

Determinants of knowledge, attitude, and practice regarding oral hygiene and sugar consumption among adolescents: A cross-sectional analysis

Arunima Aich *

Department of Public Health and Informatics, Jahangirnagar University, Dhaka, Bangladesh.

International Journal of Biological and Pharmaceutical Sciences Archive, 2026, 12(01), 089–099

Publication history: Received on 30 June 2026; revised on 06 August 2026; accepted on 10 August 2026

Article DOI: <https://doi.org/10.53771/ijbpsa.2026.12.1.0070>

Abstract

Oral diseases are prevalent preventable non-communicable diseases, and adolescence is a vital era for the establishment of dental hygiene and eating habits. The present study investigated the knowledge, attitude and practices (KAP) about dental hygiene and sugar intake among school going teenagers in a largely rural area. A school-based cross-sectional analytical study was carried out among 423 adolescents from one public and one private secondary school. Data were obtained using a structured self-administered questionnaire that included sociodemographic factors, oral-health knowledge, attitude, oral hygiene practices and sugar consuming behavior. Composite scores were calculated and classified into adequate knowledge, positive attitude, good practice and high sugar consumption. The data were analyzed using descriptive statistics, reliability analysis, chi-square, multivariable logistic regression and multicollinearity testing. The results revealed that 71.2% of the participants had acceptable knowledge, 55.1% had favorable attitudes, 80.3% had good dental hygiene practice, and 75.7% indicated high sugar consumption. Higher maternal education was an independent predictor of adequate knowledge. Female gender and rural residency were predictors of positive attitude. Number of siblings was an independent predictor of excessive sugar consumption. After correction, no sociodemographic characteristic was an independent predictor of good practice. The study found rather good awareness and cleanliness habits stated, but increased sugar consumption continued to be a key behavioral problem. Interventions at school and family level should target dental hygiene and nutritional risk behaviors.

Keywords: Oral Hygiene; Adolescents; KAP; Sugar Consumption; Dental Caries; Rural Health; Maternal Education.

1. Introduction

Oral disorders are still relatively widespread worldwide in children and adolescents, while oral health is of great importance for general health (WHO, 2022). Modifiable behaviors such inadequate fluoride exposure, frequent sugar consumption, infrequent dental visits and poor brushing are substantially related with dental caries, gingival inflammation, plaque accumulation and other avoidable oral illnesses (WHO, 2025a). It is particularly important in promoting oral health, as food preferences, sanitary practices, peer pressure and health-related self-care habits are typically acquired throughout adolescence (Taheri et al., 2025). Poor oral hygiene among adolescents may lead to dental plaque, gingival problems, dental cavities, discomfort, eating difficulties, school absences and a worse quality of life (WHO, 2025a). Sugar consumption is a significant behavioral risk factor for dental caries in adolescents (WHO, 2025b). Free sugars and sugar-sweetened beverages increase the risk of caries providing fermentable carbohydrates that oral bacteria metabolize into acids that lead to demineralization of tooth enamel (Valenzuela et al., 2021). A systematic review and meta-analysis showed that higher consumption of sugar-sweetened beverages is associated with higher risk of dental caries and dental erosion, and there is a dose-response relationship between level of consumption and oral-health outcomes (Valenzuela et al., 2021). Thus, the regular consumption of sweets, soft drinks, packaged juices and other cariogenic foods is a major issue in studies of adolescent oral-health behavior (Jagtiani et al., 2024). Knowledge,

* Corresponding author: Arunima Aich

attitude and practice are widely used public-health constructs to understand oral-health behavior among school-going adolescents (Rajbhandari & Aryal, 2024). Adolescents' knowledge refers to their awareness of oral hygiene, sugar-related risks, brushing frequency, fluoride use, and dental care needs (Opoku et al., 2024). Attitude refers to belief, motivation, perceived importance and willingness to maintain oral hygiene and reduce harmful dietary habits (M et al., 2024). Practice refers to the actual behaviors, such as frequency of brushing, use of toothpaste with fluoride, mouth rinsing, visits to the dentist, and control over the consumption of sugary foods or drinks (Geda et al., 2025). Preventable risk factors include oral hygiene and sugar intake. Adolescent oral-health behavior is not homogenous across populations and settings (WHO, 2022). Many studies available address oral hygiene or dietary sugar separately, but fewer studies examine the influence of demographic and behavioral determinants on knowledge, attitudes and practices regarding oral hygiene and sugar consumption (Valenzuela et al., 2021). Cross-sectional study is useful in assessing the level of knowledge, attitude and practice of adolescents and associated factors at a point in time in the defined population (Rajbhandari & Aryal, 2024). This study therefore aims to evaluate the determinants of knowledge, attitude and practice regarding oral hygiene and sugar consumption among adolescents using a cross-sectional design (Geda et al., 2025).

The primary aim of this study is to determine the levels and factors that influence teenagers' knowledge, attitudes, and practices around sugar consumption and dental hygiene in a primarily rural environment.

2. Literature Review

2.1. Oral Health as a Global Public Health Concern

Oral health is an integral part of general health. Tooth and gum problems can affect daily activities such as eating and talking. Tooth decay, gum disease and oral infections are common all throughout the world. According to World Health Organization (2022) oral problems affect billions of people worldwide. These disorders are still a major threat to public health while being preventable. According to the Global Oral Health Status Report, oral issues are disproportionately affecting disadvantaged people, particularly in low- and middle-income countries (LMICs) with limited preventive services and structured oral health programs (WHO, 2022a). Oral issues are associated with unhealthy diets, increased consumption of free sugars, tobacco use and socioeconomic inequalities (Watt et al., 2019). Oral health promotion should be part of general public health policies.

2.2. Global Burden of Oral Diseases

Oral diseases are a major global health issue that need systemic preventative approaches rather than individual treatments (Peres et al., 2019). Dental caries in permanent teeth is one of the most common untreated disorders worldwide (GBD 2017 Oral Disorders Collaboration, 2020).

While there have been some gains in preventive dentistry, imbalances remain, especially in rural and socioeconomically disadvantaged communities. Socioeconomic imbalances have been associated with dental caries, especially in low- and middle-income countries (Soofi et al., 2021). The identification of contextual variables in specific geographic areas is necessary to address discrepancies in oral health behaviors among teenagers.

2.3. Sugar Consumption and Dental Caries

Frequent consumption of sugar is a key dietary risk factor for dental caries, as oral bacteria digest sugars to create acids that demineralize tooth enamel (World Health Organization, 2025). Sugar-sweetened beverages are particularly detrimental, as higher intake has been linked to increased risk of dental caries and tooth erosion among children and adolescents (Valenzuela et al., 2021). Recent evidence also reveals that free sugar intake is associated with a higher caries risk, making sugar reduction an important preventative strategy in oral-health promotion (Cheever et al., 2025). Thus, adolescents' knowledge and practices of sugary foods and drinks are crucial determinants to explain their oral-health behavior (Large et al., 2024).

2.4. Knowledge, Attitude, and Practice (KAP) Framework

The Knowledge, Attitude and Practice (KAP) model has been widely applied in oral-health research to assess adolescents' knowledge, attitudes and preventive behaviors on oral health (Alshloul, 2023). Here knowledge refers to awareness and understanding; attitude refers to beliefs and motivation; and practice refers to actual behaviors such as regular tooth brushing, dental visits, and control of sugary-food intake (Liu & Li, 2024). However, knowledge might not be translated into proper oral-health practice, as adolescent behavior might also be influenced by motivation, peer

influence, family supervision, and perceived ability to maintain healthy habits (Shitu et al., 2021). This gap is explained in the Theory of Planned Behavior (TPB), which indicates that the attitude, social pressure, and perceived behavioral control influence the students' intention to perform oral-hygiene behaviors regularly (Rajeh, 2022).

2.5. Social Determinants of Oral Health

Social determinants of oral health are the social, economic, family, school, and environmental conditions with a direct impact on adolescents' oral-health knowledge, attitude and daily practices (Shomuyiwa & Bridge, 2023). Low oral-health awareness, limited access to dental care, and fewer preventive resources at home may result in poor oral-health outcomes in adolescents from lower socioeconomic backgrounds (Alhassan et al., 2024). Parental education and rural residence have also been found to be important predictors of dental caries and oral-health inequality among children and adolescents (Monsalves et al., 2023). Hence, the knowledge of social determinants is essential to explain differences in oral-hygiene behavior and sugar-consumption practices among adolescents (Shomuyiwa & Bridge, 2023).

Previous oral-health studies have examined adolescent hygiene knowledge, brushing behavior, or dental-caries risk separately, but fewer studies have analyzed KAP and sugar consumption together in a rural setting. This study addresses this gap by examining knowledge, attitude, practice, and high sugar consumption as related but distinct outcomes and by identifying their independent sociodemographic predictors through multivariable logistic regression.

2.6. Research Questions

- What percentage of adolescents have adequate knowledge of oral hygiene?
- What percentage has positive attitudes concerning oral health?
- What proportion of people practice good oral hygiene habits?
- What fraction of people consume a lot of sugar?
- What sociodemographic characteristics are strongly connected with these outcomes?

2.7. Specific Objectives

- To evaluate the extent of adolescents' understanding of dental hygiene.
- To learn what they believe about oral hygiene.
- To determine how many of them brush and care for their teeth correctly.
- To determine how much sugary food and beverages they consume.
- Identify factors influencing oral hygiene and sugar intake.

3. Methodology

A quantitative school based cross-sectional analytical design was used to assess knowledge, attitude, practice and sugar consumption regarding oral hygiene among adolescents. This design was appropriate as it allowed the measurement of outcome prevalence and the study of association between oral-health behaviors and sociodemographic variables at a specific point in time (Geda et al., 2025). The study took place in two secondary schools, one public and one private, in a predominantly rural area. The study population consisted of school going adolescents of selected grades. Eligible students were invited to participate if they were present during data collection and provided assent and parental or guardian consent. Students who were absent, did not wish to participate or did not complete the questionnaire were excluded. A school-based census sampling technique was used to include a total of 423 adolescents. Data collection was done using a structured self-administered questionnaire prepared in Bangla and English. The questionnaire consisted of sociodemographic information, oral-hygiene knowledge, attitude toward oral health, oral-hygiene practice, and sugar-consumption behavior. Similar questionnaire-based methods have been conducted in recent oral health KAP studies among school students (Rajbhandari & Aryal, 2024).

The dependent variables were good knowledge, positive attitude, good oral hygiene practice and high sugar consumption. Independent variables were age, gender, type of school, grade, place of residence, father's education, mother's education, family income and number of siblings. Knowledge was scored using six dichotomous items. Attitude was measured using Likert-scale items. Practice was measured using five oral hygiene behavior items. Sugar consumption was measured using three frequency-based items.

Data were entered and analyzed in R/RStudio. Descriptive statistics were used to provide an overview of participant characteristics and outcome distributions. Dichotomous knowledge scale was used, and KR-20 and Cronbach's alpha were used for attitude and practice scales. Chi-square tests were employed to investigate bivariate relationships. Binary

logistic regression was used to identify independent predictors. Adjusted odds ratio with 95% confidence intervals was reported. Multicollinearity among predictors was assessed using variance inflation factor.

4. Results and Analysis

4.1. Demographic Profile

This section presents the analysis of 423 adolescent respondents. The mean age of the participants was 13.9 years (SD=1.35 years) with a range from 10 to 17 years. Demographic results show the sample contained male and female students, students from public and private schools, and respondents from rural, suburban, and upgraded rural areas.

Table 1 Demographic Frequency Distribution

Category	Group	Frequency	Percent
Gender	Male	156	36.9
	Female	267	63.1
School type	Public	209	49.4
	Private	214	50.6
Class grade	Six	86	20.3
	Seven	164	38.8
	Nine	173	40.9
Residence	Urban/Upgraded rural	42	9.9
	Suburb	74	17.5
	Rural	307	72.6
Father's education	No schooling	49	11.6
	Primary	106	25.1
	Secondary	168	39.7
	Higher	100	23.6
Mother's education	No schooling	43	10.2
	Primary	115	27.2
	Secondary	190	44.9
	Higher	75	17.7

Females comprised the majority of the sample with 63.1% of respondents and males 36.9% (Table 1). The distribution of the school type was almost equal; 49.4% were from public school and 50.6% were from private school. The biggest class group was Class Nine at 40.9%, followed by Class Seven with 38.8% and Class Six with 20.3%. Distribution of residence showed that 72.6% of the participants resided in rural areas, which confirmed that the study sample was predominantly rural. Parental education was variable, although secondary education was the most common category for fathers and mothers. The demographic characteristics imply that the study was appropriate for studying oral health behaviour in a rural adolescent population (Table 1).

4.2. Distribution of Knowledge, Attitude, Practice, and Sugar Consumption

The distribution of knowledge, attitude, practice and sugar consumption showed that most of the adolescents had adequate knowledge of oral hygiene, 71.2% of them were described as knowledgeable. The majority of the respondents (>50%) had a positive attitude towards oral health, while 80.3% reported good oral hygiene practice. However, high sugar consumption was also common among the participants as 75.7% were classified as having high sugar intake. The

results showed that although the level of knowledge and reported hygiene practices were good, unhealthy dietary behavior continued to be a major concern.

Table 2 Distribution of Knowledge, Attitude, Practice, and Sugar Consumption

Outcome variable	Frequency	Percent
Adequate knowledge	301	71.2
Inadequate knowledge	122	28.8
Positive attitude	233	55.1
Negative attitude	190	44.9
Good oral hygiene practice	340	80.3
Poor oral hygiene practice	83	19.7
High sugar consumption	320	75.7
Low sugar consumption	103	24.3

Table 2 Adequate knowledge regarding oral hygiene was observed in 71.2% of the respondents. The majority of the adolescents were aware of the major issues related to oral health, such as brushing, damage to teeth caused by sugar, fluoride toothpaste and dental check-ups. However, 28.8% had inadequate knowledge which indicated the need of school based oral-health education.

The attitude results revealed that 55.1% of respondents had a positive attitude towards oral health and 44.9% had a negative attitude. The result of the practice showed that 80.3% of adolescents were classified as having good oral hygiene practice. Nevertheless, 75.7% of the participants reported high sugar consumption, which shows that dietary risk behavior was still prevalent among students with reasonable knowledge and self-reported hygiene practices (Table 2).

4.3. Reliability Analysis

Reliability analysis was done to assess the internal consistency of the knowledge, attitude and practice scales. The KR-20 of knowledge scale was 0.57 which showed moderate reliability for dichotomous items. The internal consistency of the attitude scale was acceptable (Cronbach's $\alpha=0.69$). However, the practice scale had a low reliability, with a Cronbach's α of 0.33, which may be due to the different types of behavior measured, including brushing frequency, fluoride toothpaste use, and dental visits.

Table 3 Reliability Analysis of Study Scales

Scale	Reliability test	Value	Interpretation
Knowledge	KR-20	0.57	Moderate internal consistency
Attitude	Cronbach's alpha	0.69	Acceptable internal consistency
Practice	Cronbach's alpha	0.33	Low internal consistency

The knowledge scale had a KR-20 value of 0.57, indicating moderate internal consistency. This is a reasonable value as the knowledge items covered a range of related but different areas such as toothbrushing, fluoride use, sugar damage, dental check-ups and symptom-free decay.

The Cronbach's α for the attitude scale was 0.69, which is acceptable for exploratory analysis. The internal consistency of the practice scale was lower with an α value of .33. The lower value might be explained by the multidimensional nature of oral hygiene practice as brushing frequency, night brushing, brushing duration, fluoride toothpaste use and dental visits do not necessarily coexist as one uniform behavior (Table 3).

4.4. Bivariate Analysis

Bivariate analysis was carried out to determine the relationship between sociodemographic factors and each of the outcome variables using the chi-square test. The analysis showed that gender, school type and mother's education were significantly associated with adequate knowledge. There was a significant relationship between positive attitude and gender, type of school, residence, and family income. Gender was the only variable that was significantly associated with good practice. High sugar consumption was significantly associated with gender, school type and number of siblings.

Table 4 Significant Bivariate Associations

Outcome	Associated variable	Key comparison	χ^2	df	P-value
Adequate knowledge	Gender	Female: 77.5% vs Male: 60.3%	13.483	1	<0.001
Adequate knowledge	School type	Private: 79.0% vs Public: 63.2%	12.125	1	<0.001
Adequate knowledge	Mother's education	Higher: 84.0% vs No schooling: 58.1%	9.870	3	0.020
Positive attitude	Gender	Female: 65.5% vs Male: 37.2%	30.881	1	<0.001
Positive attitude	School type	Private: 66.4% vs Public: 43.5%	21.331	1	<0.001
Positive attitude	Residence	Rural: 60.3%; Suburb: 44.6%; Urban: 35.7%	12.985	2	0.002
Positive attitude	Family income	Low/High: 59.6% vs Middle: 46.1%	6.899	2	0.032
Good practice	Gender	Female: 83.9% vs Male: 74.4%	5.089	1	0.024
High sugar consumption	Gender	Female: 82.4% vs Male: 64.1%	16.911	1	<0.001
High sugar consumption	School type	Private: 82.7% vs Public: 68.4%	10.957	1	<0.001
High sugar consumption	Number of siblings	3+: 81.6% vs 0-1: 65.0%	6.927	2	0.031

Table 4 shows significant bivariate associations. There was a significant association with adequate knowledge with gender, type of school and mother's education. Female and private school students had higher knowledge levels and adolescents with more educated mothers showed the strongest knowledge profile. Positive attitude was significantly associated with gender, type of school, place of residence and family income. Female students and students from private schools had more positive attitudes concerning oral hygiene. Students from rural areas also had a more positive attitude than students from suburban and upgraded rural areas. Bivariate analysis showed a significant association of good oral hygiene practice only with gender where females reported better practice than males. High sugar consumption was significantly associated with gender, type of school and number of siblings. Higher prevalence of high sugar consumption was found in female, private school students and adolescents with three or more siblings (Table 4)

4.5. Multivariable Logistic Regression Analysis

Table 5 Logistic Regression Results

Outcome	Predictor	AOR (95% CI)	P-value
Adequate knowledge	Female vs male	1.28 (0.82-1.99)	0.274
	Private school vs public	1.14 (0.74-1.75)	0.554
	Mother's higher education vs none	3.65 (1.10-12.06)	0.034
Positive attitude	Female vs male	2.69 (1.39-5.31)	0.004
	Private school vs public	1.48 (0.74-2.96)	0.265

	Rural vs urban/upgraded rural	2.72 (1.32-5.77)	0.007
Good practice	Female vs male	2.16 (0.51-14.32)	0.350
	Private school vs public	2.81 (0.35-22.94)	0.308
High sugar consumption	Female vs male	2.14 (1.01-4.84)	0.055
	Siblings	1.48 (1.13-1.96)	0.005

Maternal higher education was also a significant independent predictor of enough knowledge in the adjusted model. Adolescents with moms who had greater level of education were 3.65 times more likely to have adequate oral-health awareness than adolescents with no formal education of their mother. Findings indicate that maternal education might enhance adolescent health literacy via home communication, monitoring and exposure to preventive knowledge. The only statistically significant predictors of positive attitude were female gender and rural residence. The odds of reporting positive attitudes were 2.69 times greater for female students than for male students and 2.72 times greater for rural students than for students from urban and upgraded rural areas. These results suggest that attitude may be shaped by gender-related hygiene norms and local social context. None of the sociodemographic variables independently predicted good oral hygiene practice after adjustment. Female students and students from private schools had higher odds of good practice but the associations were not statistically significant. High prevalence of good practice was associated with wide confidence intervals, reducing precision of regression estimates. Only the number of siblings was a significant independent predictor of high sugar consumption. For every extra sibling, the probability of high sugar intake increased by 48%. This finding suggests that dietary risk behavior may be closely related to household size, shared snack access and the difficulty of monitoring dietary behavior in larger families (Table 5).

4.6. Multicollinearity Assessment

The Multicollinearity test was conducted using Variance Inflation Factor (VIF) to determine if there is a substantial association between the independent variables. All VIF readings were within the range of 1.059 to 1.848 which were less than the acceptable cut-off value of 5. This suggests that there is no severe multicollinearity among predictors. Thus, all discovered sociodemographic characteristics were retained in the multivariable logistic regression models.

Table 6 Multicollinearity Assessment Using VIF

Predictor	VIF
Age	1.848
School type	1.768
Gender	1.613
Class grade	1.449
Father's education	1.241
Mother's education	1.233
Residence	1.074
Family income	1.066
Number of siblings	1.059

The values of VIF are in the range of 1.059–1.848 indicating that there was not high correlation between the independent variables. As all values were below the customary threshold of 5 there was no indication of serious multicollinearity and all predictors were kept in the regression models (Table 6).

5. Discussion

The study indicated that oral-health behavior among teenagers in a predominantly rural educational context was mixed. Most kids had enough knowledge and acceptable reported oral hygiene habits but high sugar consumption was remained quite common. Thus, knowledge about oral health and appropriate brushing does not always result in healthy eating behavior.

The result that 71.2% of the students had appropriate knowledge indicates that many adolescents are already aware of the basic messages regarding oral hygiene. However, only 55.1% had a favorable attitude, which implies that education may not totally transform their motivation or worry about oral health. Other KAP research also suggest that oral-health behavior is influenced by gender, parental education, socioeconomic level, and attitude, not merely by knowledge (Islam et al., 2025). Adequate knowledge was predicted by maternal education. Students whose mothers had a higher education were more likely to have greater awareness about oral health. This might be because educated women can better counsel children on brushing, dental care and healthy food habits. In another study conducted in Bangladesh, mothers' education, family size and wealth were found to be strongly associated with oral-health knowledge and children's oral hygiene behaviors (Tamannur et al., 2025). Knowledge differences were less obvious than attitude differences. Female students showed a more positive attitude towards oral hygiene, although gender was not an independent predictor of knowledge. It implies that boys and girls may be given identical knowledge about oral health, but that girls may take oral hygiene more seriously or feel more motivated to keep it up. The effect of practice needs to be carefully explained. Although 80.3% of students were found to have good oral hygiene practice, no sociodemographic factor remained significant after adjustment. This could be because most students reported good practice and hence there were fewer students in the poor-practice group. Moreover, the low reliability of the practice scale implies that brushing frequency, brushing time, fluoride toothpaste use and dental visits are different behaviors and may not necessarily occur concurrently. The biggest worry in this study was high sugar consumption. Free sugar intake was high in 75.7% of teenagers, which is significant because free sugar is highly associated with dental caries. Indeed, a recent study indicated that higher free sugar intake was substantially connected with increased dental caries experience among children (Cheever et al., 2025). The high consumption of sugar despite sufficient knowledge is an obvious knowledge-behavior mismatch. Students may know that sugar is bad, yet they may nevertheless consume sugary snacks and sweet drinks because these foods are delicious, accessible, affordable and prevalent during school holidays. Recent data also reveals that oral hygiene practices, eating habits and sugar intake are closely associated to the risk of caries in children, adolescents and young adults (Iqbal et al., 2025). Number of siblings independently predicted excessive sugar intake. This means that larger families can have food-sharing patterns that improve access to packaged snacks and sweet drinks. Larger homes may also make it more difficult for parents to oversee the food choices of each child. So, sugar-reduction initiatives should involve family counselling, not just classroom-based information. The rural setting matters too. Rural teenagers may have reduced access to routine dental check-ups and organized oral-health education. At the same time sugary foods and drinks may be readily available around schools and local stores. Oral-health programs should, for this reason, integrate student education, parental involvement, school food regulations, and community awareness.

5.1. Public Health Implications

The findings imply that teenage oral-health promotion should include information upgrading, attitude development, practical behavior reinforcement and reduction of dietary risk. Oral-health instruction in schools should be on a regular basis rather than a one-off, and should include demonstrations of brushing technique, fluoride use and the effect of sugar on teeth.

Oral-health promotion should involve mothers and carers as maternal education was significantly associated with knowledge. Talking with parents helps reinforce brushing, dental appointments and sugar-control behaviors at home. Interventions that include families may be especially beneficial in the larger households where sugar intake was higher. School policies may include banning the sale and availability of sugar-sweetened beverages and highly processed snacks during school hours. Education alone, however, is unlikely to lead to persistent change as sugar consumption is influenced by environment and peer behavior. The school food environment must also support healthy choices. Oral health promotion should be integrated into adolescent health programmes by health authorities, especially in remote areas. Regular dental check-ups, referral services, teacher-led oral health classes and community initiatives can increase prevention and lessen the need for treatment if discomfort or disease occurs.

5.2. Strengths and Limitations

The study offers a number of strengths. It had a good sample size of 423 teenagers, covered both public and private schools, employed a structured questionnaire-based data collection method and looked at knowledge, attitude, practice and sugar consumption simultaneously. It also did bivariate and multivariable analysis and tested for multicollinearity among predictors.

The study is not without limits. The design is cross-sectional; hence no causal inference can be made. Self-reported data are prone to recall or social desirability bias. The investigation was conducted in one mostly rural locality restricting generalization to all adolescents. The practice scale's low internal consistency indicates that more refined and validated practice measures should be used in future studies.

6. Conclusions

The present investigation showed that majority of the teens had acceptable knowledge and satisfactory reported oral hygiene practice although the prevalence of high sugar consumption was significant. Female gender and rural residency were significant positive predictors of attitude while maternal education was a significant predictor of knowledge. Number of siblings was also independently associated with increased sugar consumption which indicates that household structure affects dietary behavior. The results indicate that raising awareness alone is not enough to improve the oral health of adolescents. Knowledge based education needs to be complemented with involvement of the family, regulation of school food environment, frequent dental screening and behavior orientated interventions. School, home, and public health efforts must be linked to reduce sugar-related dental risk and to enhance lifetime oral hygiene habits in largely rural settings.

Longitudinal studies are needed to determine whether knowledge and attitude influence later oral hygiene behavior and sugar consumption. Qualitative interviews with students, parents and instructors may also shed light on why adolescents continue to eat sugar despite knowledge of the oral-health dangers. Including urban, semi-urban and rural people in multi-site studies would enhance generalizability and allow for contextual comparison. School administrators should also check the availability of sweetened drinks, packaged snacks and high sugar items around the school premises. "Reducing the availability of sugar-rich foods, promoting water consumption and encouraging healthier alternatives may help to close the gap between knowledge and dietary behavior. Family participation is vital since maternal education was substantially correlated with teenage knowledge and number of siblings was associated with excessive sugar consumption. Messages for parents should include encouragement on supervision of brushing, management of sugary snacks at home, and healthier food choices on school days and family occasions. Based on the findings, oral-health education should be a part of the routine school health activities and not an occasional awareness programme. Schools should teach brushing technique, fluoride toothpaste use, dental check-ups and the hazards of frequent sugar intake through practical demonstrations, peer-led learning, posters and short classroom talks.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

- [1] Alhassan, A. I., Alghofaily, N. A., Alhassan, A. I., & Sr, N. A. A. (2024). The Impact of Facilitators' Competencies and Characteristics on Faculty Enhancement Activities in Saudi Arabia: A Mixed-Methods Research. *Cureus*, 16. <https://doi.org/10.7759/cureus.54650>
- [2] Alshloul, M. N. (2023). Oral Health Knowledge, Attitude, and Practice Among School Children in Abha-Saudi Arabia. *The Journal of School Nursing*, 39(4), 295–304. <https://doi.org/10.1177/10598405211012981>

- [3] Cheever, V. J., Mohajeri, A., Patel, K., Burris, R. C., & Hung, M. (2025). Impact of Free Sugar Consumption on Dental Caries: A Cross-Sectional Analysis of Children in the United States. *Dentistry Journal*, 13(2), 48. <https://doi.org/10.3390/dj13020048>
- [4] Geda, Z. T., Asefa, K. Z., Gonfa, A. N., & Assefa, M. (2025). Oral health-related knowledge, attitudes, and practices among high school students in Robe Town, Ethiopia: A cross-sectional study. *BMC Public Health*, 25(1), 3848. <https://doi.org/10.1186/s12889-025-25169-8>
- [5] Iqbal, A., Khattak, O., Siddiqui, Y. D., Almaeen, S. H., Alqahtani, S., Alqahtani, S. A., Hassan, S. A. B., Alshehri, F. H., Alsaed, A. Y., & AL-Omiri, M. K. (2025). Exploring oral hygiene practices, nutritional habits and caries risk among children, adolescents and young adults: A multiregional perspective in the post-COVID-19 era. *BMC Oral Health*, 25(1), 1224. <https://doi.org/10.1186/s12903-025-06540-y>
- [6] Jagtiani, P., Young, T., Ahmed, W., Devarajan, A., Hickman, Z. L., Jones, S., Jagtiani, P., Young, T., Ahmed, W., Devarajan, A., Hickman, Z. L., & Jones, S. (2024). Prevalence of Acute Alcohol Use in Traumatic Brain Injury Patients During the COVID-19 Pandemic: A Retrospective Analysis From Queens, New York. *Cureus*, 16. <https://doi.org/10.7759/cureus.58928>
- [7] Large, J. F., Madigan, C., Pradeilles, R., Markey, O., Boxer, B., & Rousham, E. K. (2024). Impact of unhealthy food and beverage consumption on children's risk of dental caries: A systematic review. *Nutrition Reviews*, 82(11), 1539–1555. <https://doi.org/10.1093/nutrit/nuad147>
- [8] Liu, D., & Li, H. (2024). Knowledge, attitude, and practice of adolescents and parents toward malocclusion and orthodontic treatment. *Scientific Reports*, 14(1), 26553. <https://doi.org/10.1038/s41598-024-77474-8>
- [9] M, J. B., Shyaka, G., & Ogendi, J. (2024). Knowledge, attitude and practices towards oral health among secondary school students in Huye district, Rwanda. *African Health Sciences*, 24(1), 250–261. <https://doi.org/10.4314/ahs.v24i1.30>
- [10] Monsalves, M. J., Espinoza, I., Moya, P., Aubert, J., Durán, D., Arteaga, O., Kaufman, J. S., & Bangdiwala, S. I. (2023). Structural determinants explain caries differences among preschool children in Chile's Metropolitan Region. *BMC Oral Health*, 23(1), 136. <https://doi.org/10.1186/s12903-023-02778-6>
- [11] Opoku, P., Salu, S., Azornu, C. K., & Komesuor, J. (2024). Oral health knowledge, practice and associated factors among Junior High School students of Koforidua, Ghana: A cross-sectional study. *BMC Oral Health*, 24(1), 449. <https://doi.org/10.1186/s12903-024-04148-2>
- [12] Peres, M. A., Macpherson, L. M. D., Weyant, R. J., Daly, B., Venturelli, R., Mathur, M. R., Listl, S., Celeste, R. K., Guarnizo-Herreño, C. C., Kearns, C., Benzian, H., Allison, P., & Watt, R. G. (2019). Oral diseases: A global public health challenge. *The Lancet*, 394(10194), 249–260. [https://doi.org/10.1016/S0140-6736\(19\)31146-8](https://doi.org/10.1016/S0140-6736(19)31146-8)
- [13] Rajbhandari, A., & Aryal, N. (2024). Assessment of knowledge, attitude and practice (KAP) on oral health among secondary-level students: A cross-sectional study in Kathmandu, Nepal. *BMJ Public Health*, 2(1). <https://doi.org/10.1136/bmjph-2023-000438>
- [14] Rajeh, M. T. (2022). Modeling the theory of planned behavior to predict adults' intentions to improve oral health behaviors. *BMC Public Health*, 22(1), 1391. <https://doi.org/10.1186/s12889-022-13796-4>
- [15] Shitu, K., Alemayehu, M., Buunk-Werkhoven, Y. A. B., & Handebo, S. (2021). Determinants of intention to improve oral hygiene behavior among students based on the theory of planned behavior: A structural equation modelling analysis. *PLOS ONE*, 16(2), e0247069. <https://doi.org/10.1371/journal.pone.0247069>
- [16] Shomuyiwa, D. O., & Bridge, G. (2023a). Oral health of adolescents in West Africa: Prioritizing its social determinants. *Global Health Research and Policy*, 8(1), 28. <https://doi.org/10.1186/s41256-023-00313-2>
- [17] Shomuyiwa, D. O., & Bridge, G. (2023b). Oral health of adolescents in West Africa: Prioritizing its social determinants. *Global Health Research and Policy*, 8(1), 28. <https://doi.org/10.1186/s41256-023-00313-2>
- [18] Soofi, M., Karami-Matin, B., Kazemi-Karyani, A., Soltani, S., Ameri, H., Moradi-Nazar, M., & Najafi, F. (2021). Socioeconomic Inequality in Dental Caries Experience Expressed by the Significant Caries Index: Cross-Sectional Results From the RaNCD Cohort Study. *International Dental Journal*, 71(2), 153–159. <https://doi.org/10.1111/idj.12612>
- [19] Taheri, A. M., Hidarnia, A., Zarei, F., & Tavousi, M. (2025). Investigating the relationships among oral health-related knowledge, attitude, practice, and self-efficacy in predicting oral health behaviors among female Iranian students. *Frontiers in Oral Health*, 6. <https://doi.org/10.3389/froh.2025.1533519>

- [20] Tamannur, T., Das, S. K., Nesa, A., Nahar, F., Nowshin, N., Binty, T. H., Shakil, S. A., Kundu, S. K., Siddik, M. A. B., Rafsun, S. M., Habiba, U., Farhana, Z., Sultana, H., Kamil, A. A., & Rahman, M. M. (2025). Mothers' Knowledge of and Practices Toward Oral Hygiene of Children Aged 5-9 Years in Bangladesh: Cross-Sectional Study. *JMIRx Med*, 6(1), e59379. <https://doi.org/10.2196/59379>
- [21] Valenzuela, M. J., Waterhouse, B., Aggarwal, V. R., Bloor, K., & Doran, T. (2021). Effect of sugar-sweetened beverages on oral health: A systematic review and meta-analysis. *European Journal of Public Health*, 31(1), 122–129. <https://doi.org/10.1093/eurpub/ckaa147>
- [22] Watt, R. G., Daly, B., Allison, P., Macpherson, L. M. D., Venturelli, R., Listl, S., Weyant, R. J., Mathur, M. R., Guarnizo-Herreño, C. C., Celeste, R. K., Peres, M. A., Kearns, C., & Benzian, H. (2019). Ending the neglect of global oral health: Time for radical action. *The Lancet*, 394(10194), 261–272. [https://doi.org/10.1016/S0140-6736\(19\)31133-X](https://doi.org/10.1016/S0140-6736(19)31133-X)
- [23] WHO. (2022). *Global oral health status report: Towards universal health coverage for oral health by 2030*. World Health Organization. <https://www.who.int/publications/i/item/9789240061484>
- [24] WHO. (2025a). *Oral health*. World Health Organization. <https://www.who.int/news-room/fact-sheets/detail/oral-health>
- [25] WHO. (2025b, August 14). *Sugars and dental caries*. World Health Organization. <https://www.who.int/news-room/fact-sheets/detail/sugars-and-dental-caries>