

The Effect of Residential University Life on Galala dental students: A Cross-sectional Observational Study

Sara Ibrahim Hedia

Sara.hedia@dentistry.cu.edu.eg

Galala University

Mai Mamdouh Akah

Cairo University and Galala University

Olfat Hassanein

Cairo University

Research Article

Keywords: Dental Caries, Prevalence, Prevention, Practice, Galala, Dental Students

Posted Date: July 9th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-10125259/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Additional Declarations: No competing interests reported.

Abstract

Background

The oral health of students is adversely impacted by the residential life in the University because of the change in diet, stress, and lifestyles, which result in the difference in Decayed, Missing, and Filled Teeth (DMFT) scores. Thus, the objective of this study was to determine the effect of residential university life on the prevalence of caries among senior Galala dental students.

Methods

This observational cross-sectional study was 303 dental students at Galala University, who were invited to voluntarily participate and were analysed by dividing them into two groups; Group1: Residents who were living in the university dorms for the past four years and group 2: non-residents. All were invited to voluntarily respond to an anonymous electronic questionnaire. Dental care habits, and self-caries risk determination were asked. The DMFT scores were determined by clinical examination based on World Health Organization (WHO) criteria.

Results

Among the 303 dental students surveyed, the total sample's caries experience, as measured by the DMFT index, had a mean of 3.14 ± 2.86 , reflecting a mild to moderate caries burden according to WHO thresholds. When comparing resident students and non-resident students, no statistically significant differences were observed.

Conclusions

Specific preventive oral health behaviors were significantly correlated with residence status. Nevertheless, the DMFT index was statistically comparable between the two groups, indicating that these behavioral advantages did not translate into significant differences in oral health or caries experience. The residential university life did not have a significant effect on the prevalence of caries in senior dental students.

Introduction

Dental caries, largely driven by unsuitable dietary habits, persists as a prominent oral health problem for many communities. The development of this condition is multifactorial, with its prevalence influenced by diet, salivary function, and the inherent susceptibility of the teeth oral health education [1]. Dental caries is an infectious disease that is dependent on a number of risk factors some of which are preventable whereas others cannot be. The environmental modification factors that can be manipulated include the

fluoridation of water stock and the amount and frequency of sugar intake [2]. Demographic factors, climate change and air pollution are also considered in the list of risk factors of dental caries [3]. Fermentable carbohydrate source is the most common source of dietary sugar that is also the most cariogenic. The frequency of consuming carbohydrates in the form of simple sugars increases the likelihood of an individual developing dental caries [4].

University studies are a critical time of the year during which changes in diet and other lifestyle habits can be made. The choice of food of a student is influenced by a lot of factors. These are culture, food preferences of parents and nutrition knowledge [5]. The levels of stress and social class also contribute. Food choice is a multifaceted behaviour that is influenced by a variety of factors, such as culture, parental preferences, nutrition knowledge, stress levels, and social class [6]. Regardless of their country of origin or cultural background, first-year university students exhibit a propensity for an unbalanced diet. Additionally, the relationships between determinants and the dietary behaviour of university students appeared to be moderated by university characteristics, including exams, student societies, residency, and the university lifestyle. Many students indicated that living in unstructured life (including sleeping habits), especially when living in student residences, would change their eating behaviour [7].

Studies indicate that first-year students at the university tend to consume an unbalanced diet. This is in various countries and cultures. Students are influenced by the university life alone into eating habits [8, 9]. Residing in the hostels, membership in the student organizations, and the examinations influence their dietary decisions. A lot of students claim that their eating is altered due to unstructured life. Sleeping disorders, particularly in a student hostel, influence the way they consume food [10].

A notable reduction in dental caries experience has been achieved as a result of a substantial increase in patient dental awareness and preventive knowledge [11]. Studying dental caries has gained significant attention during adolescence, as the progression of caries intensifies during this developmental stage. Moreover, during adolescence it is crucial to promote good oral hygiene, a healthy diet, and regular dental check-ups exams. Untreated carious lesions, especially those that are accompanied by pain, may adversely affect an individual's physical and psychological development, as well as their daily activities [12].

The study aimed to determine the impact of life in a residential university on the incidence of caries among senior dental students at Galala.

Methods

This cross-sectional observational study involved 303 dental students at Galala University who were instructed in dental cariology. The study was conducted in accordance with the Declaration of Helsinki. Approval was obtained to conduct the study from the Research Ethics Committee of the Faculty of Oral and Dental Medicine, Cairo University (1/11/24).

Inclusion criteria were students already taught a dental cariology in the 4th year of university, registered in the Galala dental program science year one, medically free students and having at least 1year clinical practice.

Exclusion criteria were first, second-, and third-year students and non-dental students.

Students were assessed prior to the end of their current year to ensure that all classes had received the cariology content related to etiopathogenesis, detection, diagnostics, and management of dental caries, including caries risk assessment (CRA), before completing the survey. On a daily basis, students perform CRA, caries diagnosis, and disease management with their respective patients. Participants' answers were not linked to any identifier, thus, data remained anonymous.

Selection of participants:

The target student group was presented with the study setup and the participation approval was sought during a face-to-face meeting. The students who consented to participate in the study were provided with a questionnaire that encompassed their residential habits and caries prevention practices. The Decayed, Missing, and Filled Teeth (DMFT) index of all participating students was recorded during their dental examination. The clinical findings were correlated with the digital responses, which were coded and analyzed. All students participating in the study were evaluated by the researcher using both questionnaire and DMF index [13].

Data collection:

The principal investigator explained the procedures to the target students and obtain consent for participation. Data collection was conducted using a self-administered, anonymized, electronic questionnaire that was executed using Google Forms. The principal investigator provided the target students with an explanation of the procedures and obtained their consent to participate. Two reminder emails were sent to the same list of pupils who were contacted after two and three weeks. Demographic characteristics and daily dental care practices were among the inquiries addressed in the survey. In order to ascertain the students' attitudes toward dental health, the survey featured a single discursive, short-answer question. The multiple-choice questions concerning daily oral hygiene practices were derived from surveys that had been previously published.

Additionally, eligible students who accepted to be enrolled in the study were examined to get their DMFT indices and were asked about the residential life. To ensure consistent data collection, inter- and intra-examiner reliability for DMFT scoring was assessed using calibration exercises that followed World Health Organization (WHO) oral health survey guidelines. The resulting digital responses were coded and analyzed for correlation with the clinical findings.

Data analysis:

The response rate was determined by the aggregate number of students enrolled in each dental course. DMFT is an acronym for Decayed, Missing, and Filled Teeth, a common index evaluates the number of

decayed (D), missing (M), and filled (F) teeth in an individual, with the total score providing an indication of overall dental health. Higher DMFT scores generally indicate greater dental caries experience, while lower scores reflect better oral health. In the current study, as oral and dental examination were performed using a prob, mirror, and cotton rolls, in order to score each participant using DMFT index. This index is widely used in epidemiological studies and clinical assessments to monitor trends in dental health over time and to guide public health strategies [14].

The primary independent variable was Residential status (resident vs. non-resident). The DMFT index was employed to quantify the caries experience of the dependent variable. The present study did not evaluate additional potential confounding variables, including dietary behaviors, oral hygiene practices, socioeconomic status, and sleep patterns. This is a critical point to note.

Outcome:

The current study's result was the assessment of caries prevalence using the DMFT index, which was devised by WHO and utilizes numbered scores [14].

Sample size:

The calculation was done based on the equation from the reference paper by Al Mousawi et al., [15]. This is an estimate of sample size for sensitivity or specificity alone when the true condition of disease status is known. The calculated sample size was (303). No subjects were Increased for anticipated missing data as there is no follow up.

Statistical analysis:

An examination of statistical significance was carried out using SPSS v28, which was developed by IBM (Armonk, NSW, USA). The data distribution was checked for normality using the Shapiro-Wilks test and histograms. The unpaired student t-test was used to assess quantitative parametric data, which was reported as mean and standard deviation (SD). The Mann Whitney U-test was used to assess quantitative non-parametric data, which was reported as the median and interquartile range (IQR). We used the Chi-square test or Fisher's exact test to assess qualitative variables when applicable, and we presented the results as frequency and percentage (%). Statistical significance was determined by a two-tailed P value less than 0.05. The level of correlation between two variables was estimated using Spearman correlation.

Results

The study included a total of 303 dental students. The overall mean age was 24.05 ± 0.89 years. Males constituted the majority of the studied participants (61.4%), and females represented 38.6%. The majority of participants were in the 4th year (83.2%), while the remainder were in the 5th year (16.8%). Of the total 303 dental students, there were 176 residents and 127 non-residents. The age, gender and distribution of academic levels were insignificantly different between the two groups. Table 1

Table 1
Demographic data of the studied participants

		Total (n = 303)	Resident (n = 176)	Non-resident (n = 127)	P value
Age (years)		24.05 ± 0.89	24.03 ± 0.82	24.08 ± 0.82	0.599
Gender	Male	186 (61.39%)	109 (61.93%)	77 (60.63%)	0.818
	Female	117 (38.61%)	67 (38.07%)	50 (39.37%)	
Level	4th	252 (83.2%)	148 (84.1%)	104 (81.9%)	0.613
	5th	51 (16.8%)	28 (15.9%)	23 (18.1%)	

Data are presented as frequency (%).

Table 2 represents the responses related to students' preventive behavior according to residence categorization. Toothbrushing frequency differed significantly ($P = 0.003$), residents were more likely to brush twice daily (54.5% vs. 37.8%), while non-residents more commonly brushed once daily (47.2% vs. 27.8%). The distribution of forgetting to brush also differed significantly ($P = 0.008$), with residents reporting less frequent forgetting (34.7% vs. 21.3%) and non-residents more often forgetting in the evening (57.5% vs. 48.9%). Brushing at college showed the most pronounced significant difference ($P = 0.001$), with residents more frequently reporting always (17.6% vs. 7.1%) or almost always (18.8% vs. 9.4%), whereas half of non-residents (50.4%) never brushed at college compared to 33.0% of residents. No statistically significant differences were observed for the remaining responses (all $P > 0.05$), including use of fluoridated toothpaste, toothpaste amount, brushing duration, rinsing after brushing, number of rinses, flossing frequency, dietary modification for caries prevention, and self-perceived caries risk.

Table 2: Responses related to students' preventive behavior according to residence categorization

		Total (n = 303)	Resident (n = 176)	Non-resident (n = 127)	P value
How many times/day do you brush your teeth?	Once a day	109 (36%)	49 (27.8%)	60 (47.2%)	0.003*
	Twice a day	144 (47.5%)	96 (54.5%)	48 (37.8%)	
	Less than once a day	9 (3%)	4 (2.3%)	5 (3.9%)	
	More than twice a day	41 (13.5%)	27 (15.3%)	14 (11%)	
When do you forget to brush?	I don't forget so often	88 (29%)	61 (34.7%)	27 (21.3%)	0.008*
	In the morning	51 (16.8%)	24 (13.6%)	27 (21.3%)	
	In the evening	159 (52.5%)	86 (48.9%)	73 (57.5%)	
	Both in the morning & evening	5 (1.7%)	5 (2.8%)	0 (0%)	
Do you brush your teeth at college?	Almost always	45 (14.9%)	33 (18.8%)	12 (9.4%)	0.001*
	Almost never	34 (11.2%)	22 (12.5%)	12 (9.4%)	
	Always	40 (13.2%)	31 (17.6%)	9 (7.1%)	
	Never	122 (40.3%)	58 (33%)	64 (50.4%)	
	Sometimes	62 (20.5%)	32 (18.2%)	30 (23.6%)	
Do you use fluoridated toothpaste?	Yes	234 (77.2%)	143 (81.3%)	91 (71.7%)	0.140
	No	45 (14.9%)	21 (11.9%)	24 (18.9%)	
	I don't know	24 (7.9%)	12 (6.8%)	12 (9.4%)	
How much toothpaste do you use?	1cm	198 (65.35%)	113 (64.2%)	85 (66.93%)	0.305
	2cm	64 (21.12%)	42 (23.86%)	22 (17.32%)	

	Less than 1cm	41 (13.53%)	21 (11.93%)	20 (15.75%)	
How long do you brush your teeth for?	1 min	118 (38.9%)	71 (40.3%)	47 (37%)	0.768
	2 min	132 (43.6%)	73 (41.5%)	59 (46.5%)	
	Less than 1 min	23 (7.6%)	15 (8.5%)	8 (6.3%)	
	More than 2 min	30 (9.9%)	17 (9.7%)	13 (10.2%)	
Do you rinse with water after brushing?	Yes	258 (85.15%)	147 (83.52%)	111 (87.4%)	0.349
	No	45 (14.85%)	29 (16.48%)	16 (12.6%)	
How any times do you rinse with water after brushing?	Once	91 (31.3%)	52 (31.5%)	39 (31%)	0.573
	Twice	95 (32.6%)	50 (30.3%)	45 (35.7%)	
	Several times	105 (36.1%)	63 (38.2%)	42 (33.3%)	
How often do you floss your teeth?	Everyday	49 (16.2%)	34 (19.3%)	15 (11.8%)	0.106
	Every other day	30 (9.9%)	19 (10.8%)	11 (8.7%)	
	Never	73 (24.1%)	45 (25.6%)	28 (22%)	
	Several times a month	89 (29.4%)	42 (23.9%)	47 (37%)	
	Several times a week	62 (20.5%)	36 (20.5%)	26 (20.5%)	
Do you modify your diet in order to prevent dental caries?	Yes	118 (38.94%)	63 (35.8%)	55 (43.31%)	0.186
	No	185 (61.06%)	113 (64.2%)	72 (56.69%)	
How do you classify your own caries risk	Low	143 (47.2%)	81 (46%)	62 (48.8%)	0.193
	Moderate	138 (45.5%)	83 (47.2%)	55 (43.3%)	
	High	19 (6.3%)	12 (6.8%)	7 (5.5%)	
	Extremely high	3 (1%)	0 (0%)	3 (2.4%)	

Data are presented as frequency (%).

Table 3 shows that among the 303 dental students surveyed, the total sample's caries experience, as measured by the DMFT index, had a mean of 3.14 ± 2.86 , reflecting a mild to moderate caries burden according to WHO thresholds. When comparing resident students and non-resident students, no statistically significant difference was observed.

Table 3
Evaluation of the overall dental health of the students' according to residence categorization

	Total (n = 303)	Resident (n = 176)	Non-resident (n = 127)	P value
DMFT Score	3.14 ± 2.86	2.94 ± 2.733	3.19 ± 2.911	0.859
	3 (0–5)	3 (0.5–5)	3 (0.5–5)	

Data are presented as mean $\pm$ SD or median (IQR). DMFT: Decayed, Missing, and Filled Teeth.

The residential life status showed non-significant correlation with the DMFT score ($r = 0.013$, $P = 0.822$).
Table 4

Table 4
Correlation analysis between the residential life and DMFT Score

	Residency	
	r	P
DMF Score	0.013	0.822

Data are presented as correlation coefficient. DMFT: Decayed, Missing, and Filled Teeth.

Discussion

The significance of the study on the effect of the Residential university life on the incidence of caries on the dental status is a gap in the oral epidemiology studies particularly among dental students. The lifestyle modifications and the living conditions in the university dormitory are somehow related to each other, where the change of food habits, stress, sleeping disorders, and changes in oral hygiene habits are the predetermined risk-factors of caries formation [16].

The current research resident population consisted of college students that had four years' experience in university dormitories where they shared rooms, utilized centralized food services, and structured and organized daily life. With the non-resident students, on the other hand, home based lifestyles were maintained and this would have enabled them to be more controlling in regards to their diets, sleep and oral health habits. These differences in living conditions have been cited to affect the risk of caries due to variability of frequency of sugar intake, of meals, of exposure to stress and to hygiene facilities [17].

The oral health is becoming more and more identified as a determinant of sleep patterns. Shorter sleep, as well as abnormal sleep schedules, have been linked to high risk of caries via various mechanisms, including diminished salivary flow, hormonal imbalances and nocturnal snacking [18, 19].

Nevertheless, in the current study, dental students in both residential groups are subjected to comparable academic pressures, such as exams and clinical duties, and this could lead to similar sleep patterns irrespective of residence status. This similarity could be the reason why the risk factors related to sleep did not translate into the quantifiable differences in cumulative DMFT scores.

The dietary intake of sugar is one of the main modifiable risk factors of dental caries. Regulated food services in universities and cafeterias have been found to affect the eating habits of students by restricting access to the most cariogenic foods and enhancing more balanced meal choices [20]. Had the resident and non-resident students of Galala University been equally exposed to food choices in the university premises, the overall exposure to cariogenic diets might have been reduced, thus eliminating the difference in caries prevalence between the two groups.

Other factors that might have led to homogeneity in behavior could be peer pressure and academic culture. Students studying in a similar academic setting tend to have similar routines and peer modeling can support good oral hygiene habits like regular brushing, fluoride application and less sugar intake [21]. Professional education among dental students places great emphasis on caries prevention and results in a consistent oral health behavior regardless of residence status [22].

Another significant area of dental curriculum that is applied in standardization of preventive behaviors is oral health education. Educational interventions have continuously been found to increase oral health knowledge, attitude, and practices that relate to caries prevention. Interactive and integrative education systems like problem-based learning and multimedia systems also enhance knowledge retention and a sustainable change in behavior, and therefore reduce the variability of individuals in terms of lifestyle [22].

The CAMBRA and Cariogram models are models that encourage the multifactorial approach to assessment of caries risks and preventive measures. When applied in undergraduate training, these models can encourage evidence-based decision-making in preventing caries and have the potential to reduce the impact of environmental lifestyle variations on the caries outcomes. Additionally, dental students tend to be a relatively homogenous socioeconomic group that has equal access to both fluoride exposure and dental care products and, as a result, inequalities in oral health status are even lower [23].

The present findings revealed that toothbrushing frequency differed significantly ($P = 0.003$), residents were more likely to brush twice daily. The distribution of forgetting to brush also differed significantly ($P = 0.008$), with residents reporting less frequent forgetting. Brushing at college showed the most pronounced significant difference ($P = 0.001$), with residents more frequently reporting always or almost always. No statistically significant differences were observed for the remaining responses (all $P > 0.05$).

These findings indicate that while a number of preventive behaviours did not differ by residence, residence status was significantly associated with more favourable toothbrushing habits and brushing at college, pointing to potential areas for targeted oral health promotion among non-resident students.

In line with the current findings, Ahmad et al. [24], who identified the preventive and treatment strategies among visually impaired pupils residing in a residential school in Aligarh. Of the total subjects, 55.2% had poor oral hygiene, while only 16% had excellent oral hygiene, as determined by the oral examination. Approximately 28% of individuals who maintained poor oral hygiene and 57% of those who maintained middling oral hygiene were affected by dental caries. The prevention of the disease and the treatment modalities are identical.

Moreover, Al Mousawi et al. [15], determined the incidence of dental caries and the treatment that was administered to undergraduate students aged 18–24. Furthermore, the selected sample consisted of two Dentistry College students who were responsible for the management of public oral health services in the country. There was no statistically significant difference in the prevalence rates of DMFT and each component between students of public and private Dentistry Colleges, or between different genders.

However, Musaiger et al. [25], The results indicated that women who cleaned their teeth three times or more per day, primarily after consuming candies and chocolates, and did not have gingivitis were at a lower risk of developing dental caries than other females.

Contrary to the current findings, Nassar [26], who evaluated the awareness and understanding of undergraduate dental students regarding prevalent caries-related preventive considerations and to emphasize these factors in a clear and concise manner to serve as a reference for dental practitioners. The students appeared to comprehend the intricacies of critical concepts such as flossing, brushing, reducing sugar exposure, and the use of fluoride products. However, it is imperative that students are more informed about dietary guidelines for caries prevention, as they are essential for the success of dentists upon graduation. Therefore, there is a need to prioritize this area of study.

The DMFT index was selected as the primary outcome measure, as it remains the most popular epidemiological indicator of a cumulative experience of dental caries. Standardized by the World Health Organization, DMFT is an indicator of historic disease burden and restorative treatment outcomes and can meaningfully be compared across populations and studies [27, 28].

In the present study, among the 303 dental students surveyed, the total sample's caries experience, as measured by the DMFT index, had a mean of 3.14 ± 2.86 , reflecting a mild to moderate caries burden according to WHO thresholds. When comparing resident students and non-resident students, no statistically significant differences were observed. These findings suggest that and objective caries experience did not differ significantly according to residence status, indicating comparable oral health knowledge and disease burden between the two groups. Residence status showed non-significant correlation with the DMFT score ($r = 0.013$, $P = 0.822$). These results indicate that there was no linear relationship between a student's residence status and their caries burden

Even though past researchers have found a correlation between dormitory living and increased caries risk because of poor dietary habits and disturbance of lifestyle, the lack of significant differences in this cohort may be explained by similar academic stress, the same level of stress exposure, and the same level of oral health awareness among dental students [26, 29].

Finally, the lack of significant differences in caries prevalence between resident and non-resident dental students can be explained by the fact that they are exposed to the same academic stress factors, experience the same dieting conditions, peer influence is rather strong, and the prevention program. These results imply that institutional support and oral health promotion in the curriculum are crucial in emerging the traditional caries risk factors in the university setting.

In light of these findings, aligning theoretical instruction with contemporary ecological and preventive philosophies may foster future practitioners who prioritize disease control, risk assessment, and health promotion over restorative intervention alone. Such transformation is fundamental for advancing oral health at both individual and population levels [30, 31].

Contemporary caries management is primarily guided by individualized risk assessment and the implementation of non-surgical preventive strategies. Tooth brushing with fluoridated toothpaste remains the most widely recommended preventive measure. Although fluoride does not directly eliminate etiological factors such as dietary sugars or biofilm accumulation, its topical mechanism enhances remineralization and reduces lesion progression. Therefore, evaluating students' preventive routines provides insight into the translation of theoretical knowledge into personal health behaviours [32, 33].

Although the recommendation to avoid rinsing remains debated, evidence suggests that minimizing post-brushing rinsing may improve fluoride retention and clinical effectiveness. Increased clinical exposure may heighten awareness of disease progression and risk factors, thereby influencing personal preventive habits. A comprehensive and updated understanding of dental caries is essential for preparing future dentists to adopt evidence-based, minimally invasive management strategies. Moving from a restorative-centered approach toward preventive, patient-centered, and risk-based interventions is critical for improving long-term oral health outcomes. Strengthening and standardizing cariology education will ensure that graduates are equipped to manage caries according to contemporary standards of care [34].

The cross-sectional design of the present study limited the ability to create causal inferences. Furthermore, the risk of recall and social desirability bias was elevated by the fact that all behaviors were self-reported. The scope of subgroup analyses and generalizability were also restricted by the fact that this study was conducted at a singular center.

Conclusions

The present investigation demonstrated that specific preventive oral health behaviors were significantly correlated with residence status. In comparison to non-residents, resident students exhibited a higher frequency of toothbrushing, were less likely to neglect to brush, and brushed their teeth more frequently at college. Nevertheless, the DMFT index was statistically comparable between the two groups, indicating that these behavioral advantages did not translate into significant differences in oral health or caries experience. Additionally, correlation analyses verified the absence of any significant correlation between the DMFT score, and residence. It is important to note that the absence of a substantial correlation between oral health knowledge and the actual caries burden underscores the multifactorial etiology of dental caries and implies that knowledge alone is insufficient to influence clinical outcomes. Finally, the residential university life did not have a significant effect on the prevalence of caries in senior dental students.

Longitudinal designs and more sensitive outcome variables such as caries activity indices, dietary assessment, sleep monitoring and salivary biomarkers should also be included in future research to obtain a clearer picture of the shifts in the effects of the lifestyle factors on the caries development. In that way, the findings of the research given should be considered to be rather exploratory rather than confirmation and address the need to develop analytical models in future research.

Universities should target non-resident students in their health promotion efforts and enhance on-campus oral hygiene facilities, with a focus on practical strategies to encourage consistent brushing and flossing. Additionally, in order to effectively bridge the divide between oral health knowledge and actual preventive practices, dental curricula should include behavior-change training.

Abbreviations

DMFT
Decayed
Missing
and Filled Teeth
WHO
World Health Organization
CRA
caries risk assessment.

Declarations

Ethics approval and consent to participate:

Approval was obtained from the Research Ethics Committee of the Faculty of Oral and Dental Medicine, Cairo University (Approval number: 1/11/24). Written informed consent was obtained from all participants prior to their inclusion in the study.

Consent for publication:

Not applicable.

Competing interests:

The authors declare that they have no competing interests.

Funding:

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Author Contribution

S.I.H. conceived and designed the study, collected the data, performed the clinical examinations, analyzed the data, and drafted the manuscript. M.M.A. and O.E.H. contributed to study supervision and methodology. All authors critically revised the manuscript and approved the final version.

Acknowledgements:

Not applicable.

Availability of data and materials:

The datasets generated and/or analysed during the current study are available from the corresponding author upon reasonable request.

References

1. de Barros LP, Grieleitow LC, Bomfim RA. Unhealthy dietary habits and sedentary behavior drive untreated dental caries among adolescents: A population-based study. *Sci Rep.* 2025;15:34–42. <https://doi.org/10.1038/s41598-025-16230-y>.
2. Pitts NB, Twetman S, Fisher J, Marsh PD. Understanding dental caries as a non-communicable disease. *Br Dent J.* 2021;231:749–53. <https://doi.org/10.1038/s41415-021-3775-4>.
3. Değirmenci A, Değirmenci BÜ. How do the diet, oral hygiene habits and body mass index affect tooth caries in the students of the faculty of dentistry? *East J Med.* 2020;25:25–39.

4. Palacios C, Rivas-Tumanyan S, Morou-Bermúdez E, Colon AM, Torres RY, Elías-Boneta AR. Association between Type, Amount, and Pattern of Carbohydrate Consumption with Dental Caries in 12-Year-Olds in Puerto Rico. *Caries Res.* 2016;50:560–70. <https://doi.org/10.1159/000450655>.
5. Jurado-Gonzalez P, López-Toledo S, Bach-Faig A, Medina FX. Barriers and Enablers of Healthy Eating Among University Students in Oaxaca de Juárez: A Mixed-Methods Study. *Nutrients.* 2025;17:36–49. <https://doi.org/10.3390/nu17071263>.
6. Vázquez-Aguilar A, Ballesteros-Torres JM, Escalante-Aburto A, Huerta-Canseco C, Jiménez-López KL, Caballero-Prado CJ. Dietary Trends and Lifestyle Habits Among University Students: Analysis of Consumption Patterns and Nutritional Risks. *Nutrients.* 2026;18:15–23. <https://doi.org/10.3390/nu18030532>.
7. Okoroafor CC, Okobi OE, Owodeha-Ashaka M, Okobi E, Oluseye B, Ekpang OB, et al. Dental Health Knowledge Attitude and Practice Among University of Calabar Students. *Cureus.* 2023;15:e40055. <https://doi.org/10.7759/cureus.40055>.
8. Torres K, Cáceres-Durán MA, Orellana C, Osorio M, Simón L. Nutritional imbalances among university students and the urgent need for educational and nutritional interventions. *Front Nutr.* 2025;12:15–25. <https://doi.org/10.3389/fnut.2025.1551130>.
9. Fernández CE, Chanin M, Appice GM, Culver AM, Stein A. Conceptualization of dental caries by dental students is related to their preventive oral care routine. *J Dent Educ.* 2020;84:1426–37. <https://doi.org/10.1002/jdd.12357>.
10. Methuen M, Kukkonen VF, Anttonen V, Mikkonen S, Väistö J, Soininen S, et al. Dietary Factors and Dental Caries among Adolescents: Eight-Year Follow-up Study. *JDR Clin Trans Res.* 2026;11:40–52. <https://doi.org/10.1177/23800844251314856>.
11. Jiang R, Yu J, Islam R, Li X, Nie E. Dental caries prevention knowledge, attitudes, and practice among patients at a university hospital in Guangzhou, China. *Medicina.* 2023;59:15–35.
12. Almajed O, Aljouie A, Alghamdi R, Alabdulwahab F, Laheq M. Transforming Dental Care in Saudi Arabia: Challenges and Opportunities. *Cureus.* 2024;16:5–43. <https://doi.org/10.7759/cureus.54282>.
13. Broadbent JM, Thomson WM. For debate: problems with the DMF index pertinent to dental caries data analysis. *Community Dent Oral Epidemiol.* 2005;33:400–9. <https://doi.org/10.1111/j.1600-0528.2005.00259.x>.
14. Aalemi AK, Eshraqi AM. Assessment of Dental Caries among Adolescents in Private Educational Institutions of Kabul City. *F1000Research.* 2026;15:13–20.
15. Al Mousawi A, Al Ali B, Al Mousawi Z. The prevalence of dental caries among students of dentistry colleges in holy karbala governorate in Iraq in 2017. *J Contemp Med Sci.* 2019;5:25–36.
16. Ekuni D, Tomofuji T, Mizutani S, Furuta M, Irie K, Azuma T, et al. Dental caries is correlated with knowledge of comprehensive food education in Japanese university students. *Asia Pac J Clin Nutr.* 2013;22:312–8. <https://doi.org/10.6133/apjcn.2013.22.2.13>.

17. Alawady A, Alharbi A, Alharbi H, Almesbah S, Alshammari N, Alkandari A, et al. Association between sleep duration and dental caries in a nationally representative U.S. population. *BMC Oral Health*. 2023;23:49–57. <https://doi.org/10.1186/s12903-023-03147-z>.
18. Abdul NS. Sleep Pattern and the Incidence of Early Childhood Caries: Systematic Review. *J Pharm Bioallied Sci*. 2024;16:3064–7. https://doi.org/10.4103/jpbs.jpbs_680_24.
19. Olmos-Valverde M, Carrillo-Díaz M, González-Olmo MJ, Romero-Maroto M, Jiménez-Trujillo I. Dental Caries, Periodontal Status, and Lifestyle Connections: Examining the Moderating Effects of Sleep, Smoking, Diet, and Mealtime Routines. *Nutrients*. 2025;17:114–26. <https://doi.org/10.3390/nu17061079>.
20. Tahani B, Asgari I, Golkar S, Ghorani A, Hasan Zadeh Tehrani N, Arezoo Moghadam F. Effectiveness of an integrated model of oral health-promoting schools in improving children's knowledge and the KAP of their parents, Iran. *BMC Oral Health*. 2022;22:59–69. <https://doi.org/10.1186/s12903-022-02644-x>.
21. Farje-Gallardo CA, Salazar OP, Coronel-Zubiate FT. Innovative learning in dental education: integrating narrative and 3D industrial design for teaching caries health disease processes. *BMC Oral Health*. 2025;25:38–45. <https://doi.org/10.1186/s12903-025-05711-1>.
22. Liang Y, Li D, Deng D, Chu CH, Mei ML, Li Y, et al. AI-Driven Dental Caries Management Strategies: From Clinical Practice to Professional Education and Public Self Care. *Int Dent J*. 2025;75:10–28. <https://doi.org/10.1016/j.identj.2025.04.007>.
23. TR J. CAMBRA Caries Management by Risk Assessment—is a Current Concept in Carious Prevention Cases Studies. *Oral Health Dent Sci*. 2021;5:1–5.
24. Ahmad MS, Jindal M, Khan S, Hashmi S. Oral health knowledge, practice, oral hygiene status and dental caries prevalence among visually impaired students in residential institute of Aligarh. *J Dent Oral Hyg*. 2009;1:22–6.
25. Musaiger AO, Al-Mannai M, Abduljawad E. Association of oral hygiene habits and food intake with the risk of dental caries among undergraduate university women in Saudi Arabia. *Int J Adolesc Med Health*. 2014;26:585–9. <https://doi.org/10.1515/ijamh-2013-0337>.
26. Nassar HM. Dental Caries Preventive Considerations: Awareness of Undergraduate Dental Students. *Dent J (Basel)*. 2020;8:35–46. <https://doi.org/10.3390/dj8020031>.
27. Ahmed MA, Jouhar R, Faheemuddin M, AlJafar A, Alabawi H, Alhumaidi B, et al. Assessment of Oral Health Knowledge, Attitude, Practice and DMFT Scores among Patients at King Faisal University, Al-Ahsa. *Med (Kaunas)*. 2023;59:96–112. <https://doi.org/10.3390/medicina59040688>.
28. Shah J, Poirier BF, Hedges J, Jamieson L, Sethi S. Effect of sleep on oral health: A scoping review. *Sleep Med Rev*. 2024;76:10–21. <https://doi.org/10.1016/j.smrv.2024.101939>.
29. Deliens T, Clarys P, De Bourdeaudhuij I, Deforche B. Determinants of eating behaviour in university students: a qualitative study using focus group discussions. *BMC Public Health*. 2014;14:53–67. <https://doi.org/10.1186/1471-2458-14-53>.

30. Teerawongpaibroj C, Tantipoj C, Sipiyaruk K. The design and evaluation of gamified online role-play as a telehealth training strategy in dental education: an explanatory sequential mixed-methods study. *Sci Rep.* 2024;14:9–21.
31. Li X, Peng L, Tu H, Liu L, Han X, Ye L, et al. Dental Undergraduate Students' Perceptions of Blended Learning in the COVID-19 and Post-COVID-19 Years: Survey Study. *JMIR Formative Res.* 2025;9:6–24.
32. Kassab SE, Rathan R, Taylor D, Hamouri S, Hamdy H. Understanding how medical students learn in the era of artificial intelligence: a mixed methods study. *BMC Med Educ.* 2025;25:1–10.
33. Gadbail AR, Gondivkar SM, Yuwanati M, Sonone A, Dhamande M, Panchbhai A et al. Early clinical exposure in undergraduate dental education: a systematic review of effectiveness, experiences, and outcomes. *BMC Med Educ.* 2026:7–66.
34. Wordley V, Bedi R. Developing a dental leadership programme to address global oral health challenges. *BMJ Lead.* 2020:89–99.