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PREVALENCE AND ASSOCIATED RISK FACTORS OF DENTAL CARIES AMONG UNDERGRADUATE STUDENTS AT ABASYN UNIVERSITY, PESHAWAR: A CROSS-SECTIONAL STUDY

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Abstract

Background: *Dental caries remains a major burden for young adults, particularly in low- and middle-income countries, and is one of the most common chronic, non-communicable diseases worldwide. Because university students are in a transitional phase of life a time when dietary habits, oral hygiene routines, and behaviors like smoking become deeply ingrained they represent a crucial demographic for understanding and managing modifiable risk factors for decay.*

Objective: *This study was conducted among undergraduate students at Abasyn University in Peshawar, Pakistan, with the aim of tracking how often these caries-risk behaviors occur and pinpointing the specific risk factors linked to them.*

Methods: *A cross-sectional survey was administered to a sample of 109 undergraduate students between February and July of 2026. Using a 5 margin of error and a 95% confidence level, the sample size was calculated using Raosoft's online sample size calculator. Data Collection Procedure Data were collected by a pre-tested questionnaire consisting of self-structured questions on the knowledge regarding oral health and its correlates among the research participants. dental examinations, oral hygiene, eating and tobacco use. Methods All this data analysis was done in Python (version 3.10). Age is reported as mean ± SD, and categorical variables are presented as percentages and frequencies. Statistical assessment of association between variables was done using the chi-square test*

Results: *The average age of the students was 20.58 +/ 1.71 years. The percentage of men in each age group varied, ranging from 49.54% in the next group to 85.25% in 18.20%. closely all students (99.08%) acknowledged the significantly the maintain good oral health; On the other hand, just 49.54% of people brushed their teeth twice a day, although most of them (60.55%) did so for at least two minutes as advised, while 44.95% brushed once a day. The auxiliary aids, mouthwash (41.28%) and miswak (36.70%) were most appreciated. Tendency to seek dental services was mostly occasional and reactive (treatment sought after pain), as 41.28% of students waited for pain to occur before consulting a dentist, and furthermore, 17.43% of students had never sought dental treatment some form of oral vacuum use. Tobacco use was reported in 14.68%. No statistically significant relationships were found between oral hygiene practices and tobacco use, frequency of soft drink intake or level of dental health awareness ($p > 0.05$).*

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Conclusion: *The findings show that while undergraduate students possess a strong understanding of oral hygiene, this knowledge does not automatically translate into active preventive habits. This gap is especially visible in how often they brush their teeth and their lack of routine dental check-ups. Ultimately, these outcomes emphasize an urgent need for tailored oral health campaigns. Instead of just teaching facts, these initiatives should focus on bridging the gap between awareness and practice, helping students build consistent daily habits to lower their overall risk of tooth decay.*

INTRODUCTION

Dental caries remains one of the most prevalent chronic diseases globally, affecting individuals across all ages and socioeconomic strata (WHO, 2022).Despite significant advancements in preventive dentistry, the health impact continues to escalate, particularly in developing nations where access to oral healthcare services and preventive programs remains constrained. Tooth decay is a complex but preventable condition. It happens when bacteria in your mouth feed on the sugars from the food you eat and produce acids. These acids slowly eat away at the protective enamel, damaging the structure of the tooth. The initiation and progression of this pathology are dictated by an intricate interaction of biological, behavioral, and environmental, and social determinants, underscoring the critical need for effective preventive by an intricate interaction of biological, behavioral, and interventional strategies (Subedi *et al.,* 2024).

Additionally, the probability of developing dental caries is significantly exacerbated by a variety of Changeable lifestyle behaviors Specifically, an increased risk of disease is strongly associated with poor oral hygiene practices, Consistent consumption of refined carbohydrates, tobacco consumption, and social and economic inequalities; untreated dental caries remains one of the most pervasive health disorders worldwide, affecting billions of individuals. Emphasizes a notable contradiction between the widespread occurrence of the condition and its preventable nature a divide that reveals major shortcomings in both personal preventive practices and broader public health frameworks (Subedi *et al.,* 2024)

Dietary sugar consumption is a significant factor in the development of dental caries. Enamel demineralization and cavity formation is closely related to free sugar intake, particularly in the form of sugar-sweetened drinks and processed meals. The relationship is especially significant during adolescence and early adulthood, because these developmental stages are distinguished by the establishment and consolidation of long-term dietary habits (Yang *et al.*, 2021; Que *et al.,* 2021). Fluoride strengthens the enamel the tooth's protective outer layer enabling it to better withstand acid-induced mineral loss (demineralization). However, both excessive and insufficient fluoride intake can adversely affect oral health. Excessive fluoride exposure may result in dental fluorosis, characterized by the appearance of white or brown discoloration on the teeth. It is therefore essential that fluoride be administered in a balanced and appropriate concentration, so as to maximize its protective benefits while minimizing the risk of associated harm (Manikandan *et al.,* 2023).

A number of lifestyle choices affect dental health, including food. For example, irregular sleep patterns and late-night eating disrupt the body's natural sleep-wake cycle (circadian rhythm), helping to decreased saliva flow. Its ability to neutralize acids and maintain tooth minerals is compromised by salivary decrease flow. Sleeping in an oral environment promotes tooth decay (caries) (Nishide *et al.,* 2019). Microorganisms present among the oral cavity, Streptococcus mutans and Lactobacillus species known as cariogenic bacteria. These bacteria break down dietary carbohydrates, such as sugars, to produce acids that erode dentin and enamel, weakening the tooth structure. Dental caries is not caused by a single reason, but rather by the interaction of several variables, such as a susceptible host (the tooth and oral environment), bacterial activity, dietary habits, and time (Ademe *et al.,* 2020). Limited access to

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effective preventive and dental treatment services, as well as individuals from lower socioeconomic backgrounds with suboptimal dietary habits, had a disproportionate impact on dental caries. Low oral health literacy and insufficient access to fluoridated water further exacerbate the risk of dental decay. As a result, high levels of poverty, inadequate education, and limited healthcare infrastructure are key factors contributing to the increased prevalence of dental caries in industrializing economies (Ju *et al.,* 2019; Teshome *et al.,* 2020).

The prevalence of Disease data derived from Eritrea in Bangladesh, Ethiopia, and Vietnam reveal a notably increased occurrence of dental caries children and adolescents. This result underscores those dental caries remains a very important public health regards in resource-constrained regions. The regional comparative studies corroborate this observation, demonstrating that the geographic distribution of dental caries pronounced in various parts of the world, those areas with limited healthcare resources.

There are some other Challenges become evident from behavioral and psychological dimensions. The population o university student has been Investigates, with the emphasis on elevated stress levels, tobacco use, alcohol consumption, and irregular dietary habits have emerged as key determinants of the disease. Eating disorders Described by binge-eating behaviors or purging cycles may lead to severe enamel deterioration, markedly heightening the susceptibility to dental caries development (Brandt *et al.,* 2017; Peltzer & Pengpid, 2017).

The significant of Early childhood caries (ECC) represents a public health concern comparable public health challenge at the opposite extreme of the group of age, with well-established Negative implications for their growth, nutritional status, and development, speech development, and the overall quality of life. The need for preventive measures and parental education (Su *et al.,* 2018)

The growing of the multifactorial etiology of dental caries has shifted the treatment approach away from the dental restorative therapy alone, concerning preventive and minimally invasive conservative approaches. Now a days management of dental caries increasingly relies on early detection of the disease, individualized the risk assessment for each patient, for the betterment in patient behavior and their habits (behavioral adjustments). This paradigm clearly reflected in the CAMBRA (Caries Management by Risk Assessment) framework. This system takes into account patient behavior, biological factors, and environmental circumstances. The objective is to enhance protective factors like appropriate fluoride use and consistent oral hygiene practices while simultaneously reducing modifiable factors elevate the risk of dental caries (Young *et al.* 2013).

The dental caries has declined in several affluent and growing nations. This reduction is largely attributable to preventive strategies, for example water fluoridation and dental the health education. despite these improvements, disparities in the healthcare and socioeconomic conditions continue to persist. Disadvantaged communities remain disproportionately burdened by dental caries, owing to their limited access to quality dental care, education, and preventive resources (Matsuo *et al.* 2020)

University students represent a population of particular relevance to the study of dental caries risk. They are in a transitional stage of life characterized by greater dietary independence, evolving self-care behaviors, and the establishment of lifelong health habits, and exposure to behaviors like smoking, all of which can have an impact on long-term dental health. Previous research has identified poor oral-hygiene behavior, smoking, and alcohol use as important risk factors within this group, it has also revealed a gap between students' knowledge of oral health and their implementation of preventive oral health practices (Peltzer & Pengpid, 2017; Nassar, 2020). In Pakistan, however, locally generated evidence on the prevalence and determinants of dental caries among undergraduate students remains limited, thereby constraining the development of context-specific prevention and intervention programs.

Given this background, the present study was undertaken to determine the prevalence of caries-related risk behaviors and to identify the

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associated risk factors among undergraduate students at Abasyn University, Peshawar. Specifically, the study assessed oral health awareness, dental attendance patterns, oral hygiene practices, dietary habits, and tobacco use within a defined population, and examined the statistical associations among selected behavioral variables. By generating local, evidence-based data, the study aims to inform targeted oral-health promotion efforts and to contribute to a fuller understanding of modifiable caries risk factors in a developing-country setting.

2. Materials and Methods

2.1 Study design

A descriptive cross-sectional study design was employed. In this design, data are collected from the study population at a single point in time, which allows the characteristics of the population and the variables of interest to be described and the prevalence of behaviours and exposures to be estimated. The design was considered appropriate for the descriptive and exploratory objectives of the present study, which sought to characterize oral-health awareness, practices, and related risk behaviours rather than to establish causal relationships.

2.2 Study setting and population

The study was conducted at Abasyn University, located on Ring Road in Peshawar, Khyber Pakhtunkhwa province, Pakistan. Undergraduate students enrolled at the university throughout the study period made up the study population. The period of data collection was February through July of 2026. Those who fit the requirements and agreed to participate were recruited after being approached on campus.

2.3 Sample size

The RaoSoft online sample-size calculator was used to calculate the required sample size, which was based on previous prevalence studies. A 5% margin of error and a 95% confidence level were used. Based on this, a final sample of 109 people was obtained, which was judged sufficient to offer suitable reliability and representativeness for the descriptive objectives of the study.

2.4 Eligibility criteria

The individuals who participated had to be present at the time of data collection, be undergraduate students registered at the institution, be between the ages of 18 and 25, and be willing to participate after giving their informed consent in order to be included. Students were not permitted to participate if they were professors or postgraduate students, had systemic conditions that could affect oral health, or were undergoing extensive dental or orthodontic treatment. These criteria were intended to focus the study on a fairly homogeneous group of generally healthy undergraduate students.

2.5 Data analysis

Python (version 3.10) was used to analyze the data. Frequencies and percentages were used to summarize categorical data, while the mean and standard deviation were used to convey the continuous variable of age. The chi-square test of independence was used to look for possible relationships between certain pairs of category data. A statistically significant link was defined as having a p-value of less than 0.05. To make comprehension easier, the results were arranged into supporting figures and summary tables.

2.6 Funding Statement

No particular grant from public, private, or nonprofit funding organizations was received for this study.

3. Results

The study involved 109 undergraduate students in total. The results are shown below in accordance with the primary areas that the questionnaire evaluated: food habits, tobacco use, dental attendance patterns, oral hygiene practices, awareness of oral hygiene, and the relationships between specific factors.

3.1 Demographic characteristics

The demographic details of the participants are summarized in Table 1. Of the responders, 33.03% were women and 66.97% were men. The sample was homogenous and relatively young, with a mean age of 20.58 ± 1.71 years. In terms of academic stage, the majority of participants

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(61.47%) were enrolled in the fourth through eighth semesters, followed by those in the second semester (33.94%), with very little representation from the first (3.67%) and third semesters (0.92%).

Table 1. Demographic characteristics of study participants (n = 109)

Variable	Category / Statistic	Frequency (n)	Percentage (%)
Gender	Male	73	66.97
Gender	Female	36	33.03
Age (years)	Mean ± SD	20.58 ± 1.71	–
Semester	4th to 8th	67	61.47
Semester	2nd	37	33.94
Semester	1st	4	3.67
Semester	3rd	1	0.92

3.2 Awareness of oral hygiene

Approximately all of the participants understood the value of good dental hygiene, as Table 2 and Figure 1 demonstrate. Only one (0.92%) of the 109 respondents indicated they were unaware of the importance of dental hygiene, whereas 108 (99.08%) said they were. This nearly complete awareness provides an essential framework for comprehending the oral hygiene practices described here.

Table 2. Awareness regarding the importance of oral hygiene among participants

Oral-hygiene importance	Frequency (n)	Percentage (%)
Yes	108	99.08
No	1	0.92

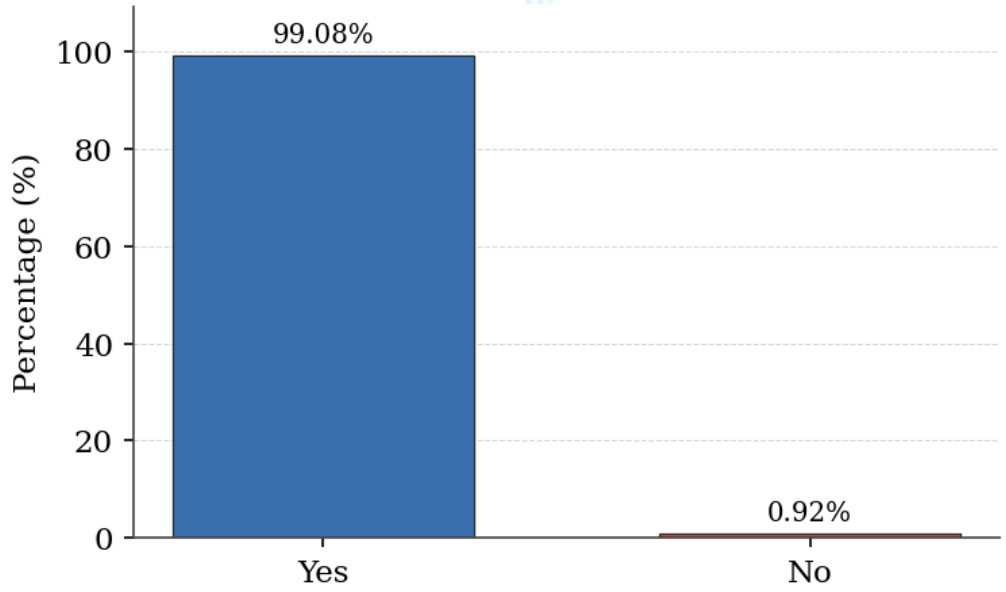


Figure 1. Awareness of the importance of oral hygiene among participants.

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3.3 Pattern of dental visits

Table 3 and Figure 2 show dental attendance patterns. The majority of participants (41.28%) said they only went to the dentist when they were in pain, followed by those who said they went twice (26.61%). 17.43% of students said they had never seen a dentist, whilst 14.68% said they had only seen one. This population's usage of dental services is mostly reactive rather than preventative, as evidenced by the prevalence of pain-related and infrequent attendance.

Table 3. Pattern of dental visits among participants

Dental-visit behavior	Frequency (n)	Percentage (%)
When in pain	45	41.28
Twice	29	26.61
Never	19	17.43
Once	16	14.68

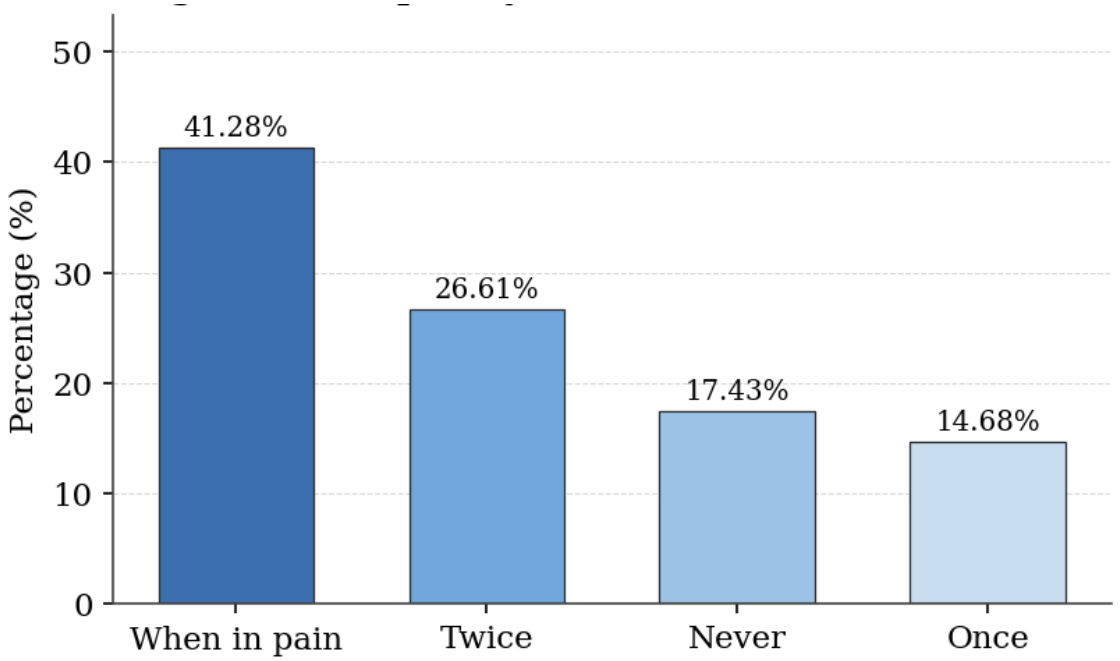


Figure 2. Frequency and reasons for dental visits.

3.4 Oral-hygiene practices

Table 4 provides details on oral hygiene practices, which are depicted in Figures 3 and 4. In terms of brushing frequency, 49.54% of individuals reported brushing their teeth twice daily, 44.95% brushed once daily, and a tiny percentage reported unusual patterns, such as brushing not every day (3.67%) or three times per day (1.83%). In terms of brushing duration, the majority (60.55%) followed the suggested two-minute brushing period, with 22.02% brushing for less than one minute and 17.43% brushing for more over two minutes. Mouthwash (41.28%) and miswak (36.70%) were the most frequently reported primary cleaning methods, followed by dental floss (7.34%) and finger cleaning (14.68%). Lastly, over half of the participants (55.05%) said they changed their toothbrush after a month; lesser percentages said they did so after two months (21.10%) or

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three months (19.27%); while a tiny minority said they never changed their toothbrush (4.59%).

Table 4. Oral-hygiene practices among participants

Practice variable	Category	Frequency (n)	Percentage (%)
Brushing frequency	Twice a day	54	49.54
Brushing frequency	Once a day	49	44.95
Brushing frequency	Not daily	4	3.67
Brushing frequency	Thrice a day	2	1.83
Brushing time	Two minutes	66	60.55
Brushing time	Less than one minute	24	22.02
Brushing time	More than two minutes	19	17.43
Cleaning method	Mouthwash	45	41.28
Cleaning method	Miswak	40	36.70
Cleaning method	Finger	16	14.68
Cleaning method	Flossing	8	7.34
Toothbrush change	After one month	60	55.05
Toothbrush change	After two months	23	21.10
Toothbrush change	After three months	21	19.27
Toothbrush change	Never	5	4.59

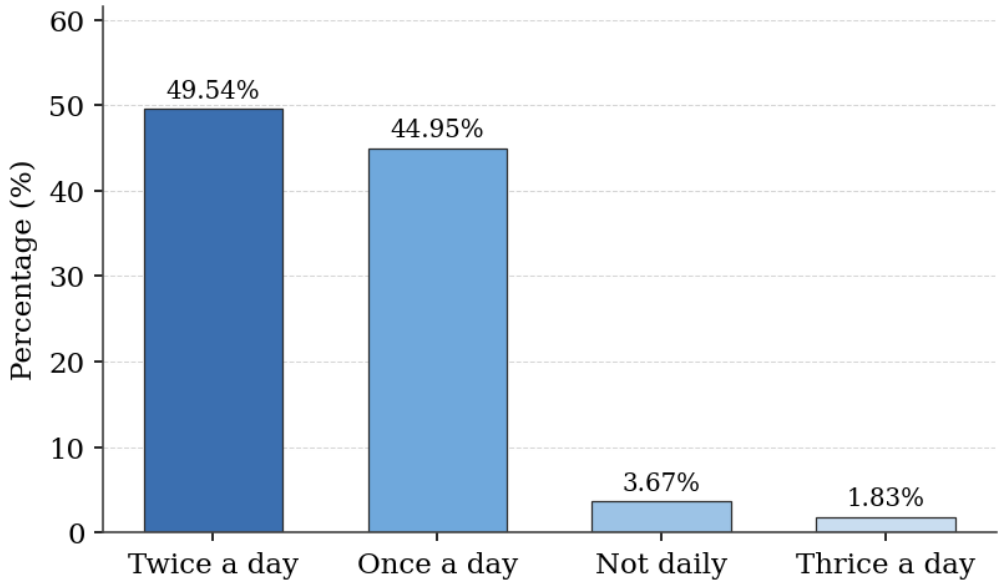


Figure 3. Brushing frequency among participants.

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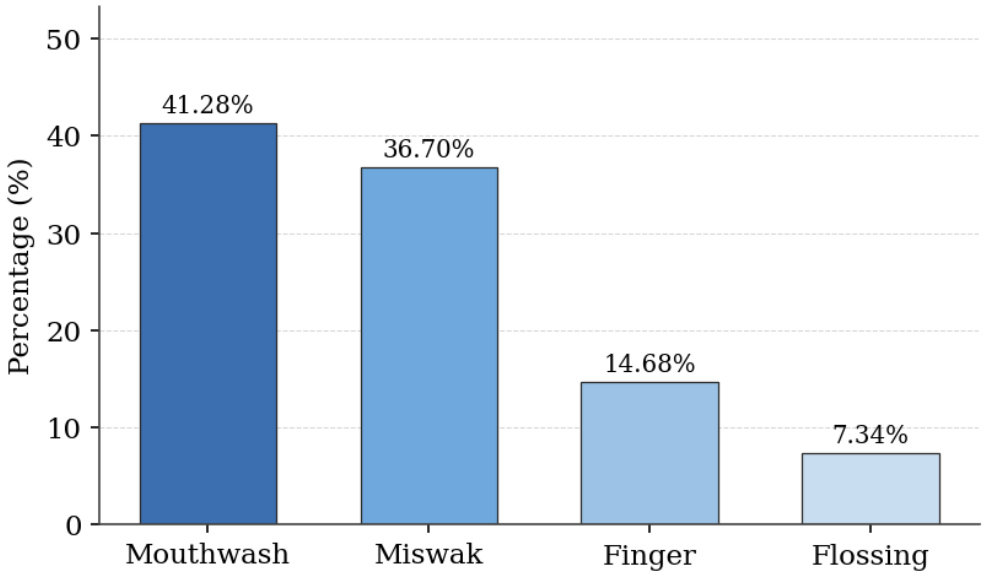


Figure 4. Methods used for oral cleaning.

3.5 Dietary habits

Table 5 and Figure 5 highlight dietary practices related to dental health. 54.13% of individuals reported consuming sweets less than once during the observation period, compared to 35.78% who reported consuming them two to four times and 10.09% who reported consuming them more than four times. Soft drink consumption showed a similar distribution: 54.13% said they drank soft drinks once a week, 26.61% two or three times a week, and 19.27% more than three times a week. These results show that a significant minority of individuals regularly consumed cariogenic foods and beverages, despite the majority reporting very modest use.

Table 5. Dietary habits related to oral health

Dietary variable	Category	Frequency (n)	Percentage (%)
Sweets intake	Less than one time	59	54.13
Sweets intake	Two to four times	39	35.78
Sweets intake	More than four times	11	10.09
Soft-drink consumption	One time a week	59	54.13
Soft-drink consumption	Two to three times a week	29	26.61
Soft-drink consumption	More than three times	21	19.27

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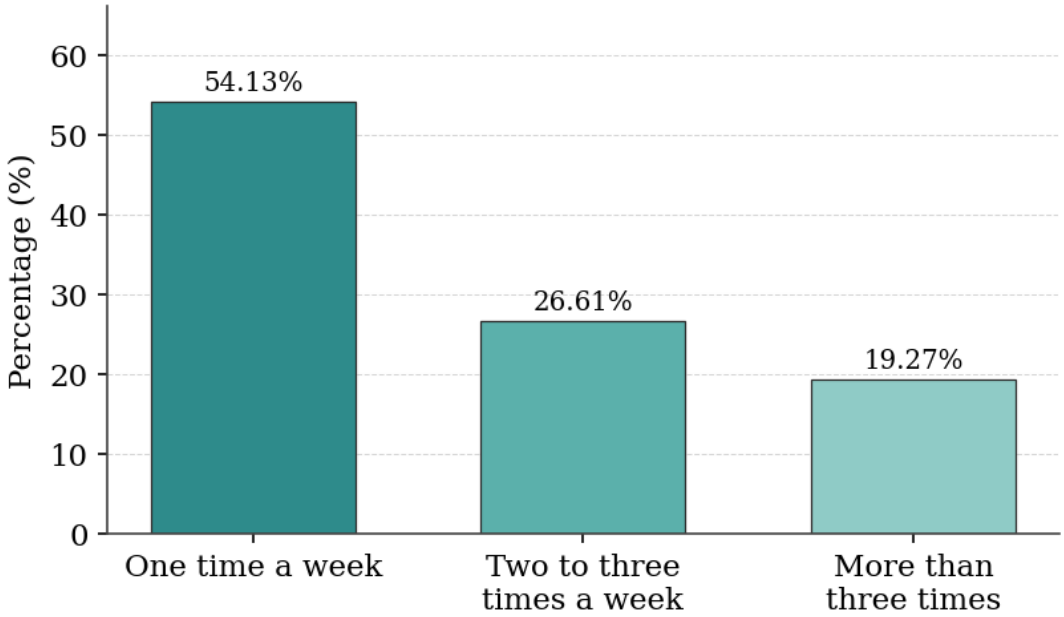


Figure 5. Frequency of soft-drink consumption.

3.6 Tobacco use

Table 6 and Figure 6 show the distribution of tobacco consumption. While 14.68% of participants in the survey revealed to using tobacco products, the majority (85.32%) said they did not. Even though a small percentage of participants reported using tobacco, this percentage is not insignificant considering the known link between tobacco use and worse oral health issues.

Table 6. Distribution of tobacco use among participants

Tobacco use	Frequency (n)	Percentage (%)
No	93	85.32
Yes	16	14.68

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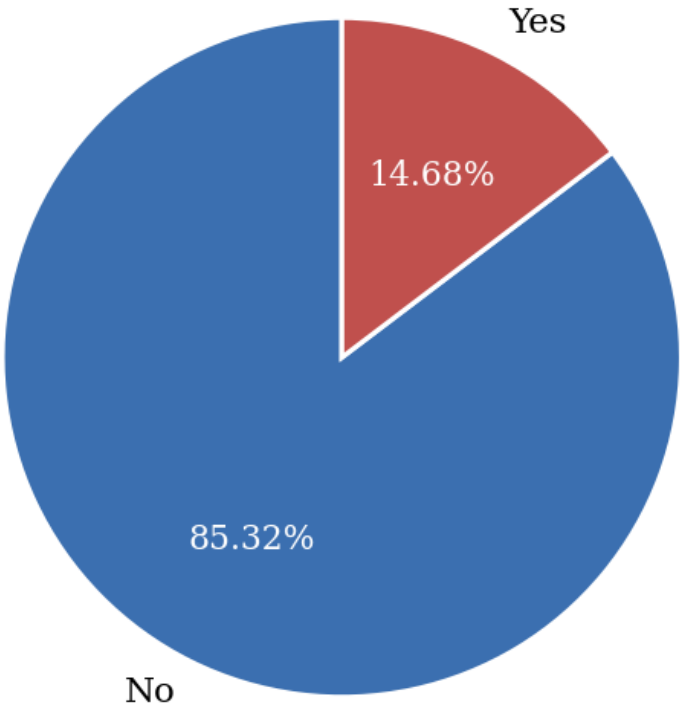


Figure 6. Prevalence of tobacco use among participants.

3.7 Associations between selected variables

Chi-square tests of independence were carried out for certain variable pairings in order to investigate any correlations between oral hygiene habits and other behavioral factors, as indicated in Table 7. Brushing frequency and tobacco use ($p = 0.821$), dental visit behavior and soft drink consumption ($p = 0.338$), brushing frequency and oral hygiene awareness ($p = 0.744$), and cleaning method and brushing time ($p = 0.592$) were not found to be statistically significantly correlated. There were no statistically significant correlations between the variables examined in this dataset since the p-value in each instance was higher than the traditional significance level of 0.05.

Table 7. Association between oral-hygiene practices and selected variables

Variable 1	Variable 2	Test	p-value
Brushing frequency	Tobacco use	Chi-square	0.821
Dental visit	Soft drinks	Chi-square	0.338
Brushing frequency	Awareness	Chi-square	0.744
Cleaning method	Brushing time	Chi-square	0.592

4. Discussion

The purpose of this study was to ascertain the frequency of caries-related risk behaviors and the characteristics that are linked to them among undergraduate students at Abasyn University in Peshawar. The results are generally in line with the larger corpus of research that describes dental caries as a complex condition influenced by a

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variety of biological, behavioral, and socioeconomic factors. The study offers locally relevant information into the oral health behaviors of young adults in a developing-country setting by concentrating on a specific undergraduate group.

The distinction between awareness and practice was probably the most shocking discovery. Less than half of the participants reported brushing twice a day, and a significant portion only visited the dentist when they were in pain or had never gone at all, despite the fact that virtually all participants (99.08%) acknowledged the importance of maintaining excellent dental hygiene. This awareness-practice gap, which suggests that information alone cannot guarantee optimal preventative behavior, is repeatedly found in studies of university populations. The pattern is in line with the findings of Peltzer and Pengpid (2017), who reported suboptimal oral-health behavior among university students across several countries despite reasonable levels of knowledge, and Nassar (2020), who emphasized that students' awareness of preventive considerations does not always turn into corresponding action.

sample require particular attention. Only roughly half of the participants brushed twice a day, despite the majority adhering to the suggested two-minute brushing length, leaving a sizable portion vulnerable to less effective plaque control. The study population's cultural and regional background is reflected in the use of mouthwash and, especially miswak as standard cleaning methods. Miswak, a traditional chewing stick that is extensively used in many Muslim communities, is a common and easily accessible supplement to traditional oral hygiene in this area. Its popularity is in line with trends observed in similar regional contexts. These findings corroborate Soroye and Braimoh's (2017) hypothesis that the key to preventing dental cavities is the regular use of appropriate oral hygiene products and effective plaque removal.

The current sample's dietary habits were very moderate, with the highest percentages of participants reporting once-weekly soft drink consumption and seldom sugar eating. However, a significant minority stated that they frequently consumed soft drinks and sweets. Given the proven link between free-sugar consumption and enamel demineralization documented by Yang *et al.*, (2021) and the more general impact of nutrition, oral hygiene, and access to dental care in influencing caries prevalence noted by Que *et al.*, (2021), this has clinical significance. Dietary counseling should continue to be a part of any preventative program aimed at this demographic, as evidenced by the persistence of a high-consumption minority even within a generally moderate sample.

The percentage of people who reported using tobacco was 14.68%. Peltzer and Pengpid (2017) and Subedi *et al.*, (2024) have found that tobacco smoking is a risk factor for periodontal disease and caries in young adults, despite the fact that this is a small percentage. Even a little incidence in a young, educated population is significant given the known negative effects of tobacco use, and it justifies the inclusion of tobacco-cessation message in campus oral health promotion initiatives.

There were no statistically significant correlations found by the chi-square analysis between oral hygiene habits and the chosen factors, such as awareness, soft drink consumption, and tobacco use. There are several possible explanations. The relatively small sample size reduces the statistical power available to identify minor relationships, and the number of variable pairs evaluated was limited. Furthermore, the study population's homogeneity young undergraduate students with comparable ages and educational backgrounds may have decreased the variability required to identify correlations that would be visible in a group with greater diversity. As a result, these findings should be read cautiously and considered descriptive rather than proof that there is no underlying relationship. Research using larger and more diverse samples, such Chen *et al.*, (2025) and Ceinos *et al.*, (2017), has been in a better position to analyze and prioritize behavioral risk factors for dental caries in college students.

The results have several implications for public health. A reactive model of service usage, where care is sought mostly in response to symptoms rather than for prevention, is indicated by the prevalence of pain-driven and infrequent dental

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visits. This pattern is consistent with findings in other developing nations, where treatment is postponed until the disease has progressed due to a lack of access to reasonably priced dental care and a low priority for preventive visits (Teshome *et al.*,2020; Tafere *et al.*,2018). The ongoing disparities noted by Drachev *et al.,* (2017) are underscored by the contrast with industrialized nations, where preventive interventions like water fluoridation and systematic oral-health education have led to reductions in caries prevalence. A helpful foundation for putting these findings into reality is provided by methods like the CAMBRA model, which places an emphasis on enhancing protective variables and individualized risk assessment (Nassar, 2020).

Several limitations should be acknowledged when interpreting the results. First, the cross-sectional design captures information at a single point in time and therefore precludes any inference about causality. Second, the reliance on a self-administered questionnaire introduces the possibility of recall bias and social-desirability bias, which may be particularly relevant for self-reported behaviours such as brushing frequency and tobacco use. Third, the study did not include a clinical oral examination, so the prevalence of clinically diagnosed caries could not be established; the analysis instead characterized self-reported risk behaviours and oral-health practices. Finally, the sample was drawn from a single institution and was relatively small, which limits the generalizability of the findings to the wider student population of Peshawar or Pakistan. Future research employing larger, multi-center samples, combining questionnaire data with clinical examination, and adopting longitudinal follow-up would help to clarify the causal relationships between these risk factors and the development of dental caries, and would strengthen the evidence base for targeted interventions.

5. Conclusion and Recommendations

Dental caries remains a major public health concern among young adults despite being largely preventable. This study found that undergraduate students at Abasyn University generally possessed good knowledge of oral hygiene; however, this awareness did not consistently translate into preventive behaviors. Inadequate tooth-brushing frequency and a predominantly pain-driven pattern of dental visits highlight a gap between knowledge and practice. Furthermore, tobacco use and the frequent consumption of sugary foods and soft drinks among a proportion of students further increased their risk of developing dental caries. Although the chi-square analysis did not demonstrate statistically significant associations between the assessed variables, these findings should be interpreted cautiously, considering the relatively small sample size and the homogeneity of the study population. Overall, the results underscore the persistent gap between oral health awareness and healthy behavioral practices among university students. They highlight the need for comprehensive oral health promotion strategies that focus not only on increasing knowledge but also on encouraging sustained behavior change, including regular tooth brushing, routine preventive dental check-ups, reduced sugar intake, and tobacco cessation.

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