JHWCR JOURNAL OF HEALTH, WELLNESS AND COMMUNITY RESEARCH 3007-0570

https://doi.org/10.61919/pbjver64

Original Article

Dietary Habits and Their Impact on Oral Health Among Government School Children in Hyderabad: A Cross-Sectional Study

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"Cite this Article" Received: 23 March 2026; **Accepted**: 12 June 2026; **Published**: 03 July 2026

Author Contributions: Concept: UK, AU, RP; Design: MTKK, SFZ, MA, MB; Data Collection: UK, AU, SFZ, MA; Analysis: RP, MTKK, MB; Drafting: UK, AU, MB. **Ethical Approval**: Liaquat University of Medical and Health Sciences, Jamshoro, Sindh, Pakistan. **Informed Consent**: Written informed consent was obtained from the guardian of the participants; **Conflict of Interest**: The authors declare no conflict of interest. **Funding**: No external funding; **Data Availability**: Available from the corresponding author on reasonable request; **Acknowledgments**: NA

ABSTRACT

Background: Dietary habits and oral hygiene practices are important determinants of oral health among school-aged children. Frequent intake of sugary foods, inadequate brushing practices, and limited preventive dental care may contribute to dental caries and other oral health problems, particularly in government school settings where access to preventive services may be limited. Objective: To assess dietary habits among government school children in Hyderabad, Sindh, Pakistan, and determine their association with oral health complaints and clinical oral findings. Methods: A cross-sectional observational study was conducted among 387 students aged 5–18 years at Government Naval Rai Hiranand High School, Hyderabad. Data were collected using a structured questionnaire covering demographic characteristics, dietary practices, oral hygiene behaviors, dental history, and oral habits, followed by clinical oral examination. Descriptive statistics were calculated, and chi-square tests were used to assess associations between selected behavioral and dietary factors and oral health outcomes. Results: The mean age was 12.76 ± 3.46 years, and 242 participants (62.5%) were male. Most children brushed their teeth (89.7%), but only 38.3% of brushers reported twice-daily brushing, and 76.2% had never visited a dentist. Daily sweet intake was reported by 35.7%, while 40.6% always consumed sugary snacks between meals. Decayed teeth were observed in 49.9% of participants. Brushing habit was significantly associated with decayed teeth ($\chi^2 = 8.156$, $p = 0.004$), as was sweet intake frequency ($\chi^2 = 6.460$, $p = 0.040$). Gender was significantly associated with oral complaints ($\chi^2 = 4.619$, $p = 0.032$). Conclusion: Government school children in Hyderabad showed a high burden of dental caries and limited preventive dental care utilization. Sweet intake and brushing behavior were significantly associated with decayed teeth, supporting the need for school-based oral health education, dietary counseling, dental screening, and preventive care programs. Keywords: Oral Health; Dental Caries; Diet; Feeding Behavior; School Children; Oral Hygiene; Cross-Sectional Studies; Pakistan.

INTRODUCTION

Oral health is an essential component of general health and quality of life, particularly among school-aged children, in whom untreated oral disease can affect eating, speech, school attendance, self-confidence, and daily functioning. Globally, oral diseases remain highly prevalent, and children represent a vulnerable population because their dietary choices, oral hygiene practices, access to preventive dental care, and parental guidance collectively influence oral health outcomes. Dental caries is among the most common preventable oral conditions in childhood and is strongly shaped by behavioral and environmental exposures, including inadequate tooth brushing, cariogenic dietary intake, socioeconomic conditions, fluoride exposure, parental education, dental service utilization, and broader demographic and cultural factors (1,2).

Dietary behavior has a central role in oral health because frequent intake of fermentable carbohydrates and sugar-containing foods increases the risk of enamel demineralization when oral hygiene and salivary buffering are insufficient. Children commonly consume sweetened snacks, confectionery items, and soft drinks between meals, and repeated exposure to these foods creates a favorable environment for cariogenic bacterial activity. International recommendations emphasize limiting free sugar intake because high consumption of simple sugars is associated with dental caries and other adverse health outcomes. In addition, poor oral hygiene practices, including irregular brushing and inadequate plaque control, further increase caries risk by allowing sustained bacterial biofilm accumulation on tooth surfaces (3–5).

In Pakistan, changing dietary patterns, increasing availability of processed sugary foods, and limited preventive dental service utilization have contributed to oral health concerns among children and adolescents. Evidence from urban and semi-urban settings suggests that poor oral hygiene awareness, infrequent dental visits, and high sugar exposure are common among school-aged populations. However, oral health outcomes are not determined by diet alone; nutritional status, salivary function, oral hygiene behavior, and harmful oral habits may also influence disease patterns. Malnutrition and reduced salivary flow may compromise protective oral mechanisms, while frequent use of sweetened beverages and other cariogenic foods may further increase susceptibility to dental caries, especially where preventive care is limited (6–9).

Hyderabad is one of the major urban centers of Sindh, Pakistan, with diverse socioeconomic and dietary patterns among school-going children. Despite the recognized relationship between sugar exposure, oral hygiene behavior, and dental caries, limited school-based evidence is available from government school settings in Hyderabad. This gap is important because children in government schools may differ from private-school populations in socioeconomic background, dietary access, oral health awareness, and utilization of preventive dental services. Locally generated evidence is therefore needed to guide school-based oral health education, dietary counseling, preventive screening, and public health planning.

Therefore, this study aimed to assess dietary habits among government school children in Hyderabad, Sindh, Pakistan, and to determine their association with oral health complaints and clinical oral findings. The study specifically examined oral hygiene practices, sweet consumption, between-meal sugary snacking, selected oral habits, self-reported oral complaints, and clinically observed oral findings among school children aged 5–18 years.

MATERIAL AND METHODS

This cross-sectional observational study was conducted at Government Naval Rai Hiranand High School, Hyderabad, Pakistan, over a period of four to six months. The cross-sectional design was selected because it allowed assessment of dietary habits, oral hygiene practices, oral complaints, and clinical oral findings at a single point in time within a defined school-based population. The target population comprised primary and secondary school students aged 5–18 years enrolled at the selected government school. Students present on the day of data collection and willing to participate were included. Students with severe systemic illness or physical disability preventing oral examination, those absent on the day of data collection, those who declined participation, and those with incomplete questionnaire responses were excluded from the final analysis.

Participants were selected using a non-probability convenience sampling approach. Before data collection, eligible students were informed about the purpose of the study, voluntary nature of participation, confidentiality of responses, and right to withdraw at any stage without penalty. The final analyzed sample consisted of 387 students. The required sample size was calculated as 380 participants using the standard formula for prevalence studies at a 95% confidence level and 5% margin of error, and the final sample exceeded the minimum calculated requirement (10).

Data were collected in person using a structured questionnaire followed by clinical oral examination. The questionnaire included demographic characteristics, medical history, dental history, oral hygiene practices, dietary habits, selected oral habits, and self-reported oral complaints. Demographic variables included age and gender. Oral hygiene variables included brushing habit, brushing frequency, mouthwash use, and dental visit frequency. Dietary variables included frequency of sweet or chocolate intake and between-meal sugary snacking. Oral habit variables included paan, naswar, or chalia use, bruxism, and lip or cheek biting. Self-reported oral complaints included gum bleeding, toothache, tooth sensitivity, and related oral symptoms recorded through participant responses.

Clinical oral examination was performed after questionnaire completion using standardized procedures consistent with oral health assessment principles. Oral health status was assessed through direct clinical evaluation of oral hygiene condition and visible oral findings. The main clinical outcome was the presence of decayed teeth, recorded as a binary finding based on clinical observation. Additional clinical findings included plaque, calculus, staining, and missing teeth. For analysis, oral complaints were treated as a self-reported outcome, while decayed teeth and other visible findings were treated as clinically assessed outcomes. Brushing habit was categorized as yes or no, brushing frequency was categorized among students who brushed, sweet intake was categorized as daily, sometimes, or rarely, and between-meal sugary snacking was categorized as always, occasionally, or never.

To reduce information bias, data were collected using a uniform questionnaire format for all participants, and clinical findings were recorded immediately after oral examination. Incomplete questionnaire responses were excluded from the final dataset. Data were entered and organized using Microsoft Excel, and statistical analysis was performed using Statistical Package for the Social Sciences version 26. Descriptive statistics were calculated for all variables. Frequencies and percentages were used for categorical variables, while mean and standard deviation were used for continuous variables such as age. Associations between dietary or behavioral variables and oral health outcomes were assessed using the chi-square test. Statistical significance was set at $p < 0.05$. The primary bivariate associations assessed included brushing habit with decayed teeth, sweet or chocolate intake frequency with decayed teeth, gender with oral complaints, between-meal sugary snacking with oral complaints, sweet or chocolate intake frequency with oral complaints, and paan, naswar, or chalia use with oral complaints.

All data were handled confidentially and used only for research purposes. Participant anonymity was maintained during data entry, analysis, and reporting. The study followed ethical principles for research involving human participants, including voluntary participation, privacy, confidentiality, and respect for participant autonomy, in accordance with established human research ethics principles (11)

RESULTS

A total of 387 government school children were included in the final analysis. The mean age of participants was 12.76 ± 3.46 years, with an age range of 5–18 years. Males constituted 242 participants (62.5%), while females constituted 145 participants (37.5%). The largest reported age category was 11–13 years, comprising 143 participants (36.9%), followed by 14–16 years with 139 participants (35.9%). The reported age-group frequencies accounted for 376 participants; therefore, age-group classification for 11 participants was not identifiable from the supplied manuscript data.

Table 1. Demographic Characteristics of Participants (N = 387)

Variable	Category	n	%
Age, years	Mean ± SD	12.76 ± 3.46	—
Age range, years	Minimum–maximum	5–18	—
Gender	Male	242	62.5
	Female	145	37.5
Age group, years	≤10	74	19.1
	11–13	143	36.9
	14–16	139	35.9

Variable	Category	n	%
	≥17	20	5.2
	Not identifiable from supplied data	11	2.8

SD: standard deviation. The age-group frequencies reported in the manuscript summed to 376; therefore, 11 participants were retained as not identifiable from the supplied age-group data.

The sample was predominantly male, with nearly two-thirds of participants being boys. Most participants were in early to mid-adolescence, particularly the 11–13-year and 14–16-year age groups. Because the age-group frequencies did not sum to the total sample, the age-category distribution should be verified against the original dataset before final submission.

Table 2. Oral Hygiene and Dental Care Practices Among Participants

Variable	Category	Denominator	n	%
Brushing habit	Yes	387	347	89.7
	No	387	40	10.3
Brushing frequency	Once daily	347	163	47.0
	Twice daily	347	133	38.3
	Occasionally/weekly	347	51	14.7
Mouthwash use	Never	387	349	90.2
	Occasionally/daily	387	38	9.8
Dental visit frequency	Never	387	295	76.2
	Occasionally	387	54	14.0
	Once a year	387	24	6.2
	Within last 6 months	387	14	3.6

Most participants reported brushing their teeth; however, fewer than half of those who brushed reported twice-daily brushing. Preventive dental care utilization was low, as 295 children (76.2%) had never visited a dentist and only 14 children (3.6%) reported a dental visit within the last 6 months. Mouthwash use was also uncommon, with 349 participants (90.2%) reporting never using mouthwash.

Table 3. Dietary and Oral Habit Characteristics of Participants

Variable	Category	Denominator	n	%
Sweet/chocolate intake	Daily	387	138	35.7
	Sometimes	387	179	46.3
	Rarely	387	70	18.1
Between-meal sugary snacking	Always	387	157	40.6
	Occasionally	387	184	47.5
	Never	387	46	11.9
Paan/naswar/chalia use	Yes	387	105	27.1
Bruxism	Yes	387	58	15.0
Lip/cheek biting	Yes	387	38	9.8

Sweet consumption and between-meal sugary snacking were common among participants. Daily sweet or chocolate intake was reported by 138 children (35.7%), while 157 children (40.6%) reported always consuming sugary snacks between meals. Paan, naswar, or chalia use was reported by 105 children (27.1%), which represents a clinically important oral habit exposure in this school-aged population.

Table 4. Self-Reported Oral Complaints and Clinical Oral Findings

Variable Type	Finding	Denominator	n	%
Self-reported oral complaint	Gum bleeding	387	90	23.3
Self-reported oral complaint	Toothache	387	88	22.7
Self-reported oral complaint	Tooth sensitivity	387	88	22.7
Clinical oral finding	Decayed teeth	387	193	49.9
Clinical oral finding	Plaque/calculus/staining	387	53	13.7
Clinical oral finding	Missing teeth	387	36	9.3

Frequencies for oral complaints and clinical findings were calculated from the reported percentages and total sample size where exact numerators were not separately provided in the manuscript. These numerators should be verified against the original dataset before submission.

Decayed teeth represented the most frequent clinical oral finding and were observed in approximately half of the sample. Gum bleeding, toothache, and tooth sensitivity were the most commonly reported oral complaints, each affecting approximately one-fifth to one-quarter of participants. The high frequency of decayed teeth, alongside low dental visit utilization and frequent sugar exposure, indicates a substantial burden of preventable oral health problems in this school population.

Table 5. Chi-Square Analysis of Associations Between Behavioral, Dietary, and Demographic Factors and Oral Health Outcomes

Predictor Variable	Outcome Variable	χ^2	df	p-value
Brushing habit	Decayed teeth	8.156	1	0.004
Sweet/chocolate intake frequency	Decayed teeth	6.460	2	0.040
Gender	Oral complaints present	4.619	1	0.032
Between-meal sugary snacking	Oral complaints present	2.298	2	0.317
Sweet/chocolate intake frequency	Oral complaints present	1.050	2	0.591
Paan/naswar/chalia use	Oral complaints present	1.658	1	0.198

χ^2: chi-square statistic; df: degrees of freedom. Statistical significance was assessed at $p < 0.05$.

Brushing habit showed a statistically significant association with decayed teeth, indicating that tooth-brushing behavior differed meaningfully according to caries status. Sweet or chocolate intake frequency was also significantly associated with decayed teeth, supporting the relevance of dietary sugar exposure in the observed oral health pattern. Gender was significantly associated with the presence of oral complaints. Between-meal sugary snacking, sweet or chocolate intake frequency, and paan/naswar/chalia use were not statistically associated with oral complaints in the supplied bivariate analyses; however, these findings should be interpreted cautiously because the analysis did not include adjusted estimates or detailed cross-tabulated distributions.

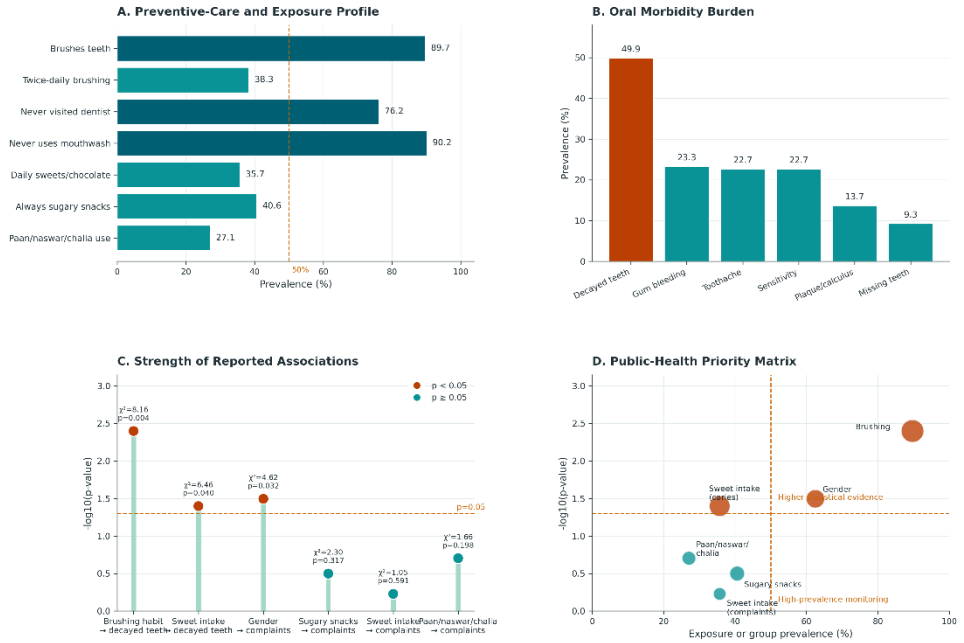

Figure 1. Dietary, hygiene, and oral health patterns among government school children in Hyderabad. Panel A shows the distribution of preventive-care practices and dietary/oral exposures. Panel B summarizes the prevalence of self-reported oral complaints and clinical oral findings. Panel C presents the strength of reported bivariate associations using −log10 p-values, with the dashed reference line indicating p = 0.05. Panel D integrates exposure prevalence with statistical evidence to identify public-health priority areas. The strongest reported association was observed between brushing habit and decayed teeth ($\chi^2 = 8.156$, $p = 0.004$), followed by sweet intake and decayed teeth ($\chi^2 = 6.460$, $p = 0.040$), while decayed teeth affected 49.9% of the sample and 76.2% of children had never visited a dentist.

DISCUSSION

This study identified a substantial burden of oral health problems among government school children in Hyderabad, with decayed teeth observed in nearly half of the participants. Although most children

reported brushing their teeth, fewer than half of the brushers reported twice-daily brushing, and preventive dental care utilization was low, as more than three-quarters of the participants had never visited a dentist. Frequent dietary sugar exposure was also common, with more than one-third of children reporting daily sweet or chocolate intake and more than two-fifths reporting regular between-meal sugary snacking. These findings indicate that oral health risk in this school-based population is shaped by the combined presence of high sugar exposure, incomplete preventive hygiene practices, and limited use of dental services rather than by a single behavioral factor alone.

The prevalence of decayed teeth in this study was 49.9%, which reflects a considerable burden of dental caries among school-aged children. This finding is consistent with previous evidence from Pakistani school populations showing that dental decay remains common among children attending government or socioeconomically constrained school settings (12). Some regional studies have reported even higher caries prevalence among toddlers and adolescents in Sindh and Balochistan, suggesting that disease burden may vary according to age group, geographic setting, socioeconomic profile, diagnostic criteria, and access to preventive dental care (13). The present findings therefore support the need for locally targeted school oral health programs in Hyderabad, while also indicating that single-school data should be interpreted cautiously when estimating broader citywide or provincial prevalence.

Brushing habit showed a statistically significant association with decayed teeth in the present study. This finding is biologically plausible because inadequate brushing may allow plaque accumulation and sustained bacterial activity on tooth surfaces, increasing the likelihood of enamel demineralization and caries formation. Although 89.7% of participants reported brushing, only 38.3% of brushers reported brushing twice daily, indicating that the presence of brushing as a habit does not necessarily reflect optimal oral hygiene practice. Previous studies have similarly emphasized that brushing frequency, quality of brushing, fluoride exposure, and oral hygiene awareness are important determinants of oral health status in children and adolescents (14). These findings suggest that school-based oral health promotion should focus not only on encouraging children to brush, but also on improving brushing frequency, technique, supervision, and awareness of preventive dental care.

Sweet or chocolate intake frequency was also significantly associated with decayed teeth. This association is consistent with the established role of dietary sugar in caries development, where frequent exposure to fermentable carbohydrates promotes acid production by cariogenic bacteria and reduces the opportunity for salivary buffering and enamel remineralization (15,16). In the present study, 35.7% of children consumed sweets or chocolates daily, while 40.6% reported always consuming sugary snacks between meals. Even though between-meal sugary snacking was not statistically associated with oral complaints in the reported bivariate analysis, the high prevalence of this behavior remains clinically relevant because repeated sugar exposure is a recognized risk factor for dental caries. The non-significant association with oral complaints may reflect the use of self-reported symptoms rather than clinical caries as the outcome, limited statistical power within categories, or the absence of adjusted analysis.

Gender was significantly associated with oral complaints, with males showing a higher reported prevalence in the supplied manuscript. This finding should be interpreted cautiously because the analysis did not provide gender-specific complaint counts or adjusted estimates. Differences in oral complaints by gender may be influenced by oral hygiene practices, dietary habits, dental care-seeking behavior, reporting patterns, or exposure to harmful oral habits. Previous evidence has suggested that oral hygiene awareness and preventive dental behavior may differ between males and females, but such differences are context-specific and should not be interpreted as inherent behavioral traits (17). Future studies should examine whether gender differences persist after adjustment for age, brushing frequency, sweet intake, dental visit history, and socioeconomic background.

The reported use of paan, naswar, or chalia by 27.1% of school children is an important public health concern. Although this habit was not statistically associated with oral complaints in the present bivariate

analysis, lack of statistical significance does not imply absence of harm. These substances are associated with adverse oral health consequences, mucosal irritation, staining, periodontal problems, and longer-term oral disease risks. The observed prevalence among school-aged children suggests a need for preventive counseling, parental awareness, and school-level monitoring. Because the present study did not provide detailed information on frequency, duration, age of initiation, or type of product used, further research is needed to understand the extent and clinical consequences of these exposures in this population.(18,19,20)

The findings have practical implications for school health services in Hyderabad and similar urban government school settings. Oral health interventions should combine dietary counseling, supervised tooth-brushing education, awareness sessions for teachers and parents, and periodic dental screening camps. The high proportion of children who had never visited a dentist indicates that preventive services are either unavailable, underutilized, or not perceived as necessary until symptoms develop. School-based screening may therefore be a feasible strategy to identify children with untreated decay, gum bleeding, toothache, or sensitivity and refer them for timely dental care. Educational interventions should also address frequent sweet consumption and between-meal sugary snacking, particularly because dietary behaviors established during childhood may continue into adolescence and adulthood.

This study has several limitations. First, the cross-sectional design allows assessment of associations but does not establish temporality or causality. Second, participants were selected from a single government school using convenience sampling, which limits generalizability to all school children in Hyderabad, private school populations, rural areas, or other provinces. Third, dietary habits, oral complaints, and oral habits were self-reported, which may introduce recall bias and social desirability bias, particularly among younger children. Fourth, the manuscript did not include socioeconomic status, parental education, fluoride exposure, detailed dietary frequency, or parental oral health knowledge, all of which may influence oral health outcomes. Fifth, the reported analysis was limited to bivariate chi-square testing and did not include adjusted models to account for potential confounding. Finally, detailed examiner calibration and standardized diagnostic indices such as DMFT/dmft were not reported, which may affect comparability with other studies. Despite these limitations, the study provides useful preliminary evidence on oral health burden and associated behavioral factors among government school children in Hyderabad.

CONCLUSION

This study demonstrated a considerable burden of oral health problems among government school children in Hyderabad, with nearly half of the participants presenting with decayed teeth and many reporting gum bleeding, toothache, or tooth sensitivity. Frequent sweet consumption and tooth-brushing behavior were significantly associated with decayed teeth, while gender was associated with oral complaints; however, these findings should be interpreted as associations because of the cross-sectional design. The low frequency of preventive dental visits, high exposure to sugary foods, and reported use of paan, naswar, or chalia among school children highlight the need for school-based oral health education, dietary counseling, periodic dental screening, and referral pathways for preventive and restorative dental care. Further multicenter studies using standardized oral health indices, socioeconomic variables, parental factors, and adjusted statistical models are recommended to better define the determinants of oral health among school-aged children in Pakistan.

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