caries experience.¹⁴

The CAMBRA approach was developed to identify patients according to their individual caries risk and to guide individualized preventive and therapeutic management.¹⁵ Evidence supporting CAMBRA has demonstrated a relationship between CAMBRA risk categories and subsequent development of cavitation or dental lesions.¹⁴ Therefore, the findings of the present study suggest that screen-based lifestyle behaviors may represent an important behavioral component that should be considered during comprehensive pediatric caries risk assessment (Table 2). This indicates a strong association between excessive screen time and behaviors that increase the risk of dental caries. Mouth breathing did not show a statistically significant difference between the groups.

From a clinical perspective, pediatric dentists should consider incorporating counseling regarding appropriate screen-time practices, avoidance of screen use during meals, healthy dietary choices, regular tooth brushing, and parental supervision into preventive dental care. Such an approach is consistent with the CAMBRA philosophy of addressing modifiable risk factors and strengthening protective factors as part of individualized caries management.¹⁵

Despite these findings, the study has certain limitations. Its cross-sectional design does not permit causal inference, and the use of parent-reported questionnaires may have introduced recall bias.¹⁶ Additionally, factors such as socioeconomic status, parental education, fluoride exposure, and access to dental care were not fully evaluated. Future longitudinal studies with larger sample sizes are recommended to further clarify the relationship between screen-based behaviors and caries risk. Overall, the present findings emphasize the importance of limiting excessive screen time and promoting healthy lifestyle habits to reduce caries risk among school-age children.¹⁷ This suggests that excessive screen time negatively impacts oral hygiene practices, possibly due to reduced parental monitoring or irregular routines (Table 3).

V. Conclusion:

The study demonstrates that excessive screen time in school-age children is significantly associated with higher caries risk. Children with longer screen exposure exhibited more behavioral risk factors, poorer protective oral hygiene practices, and a higher proportion of CAMBRA high-risk categorization. Limiting screen time, especially during meals, and ensuring parental supervision of dietary and oral hygiene habits are essential for effective caries prevention.

The CAMBRA approach provides a structured, risk-based framework to identify high-risk children and implement targeted preventive interventions such as fluoride therapy and antibacterial measures.

CONFLICT OF INTEREST

No conflicts of interest .

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