Volume 4, Issue 3, 2026

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

ASSESSMENT OF ORAL HYGIENE STATUS AND ASSOCIATED FACTORS AMONG UNDERGRADUATE UNIVERSITY STUDENTS: A CROSS-SECTIONAL STUDY

Nisar Ud Din[1], Hamza khan[2], Dr. Safi Ullah[3], Iqra Ameer[4], Mah Noor[5], Iqra Asif[6], Syed Muhammad Salman[*7]

[1,2]*Lecturer Dental Department, The University of Veterinary and Animal Sciences, Swat, KP, Pakistan*
[3]*B.Sc. Hons (Bacha Khan University), CHPE (Riphah University) DMD (Rokhan University) BS Dental Technology, Gomal University Dera Ismail Khan, KPK*
[4]*MPH Scholar Kabir Institutes of Public Health Gandhara University Peshawar Lecturer Dental* [5]*Department, Iqra National University Peshawar*
[6]*Lecturer Department of Dental Technology, Jebran College of Allied Health Science and Institute of Nursing Odigram, Swat*
[*7]*Lecturer Dental Department, The University of Veterinary and Animal Sciences, Swat, KP, Pakistan*

[1]nisar.uddin@uvasswat.edu.pk, [2]hk684859@gmail.com, [3]safiu7677@gmail.com, [4]iqraameer213@gmail.com, [5]mahnoor@inu.edu.pk, [6]iqraasif5858@gmail.com, [*7]sm.salman@uvasswat.edu.pk

DOI: https://doi.org/10.5281/zenodo.23364911

Keywords
Oral hygiene; OHI-S; undergraduate students; toothbrushing; oral hygiene practices; university students; cross-sectional study.

Article History
Received: 01 January 2026
Accepted: 17 March 2026
Published: 31 March 2026

Copyright @Author
Corresponding Author: *
Syed Muhammad Salman

Abstract

Background: *Oral hygiene is an important component of overall health, while inadequate oral hygiene practices may contribute to poor oral health outcomes. University students experience changes in lifestyle and health-related behaviors that may influence their oral hygiene status. This study assessed oral hygiene status and examined its association with oral hygiene practices and sociodemographic factors among undergraduate university students.*

Objective: *To assess oral hygiene status using the Simplified Oral Hygiene Index (OHI-S) and determine the association of oral hygiene practices and sociodemographic factors with oral hygiene status among undergraduate students.*

Methods: *A cross-sectional study was conducted among undergraduate students at IQRA National University–Swat Campus, Khyber Pakhtunkhwa, Pakistan, from February 2024 to July 2024. A sample of 306 students was selected from a population of 1,500 undergraduate students using simple random sampling. Students aged 18–25 years who met the eligibility criteria were included. Oral hygiene status was assessed using the Simplified Oral Hygiene Index (OHI-S), categorized as good, fair, or poor. Data regarding toothbrushing frequency, brushing duration, and use of oral hygiene aids were collected through a structured questionnaire. Data was analyzed using IBM SPSS Statistics version 25. Descriptive statistics, chi-square/Fisher's exact tests, and binary logistic regression were used. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated, and statistical significance was set at $p<0.05$.*

Results: *The mean age of participants was 21.41 ± 1.79 years. Of the 306 participants, 168 (54.9%) were male and 138 (45.1%) were female. Overall, 52 (17.0%) participants had good oral hygiene, 171 (55.9%) had fair oral*

Volume 4, Issue 3, 2026

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

hygiene, and 83 (27.1%) had poor oral hygiene. Toothbrushing frequency was significantly associated with oral hygiene status (χ^2=23.84, p<0.001), with mean OHI-S scores of 2.42 ± 0.98 among students brushing once daily, 1.86 ± 0.84 among those brushing twice daily, and 1.58 ± 0.71 among those brushing three or more times daily (p<0.001). Brushing duration was also significantly associated with oral hygiene status (χ^2=11.66, p=0.020), with higher mean OHI-S scores among students brushing for less than one minute (2.39 ± 0.99) compared with those brushing for 1–2 minutes (1.98 ± 0.88) or more than two minutes (1.76 ± 0.81; p=0.002). In adjusted logistic regression, male sex (adjusted OR=1.71, 95% CI: 1.02–2.86, p=0.041), age 24–25 years (adjusted OR=3.08, 95% CI: 1.39–6.84, p=0.006), brushing once daily (adjusted OR=2.56, 95% CI: 1.54–4.25, p<0.001), and brushing for less than one minute (adjusted OR=2.31, 95% CI: 1.36–3.92, p=0.002) were significantly associated with higher odds of poor oral hygiene.

Conclusion: *Fair and poor oral hygiene were common among the undergraduate students included in this study. Toothbrushing frequency and duration were significantly associated with oral hygiene status, while selected sociodemographic factors were also independently associated with poor oral hygiene. These findings highlight the need for targeted oral health education and promotion of appropriate toothbrushing practices among university students.*

1. INTRODUCTION

Oral health is an essential component of general health and well-being, influencing an individual's ability to eat, speak, socialize, and maintain an acceptable quality of life. Poor oral health is not limited to localized dental problems; it can contribute to pain, discomfort, functional limitations, impaired social interaction, and reduced academic and occupational performance. The World Health Organization (WHO) identifies oral diseases as among the most prevalent noncommunicable diseases worldwide, affecting approximately 3.5 billion people globally. Dental caries and periodontal diseases constitute major components of this burden, with a disproportionate impact on populations in low- and middle-income countries. Despite being largely preventable through appropriate personal hygiene, healthy dietary practices, tobacco avoidance, and access to preventive dental care, oral diseases continue to represent an important public-health challenge (1).

Oral hygiene is a fundamental determinant of oral health because inadequate removal of dental plaque promotes the development of gingival inflammation, dental caries, halitosis, and periodontal disease. Regular and effective toothbrushing is therefore an important preventive behavior. However, oral hygiene cannot be considered solely in terms of the frequency of toothbrushing. The effectiveness of brushing may also depend on brushing technique, duration, use of fluoride toothpaste, interdental cleaning, tongue cleaning, toothbrush replacement, dietary habits, and regular professional dental care. Evidence from young adults demonstrates that oral hygiene practices influence the microbial environment of the mouth, while interventions directed toward interdental cleaning can reduce periodontal pathogens and support periodontal health (2, 3).

University students represent an important population for oral-health assessment because the transition from adolescence to adulthood is accompanied by increasing independence in health-related decision-making. During university life, students often establish long-term personal habits concerning diet, hygiene, tobacco use, healthcare utilization, and other lifestyle behaviors. These behaviors may be influenced by academic workload, financial circumstances, social environment, living arrangements, health

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

knowledge, and accessibility of healthcare services. Consequently, university life provides an important period for identifying unfavorable oral-health behaviors before they become established and potentially contribute to chronic oral disease (3).

Evidence from university populations indicates that possessing basic knowledge about oral health does not necessarily translate into appropriate oral hygiene practices. Yao et al. reported that the oral-health knowledge, behaviors, and status of medical and dental undergraduate students were not uniformly satisfactory, demonstrating that even students receiving health-related education may have deficiencies in preventive oral-health practices. Their findings also suggested that academic exposure to oral-health education may influence knowledge and behaviors, but improvements in knowledge do not automatically ensure optimal oral-health status (4). Similarly, Ahmad et al. demonstrated an association between oral-health knowledge, attitudes, oral-hygiene practices, and periodontal status among dental students, emphasizing that knowledge, behavior, and clinically observed oral health are interconnected but distinct dimensions of oral health (5).

The frequency and quality of toothbrushing are particularly important components of oral hygiene. Although toothbrushing is widely recognized as a basic preventive behavior, students may brush less frequently than recommended or may use ineffective techniques. A systematic review of manual toothbrushing techniques found differences in their effectiveness for plaque control and gingival health, indicating that simply reporting whether an individual brushes their teeth may not adequately describe oral hygiene behavior (6). In university students, therefore, assessment should ideally consider not only brushing frequency but also brushing duration, technique, use of fluoride toothpaste, toothbrush replacement, and additional oral hygiene measures.

Interdental cleaning is another important but frequently neglected component of oral hygiene. Dental plaque can accumulate in interdental areas that are difficult to access with conventional toothbrushes. Bourgeois et al. demonstrated that periodontal pathogens may be present in interdental sites even among young adults considered periodontally healthy, highlighting the importance of effective interdental plaque control (3). Thus, practices such as dental flossing, interdental brushing, and appropriate mouth-rinse use may provide additional information about the overall oral-hygiene behavior of university students.

Oral-health knowledge and literacy are also increasingly recognized as important determinants of preventive behavior. Knowledge encompasses understanding of dental caries, periodontal disease, fluoride, oral hygiene, dietary risks, and the relationship between oral and systemic health, whereas oral-health literacy refers more broadly to an individual's ability to obtain, understand, evaluate, and use oral-health information. A study among university nursing students found generally favorable oral-health knowledge but identified specific gaps, particularly concerning periodontal disease and oral cancer (7). This finding suggests that university students may have reasonable general awareness while still lacking knowledge in specific areas that are important for disease prevention.

Recent evidence among college students further supports the relationship between oral-health literacy and oral-health status. Agarahari et al. in a cross-sectional study involving 1,500 college students from different academic disciplines, found variation in oral-health literacy across educational fields and examined its relationship with clinically assessed oral-health status (8). These findings are particularly relevant to multidisciplinary university settings, where students from medical, allied health, social sciences, engineering, and other programs may have substantially different levels of exposure to health education.

Dietary behavior is another important factor associated with oral health among young adults. Frequent consumption of sugary foods and sugar-sweetened beverages can increase exposure of dental tissues to fermentable carbohydrates and consequently contribute to dental caries. Contemporary evidence has demonstrated that

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

higher free-sugar intake is associated with an increased risk of dental caries, particularly when protective exposure to fluoride is limited (9). University students may be particularly vulnerable to unhealthy dietary practices because of irregular meal patterns, frequent snacking, consumption of commercially available beverages, and easy access to processed foods. Therefore, assessment of oral hygiene status should consider dietary behavior as a potential associated factor rather than examining toothbrushing practices in isolation.

Tobacco use represents another relevant behavioral determinant of oral health among young adults. Smoking and smokeless tobacco use have been associated with adverse periodontal outcomes and may coexist with inadequate oral-hygiene practices. A study examining young adults with smoking and smokeless-tobacco habits found poorer periodontal parameters among individuals with tobacco exposure, with particularly poor oral-hygiene indicators among participants who used both forms of tobacco (10). This is particularly important in settings where smokeless tobacco products are culturally or socially accepted. Assessment of tobacco use among university students can therefore help identify an additional modifiable factor associated with oral hygiene and periodontal health.

Socioeconomic and demographic characteristics may also influence oral-health behavior. Access to dental services, affordability of oral-hygiene products, health literacy, parental education, residential environment, and social support can shape preventive health behaviors. Gazzaz et al. reported that lower socioeconomic status and lower family support were associated with oral-health-risk behaviors, including infrequent toothbrushing and higher consumption of sugar-sweetened beverages (11). Similarly, research examining young populations has demonstrated socioeconomic inequalities in oral-health behaviors, including toothbrushing, flossing, and dental attendance (12). These findings suggest that oral-hygiene status should be investigated within a broader behavioral and social context.

Dental attendance and preventive healthcare utilization are also important dimensions of oral health. Students who visit dental professionals only when experiencing pain or an acute problem may miss opportunities for early detection and prevention. Evidence examining pathways to adult oral-health inequalities has shown that socioeconomic position can influence oral health both directly and indirectly through behavioral factors and dental attendance (13). Consequently, determining whether university students attend routine dental examinations, seek treatment only when symptoms develop, or have limited access to dental care can provide valuable information regarding factors associated with their oral hygiene status.

The university environment may also influence oral-health behaviors through academic discipline and health-related education. However, academic specialization does not necessarily guarantee appropriate oral-health practices. A Pakistani study among undergraduate biomedical-science students found considerable gaps in routine oral-hygiene behaviors: more than half of participants reported brushing only once daily, many relied primarily on toothbrushing for oral hygiene, and a substantial proportion reported visiting a dentist only when experiencing oral disease (14). Such findings are important because they demonstrate that university students in Pakistan may have considerable room for improvement in preventive oral-health practices even when they are studying biomedical subjects.

Similarly, studies among Pakistani undergraduate dental students have identified inconsistencies between oral-health knowledge and actual oral-hygiene practices. A 2023 study reported that undergraduate students demonstrated knowledge regarding oral-health maintenance but still required improvement in their practical oral-hygiene behaviors, including brushing techniques and the use of supplementary oral-hygiene aids (15). This knowledge–behavior gap is important because oral hygiene status ultimately reflects the cumulative effect of daily practices rather than knowledge alone.

Large-scale evidence among university students also suggests that oral-health behaviors are associated with objectively assessed oral-health indicators. Nakahara et al. analyzed data from 17,996 Japanese university students and found

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

associations between oral-health behaviors, clinical oral status, bleeding on probing, decayed teeth, and the Oral Hygiene Index-Simplified (OHI-S). Students with more favorable oral-health behaviors were more likely to report better oral health (16). Although these findings were obtained from a Japanese population and therefore may not be directly generalizable to other settings, they demonstrate the value of combining behavioral information with clinical assessment of oral hygiene.

More recent evidence from university students further demonstrates that oral-health knowledge, attitudes, and behaviors can vary across health-related and non-health-related academic disciplines. Kandasamy et al. assessed 845 university students in Saudi Arabia and specifically compared health-related and non-health-related students using a structured oral-health questionnaire (17). Such multidisciplinary comparisons are valuable because university students are not a homogeneous population; their academic background, exposure to health information, and lifestyle may influence their oral-health knowledge and practices differently.

Collectively, the existing literature indicates that oral hygiene among university students is influenced by a multidimensional interaction of individual, behavioral, educational, dietary, socioeconomic, and healthcare-related factors. The evidence also highlights an important distinction between *knowledge of oral health* and *actual oral-hygiene behavior*. Students may understand the importance of oral hygiene while failing to maintain appropriate brushing frequency, brushing technique, interdental cleaning, dietary control, tobacco avoidance, or routine dental attendance. Furthermore, much of the existing literature has focused on dental or medical students, whereas comparatively less attention has been directed toward undergraduate students across diverse academic disciplines within a single university setting.

This gap is particularly relevant in Pakistan, where the WHO has identified a substantial oral-health burden and where access to preventive oral healthcare may vary according to socioeconomic and geographic circumstances (1). A university-based assessment can therefore provide useful baseline evidence regarding the oral hygiene status of young adults and the factors associated with it. Identifying modifiable determinants at this stage may help universities and healthcare professionals design targeted oral-health education, preventive screening, referral, and health-promotion programs.

Therefore, the present study, "Assessment of Oral Hygiene Status and Associated Factors Among Undergraduate University Students: A Cross-Sectional Study," is designed to assess the oral hygiene status of undergraduate students and investigate its relationship with potentially associated factors, including sociodemographic characteristics, oral-hygiene practices, oral-health knowledge, dietary habits, tobacco use, and dental-care utilization. By examining both oral hygiene status and its associated factors, the study may provide a more comprehensive understanding of oral-health behavior among university students and generate evidence for targeted preventive strategies within the university population.

2. OBJECTIVES

General Objective

To assess the oral hygiene status and determine the factors associated with oral hygiene status among undergraduate university students.

Specific Objectives

1. To assess the oral hygiene status of undergraduate university students using the Simplified Oral Hygiene Index (OHI-S).
2. To determine the oral hygiene practices of undergraduate university students, including toothbrushing frequency, brushing duration, brushing technique, and use of oral hygiene aids.
3. To assess the association between oral hygiene practices and oral hygiene status among undergraduate university students.
4. To determine the association of sociodemographic factors with oral hygiene status among undergraduate university students.
5. To identify the factors significantly associated with poor oral hygiene status among undergraduate university students.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

3. METHODOLOGY

Study Design and Setting

A cross-sectional analytical study was conducted to assess the oral hygiene status and associated factors among undergraduate university students. The study was conducted at IQRA National University–Swat Campus, Khyber Pakhtunkhwa, Pakistan, from February 2024 to July 2024. The study population comprised undergraduate students enrolled at IQRA National University–Swat Campus during the study period. A cross-sectional design was adopted to assess the oral hygiene status of the students and examine its association with selected sociodemographic characteristics and oral hygiene practices.

Study Population

The study population consisted of 1,500 undergraduate students enrolled at IQRA National University–Swat Campus. Students who fulfilled the predefined eligibility criteria were considered for participation in the study.

Inclusion Criteria

Students were included if they:

- were enrolled as undergraduate students at IQRA National University–Swat Campus;
- were 18–25 years of age;
- were available during the data-collection period;
- were willing to participate in the study; and
- provided informed consent.

Exclusion Criteria

Students were excluded if they:

- were younger than 18 years or older than 25 years;
- were not enrolled as undergraduate students at the study campus;
- declined to participate;
- did not provide informed consent; or
- were unable to undergo the required oral examination.

Sample Size

The sample size was calculated using the Raosoft sample size calculator for a target population of 1,500 undergraduate students. The calculation was based on a 95% confidence level, 5% margin of error, and 50% response distribution. Using these parameters, the calculated sample size was 306 undergraduate students. The sample size was therefore set at 306 participants for the study.

Sampling Technique

A simple random sampling technique was used to select the study participants. A sampling frame containing eligible undergraduate students was prepared, and each eligible student was assigned a unique identification number. Participants were then selected randomly from the sampling frame until the required sample size of 306 students was achieved. This procedure ensured that eligible undergraduate students had an opportunity to be selected without systematic preference for a particular academic program, year of study, or another characteristic.

Data Collection Procedure

Data was collected between February 2022 and July 2022. Eligible students were approached and informed about the purpose and procedures of the study. Those who agreed to participate provided informed consent before data collection. Data were collected through a structured questionnaire followed by a clinical oral examination. The questionnaire was used to obtain information regarding participants' sociodemographic characteristics and oral hygiene practices. The clinical examination was conducted to objectively assess the participants' oral hygiene status. The questionnaire was completed by the participants, while the oral examination was performed according to the standardized assessment procedure for the Simplified Oral Hygiene Index (OHI-S).

Assessment of Oral Hygiene Status

The oral hygiene status of the participants was assessed using the Simplified Oral Hygiene Index (OHI-S) developed by Greene and Vermillion. The OHI-S was used as an objective clinical measure of oral hygiene status.

The index consists of two components:

1. Simplified Debris Index (DI-S)
2. Simplified Calculus Index (CI-S)

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

The overall OHI-S score was calculated by combining the scores of the two components:
OHI-S = DI-S + CI-S
The selected tooth surfaces were examined for the presence of soft debris and calculus according to the standard OHI-S assessment procedure. Each component was scored according to the established OHI-S scoring criteria.

The resulting OHI-S score was used to classify participants according to their oral hygiene status:

OHI-S Score	Oral Hygiene Status
0.0–1.2	Good
1.3–3.0	Fair
3.1–6.0	Poor

Assessment of Oral Hygiene Practices

A structured questionnaire was used to assess participants' routine oral hygiene practices. Information was obtained regarding frequency of toothbrushing; duration of toothbrushing; use of toothpaste; brushing technique; use of dental floss or other interdental cleaning aids; use of mouthwash or other oral hygiene aids; and frequency of toothbrush replacement. These variables were assessed as potential factors associated with the participants objectively measured oral hygiene status.

Assessment of Sociodemographic Factors

Sociodemographic information was collected using the structured questionnaire. The information included age, sex, academic program, and year of study, according to the variables included in the study instrument. These characteristics were analyzed to determine whether they were associated with the oral hygiene status of the participants.

Assessment of Associated Factors

The study focused on sociodemographic characteristics and oral hygiene practices as potential factors associated with oral hygiene status. The relationship between these factors and the OHI-S score/category was examined statistically. The analysis was performed to determine whether differences in participants' characteristics and oral hygiene behaviors were associated with variations in their clinically assessed oral hygiene status.

Data Quality Control

A standardized data-collection procedure was followed throughout the study. The questionnaire was reviewed before data collection to ensure that the questions were clear and relevant to the study objectives. Completed questionnaires were checked for completeness before data entry. The collected data were subsequently reviewed for missing, inconsistent, or erroneous entries. Appropriate coding was applied before statistical analysis. The oral examination was conducted according to the predefined OHI-S protocol to maintain consistency in the assessment of oral hygiene status.

Data Management and Statistical Analysis

The collected data was entered, coded, and analyzed using IBM SPSS Statistics version 25. Descriptive statistics were used to summarize the characteristics of the participants. Categorical variables were presented as frequencies and percentages, while continuous variables were summarized using appropriate measures of central tendency and dispersion. The primary outcome variable was oral hygiene status assessed using the OHI-S. The association between oral hygiene status and categorical independent variables, including sociodemographic characteristics and oral hygiene practices, was assessed using the Chi-square test. Fisher's exact test was used where the assumptions for the Chi-square test were not met. For further analysis, participants' OHI-S categories were used to identify those with poor oral hygiene. Where appropriate, binary logistic regression analysis was performed to determine factors independently associated with poor oral hygiene

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

status. The results of regression analysis were reported as odds ratios (ORs) with 95% confidence intervals (CIs). A p-value of <0.05 was considered statistically significant.

Ethical Considerations

Ethical approval for the study was obtained from the ASRB Committee of IQRA National University–Swat Campus before commencement of the study. The purpose and procedures of the study were explained to all eligible participants. Participation was voluntary, and written informed consent was obtained before data collection. Participants were informed that they had the right to decline participation or withdraw from the study without any consequences. Confidentiality and privacy were maintained throughout the research process. The information obtained from participants was kept confidential and was used exclusively for research purposes. The oral examination was conducted while maintaining the privacy and dignity of the participants.

4. RESULTS

4.1 Sociodemographic Characteristics of Participants

A total of 306 undergraduate university students participated in the study. The mean age of the participants was 21.41 ± 1.79 years, with an age range of 18–25 years. Among the participants, 168 (54.9%) were male and 138 (45.1%) were female. Regarding age distribution, 119 (38.9%) participants were aged 18–20 years, 149 (48.7%) were aged 21–23 years, and 38 (12.4%) were aged 24–25 years.

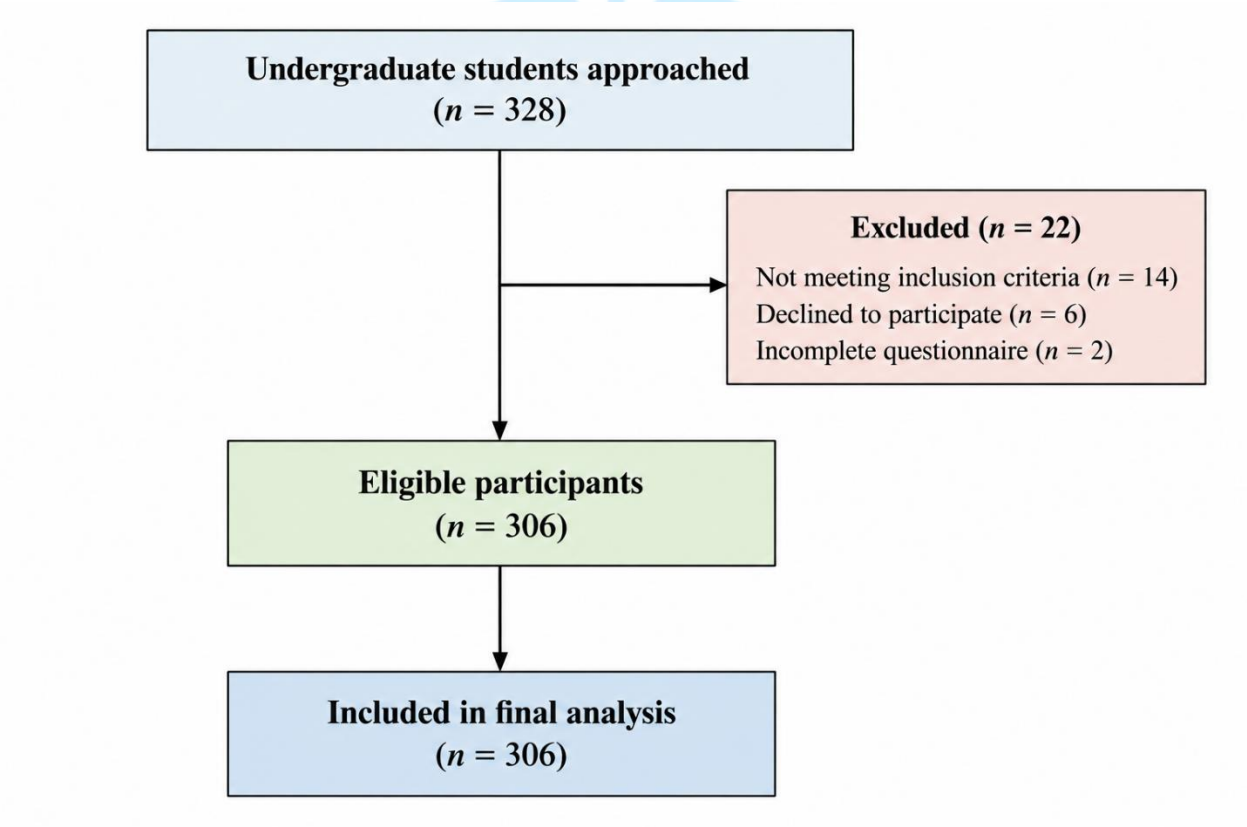


Figure 1. Participant recruitment, eligibility screening, exclusions, and inclusion in the final analysis.

Regarding academic year, the largest proportion of participants were enrolled in the second year (30.7%), followed by the third year (26.8%), first year (24.2%), and fourth year (18.3%).

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Table 1. Sociodemographic characteristics of undergraduate students (n = 306)

Variable	Category	n	%
Age group	18–20 years	119	38.9
	21–23 years	149	48.7
	24–25 years	38	12.4
Sex	Male	168	54.9
	Female	138	45.1
Academic year	1st year	74	24.2
	2nd year	94	30.7
	3rd year	82	26.8
	4th year	56	18.3
Total		306	100.0

4.2 Oral Hygiene Practices

The reported oral hygiene practices of the participants are presented in Table 2. Regarding toothbrushing frequency, 132 (43.1%) participants reported brushing their teeth once daily, 145 (47.4%) reported brushing twice daily, and 29 (9.5%) reported brushing three or more times daily. With respect to brushing duration, 91 (29.7%) participants reported brushing for less than one minute, 139 (45.4%) brushed for 1–2 minutes, and 76 (24.8%) brushed for more than two minutes. Most participants, 276 (90.2%), reported using toothpaste, while 30 (9.8%) did not. Interdental cleaning was reported by 91 (29.7%) participants, whereas 215 (70.3%) did not use interdental cleaning aids. Mouthwash was used by 82 (26.8%) participants, while 224 (73.2%) reported that they did not use mouthwash. Regarding toothbrush replacement, 101 (33.0%) participants reported replacing their toothbrush every three months or less, 151 (49.3%) replaced it every 3–6 months, and 54 (17.6%) replaced it after more than six months.

Table 2. Oral hygiene practices among undergraduate students (n = 306)

Oral hygiene practice	Category	n	%
Toothbrushing frequency	Once daily	132	43.1
	Twice daily	145	47.4
	≥3 times daily	29	9.5
Brushing duration	<1 minute	91	29.7
	1–2 minutes	139	45.4
	>2 minutes	76	24.8
Toothpaste use	Yes	276	90.2
	No	30	9.8
Interdental cleaning	Yes	91	29.7
	No	215	70.3
Mouthwash use	Yes	82	26.8
	No	224	73.2
Toothbrush replacement	<3 months	101	33.0
	3–6 months	151	49.3
	>6 months	54	17.6

4.3 Clinical Assessment of Oral Hygiene Status

Oral hygiene status was assessed using the Simplified Oral Hygiene Index (OHI-S). The overall mean OHI-S score was 2.08 ± 0.93, with scores ranging from 0.30 to 5.20. The mean Simplified Debris Index (DI-S) was 1.35 ± 0.60,

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

while the mean Simplified Calculus Index (CI-S) was 0.73 ± 0.46. Based on the predefined OHI-S classification, 52 (17.0%) participants had good oral hygiene, 171 (55.9%) had fair oral hygiene, and 83 (27.1%) had poor oral hygiene.

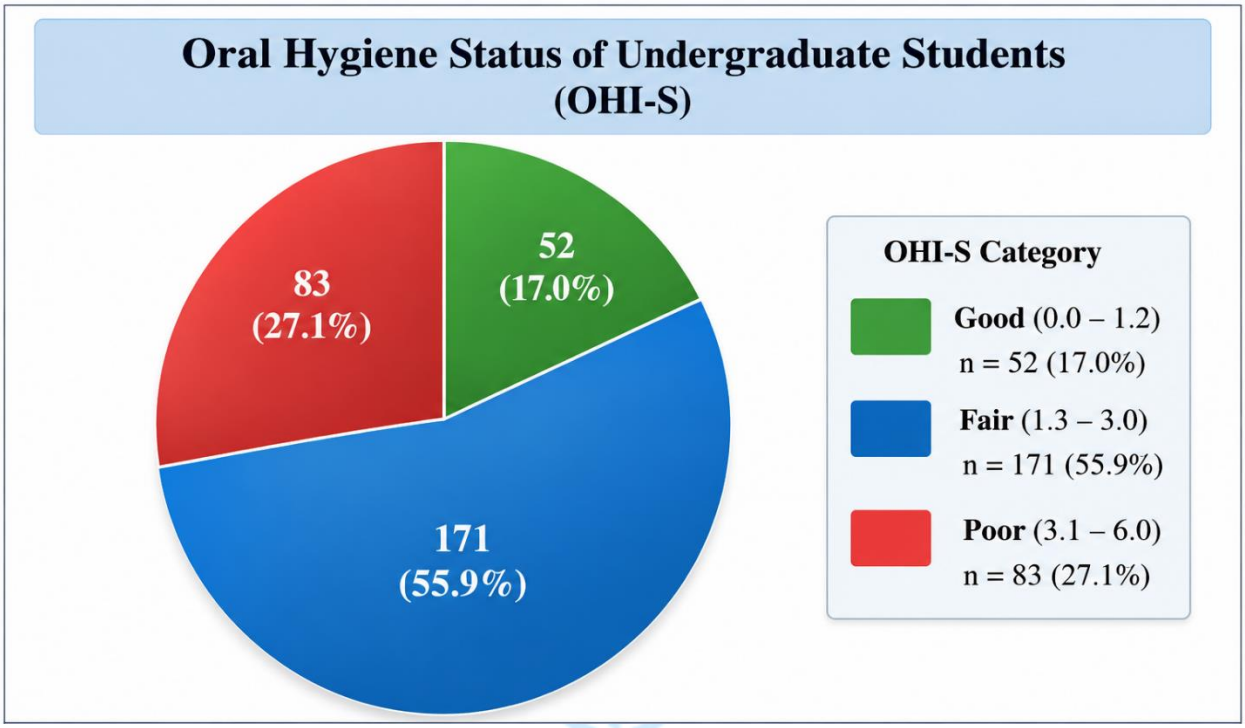


Figure 2. Distribution of participants according to oral hygiene status based on the Simplified Oral Hygiene Index (OHI-S).

Table 3. Descriptive statistics of OHI-S components

OHI-S component	Mean ± SD	Minimum	Maximum
Simplified Debris Index (DI-S)	1.35 ± 0.60	0.10	3.00
Simplified Calculus Index (CI-S)	0.73 ± 0.46	0.00	2.20
OHI-S	2.08 ± 0.93	0.30	5.20

Table 4. Overall oral hygiene status according to OHI-S (n = 306)

Oral hygiene status	OHI-S score	n	%
Good	0.0–1.2	52	17.0
Fair	1.3–3.0	171	55.9
Poor	3.1–6.0	83	27.1
Total		306	100.0

Overall, 254 (83.0%) participants had either fair or poor oral hygiene, whereas 52 (17.0%) demonstrated good oral hygiene.

4.4 Association Between Sociodemographic Characteristics and Oral Hygiene Status

The association between sociodemographic characteristics and oral hygiene status was assessed using the chi-square test. The results are presented in Table 5. A statistically significant association

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

was found between age group and oral hygiene status (χ^2 = 21.69, p < 0.001). Poor oral hygiene was observed among 21.0% of participants aged 18–20 years, 24.2% of those aged 21–23 years, and 57.9% of those aged 24–25 years. The association between sex and oral hygiene status was not statistically significant (χ^2 = 4.42, p = 0.110). Poor oral hygiene was observed among 52 (31.0%) male participants compared with 31 (22.5%) female participants. Academic year was significantly associated with oral hygiene status (χ^2 = 13.39, p = 0.037). Poor oral hygiene was observed among 20.3% of first-year participants, 21.3% of second-year participants, 29.3% of third-year participants, and 42.9% of fourth-year participants.

Table 5. Association between sociodemographic characteristics and oral hygiene status

Variable	Category	Good n (%)	Fair n (%)	Poor n (%)	χ^2	p-value
Age	18–20	24 (20.2)	70 (58.8)	25 (21.0)	21.69	<0.001
	21–23	24 (16.1)	89 (59.7)	36 (24.2)		
	24–25	4 (10.5)	12 (31.6)	22 (57.9)		
Sex	Male	23 (13.7)	93 (55.4)	52 (31.0)	4.42	0.110
	Female	29 (21.0)	78 (56.5)	31 (22.5)		
Academic year	1st	17 (23.0)	42 (56.8)	15 (20.3)	13.39	0.037
	2nd	18 (19.1)	56 (59.6)	20 (21.3)		
	3rd	13 (15.9)	45 (54.9)	24 (29.3)		

5.5 Association Between Oral Hygiene Practices and Oral Hygiene Status

The association between oral hygiene practices and oral hygiene status was assessed using the chi-square test. The findings are presented in Table 6. A statistically significant association was found between toothbrushing frequency and oral hygiene status (χ^2 = 23.84, p < 0.001). Poor oral hygiene was observed in 39.4% of participants who brushed once daily, compared with 18.6% of those who brushed twice daily and 13.8% of those who brushed three or more times daily. Brushing duration was also significantly associated with oral hygiene status (χ^2 = 11.66, p = 0.020). Poor oral hygiene was observed in 36.3% of participants who brushed for less than one minute, compared with 22.3% among those who brushed for 1–2 minutes and 25.0% among those who brushed for more than two minutes. No, statistically significant association was observed between toothpaste use and oral hygiene status (χ^2 = 1.62, p = 0.444).

Volume 4, Issue 3, 2026

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

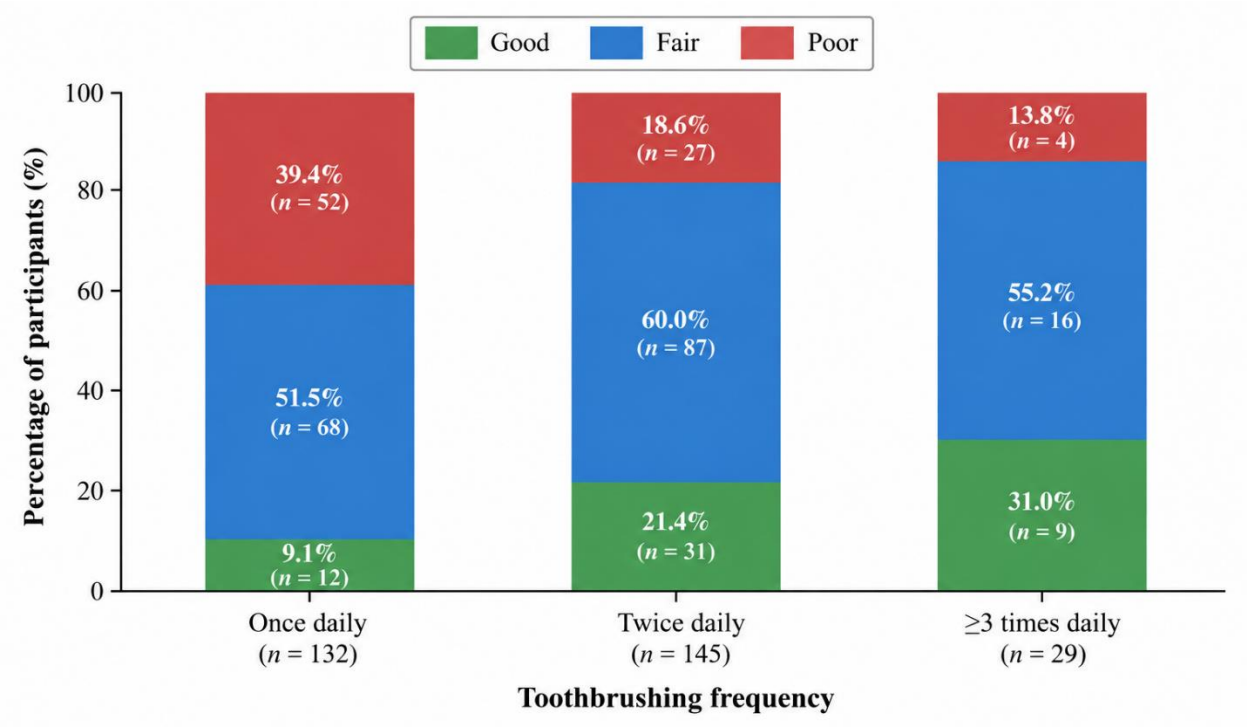


Figure 3. OHI-S status × toothbrushing frequency

The association between interdental cleaning and oral hygiene status was not statistically significant (χ^2 = 3.14, p = 0.208). Poor oral hygiene was observed in 20.9% of participants who used interdental cleaning aids compared with 29.8% of those who did not. Similarly, the association between mouthwash use and oral hygiene status was not statistically significant (χ^2 = 3.35, p = 0.187).

Table 6. Association between oral hygiene practices and oral hygiene status

Variable	Category	Good n (%)	Fair n (%)	Poor n (%)	χ^2	p-value
Brushing frequency	Once daily	12 (9.1)	68 (51.5)	52 (39.4)	23.84	<0.001
	Twice daily	31 (21.4)	87 (60.0)	27 (18.6)		
	≥3 times daily	9 (31.0)	16 (55.2)	4 (13.8)		
Brushing duration	<1 min	7 (7.7)	51 (56.0)	33 (36.3)	11.66	0.020
	1–2 min	27 (19.4)	81 (58.3)	31 (22.3)		
	>2 min	18 (23.7)	39 (51.3)	19 (25.0)		
Toothpaste use	Yes	47 (17.0)	157 (56.9)	72 (26.1)	1.62	0.444
	No	5 (16.7)	14 (46.7)	11 (36.7)		
Interdental cleaning	Yes	19 (20.9)	53 (58.2)	19 (20.9)	3.14	0.208
	No	33 (15.3)	118 (54.9)	64 (29.8)		
Mouthwash use	Yes	18 (22.0)	47 (57.3)	17 (20.7)	3.35	0.187
	No	34 (15.2)	124 (55.4)	66 (29.5)		

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

4.6 Comparison of Mean OHI-S Scores According to Oral Hygiene Practices

Mean OHI-S scores were compared across selected oral hygiene practices. The results are presented in Table 7. A statistically significant difference in mean OHI-S score was observed according to toothbrushing frequency ($p < 0.001$). Participants who brushed once daily had a mean OHI-S score of 2.42 ± 0.98, those who brushed twice daily had a mean score of 1.86 ± 0.84, and those who brushed three or more times daily had a mean score of 1.58 ± 0.71. A statistically significant difference was also observed according to brushing duration ($p = 0.002$). The mean OHI-S score was 2.39 ± 0.99 among participants who brushed for less than one minute, 1.98 ± 0.88 among those who brushed for 1–2 minutes, and 1.76 ± 0.81 among those who brushed for more than two minutes. Participants who used interdental cleaning aids had a mean OHI-S score of 1.81 ± 0.82, compared with 2.19 ± 0.96 among those who did not use interdental cleaning aids. This difference was statistically significant ($p = 0.012$).

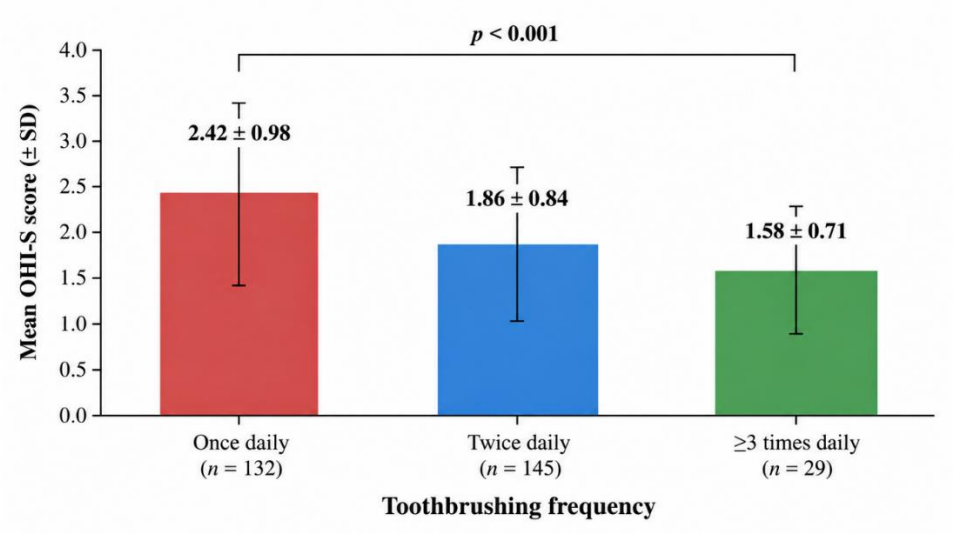


Figure 4. Mean OHI-S × toothbrushing frequency

Frontier in Medical & Health Research
ISSN: (e) 3007-1607 (p) 3007-1593

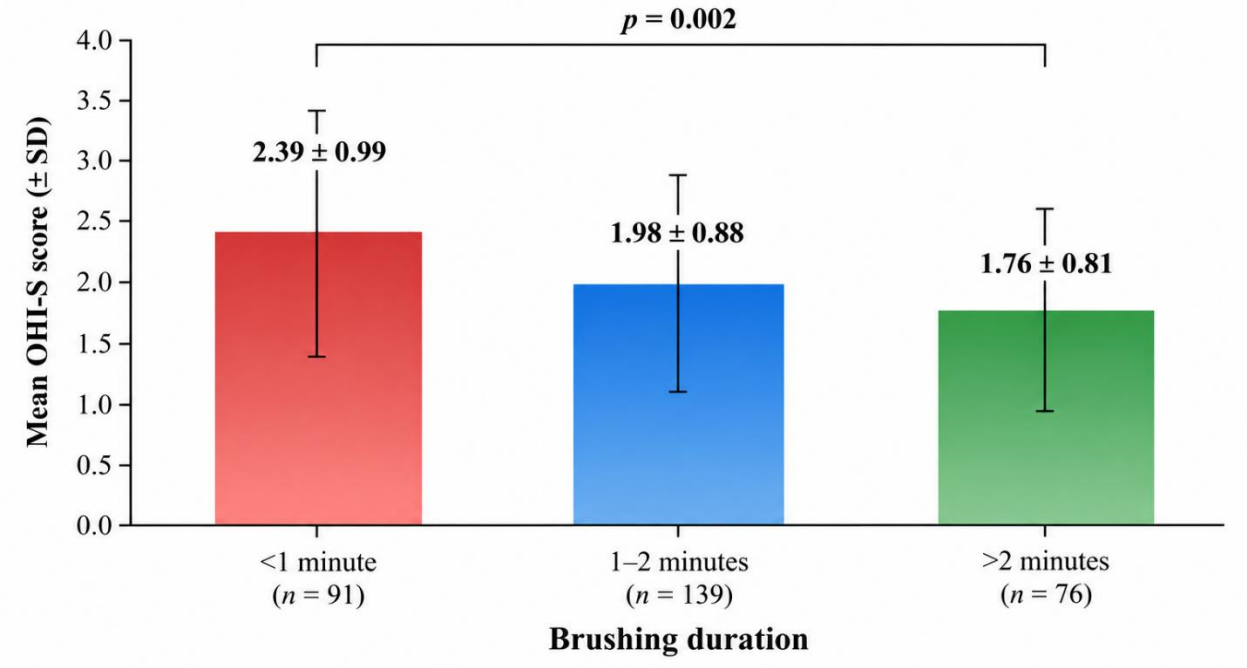


Figure 5. Mean OHI-S × brushing duration

Table 7. Mean OHI-S scores according to selected oral hygiene practices

Variable	Category	Mean OHI-S ± SD	Statistical test	p-value
Brushing frequency	Once daily	2.42 ± 0.98	ANOVA	<0.001
	Twice daily	1.86 ± 0.84		
	≥3 times daily	1.58 ± 0.71		
Brushing duration	<1 minute	2.39 ± 0.99	ANOVA	0.002
	1–2 minutes	1.98 ± 0.88		
	>2 minutes	1.76 ± 0.81		
Interdental cleaning	Yes	1.81 ± 0.82	Independent t-test	0.012
	No	2.19 ± 0.96		

4.7 Factors Associated with Poor Oral Hygiene

Binary logistic regression analysis was performed to identify factors independently associated with poor oral hygiene. Participants with poor oral hygiene were compared with participants who had good or fair oral hygiene. In the crude analysis, age, sex, toothbrushing frequency, and brushing duration demonstrated statistically significant associations with poor oral hygiene. Interdental cleaning and mouthwash use were not statistically significant after adjustment. After adjustment for the variables included in the analysis, age group, sex, toothbrushing frequency, and brushing duration remained statistically associated with poor oral hygiene. Male participants had higher odds of poor oral hygiene compared with female participants (adjusted OR = 1.71, 95% CI: 1.02–2.86, p = 0.041). Participants aged 24–25 years had higher odds of poor oral hygiene compared with those aged 18–20 years (adjusted OR = 3.08, 95% CI: 1.39–6.84, p = 0.006). Participants who brushed their teeth once daily had higher odds of poor oral hygiene compared with those who brushed at least twice daily (adjusted OR = 2.56, 95% CI: 1.54–4.25, p < 0.001). Participants who brushed for less than one minute had higher odds of poor oral hygiene compared with those who brushed for at least two minutes (adjusted OR = 2.31, 95% CI: 1.36–3.92, p = 0.002). Interdental cleaning was not statistically associated with poor

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

oral hygiene after adjustment (adjusted OR = 1.27, 95% CI: 0.74–2.19, p = 0.382). Similarly, mouthwash use was not statistically associated with poor oral hygiene (adjusted OR = 1.43, 95% CI: 0.78–2.62, p = 0.246).

Table 8. Logistic regression analysis of factors associated with poor oral hygiene

Variable	Comparison	Crude OR	95% CI	p-value	Adjusted OR	95% CI	p-value
Sex	Male vs. female	2.01	1.21–3.35	0.007	1.71	1.02–2.86	0.041
Age	24–25 vs. 18–20	3.62	1.71–7.67	<0.001	3.08	1.39–6.84	0.006
Brushing frequency	Once vs. ≥2/day	2.88	1.77–4.69	<0.001	2.56	1.54–4.25	<0.001
Brushing duration	<1 min vs. ≥2 min	2.54	1.53–4.22	<0.001	2.31	1.36–3.92	0.002
Interdental cleaning	No vs. yes	1.61	0.95–2.73	0.077	1.27	0.74–2.19	0.382
Mouthwash use	No vs. yes	1.59	0.91–2.78	0.101	1.43	0.78–2.62	0.246

OR = odds ratio; CI = confidence interval.

4.8 Overall Findings

Among the 306 undergraduate students, fair oral hygiene was the most frequently observed category, accounting for 171 (55.9%) participants. Poor oral hygiene was observed among 83 (27.1%) participants, while 52 (17.0%) participants had good oral hygiene. Overall, 83.0% of the participants had either fair or poor oral hygiene. Significant associations were observed between oral hygiene status and age group, academic year, toothbrushing frequency, and brushing duration. Sex, toothpaste use, interdental cleaning, and mouthwash use did not demonstrate statistically significant associations in the corresponding chi-square analyses. Participants aged 24–25 years, those in the fourth academic year, those brushing once daily, and those brushing for less than one minute showed higher proportions of poor oral hygiene. The comparison of mean OHI-S scores demonstrated significant differences according to toothbrushing frequency, brushing duration, and interdental cleaning.

In the multivariable analysis, age, sex, toothbrushing frequency, and brushing duration remained statistically associated with poor oral hygiene. The adjusted analysis showed higher odds of poor oral hygiene among participants aged 24–25 years, male participants, those brushing once daily, and those brushing for less than one minute. Overall, the findings indicate that fair and poor oral hygiene were prevalent among the undergraduate students included in the study, with age, academic year, and selected oral hygiene practices showing statistically significant associations with oral hygiene status.

5. DISCUSSION

The present study assessed oral hygiene status and associated factors among undergraduate university students using the Simplified Oral Hygiene Index (OHI-S). The study also examined oral hygiene practices and their relationship with clinically assessed oral hygiene status, as well as the association of sociodemographic characteristics with oral hygiene. Overall, the findings demonstrated that fair and poor oral hygiene were common among the participating undergraduate students, with more than four-fifths of the participants classified as having either fair or poor oral hygiene. In addition, toothbrushing frequency and duration were significantly associated with oral hygiene status, while age and academic years were among the sociodemographic characteristics associated with oral hygiene. These

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

findings support the concept presented in the literature that oral hygiene among university students is influenced by a combination of behavioral, demographic, educational, and environmental factors rather than by knowledge or a single preventive behavior alone.

5.1 Overall Oral Hygiene Status

The most important finding of the present study was that 55.9% of students had fair oral hygiene and 27.1% had poor oral hygiene, whereas only 17.0% demonstrated good oral hygiene. Thus, approximately 83% of participants had less-than-good oral hygiene according to the OHI-S classification. The overall mean OHI-S score was 2.08 ± 0.93, indicating that, on average, the study population fell within the fair oral hygiene category. This finding is important because the participants were university students and therefore represented a relatively educated young-adult population. Nevertheless, educational attainment alone did not appear to translate into optimal clinically observed oral hygiene. This observation is consistent with previous literature indicating that oral-health knowledge and actual oral-health behavior are not necessarily equivalent. Yao et al. reported that oral-health knowledge, behaviors, and oral-health status among medical and dental undergraduate students were not uniformly satisfactory, suggesting that exposure to health-related education does not automatically result in appropriate preventive practices (4). Similarly, Ahmad et al. demonstrated that oral-health knowledge, attitudes, practices, and periodontal status represent related but distinct dimensions of oral health (5). The present findings therefore reinforce the distinction between knowing about oral health and consistently implementing effective oral-hygiene practices. This distinction is particularly relevant among university students because this developmental period is characterized by increasing independence in lifestyle and healthcare decisions. Students may understand the importance of toothbrushing while still brushing infrequently, brushing for an inadequate duration, or failing to use supplementary oral-hygiene measures. The literature included in the present study similarly emphasizes that university students may establish long-term health behaviors during this period, making university-based prevention particularly relevant. The observed prevalence of fair and poor oral hygiene also has public-health significance. Poor plaque control can contribute to gingival inflammation, periodontal disease, dental caries, and other oral-health problems (1). The WHO has identified oral diseases as a major global health burden, with a particularly substantial impact in low- and middle-income countries (1). Therefore, the relatively high proportion of students with less-than-good oral hygiene in the present study should not be regarded merely as an individual behavioral issue but as an opportunity for preventive oral-health promotion within the university setting.

5.2 Oral Hygiene Practices Among Undergraduate Students

The present study demonstrated considerable variation in oral-hygiene practices. Less than half of the participants reported brushing their teeth once daily, while approximately half reported brushing twice daily. A smaller proportion reported brushing three or more times daily. Similarly, nearly one-third of the students reported brushing for less than one minute. These findings indicate that although toothbrushing was practiced by most students, the frequency and duration of brushing were not uniformly optimal. This observation is consistent with previous evidence showing that the mere presence of toothbrushing behavior does not necessarily indicate effective plaque control. A systematic review of manual toothbrushing techniques demonstrated differences in the effectiveness of different brushing approaches for plaque removal and gingival health, emphasizing that brushing behavior involves more than frequency alone (6). The present findings also support the conceptual framework in the introduction that effective oral hygiene depends on several components, including brushing frequency, brushing duration, technique, fluoride toothpaste, interdental cleaning, and other preventive behaviors (2, 6). Consequently, oral-health promotion programs directed toward university students should not simply communicate the message "brush your

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

teeth" but should emphasize how often, how long, and how effectively students should brush. Toothpaste use was relatively high in the present study, with 90.2% of participants reporting its use. However, toothpaste use was not significantly associated with oral hygiene status. This finding may indicate that simply using toothpaste does not guarantee adequate plaque removal. The clinical outcome is likely influenced by the overall quality and consistency of oral-hygiene behavior, including brushing frequency, duration, and technique. Therefore, the high prevalence of toothpaste use alongside the substantial proportion of students with fair or poor OHI-S scores further illustrates the difference between possessing a preventive behavior and implementing it effectively. Interdental cleaning was reported by only 29.7% of participants. Although the proportion was relatively small, students who reported interdental cleaning had a lower mean OHI-S score than those who did not. This finding is biologically plausible because conventional toothbrushing may not adequately remove plaque from interdental areas. Bourgeois et al. demonstrated that periodontal pathogens can be detected at interdental sites even among young adults without established periodontal disease and reported benefits of calibrated interdental brushing for periodontal pathogen control (3). The present finding therefore supports the importance of considering interdental cleaning as an additional component of oral-hygiene promotion.

5.3 Toothbrushing Frequency and Oral Hygiene Status

One of the clearest findings of the present study was the significant association between toothbrushing frequency and oral hygiene status. Students who brushed once daily had a substantially greater proportion of poor oral hygiene than those who brushed twice daily or three or more times daily. Furthermore, mean OHI-S scores decreased progressively with increasing brushing frequency, from 2.42 ± 0.98 among once-daily brushers to 1.86 ± 0.84 among twice-daily brushers and 1.58 ± 0.71 among those brushing at least three times daily. This pattern suggests a relationship between more frequent brushing and better clinically assessed oral hygiene. The finding is consistent with the broader literature emphasizing regular mechanical plaque removal as a fundamental component of oral disease prevention (1, 2). Large-scale evidence among university students has also demonstrated associations between oral-health behaviors and objectively assessed oral-health indicators, including OHI-S and other clinical measures (16). The association remained significant in the logistic regression analysis. Participants who brushed once daily had approximately 2.56 times higher adjusted odds of poor oral hygiene compared with those who brushed at least twice daily. This finding suggests that brushing frequency may remain relevant even after accounting for other variables included in the model. However, the cross-sectional design should be considered when interpreting this relationship. The study identifies an association rather than establishing that reduced brushing frequency directly causes poor oral hygiene. Other unmeasured factors, such as brushing technique, dietary habits, oral-health knowledge, socioeconomic circumstances, or access to dental care, may also contribute to the observed relationship. Nevertheless, the consistency between the categorical analysis, mean OHI-S comparison, and regression analysis strengthens the evidence that toothbrushing frequency is an important behavioral correlate of oral hygiene in this population.

5.4 Brushing Duration and Oral Hygiene Status

Brushing duration was another important behavioral factor. Students who brushed for less than one minute had the highest proportion of poor oral hygiene, while those brushing for 1–2 minutes or more than two minutes had comparatively lower proportions of poor oral hygiene. Mean OHI-S scores followed a similar pattern, with the highest mean score among participants brushing for less than one minute. The association was statistically significant, and logistic regression demonstrated that participants brushing for less than one minute had approximately 2.31 times higher adjusted odds of poor oral hygiene compared with those brushing

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

for at least two minutes. This finding supports the principle that the effectiveness of toothbrushing depends not only on whether brushing occurs but also on the adequacy of the brushing episode. The systematic review cited in the introduction similarly emphasizes variation in plaque-control effectiveness across manual toothbrushing practices (6). Short brushing duration may reduce the opportunity to adequately clean all accessible tooth surfaces and may therefore contribute to greater residual plaque accumulation. The finding also provides an important practical implication for university-based oral-health education. Students who already brush their teeth may not perceive themselves as needing further oral-health education. However, the present results suggest that quality and duration of brushing may be as relevant as the existence of the behavior itself. Educational interventions could therefore incorporate practical demonstrations and individualized feedback rather than relying exclusively on theoretical information.

5.5 Interdental Cleaning and Oral Hygiene

Approximately 30% of participants reported using interdental cleaning aids, while the majority did not. Participants who practiced interdental cleaning had a lower mean OHI-S score than those who did not, and the difference in mean OHI-S was statistically significant. This finding is consistent with the established understanding that toothbrushing alone may not adequately address plaque in interdental areas. Bourgeois et al. demonstrated that interdental sites could harbor periodontal pathogens even among young adults who appear clinically healthy and suggested a role for interdental brushing in reducing periodontal pathogen burden (3). However, in the present study, interdental cleaning was not independently associated with poor oral hygiene in the adjusted logistic regression model. This difference between the mean OHI-S comparison and multivariable analysis is important. It suggests that the relationship between interdental cleaning and oral hygiene may partly overlap with other characteristics or behaviors included in the regression model. Therefore, the findings should not be interpreted as evidence that interdental cleaning is unimportant. Rather, they indicate that its independent contribution could not be clearly demonstrated after adjustment for other variables. Future studies could investigate the type, frequency, and technique of interdental cleaning in greater detail because these aspects were not fully differentiated in the present analysis.

5.6 Toothpaste and Mouthwash Use

The present study found that toothpaste use was highly prevalent, with more than 90% of students reporting its use. However, toothpaste use was not significantly associated with oral hygiene status. Similarly, mouthwash use was reported by approximately one-quarter of participants and was not significantly associated with oral hygiene status. These findings suggest that the use of additional oral-hygiene products alone may not be sufficient to ensure good clinical oral hygiene. Effective oral hygiene is likely to depend primarily on consistent and effective mechanical plaque removal, with supplementary products serving an additional role. This interpretation is compatible with the literature emphasizing that oral hygiene should be considered as a combination of behaviors rather than as a single product-dependent practice (2, 6). The findings also reinforce the distinction between availability or use of oral-hygiene products and effective oral-hygiene behavior.

5.7 Sociodemographic Factors and Oral Hygiene Status

Age demonstrated a statistically significant association with oral hygiene status. Participants aged 24–25 years had a markedly higher proportion of poor oral hygiene than younger participants aged 18–20 and 21–23 years. The logistic regression analysis further demonstrated that participants aged 24–25 years had approximately 3.08 times higher adjusted odds of poor oral hygiene compared with those aged 18–20 years. This finding may reflect changes in lifestyle and health behavior as a students progress through university and become increasingly independent. However, because the study was cross-sectional, the reason for the age-related difference cannot be determined directly. It may

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

reflect differences in academic workload, living arrangements, socioeconomic circumstances, healthcare utilization, or accumulated oral-hygiene behaviors. The finding should therefore be interpreted as an observed association rather than evidence that increasing age itself causes poor oral hygiene. Previous literature supports the broader concept that oral-health behaviors are shaped by multiple social and behavioral determinants, including socioeconomic circumstances and healthcare access (11-13). Academic year was also significantly associated with oral hygiene status. The proportion of poor oral hygiene was highest among fourth-year students. This pattern is noteworthy because students in later academic years may experience greater academic responsibilities and changes in daily routines. Academic workload, stress, altered schedules, and changes in residence or lifestyle could potentially influence preventive health behaviors. Nevertheless, academic year may also act as a marker for other characteristics rather than being a direct cause of poor oral hygiene. Therefore, future longitudinal research would be useful to determine whether oral hygiene deteriorates as students progress through university or whether differences between academic years reflect underlying differences in student characteristics.

5.8 Sex and Oral Hygiene Status

In the present study, males demonstrated a higher proportion of poor oral hygiene than females. However, the association between sex and oral hygiene status was not statistically significant in the chi-square analysis. Interestingly, sex became statistically significant in the multivariable logistic regression model, with male participants demonstrating higher adjusted odds of poor oral hygiene. This difference between the unadjusted and adjusted analyses indicates that the relationship between sex and poor oral hygiene may be influenced by other characteristics in the model. After controlling for relevant factors, male sex remained independently associated with higher odds of poor oral hygiene. Previous literature has demonstrated that oral-health behaviors may differ according to demographic and social characteristics (12). However, the mechanisms underlying sex-related differences are likely to involve multiple behavioral and social factors rather than biological sex alone. Differences in healthcare-seeking behavior, preventive practices, health literacy, and lifestyle may contribute to observed differences.

Because the present study did not comprehensively measure all such factors, the findings should be interpreted cautiously. Further studies should examine these potential pathways directly.

5.9 Independent Factors Associated with Poor Oral Hygiene

The multivariable logistic regression analysis provided an important additional perspective by identifying factors that remained associated with poor oral hygiene after adjustment. Age group, sex, toothbrushing frequency, and brushing duration remained statistically significant predictors in the adjusted model. The strongest behavioral findings were related to toothbrushing frequency and duration. Students who brushed once daily had more than twice the adjusted odds of poor oral hygiene, while those who brushed for less than one minute also demonstrated substantially higher adjusted odds. These findings suggest that modifiable daily behaviors may represent important targets for university-based preventive interventions. This is consistent with the broader evidence that oral-health status is associated with health behaviors and that knowledge alone may not be sufficient to produce favorable clinical outcomes (16). At the same time, the regression results should not be interpreted as demonstrating causality. Because the study used a cross-sectional design, exposure and outcome were measured at approximately the same time. Therefore, temporal relationships cannot be established. In addition, factors such as dietary behavior, tobacco use, oral-health literacy, dental attendance, socioeconomic status, and brushing techniques may influence oral hygiene but were not all incorporated into the final regression model. The introduction identifies these factors as potentially important determinants of oral health (7, 8), highlighting areas for future investigation.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

5.10 Comparison with Previous Evidence

The findings of the present study broadly agree with previous research demonstrating that university students can have considerable deficiencies in oral-hygiene behavior despite their educational background. Yao et al. reported that medical and dental students did not uniformly demonstrate satisfactory oral-health behavior or status (4). Similarly, research among university nursing students has shown that students may possess generally favorable oral-health knowledge while still demonstrating specific gaps in oral-health literacy (7). Evidence from Pakistani university populations is particularly relevant. Previous research among undergraduate biomedical-science students reported considerable shortcomings in routine oral-hygiene practices, including infrequent toothbrushing and limited preventive dental attendance (14). Similarly, Pakistani dental students have been reported to possess oral-health knowledge while still requiring improvement in practical oral-hygiene behaviors (15). The present study adds to this literature by demonstrating that clinically assessed oral hygiene can remain suboptimal among undergraduate students and that specific daily practices are associated with the observed clinical status. The findings are also consistent with the large study by Nakahara et al. which examined oral-health behaviors and clinical oral-health indicators among a very large university-student population and demonstrated relationships between behavioral factors and objective oral-health measures (16). Although differences in healthcare systems, culture, socioeconomic conditions, and student populations limit direct comparison, the consistency of the behavioral pattern across settings strengthens the importance of examining both self-reported practices and objective clinical measures.

5.11 Implications for University Oral-Health Promotion

The findings have practical implications for university-based health promotion. Since a substantial majority of participants demonstrated fair or poor oral hygiene, universities may provide an appropriate setting for preventive oral-health interventions. The results suggest that interventions should particularly emphasize regular toothbrushing, adequate brushing duration, effective brushing technique, and appropriate interdental cleaning. This approach is preferable to focus solely on general awareness because previous research has repeatedly demonstrated that knowledge does not necessarily translate into behavior (4, 5). University health services could incorporate periodic oral-health screening, brief oral-hygiene counseling, practical demonstrations of toothbrushing and interdental cleaning, and referral pathways for students requiring professional dental assessment. Such approaches may be especially relevant for students in later academic years, who demonstrated a greater proportion of poor oral hygiene in the present study. The university environment may also provide an opportunity to integrate oral health into broader health-promotion programs. Since dietary behaviors, tobacco use, socioeconomic conditions, and dental attendance may also contribute to oral-health inequalities (9, 10), future interventions should ideally address oral health within a broader preventive-health framework rather than treating toothbrushing as an isolated behavior.

5.12 Strengths of the Study

One strength of the present study was the use of a clinical measure of oral hygiene, rather than relying exclusively on self-reported oral-health status. The OHI-S provided an objective assessment of debris and calculus accumulation and allowed participants to be categorized into good, fair, and poor oral hygiene groups. A further strength was the examination of both sociodemographic characteristics and multiple oral-hygiene practices. This allowed the study to move beyond a simple description of oral hygiene and investigate factors associated with the observed clinical status. The use of chi-square analysis, comparison of mean OHI-S scores, and multivariable logistic regression also provided complementary perspectives on the relationships between behavioral characteristics and oral hygiene.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

5.13 Limitations of the Study

Several limitations should be considered when interpreting the findings. First, the cross-sectional design prevents establishing temporal or causal relationships between oral-hygiene practices and oral hygiene status. Therefore, the identified associations should not be interpreted as causal effects. Second, several oral-hygiene practices were based on self-reported information, which may be affected by recall bias or social-desirability bias. Students may report behaviors that they perceive as socially or academically desirable. Third, the study was conducted at a single university campus, which may limit the generalizability of the findings to students from other universities, geographic regions, or socioeconomic backgrounds. Fourth, although the introduction identifies factors such as oral-health literacy, dietary habits, tobacco use, socioeconomic status, and dental-care utilization as potentially relevant determinants, these factors were not comprehensively represented in the final statistical analyses presented in this study. Consequently, residual confounding cannot be excluded. Finally, the study assessed oral hygiene using OHI-S and therefore primarily reflects debris and calculus accumulation. OHI-S should not be interpreted as a comprehensive measure of all dimensions of oral health, such as dental caries, periodontal disease, oral-health-related quality of life, or specific periodontal clinical parameters.

6. CONCLUSION

Overall, the present study demonstrates that fair and poor oral hygiene were highly prevalent among undergraduate university students, despite the relatively high reported use of toothpaste and the widespread practice of toothbrushing. The findings indicate that the quality and frequency of daily oral-hygiene practices are more informative than simply whether students report brushing their teeth. Toothbrushing frequency and duration demonstrated consistent relationships with clinically assessed oral hygiene, while age and academic years were also associated with differences in oral hygiene status. In the adjusted analysis, age, sex, toothbrushing frequency, and brushing duration remained independently associated with poor oral hygiene. These findings are consistent with previous evidence showing that university students may possess basic oral-health knowledge while still demonstrating inadequate preventive behaviors. The results therefore support the need for university-based oral-health promotion strategies that move beyond awareness alone and emphasize practical, sustainable, and behavior-focused preventive measures. Periodic screening individualized oral-hygiene education, promotion of appropriate toothbrushing practices, and encouragement of interdental cleaning may help address the high burden of fair and poor oral hygiene observed in this population.

REFRENCES

1. Organization WH. Global oral health status report: towards universal health coverage for oral health by 2030: World Health Organization; 2022.
2. Rajwani AR, Hawes SND, To A, Quaranta A, Aguilar JCR. Effectiveness of manual toothbrushing techniques on plaque and gingivitis: a systematic review. Oral health & preventive dentistry. 2020;18(4):a45354.
3. Bourgeois D, Bravo M, Llodra J-C, Inquimbert C, Viennot S, Dussart C, et al. Calibrated interdental brushing for the prevention of periodontal pathogens infection in young adults-a randomized controlled clinical trial. Scientific reports. 2019;9(1):15127.
4. Yao K, Yao Y, Shen X, Lu C, Guo Q. Assessment of the oral health behavior, knowledge and status among dental and medical undergraduate students: a cross-sectional study. BMC oral health. 2019;19(1):26.
5. Ahmad FA, Alotaibi MK, Baseer MA, Shafshak SM. The effect of oral health knowledge, attitude, and practice on periodontal status among dental students. European journal of dentistry. 2019;13(03):437–43.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

6. Van Gils LM, Slot DE, Van der Sluijs E, Hennequin-Hoenderdos NL, Van der Weijden F. Tongue coating in relationship to gender, plaque, gingivitis and tongue cleaning behaviour in systemically healthy young adults. International journal of dental hygiene. 2020;18(1):62–72.
7. Wong G, Koo TF, Fethney J, Chen R. Assessing oral health literacy of university nursing students: A cross-sectional exploratory study. Nurse education in practice. 2021;53:103066.
8. Agarahari P, Jain A, Pandey SM, Agrahari AK, Yadav J, Srivastava R, et al. Exploring the synergistic association between oral health status and oral health literacy among college students: A Cross-Sectional study. Cureus. 2023;15(7).
9. Ha D, Spencer A, Moynihan P, Thomson W, Do L. Excess risk of dental caries from higher free sugars intake combined with low exposure to water fluoridation. Journal of Dental Research. 2021;100(11):1243–50.
10. Ahad A, Bey A, Khan S, Ahmad MS. Periodontal status associated with dual habits of smoking and smokeless tobacco use: A cross-sectional study in young adults. Journal of advanced periodontology & implant dentistry. 2021;13(2):69.
11. Gazzaz AZ, Carpiano RM, Aleksejuniene J. Socioeconomic status, social support, and oral health-risk behaviors in Canadian adolescents. Journal of public health dentistry. 2021;81(4):316–26.
12. da Mata LL, Azevedo A, de Lurdes Pereira M. Socioeconomic inequalities in oral health-related behaviors in 18-year-old adolescents: a cross-sectional study. Journal of International Society of Preventive & Community Dentistry. 2021;11(6):703.
13. Guarnizo-Herreño CC, Scholes S, Heilmann A, O'Connor R, Fuller E, Shen J, et al. Dental attendance and behavioural pathways to adult oral health inequalities. Journal of Epidemiology and Community Health. 2021;75(11):1063–9.
14. Aslam S, Rasheed N, Akram Z, Ali F, Jalil V. Evaluation of the Oral Health Knowledge Among Undergraduate Students. NUST Journal of Natural Sciences. 2022;7(2).
15. Adnan S, Zafar K, Khan FR, Ullah R. Bibliometric study on the literature related to dental research and education published in Journal of Pakistan Medical Association. Journal of the Pakistan Medical Association. 2022;72(1):84.
16. Nakahara M, Toyama N, Ekuni D, Takeuchi N, Maruyama T, Yokoi A, et al. Trends in self-rated oral health and its associations with oral health status and oral health behaviors in Japanese university students: A cross-sectional study from 2011 to 2019. International journal of environmental research and public health. 2022;19(20):13580.
17. Kandasamy G, Almeleebia T, editors. Assessment of oral health knowledge, attitudes, and behaviours among university students in the Asir Region—Saudi Arabia: a cross-sectional study. Healthcare; 2023: MDPI.