



Prevalence and severity of dental caries among 7–13-year-old schoolchildren in Herat, Afghanistan: a cross-sectional study in 2022

✉    
 Sayed Eshaq Amin^{1*}, Ghulamsakhi parsaa², Said Amir Sady², Abdul Tawab Rauf², Shakila
 Chakari²

¹: Clinic Department, Faculty of Dentistry, Ghalib University, Herat, Afghanistan (Corresponding author Email: sayedshaq.amin@ghalib.edu.af)

² Dentist, Herat, Afghanistan

Article Info

Article type:
Research Article

pp:183-200

Received:

30/01/2026

Accepted:

19/03/2026

Published:

21/03/2026

ABSTRACT

Background and Objective: Dental caries disproportionately affects children in low-income countries like Afghanistan. This study assessed the prevalence, severity, and risk factors of dental caries among schoolchildren in Herat City.

Method: A cross-sectional study was conducted in 2022 involving 446 children aged 7–13 years. Data collection included parental questionnaires and clinical oral examinations using WHO criteria. Logistic regression analyzed associations with sociodemographic and behavioral factors.

Findings/Result: The overall caries prevalence was 87.2% (95% CI: 83.8%–90.0%), with a mean C-dmft/DMFT score of 3.26 ± 1.86 . Restorative care was minimal, with only 3.6% of children having filled teeth. Older age was significantly protective against caries presence (AOR=0.515, p=0.002). No significant associations were found between caries and oral-health behaviors, parental education, or income after adjustment.

Conclusion: schoolchildren in Herat face an alarmingly high, largely untreated caries burden. Urgent scalable interventions are needed, including school-based prevention programs, fluoride promotion, nutrition education, and expanded access to affordable restorative care to mitigate this public health crisis.

Keywords: Dental caries, Schoolchildren, Herat, Afghanistan, C-dmft/DMFT

Cite this article: Amin S. E, Parsa G, Sady S.A, Rauf A. T, Chakari S. T. Prevalence and severity of dental caries among 7–13-year-old schoolchildren in Herat, Afghanistan: a cross-sectional study in 2022. *Ghalib Medical Journal*. [Internet]. Publication date. 21.03.2026; 3 (1): 183-200: <https://doi.org/10.58342/MJ.V.3.I.1.12>





مجله علوم طبى غالب (MJ)

صفحه اصلی مجله: <https://www.mj.ghalib.edu.af>

ISSN

P: 3105-0786

E: 3006-094X



<https://doi.org/10.58342/MJ.V.3.I.1.12>

ناشر: پوهنتون / دانش‌گاه غالب - هرات

شیوع و شدت پوسیدگی دندان در میان متعلمین ۷-۱۳ ساله در هرات، افغانستان:

یک مطالعه مقطعی در سال ۱۴۰۱

سید اسحاق امین^{۱*}، غلام سخی پارسا^۲، سید امیر سعدی^۲، عبدالنواب رئوف^۲، شکیلا چکری^۲

^{۱*} دپارتمان طب دندان، پوهنتون / دانش‌کده سوماتولوژی، پوهنتون / دانش‌گاه غالب، هرات، افغانستان (ایمیل نویسنده مسؤول: savedeshaq.amin@ghalib.edu.af)
^۲ دکتر دندان، هرات، افغانستان

چکیده

اطلاعات مقاله

نوع مقاله: پژوهشی
صفحات: ۱۸۳-۲۰۰

زمینه و هدف: پوسیدگی دندان به‌طور نامتناسبی اطفال را در کشورهای کم‌درآمد مانند افغانستان تحت تأثیر قرار می‌دهد. این مطالعه شیوع، شدت و عوامل خطر پوسیدگی دندان را در متعلمین مکاتب در هرات بررسی کرد.

روش: یک مطالعه مقطعی در سال ۲۰۲۲ بر روی ۴۴۶ طفل ۷-۱۳ ساله انجام شد. گردآوری داده‌ها شامل پرسش‌نامه والدین و معاینات کلینیکی دهان با استفاده از معیارهای سازمان جهانی بهداشت بود. رگرسیون لجستیک ارتباطات با عوامل جامعه‌شناختی و رفتاری را تحلیل کرد.

یافته‌ها: شیوع کلی پوسیدگی ۸۷/۲٪ (فاصله اطمینان ۹۵٪: ۸۳/۸٪-۹۰/۱٪) بود، با میانگین نمره C-dmft/DMFT برابر $3/26 \pm 1/86$. مراقبت‌های ترمیمی به‌طور حداقل بود؛ تنها ۳/۶٪ از متعلمین دارای دندان پر شده بودند. سن بالاتر به‌طور معنی‌داری در برابر وجود پوسیدگی محافظت‌کننده بود ($p=0.002$, AOR=0.515). پس از تعدیل، بین پوسیدگی و رفتارهای بهداشت دهان، تحصیلات والدین یا درآمد، ارتباط معناداری یافت نشد.

نتیجه‌گیری: متعلمین مکاتب در هرات با بار بسیار بالای پوسیدگی دندان مواجه هستند که عمدتاً درمان نشده باقی مانده است. مداخلات قابل‌گسترش و فوری لازم است، از جمله برنامه‌های پیشگیری در مکاتب، ترویج فلوراید، آموزش تغذیه و توسعه دسترسی به مراقبت‌های ترمیمی ارزان‌قیمت تا این بحران بهداشت عمومی کاهش یابد.

کلیدواژه‌ها: پوسیدگی دندان، متعلمین، هرات، افغانستان، C-dmft/DMFT

ارجاع به این مقاله: امین س. ا. پارسا غ. س. سعدی س. ا. رئوف ع. چکری ش. شیوع و شدت پوسیدگی دندان در میان متعلمین ۷-۱۳ ساله در هرات، افغانستان: یک مطالعه مقطعی در سال ۱۴۰۱. مجله علوم طبى غالب. [اینترنت]. ۱/۰۱ / ۱۴۰۵. [تاریخ برداشت: ۳(۱): ۲۰۰-۱۸۳]

<https://doi.org/10.58342/MJ.V.3.I.1.12>; ۱۸۳

Introduction

Dental caries, or tooth decay, is one of the most widespread non-communicable diseases globally, affecting nearly 3.7 billion people.^[1] Dental caries also represents a major oral health problem in early childhood, with a global prevalence of 43% in primary teeth among children under five years of age, affecting an estimated 514 million children^[2, 3]. In low- and middle-income countries (LMICs), children are disproportionately affected, with prevalence ranging from 64% to 83% among those aged 5–6 years and 40% to 90% among adolescents aged 12 years, contributing to a continued increase in the burden of early childhood caries (ECC) particularly in under-resourced and developing regions^[2, 3]. While high socio-demographic index (SDI) regions exhibit the lowest ECC burden due to effective public health measures, medium and low SDI regions face persistent challenges, highlighting the need for targeted interventions to reduce disparities in oral health outcomes^[2].

In fragile, conflict-affected settings like Afghanistan, a recent school-based survey in Kabul reported caries in 78.8% of children aged 7–13 years^[4]. Untreated caries in childhood can lead to pain, difficulty eating, malnutrition, missed school days, and a higher risk of lifelong dental problems^[2, 3].

Dental caries is a multifactorial disease in which frequent consumption of free sugars and inadequate removal of dental plaque promote acid production by cariogenic oral bacteria and progressive demineralization of tooth tissue^[3, 5]. Low exposure to fluoride—whether in drinking water or in commonly used toothpastes—and limited availability of preventive and restorative oral-health services further increase population risk^[5]. Socioeconomic and behavioral determinants—particularly low household income, lower parental education, and gaps in preventive practices and oral-health knowledge—are consistently associated with higher caries burden in children, and school- and community-based studies from low- and middle-income settings show caries clustering among disadvantaged children that is linked to more frequent sugar consumption and less effective oral-hygiene routines. Framing caries as both a biological and social problem highlights the need for integrated prevention strategies that reduce free-sugar exposure, ensure reliable fluoride provision, and expand accessible preventive and restorative oral-health services^[3, 5].

Afghanistan has endured decades of armed conflict, pervasive poverty, and dysfunctional public services that have undermined population health and weakened health-system functioning^[5]. Educational attainment and broader socioeconomic deprivation are substantial—national literacy was 37% in 2021 (52% for men; 27% for women)—constraints that limit health literacy, access to services, and preventive behaviors^[5, 6]. Recent UN/OPHI estimates document that Afghanistan experienced increases in multidimensional poverty between 2015–2016 and 2022–2023, indicating a large share of the population lives with multiple, overlapping deprivations^[7]. Consistent with these social determinants, the WHO oral-health country profile reports a high burden of untreated caries (estimated 45.8% of children aged 1–9 years with untreated deciduous caries and 36.8% of people aged 5+ years with untreated permanent caries), a limited oral-health workforce (≈ 0.7 dentists per 10,000 population in 2019), and no operational national oral-health policy^[8]. Local epidemiologic data from Herat province corroborate these findings, documenting high caries experience and largely unmet restorative needs in children, low fluoride concentrations in drinking water, and

inconsistent fluoride content in commonly used toothpastes ^[5]. Taken together, these sources indicate that Afghan children shoulder a substantial and largely unmet burden of dental disease closely linked to poverty, constrained services, and weak preventive infrastructure ^[5, 7, 8].

Published epidemiological studies conducted in Afghanistan report a high burden of dental caries and substantial unmet restorative need among schoolchildren ^[5, 9]. A stratified school-based survey in Herat found a mean DMFT of 2.57 in 12-year-olds and noted that most lesions—particularly in younger children—remained untreated ^[5]. The same Herat study measured low fluoride concentrations in drinking water (mean \approx 0.37 ppm) and documented that several commonly used toothpastes contained less fluoride than recommended ^[5]. A cross-sectional survey of 491 schoolchildren in Kabul (data collected in 2019) reported an overall caries prevalence of 78.8% and observed that virtually all students had not received restorative dental treatment ^[4]. A larger, more recent school-based survey in Herat (n = 2,089; ages 5–18) documented a mean DMFT of 4.39, a 68.2% prevalence of untreated cavitated (D3) lesions, and that only 1.8% of children had one or more restorations ^[9]. Taken together, these studies consistently demonstrate a very high prevalence of dental caries among Afghan children accompanied by very low levels of restorative care and substantial unmet treatment needs ^[5, 9].

Despite this evidence, there is no comprehensive recent data specifically on 7–13-year-old schoolchildren in Herat. Nationwide surveys are lacking, and small studies cover different age groups or areas. Herat province – Afghanistan’s third-largest province – has its own socioeconomic and cultural context (including language, dietary practices, and health access) that may influence oral health. Moreover, Herat shares a border with Iran, a country where caries is also common, suggesting cross-border influences ^[10]. Without up-to-date local data, health planners cannot gauge the true burden or target interventions (e.g. school-based prevention) effectively. Thus, our study in Herat addresses a key gap by providing current, region-specific estimates of caries prevalence and severity, along with associated risk factors. These data are needed to inform Afghan oral health policy and prioritize community and school-based programs in this fragile setting. This study aimed to assess the prevalence and severity of dental caries among 7–13-year-old schoolchildren in Herat city using the dmft/DMFT index. It also described patterns of decayed, missing, and filled teeth, examined gender differences, and explored associations with sociodemographic factors, oral-health behaviors, and dietary habits. We hypothesized that lower household socioeconomic position, less frequent toothbrushing, and lack of parental supervision would be associated with higher odds of caries.

Methods

This cross-sectional study was conducted among schoolchildren aged 7–13 years in Herat city, Afghanistan, during the first half of 2022. The study protocol was approved by the Ethical Review Committee at Ghalib University (Afg-Gh.U.H.R.E.C-2026-0046). Permission to conduct the study was obtained from the Provincial Directorate of Education, Herat Province, and from the principals of the selected schools. The questionnaires were to be sent home with selected students and completed by parents/guardians (or another literate relative). Only children who returned a completed

parent/guardian questionnaire and whose parent/guardian provided verbal consent were examined; verbal assent was obtained from each child. All procedures complied with relevant ethical standards.

The initial sample size was calculated using Cochran's formula for simple random sampling ($n_0 = 384$, assuming a 95% confidence level, $p = 0.5$, and margin of error $e = 0.05$). Because the study used a multistage cluster sampling design, the effective sample size could be affected by clustering within classrooms. A multistage cluster sampling approach was employed. Five municipal districts within Herat City were selected by convenience for practical accessibility. Within each district, one school was randomly selected; within each school, one class per grade (when parallel classes existed) was randomly chosen. Students were then selected systematically from class attendance lists (every second student). Because district selection was by convenience, the sample is not strictly probability-based at the district level, as shown in Figure 1. Of the 500 targeted students, 446 returned completed questionnaires and underwent clinical examination (response rate 89.2%). Children absent on the examination day or without returned parental/guardian consent were excluded.

Data collection comprised a parent/guardian questionnaire and a school-based clinical oral examination. The structured questionnaire collected child demographics (age grouped into three categories, sex, grade), household socioeconomic indicators (parental education and occupation, monthly household income, residence), oral-health behaviors (tooth-brushing frequency, parental supervision, toothbrush replacement, dental visits, floss and mouthwash use) and dietary factors (frequency of fruit/vegetable and dairy consumption, and source of drinking water). Because these behavioral variables were reported by parents or guardians, some degree of recall bias or social desirability bias may be present. However, the questionnaire used simple and standardized response options to reduce reporting errors. Six dental interns from the Ghalib University Stomatology Faculty performed the clinical examinations using disposable mouth mirrors and dental probes under natural light, following WHO oral health survey criteria (visual inspection without radiographs). Examiners completed a three-day training session led by an experienced faculty dentist, including instruction on WHO diagnostic criteria and supervised practice on 18 non-participant children. Due to the unavailability of a calibration expert, formal inter-examiner calibration with kappa statistics was not performed, which may introduce measurement variability. The reliance on visual examination alone may also underestimate interproximal and early caries lesions.

For every erupted tooth, examiners recorded whether it was decayed (presence of caries lesion), missing due to caries, or filled with a restoration. unerupted teeth, congenitally missing teeth, and teeth lost for non-caries reasons were excluded; normal exfoliation of primary teeth was accepted. For each participant, caries experience was recorded at the individual level as total counts of affected teeth, without differentiation between primary and permanent dentition. Specifically, the total number of decayed teeth (including both d and D), missing teeth due to caries (m and M), and filled teeth (f and F) was recorded. An overall caries experience score (combined $dmft/DMFT$ or $C-dmft/DMFT$) was calculated for each child by summing the total decayed, missing, and filled teeth. This composite index represents cumulative caries experience in children with mixed dentition and was used as the primary caries outcome. Based on C-

dmft/DMFT, caries prevalence was defined as the presence of at least one affected tooth ($C\text{-dmft/DMFT} > 0$). Caries severity was assessed using the mean $C\text{-dmft/DMFT}$ score.

Data were analyzed in IBM SPSS Statistics version 27. Descriptive statistics (frequencies, proportions, means \pm SD, medians) summarized participant characteristics and caries outcomes. Prevalence estimates for $C\text{-dmft/DMFT} > 0$ were presented with 95% confidence intervals (CIs) calculated using the Wilson method. Comparisons of caries prevalence and severity categories across subgroups were performed using chi-square test. Differences in mean $C\text{-dmft/DMFT}$ between groups were analyzed using Mann–Whitney U for non-normal distributions. Binary logistic regression was used to examine factors associated with caries presence, with covariates selected a priori and variables with $p < 0.20$ in bivariate analysis considered for the final model. Adjusted odds ratios (AORs) with 95% CIs were reported, and model fit was assessed using the log-likelihood ratio test and McFadden's pseudo- R^2 . Missing data (<2%) were handled using complete-case analysis. Because classroom identifiers were unavailable, cluster-adjusted analyses were not performed; therefore, a sensitivity analysis assuming ICC values of 0.01–0.05 and an average class size of 40 was conducted to estimate potential design effects. Subgroup analyses were performed by age group, sex, residence, and family income. Statistical significance was set at $p < 0.05$, and all tests were two-tailed.



Figure 1: Map of Herat City showing the five municipal districts selected for sampling. One school per district was randomly selected (indicated by markers).

Result

Of the 446 children included in the analysis, 41.5% (185/446) were aged 11–13 years, 34.8% (155/446) were 9–11 years, and 23.8% (106/446) were 7–9 years. The sample comprised 57.0% boys (254/446) and 43.0% girls (192/446). Most households reported a monthly family income under 10,000 Afghanis (69.5%, 310/446). Maternal education was evenly split, with 49.3% (220/446) of mothers classified as illiterate and 50.7% (226/446) as literate; paternal literacy was higher (61.2%, 273/446 literate). The

majority of mothers were housewives (88.3%, 394/446) and most families resided in urban areas (80.9%, 361/446) as shown in the Table 1.

Toothbrushing once daily was the most common practice (49.8%, 222/446); 20.6% (92/446) brushed twice daily, 20.0% (89/446) three times or more, and 9.6% (43/446) reported never brushing. Parental supervision of brushing was reported for 74.7% (333/446) of children. Nearly half reported replacing the toothbrush monthly (47.5%, 212/446). Use of mouthwash and dental floss were reported by 29.1% (130/446) and 27.1% (121/446) of students, respectively. One-third (33.2%, 148/446) reported having dental check-ups. Dairy and vegetable intake were distributed across low, medium and high frequency categories as shown in Table 2.

Among the participants, the prevalence of decayed teeth was very high at 83.9% (374/446) and identical in girls and boys (161/192, 83.9% vs. 213/254, 83.9%; $p = 0.999$, $\chi^2 = 0.00$). Missing teeth were observed in 43.5% of the sample (194/446) and were significantly more common in boys than girls (130/254, 51.2% vs. 64/192, 33.3%; $p < 0.001$, $\chi^2 = 14.172$). Filled teeth were rare overall (16/446, 3.6%) and showed no significant gender difference (girls 9/192, 4.7%; boys 7/254, 2.8%; $p = 1.00$, $\chi^2 = 1.180$) as shown in the Table 3.

The overall prevalence of dental caries (C-dmft/DMFT > 0) was 87.2% (95% CI: 83.8% – 90.0%), while 12.8% (57/446) were caries-free. Prevalence varied by age group, with the highest rates observed in children aged 9–11 years (92.9%, 95% CI: 87.7% – 96.0%) and 7–9 years (91.5%, 95% CI: 84.7% – 95.5%), compared to those aged 11–13 years (80.0%, 95% CI: 73.7% – 85.1%; $\chi^2 = 11.24$, $p = 0.004$). No significant differences were observed by gender (boys: 87.0% vs. girls: 87.5%, $p = 0.991$), residence (urban: 87.8% vs. suburb: 84.7%, $p = 0.554$), or family income ($p = 0.386$), as seen in the Table 4

Boys exhibited a significantly greater caries burden than girls, as indicated by higher mean ranks (238.55 vs. 203.59; Mann–Whitney $U = 20,562$, $p = .004$). Although the difference was statistically significant, the effect size was small ($r = .14$). The overall study population ($N = 446$) had a mean C-dmft/DMFT score of 3.26 ± 1.86 and a median of 4, as shown in Table 5.

In bivariate analyses, no statistically significant associations between dental caries and various oral-health factors, including father's education ($p = 0.353$), mother's education ($p = 0.759$), tooth-brushing frequency ($p = 0.616$), dental floss use ($p = 0.624$), mouthwash use ($p = 0.665$), parental supervision ($p = 0.137$), and dental check-ups ($p = 0.980$). Descriptively, although children with caries were more likely to have fathers with no formal education (47.4% vs. 37.5%) and the caries-free group showed a higher rate of brushing three or more times (20.8% vs. 14.0%), these differences did not reach statistical significance as indicated in Table 6.

Variables with a p -value < 0.20 in bivariate analyses (gender and parental supervision) were entered into a multivariable logistic regression model as seen in the Table 7. After adjustment, boys had twice the odds of having dental caries compared to girls (adjusted odds ratio [AOR] = 2.08, 95% CI: 1.16 – 3.72, $p = 0.014$). Lack of parental supervision was associated with a 56% increase in the odds of caries, but this did not reach statistical significance (AOR = 1.56, 95% CI: 0.85 – 2.84, $p = 0.15$).

Given the multistage cluster sampling design, we conducted sensitivity analyses to assess the potential impact of clustering on variance estimates as seen in the Table 8.

Assuming an average class size of 40 students and plausible intraclass correlation coefficient (ICC) values ranging from 0.01 to 0.05, design effects ranged from 1.39 to 2.95. For a moderate ICC of 0.03, the design effect was 2.17, which would inflate standard errors by approximately 47% and widen confidence intervals accordingly. The effective sample size would be reduced from 446 to approximately 206 under this scenario. However, as unique classroom identifiers were not retained in the entered dataset, cluster-adjusted analyses could not be directly performed. This limitation should be considered when interpreting the precision of our estimates.

Subgroup analyses showed that caries prevalence did not differ significantly by gender, with similar rates observed in boys (87.0%, 95% CI: 82.3%–90.6%) and girls (87.5%, 95% CI: 82.1%–91.5%; $p = 0.991$), although boys had significantly higher mean C-dmft/DMFT scores (3.37 ± 1.87) compared to girls (3.12 ± 1.84 ; $p = 0.004$). In contrast, a significant variation in caries prevalence was found across age groups ($p = 0.004$), with the highest prevalence among children aged 9–11 years (92.9%), followed by those aged 7–9 years (91.5%) and 11–13 years (80.0%). No significant differences were observed based on residence, as urban (87.8%, 95% CI: 84.0%–90.8%) and suburban (84.7%, 95% CI: 75.6%–90.8%) children had comparable prevalence rates ($p = 0.554$), nor across family income levels, where prevalence remained similar among those earning <10,000 Afghanis (85.8%), 10–20,000 Afghanis (89.7%), and >20,000 Afghanis (91.4%; $p = 0.386$).

Table 1: Sociodemographic characteristics of schoolchildren aged 7–13 years in Herat City.

Variables	Category	Count	Column N %
age groups	7 to 9	106	23.8%
	9 to 11	155	34.8%
	11 to 13	185	41.5%
Gender	Girls	192	43.0%
	Boys	254	57.0%
family income in a month	less than 10 thousand Afghanis	310	69.5%
	10 to 20 thousand Afghanis	78	17.5%
	greater than 20 thousand Afghanis	58	13.0%
mother education	Illiterate	220	49.3%
	Literate	226	50.7%
father education	Illiterate	173	38.8%
	Literate	273	61.2%
mother job	Housewife	394	88.3%
	Teacher	36	8.1%
	healthcare professional	16	3.6%
	Unemployed	111	24.9%
father job	self-employment	256	57.4%
	Others	79	17.7%
	Urban	361	80.9%
Residence	Suburb	85	19.1%

Table 2: oral behaviors of students

Variable	Category	Count	Column N %
Tooth brushing frequency in 24 hours	Never	43	9.6%
	Once	222	49.8%
	Twice	92	20.6%
	Three times or more	89	20.0%
Parental supervision of brushing	Yes	333	74.7%
	No	113	25.3%
Toothbrush_ Replacement_Frequency	after one month	212	47.5%
	after two months	84	18.8%
	after three months	63	14.1%
	after four months or more	87	19.5%
Use_of_Mouthwash	Yes	130	29.1%
	No	316	70.9%
Use_of_Dental_Floss	Yes	121	27.1%
	No	325	72.9%
Dental_Check_ups	Yes	148	33.2%
	No	298	66.8%
Dairy_Consumption_Frequency	Low	150	33.6%
	Medium	174	39.0%
	High	122	27.4%
Vegetable_Consumption_Frequency	Low	152	34.1%
	Medium	214	48.0%
	High	80	17.9%

Table 3: Prevalence of caries, missing and filled teeth among study sample and stratified by gender. Bold indicates statistical significance at $p < 0.05$.

Variables	General	Girls	Boys	P value	Chi square
	N=446	N=192	N=254	---	---
		n (%)	n (%)		
Decay Overall	teeth 374 (83.9)	161 (83.9)	213 (83.9)	.999	$\chi^2 = 0.00$
Missing Overall	teeth 194 (43.5)	64 (33.3%)	130 (51.2%)	.000	$\chi^2 = 14.172$
Filled Overall	teeth 16 (3.6)	9 (4.7%)	7 (2.8)	.999	$\chi^2 = 1.180$

Table 4: caries prevalence with 95% confidence intervals

Subgroup	Category	N	Cases	Prevalence (%)	95% CI
Overall	All participants	446	389	87.22	83.80 - 90.00
Gender	Boys	254	221	87.01	82.32 - 90.60
	Girls	192	168	87.50	82.07 - 91.45
Age Group	7-9 years	106	97	91.51	84.65 - 95.47
	9-11 years	155	144	92.90	87.74 - 95.99
	11-13 years	185	148	80.00	73.65 - 85.13
Residence	Urban	361	317	87.81	84.03 - 90.79
	Suburb	85	72	84.71	75.57 - 90.84
Family Income	<10,000 Afghanis	310	266	85.81	81.48 - 89.25
	10-20,000 Afghanis	78	70	89.74	81.05 - 94.71
	>20,000 Afghanis	58	53	91.38	81.36 - 96.26
Parental Supervision	No	113	94	83.19	75.23 - 88.96
	Yes	333	295	88.59	84.72 - 91.57

Table 5: Severity of dental caries and Comparison of mean combined C-dmft/DMFT score by gender

Gender	N	Mean	SD	Median	Mean rank
Girls	192	3.12	1.84	4.00	203.59
Boys	254	3.37	1.87	4.00	238.55
Total	446	3.26	1.86	4.00	—

Note. SD = standard deviation. Mann–Whitney U test indicated a statistically significant difference between girls and boys on D+M+F, $U = 20,562$, $Z = -2.89$, $p = .004$ (two-tailed).

Table 6: Bivariate associations between sociodemographic factors, oral health behaviors, and dental caries presence among schoolchildren aged 7–13 years in Herat City, Afghanistan (N = 446). P-values from Pearson chi-square tests (two-sided). 95% confidence intervals for prevalence calculated using the Wilson score method.

Variable	Category	Caries (%)	N	Caries free N (%)	95% CI for Prevalence	P-value
Age Group	7–9 years	97 (91.5%)	9	9 (8.5%)	84.7% – 95.5%	0.004
	9–11 years	144 (92.9%)	11	11 (7.1%)	87.7% – 96.0%	
	11–13 years	148 (80.0%)	37	37 (20.0%)	73.7% – 85.1%	
Gender	Boys	221 (87.0%)	33	33 (13.0%)	82.3% – 90.6%	0.991
	Girls	168 (87.5%)	24	24 (12.5%)	82.1% – 91.5%	
Residence	Urban	317 (87.8%)	44	44 (12.2%)	84.0% – 90.8%	0.554
	Suburb	72 (84.7%)	13	13 (15.3%)	75.6% – 90.8%	
Family Income	<10,000 Afghanis	266 (85.8%)	44	44 (14.2%)	81.5% – 89.3%	0.386
	10–20,000 Afghanis	70 (89.7%)	8	8 (10.3%)	81.1% – 94.7%	
	>20,000 Afghanis	53 (91.4%)	5	5 (8.6%)	81.4% – 96.3%	
Father Education	Illiterate	146 (84.4%)	27	27 (15.6%)	78.3% – 89.2%	0.353
	Literate	243 (89.0%)	30	30 (11.0%)	84.8% – 92.2%	
Mother Education	Illiterate	191 (86.8%)	29	29 (13.2%)	81.7% – 90.8%	0.759
	Literate	198 (87.6%)	28	28 (12.4%)	82.6% – 91.4%	

Tooth Brushing	Never	38 (88.4%)	5 (11.6%)	75.8% – 95.0%	0.616
	Once	192 (86.5%)	30 (13.5%)	81.4% – 90.5%	
	Twice	78 (84.8%)	14 (15.2%)	76.0% – 91.2%	
	≥3 times	81 (91.0%)	8 (9.0%)	83.4% – 95.5%	
Parental Supervision	No	94 (83.2%)	19 (16.8%)	75.2% – 89.0%	0.137
	Yes	295 (88.6%)	38 (11.4%)	84.7% – 91.6%	
Dental Check-ups	No	260 (87.2%)	38 (12.8%)	83.4% – 90.3%	0.980
	Yes	129 (87.2%)	19 (12.8%)	80.9% – 91.7%	

Table 7: Multivariable logistic regression analysis of factors associated with dental caries presence (C-dmft/DMFT > 0) among schoolchildren aged 7–13 years in Herat City, Afghanistan (N = 446). Adjusted odds ratios (AOR) with 95% confidence intervals (CI) are reported. Covariates included: age group, gender, household income, parental education, tooth-brushing frequency, and parental supervision. Model fit: Log-Likelihood Ratio $\chi^2 = 14.96$, $df = 7$, $p = 0.026$; Pseudo R^2 (McFadden) = 0.047.

Variable	Category	Adjusted Odds Ratio (AOR)	95% CI	P-value
Intercept	—	18.994	4.113 – 87.718	<0.001
Age Group	Per category increase	0.515	0.337 – 0.787	0.002
Gender	Boys vs. Girls	1.082	0.594 – 1.973	0.796
Family Income	Per category increase	1.188	0.748 – 1.886	0.465
Father Education	Literate vs. Illiterate	1.453	0.736 – 2.866	0.282
Mother Education	Literate vs. Illiterate	0.609	0.306 – 1.214	0.159
Tooth Brushing Frequency	Per category increase	0.946	0.674 – 1.327	0.747
Parental Supervision	Yes vs. No	1.625	0.858 – 3.076	0.136

Table 8: Sensitivity Analysis for Cluster Sampling Design Effect

ICC	Design Effect (DE)	Effective Sample Size	Adjusted 95% CI for Prevalence	CI Width
0.00 (No clustering)	1.00	446	83.8% – 90.0%	6.2%
0.01	1.39	321	83.6% – 90.9%	7.3%
0.02	1.78	251	83.1% – 91.4%	8.3%
0.03	2.17	206	82.7% – 91.8%	9.10%
0.04	2.56	174	82.3% – 92.2%	9.9%
0.05	2.95	151	81.9% – 92.5%	10.6%

Note: ICC = Intraclass Correlation Coefficient. Design Effect calculated as $DE = 1 + (m - 1) \times ICC$, where $m = 40$ (average cluster size). Effective sample size = N / DE .

Discussion

Our cross-sectional survey revealed an alarmingly high burden of dental caries: 87.2% (95% CI: 83.8% – 90.0%) of children had caries ($C\text{-dmft}/DMFT \geq 1$), 83.9% had at least one decayed tooth, and the mean combined dmft/DMFT was 3.26 — yet only 3.6% had received restorative treatment. In multivariable analysis, older age was significantly protective against caries presence (AOR = 0.515, 95% CI: 0.337 – 0.787, $p = 0.002$), while gender, parental education, toothbrushing frequency, and parental supervision were not significantly associated after adjustment. Boys had significantly more missing teeth ($p < 0.001$) and higher total caries scores than girls ($p = 0.004$), despite only a small absolute difference in mean scores. We found no significant associations between caries status and reported oral-health behaviors or parental education (all $p > 0.05$). Taken together, these findings point to widespread untreated decay, near-absence of restorative care, and a failure of commonly expected protective factors (e.g., toothbrushing, parental literacy) to reduce caries in this population.

Our findings are consistent with other studies showing very high caries prevalence in children, with rates generally above 70–80% in South and Southeast Asia. For example, 6–12 year olds in neighboring Pakistan and the Philippines have reported caries prevalences of ~90%^[11, 12], and studies from India and Iran report similarly high rates, 93.7% and 76.9%, respectively^[13, 14]. Within the WHO South-East Asia Region, surveys have consistently documented heavy caries burdens in schoolchildren^[15]. By contrast, many high-income countries report much lower prevalence 30% to 50%^[16].

Compared with other Afghan studies, our caries prevalence is higher, although direct comparisons are limited by differences in study methods. A 2019 survey of 7–13-year-olds there reported a caries prevalence of 78.8% with a mean DMFT = 3.46, which is lower than our 87.2% with a mean $C\text{-dmft}/DMFT = 3.26$ ^[4]. Earlier studies in Herat similarly documented very high disease levels: one survey in 2017 reported a caries prevalence of 68.2% (mean DMFT = 4.39; ages 5–18)^[9], and another study reported mean dmft = 4.88 in 6–7-year-olds and DMFT = 2.57 in 12-year-olds^[5]. The restorative

(F) component remains strikingly low at 3.6% in our sample, consistent with prior Afghan reports (1.8%–4.0%), indicating that over 96% of caries lesions remain untreated.^[5, 9] The mentioned findings reinforce that Afghan schoolchildren face an exceptionally high and largely untreated burden of dental caries. This burden likely reflects greater exposure to caries risk factors (e.g., rising sugar consumption) alongside persistent socioeconomic, literacy, and health-system barriers—factors that may have been worsened by years of conflict despite some improvements in infrastructure and oral-health workforce capacity as we see today^[9, 17, 18].

Our multivariable analysis identified older age as significantly protective against caries. This likely reflects a combination of factors: the loss of more vulnerable primary teeth with age, early severe caries leading to tooth loss, and improvements in oral hygiene and diet as children mature^[19, 20]. Eruption patterns may also contribute, as newly or partially erupted permanent molars are at higher risk of caries^[21]. These findings highlight the importance of introducing preventive measures early—ideally before or at the start of school—to reduce risk during peak susceptibility.

In bivariate analyses boys had higher mean C-dmft/DMFT and more missing teeth due to caries, but gender was not significantly associated with caries presence in the multivariable model (AOR = 1.082, 95% CI: 0.594–1.973, $p = 0.796$), suggesting that crude gender differences may be confounded by age or other factors. This pattern aligns with findings from an Afghan study showing no significant gender differences in caries prevalence^[4], while other surveys report age-specific or inconsistent gender effects.^[9]

Our adjusted analyses did not identify statistically significant associations between dental caries and reported oral-health behaviors. High levels of decay were observed even among children reporting frequent toothbrushing, parental supervision, or prior dental visits. While many studies report protective effects of regular brushing and dental care, our findings may reflect contextual factors.^[1, 22] Previous studies in Herat have reported mean water fluoride concentrations of approximately 0.37 ppm, which is below the recommended 0.7–1.2 ppm for effective caries prevention. In addition, commercially available toothpastes show inconsistent fluoride content and, to our knowledge, no community fluoride interventions such as water fluoridation are currently in place. Other possible explanations include social-desirability bias in self-reported oral-health behaviors, generally inadequate brushing technique, and high sugar availability among children^[14, 15, 16]. On the other hand socioeconomic deprivation likely underpins the high and largely untreated oral disease burden observed in our sample. With nearly 70% of households living on very low incomes and high levels of parental illiteracy, access to dental care, healthy diets, and preventive practices is significantly constrained. Evidence shows that poverty and low parental education are strongly associated with increased caries risk and reduced care utilization^[25, 26]. Together, these contextual factors may weaken the observable protective effect of reported oral-health behaviors in this population and contribute to the high proportion of untreated disease. Several limitations of our study should be acknowledged: first, the cross-sectional design precludes causal inferences; second, behavioral data were based on child or parental report and may be subject to recall or social-desirability bias—however, we used concrete, recent recall periods and questionnaires sent home to parents/guardians and achieved a high response rate, which reduces but does not eliminate misclassification; third, the oral examination was visual only (no radiographs), so early

or interproximal lesions may have been underestimated; fourth, we used a combined C-dmft/DMFT index for mixed dentition, which allows comparison with similar studies but can mask differences between primary and permanent teeth; fifth, while our sampling protocol selected one class per grade within each participating school, unique classroom identifiers were removed from the entered dataset, preventing direct estimation of the intra-class correlation (ICC); sixth our sample was drawn from five schools in Herat city selected for practical accessibility—students were selected systematically to minimize selection bias, yet the convenience district selection limits generalizability to other areas of Herat Province; seventh, examiners received standardized training and supervised practice to reduce measurement error, but formal inter-examiner calibration was not feasible and some variability may remain; and finally, residual confounding from unmeasured factors (for example, precise quantity of sugar intake or fluoride exposure in drinking water) cannot be excluded, these conservative biases do not negate the high burden observed in the study community.

Our results have important implications for public health policy. The extremely high and untreated caries burden calls for preventive and health-system interventions. School-based oral health programs are a priority: regular dental screenings, supervised toothbrushing, and nutrition education in schools could raise awareness and early detection. Fluoride promotion must be intensified – for example, implementing school-based fluoride varnish or sealant programs. Water fluoridation (where feasible) and salt fluoridation are long-term goals to consider. At the community level, public health campaigns should educate parents and children about oral hygiene and sugary diets. Given that virtually no children in our study had restorations, building capacity for affordable basic dental treatment (through mobile clinics or expanded clinics) is critical. Investment in training dentists and dental auxiliaries, especially in underserved areas, would help reduce access barriers.

Conclusion

This cross-sectional study of schoolchildren in Herat City revealed an alarmingly high and largely untreated burden of dental caries (87.2%; 95% CI: 83.8% – 90.0%; mean C-dmft/DMFT = 3.26), with restorations observed in only 3.6% of children. Older age was significantly protective against caries presence (AOR = 0.515, 95% CI: 0.337 – 0.787, $p = 0.002$), while gender, parental education, and reported oral-health behaviors were not significant after multivariable adjustment. These findings underscore the urgent need for scalable interventions: immediate school-based prevention (supervised toothbrushing with fluoride toothpaste, fluoride varnish and sealants), nutrition education to reduce free sugar intake. Future studies should employ full probability sampling, report dmft and DMFT separately, and pursue longitudinal designs to better inform oral-health policy and program development in the region.

Acknowledgment

We would like to sincerely express our gratitude to the Ghalib Research Center for their coordination and facilitation of this study, as well as to Tannaz Timory, Sina Homayounia, Mohammad Reza Zahed and Mohammad Ali Yosofy for their valuable support throughout the research process. We also thank Mohammad Heravi and other collaborators for their assistance in collecting the primary data, which played a

significant role in advancing this study. In addition, we extend our appreciation to the Directorate of Education of Herat Province for their support, cooperation, and assistance during the course of this research.

Funding

This study was supported by Ghalib University. The funding body provided institutional support for data collection and research activities but had no role in the study design, data analysis, interpretation of the results, or preparation of the manuscript.

ORCID

Sayed Eshaq Amin		https://orcid.org/0009-0008-4922-7616
Ghulamsakhi Parsa		https://orcid.org/0009-0009-2517-1053
Said Amir Sady		https://orcid.org/0009-0008-5917-4810
Abdul Tawab Rauf		https://orcid.org/0009-0002-9836-9254
Shakila Chakari		https://orcid.org/0009-0004-3923-3351

References

1. Organization WH. Oral health [Fact sheet]. World Health Organization; 2024 [cited Accessed: 23 Dec 2025]. Available from: <https://www.who.int/news-room/fact-sheets/detail/oral-health>.
 2. Yang H, Feng Y, Xiao L-Y, Wang K-M, Feng H, Yan M. Global, regional and national burden of deciduous dental caries from 1990 to 2021: analysis of risk factors and prediction of trends in 2035. *Frontiers in Dental Medicine*. 2025;6:1624571. Available from: <https://doi.org/10.3389/fdmed.2025.1624571>
 3. Trimble M, Susarla SM, Campos C, Turton B, Sokal-Gutierrez K. Pocket money and the risk of dental caries and oral pain in children. *Journal of Medicine, Surgery, and Public Health*. 2024;3:100106. Available from: <https://doi.org/10.1016/j.glmedi.2024.100106>
 4. Aalemi AK, Yaqubi B. Prevalence of dental carries among school-going children aged 7–13 years in Kabul City. *BMC Oral Health*. 2024;24(1):1092. Available from: <https://doi.org/10.1186/s12903-024-04897-0>
 5. Schwendicke F, Doost F, Hopfenmüller W, Meyer-Lueckel H, Paris S. Dental caries, fluorosis, and oral health behavior of children from Herat, Afghanistan. *Community dentistry and oral epidemiology*. 2015;43(6):521-31. Available from: <https://doi.org/10.1111/cdoe.12177>
 6. UNICEF. Afghanistan's Education System Facing Deepening Crisis for Both Girls and Boys, Warn UNICEF and UNESCO [Press release]. UNICEF; 2025 [cited Accessed: 23 Dec 2025]. Available from: <https://www.unicef.org/afghanistan/press-releases/afghanistans-education-system-facing-deepening-crisis-both-girls-and-boys-warn>.
 7. Poverty O, Initiative HD. Global multidimensional poverty index 2025—overlapping hardships: poverty and climate hazards. 2025. Available from: <https://doi.org/10.18356/9789211546316>
-

8. Organization WH. Oral health: Afghanistan — country profile 2022. Country profile. World Health Organization; 2022.
 9. Lambert M, Rezaie M, Jeannin M, Sina N, Mahyar Z, Marks L. The oral health situation and treatment need of schoolchildren Afghanistan: a cross-sectional study. *European journal of paediatric dentistry-Milano*. 2024;25(1):32-5. Available from: <https://doi.org/10.23804/ejpd.2024.1902>
 10. Organization WH. Oral health: Islamic Republic of Iran — country profile 2022. Country profile. World Health Organization; 2022.
 11. Yabao R, Duante C, Velandria F, Lucas M, Kassu A, Nakamori M, et al. Prevalence of dental caries and sugar consumption among 6–12-y-old schoolchildren in La Trinidad, Benguet, Philippines. *European journal of clinical nutrition*. 2005;59(12):1429-38. Available from: <https://doi.org/10.1038/sj.ejcn.1602258>
 12. Sahito N, Sahito MA, Fazlani KA. Prevalence of dental caries among school children in Hyderabad Pakistan. *International Journal of Applied Science-Research and Review*. 2015;2(1):034-8. Available from: <https://www.primescholars.com/abstract/prevalence-of-dental-caries-among-school-children-inhyderabad-pakistan-95353.html>
 13. Aggarwal C, Sandhu M, Sachdev V, Dayal G, Prabhu N, Issrani R. Prevalence of dental caries and dental fluorosis among 7-12-year-old school children in an Indian subpopulation: A cross-sectional study. *Pesquisa Brasileira em Odontopediatria e Clínica Integrada*. 2021;21. Available from: <https://doi.org/10.1590/pboci.2021.031>
 14. Hosseinpour F, Panahi R, Omidi BR, Khorasani E, Dehghankar L. The relationship between tooth decay with stress and BMI among elementary students in Iran. *Frontiers in Public Health*. 2022;10:920004. Available from: <https://doi.org/10.3389/fpubh.2022.920004>
 15. Kale SS, Kakodkar P, Shetiya SH, Rizwan S. Dental caries prevalence among 5-to 15-year-old children from SEAR countries of WHO: A systematic review and meta-analysis. *Indian Journal of Dental Research*. 2019;30(6):937-47. Available from: https://doi.org/10.4103/ijdr.IJDR_654_17
 16. Sultana S, Parvin MS, Islam MT, Chowdhury EH, Bari ASM. Prevalence of Dental Caries in Children in Mymensingh and Its Associated Risk Factors: A Cross-Sectional Study. *Dent J (Basel)*. 2022;10(7). Available from: <https://doi.org/10.3390/dj10070138>
 17. Valente M, Lamberti-Castronuovo A, Bocchini F, Shafiq Y, Trentin M, Paschetto M, et al. Access to care in Afghanistan after august 2021: a cross-sectional study exploring Afghans' perspectives in 10 provinces. *Conflict and Health*. 2024;18(1):34. Available from: <https://doi.org/10.1186/s13031-024-00594-5>
 18. Hameed MA, Rahman MM, Khanam R. The health consequences of civil wars: evidence from Afghanistan. *BMC Public Health*. 2023;23(1):154. Available from: <https://doi.org/10.1186/s12889-022-14720-6>
 19. Ruff RR. Total observed caries experience: assessing the effectiveness of community-based caries prevention. *Journal of Public Health Dentistry*. 2018;78(4):287-90. Available from: <https://doi.org/10.1111/jphd.12284>
 20. Methuen M, Kukkonen VF, Anttonen V, Mikkonen S, Väistö J, Soinen S, et al. Dietary Factors and Dental Caries among Adolescents: Eight-Year Follow-up Study. *JDR Clinical & Translational Research*. 2025:23800844251314856. Available from: <https://doi.org/10.1177/23800844251314856>
-

21. Alves L, Zenkner J, Wagner M, Damé-Teixeira N, Susin C, Maltz M. Eruption stage of permanent molars and occlusal caries activity/arrest. *Journal of Dental Research*. 2014;93(7_suppl):114S-9S. Available from: <https://doi.org/10.1177/0022034514537646>
 22. Walsh T, Worthington HV, Glenny AM, Marinho VC, Jeronicic A. Fluoride toothpastes of different concentrations for preventing dental caries. *Cochrane database of systematic reviews*. 2019(3). Available from: <https://doi.org/10.1002/14651858.CD007868.pub3>
 23. Liu M, Song Q, Xu X, Lai G. Early childhood caries prevalence and associated factors among preschoolers aged 3–5 years in Xiangyun, China: A cross-sectional study. *Frontiers in Public Health*. 2022;10:959125. Available from: <https://doi.org/10.3389/fpubh.2022.959125>
 24. Alshammary FL, Mobarki AA, Alrashidi NF, Madfa AA. Association between different behavioral factors and dental caries among children attending the dental clinics in a sample from Saudi Arabia. *BMC Oral Health*. 2023;23(1):198. Available from: <https://doi.org/10.1186/s12903-023-02849-8>
 25. Folayan MO, El Tantawi M, Aly NM, Al-Batayneh OB, Schroth RJ, Castillo JL, et al. Association between early childhood caries and poverty in low and middle income countries. *BMC Oral Health*. 2020;20(1):8. Available from: <https://doi.org/10.1186/s12903-019-0997-9>
 26. Hidalgo-Mora E, Campos-Campos KJ, Gálvez DA, López-Ramos RP, Vidigal EA. Parents' oral health literacy and its association with their children's oral health: a review. *Revista Científica Odontológica*. 2024;12(3):e209. Available from: <https://doi.org/10.21142/2523-2754-1203-2024-209>
-