

COMPARISON OF ORAL HEALTH STATUS AND PRACTICES AMONG 12-15 YEARS OLD STUDENTS IN PUBLIC AND PRIVATE SCHOOLS OF MINGORA, SWAT: A CROSS-SECTIONAL STUDY

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Abstract

Background: Dental caries remains a significant public health burden among adolescents in low- and middle-income countries, with socioeconomic disparities driving unequal oral health outcomes. Data from Khyber Pakhtunkhwa province, Pakistan, particularly semi urban regions, remain critically limited.

Objective: To assess and compare oral health status and practices among 12–15-year-old male students attending public and private schools in Mingora, Swat, Pakistan.

Methods: This cross-sectional study included 460 male students (297 public, 163 private) selected through purposive sampling. Data were collected via structured questionnaires on oral hygiene practices, dietary habits, and self-reported problems, supplemented by clinical examinations using the DMFT index. Statistical analyses included chi-square tests and independent samples t-tests.

Results: Public school students demonstrated significantly higher mean DMFT scores (4.95 ± 1.83) compared to private school students (3.89 ± 2.38); mean difference 1.06 (95% CI: 0.64–1.49), $p < 0.001$. While brushing frequency did not differ significantly, private school students exhibited superior practices, with morning brushing (40.5% vs 20.2%, $p < 0.001$) and dental floss use (39.9% vs 24.9%, $p = 0.001$). Public school students showed higher sugary food consumption (55.9% vs 41.1%, $p = 0.002$) and greater mouthwash use (45.1% vs 33.1%, $p = 0.012$). High symptom prevalence including tooth pain (45.2%), bleeding gums (42.0%), and eating difficulty (48.3%) indicated substantial unmet treatment needs across both groups.

Conclusions: Significant oral health disparities exist between public and private school students in Mingora, with socioeconomic gradients manifesting in higher caries experience and suboptimal preventive practices among public school attendees. School based interventions targeting public schools, incorporating supervised fluoride programs, dietary counselling, and accessible dental services, are urgently needed to reduce these inequities and improve adolescent oral health in underserved populations.

INTRODUCTION

Dental caries remains a major global public health problem affecting children and adolescents. The World Health Organization (WHO) has reported a substantial burden of dental caries worldwide, with marked variation across socioeconomic groups ^[1]. A recent systematic review and meta-analysis estimated the pooled global prevalence of dental caries in permanent teeth at 53.8% (95% CI: 50–57.5%) among children ^[2]. The WHO Global Oral Data Bank has compiled extensive epidemiological data on 12-year-old children and established the DMFT (Decayed, Missing, and Filled Teeth) index as a standard indicator for international comparisons ^[3]. Adolescence is a critical period for oral health. Children aged 12–15 years are particularly vulnerable to dental caries and periodontal conditions due to dietary patterns, behavioral transitions, and developing self-care practices ^[4]. Evidence from European countries demonstrates clear geographic and socioeconomic gradients in caries experience, with children from disadvantaged backgrounds exhibiting higher disease levels ^[5]. These inequalities are more pronounced in low- and middle-income countries, where preventive programs and access to dental services remain limited. Socioeconomic determinants strongly influence oral health outcomes. School type is frequently used as a proxy indicator for socioeconomic position and parental education ^[6]. Comparative studies consistently report poorer oral hygiene status and higher caries prevalence among public school students than those attending private schools. A study conducted in Bareilly, India, found significantly higher caries prevalence, gingival scores, and poorer oral hygiene indices among government school students aged 12–15 years compared to private school students ^[7]. Similar disparities have been documented in Pakistan, where students enrolled in public schools demonstrate greater oral disease burden than their counterparts in private institutions ^[8,9].

Pakistan continues to face considerable oral health challenges, with uneven distribution of services and limited epidemiological surveillance in many regions. Studies from Lahore and Rawalpindi have reported significantly higher levels of dental caries, fluorosis, and gingival

bleeding among public school students ^[9,8]. Research from Hyderabad, Sindh, also identified significant differences in caries experience between public and private schoolchildren ^[10]. However, data from Khyber Pakhtunkhwa province, particularly from semi-urban areas, remain limited ^[11,18].

Limited evidence exists regarding oral health disparities among schoolchildren in Mingora, Swat. This study aimed to assess and compare oral health status and practices between 12–15 years old students attending public and private schools. The findings will provide essential baseline data to guide targeted school-based oral health interventions and reduce existing disparities in this underserved population.

MATERIAL AND METHODS

A total of 460 male students aged 12 to 15 years participated in this descriptive cross-sectional study conducted in Mingora, Swat, Pakistan. The study duration was six months, from planning to final analysis. Ethical approval for the study was obtained from the Institutional Review Board of Iqra National University Ref No (INU/ORIC/133), before data collection. Participants were recruited from both public and private schools using a non-probability purposive sampling technique. The sample size was calculated using OpenEpi for a cross-sectional study. The total population comprised 1,569 students aged 12–15 years enrolled in public and private schools of Mingora, Swat. Assuming a prevalence of oral health problems of 50%, a 5% margin of error, and a 95% confidence level, the minimum required sample size was 308 students. To compensate for possible non-response and to enable subgroup comparison between public and private schools, the sample size was increased to 460 students. A total of 460 students were included in the final analysis, comprising 297 from public schools and 163 from private schools. Written informed consent was obtained from parents or guardians of all participants after explaining the purpose and procedures of the study. Inclusion criteria were students aged 12–15 years, enrolled in either public or private schools in Mingora, with parental consent and willingness to participate. Students with systemic illnesses, undergoing orthodontic treatment, or with physical or

mental disabilities affecting oral assessment were excluded. Data were collected using a structured questionnaire covering demographic information, oral hygiene practices, dietary habits, dental visit frequency, and self-reported oral health problems. Clinical examination was performed to assess dental caries using the DMFT (Decayed, Missing, Filled Teeth) index. All examinations were conducted by trained examiners under standardized conditions. Data were entered and analyzed using SPSS version 25. Descriptive statistics (frequencies, percentages, mean, standard deviation) were calculated for all variables. The chi-square test was used to compare categorical variables between public and private school students, while the independent samples t-test was employed to compare mean DMFT scores between the two groups. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 460 male students aged 12 to 15 years participated in this study. The mean age of participants was 13.6 years (SD = 1.07), with 45.2% (n = 208) in the 12-13 years age group and 54.8% (n = 252) in the 14-15 years age group. More than half of the students (64.6%, n = 297)

were enrolled in public schools, while 35.4% (n = 163) attended private schools (Table 1).

Regarding oral hygiene practices, most students (74.1%, n = 341) reported brushing their teeth once daily, while 24.3% (n = 112) brushed twice a day, and only 1.5% (n = 7) brushed more than twice daily. The majority (72.2%, n = 332) cleaned their teeth before bed, 27.4% (n = 126) brushed in the morning, and only 0.4% (n = 2) brushed both times. The use of additional oral hygiene aids was low, as 69.8% (n = 321) did not use dental floss, 59.8% (n = 275) did not clean their tongue, and 59.1% (n = 272) did not use mouthwash. Frequent consumption of sugary foods and drinks was reported by 50.7% (n = 233) of students, while 49.3% (n = 227) reported no frequent intake (Table 1).

Self-reported oral health problems were common among participants. Tooth pain was experienced by 45.2% (n = 208) of students, bleeding gums by 42.0% (n = 193), and swelling, lumps, or sores in the mouth by 40.2% (n = 185). Additionally, 48.3% (n = 222) reported difficulty while eating food (Table 1).

In terms of dental attendance, 45.7% (n = 210) of students visited a dentist every six months, 43.0% (n = 198) visited once a year, and 11.3% (n = 52) only visited when they had a problem (Table 1).

Table 1. Sociodemographic and Oral Health Characteristics of Study Participants

Characteristic	Category	n	%
Age groups	12-13 years	208	45.2
	14-15 years	252	54.8
Gender	Male	460	100.0
	Female	0	0.0
School Type	Public	297	64.6
	Private	163	35.4
Brushing Frequency	Once a day	341	74.1
	Twice a day	112	24.3
	More than twice a day	7	1.5
Brushing Time	Morning	126	27.4
	Before bed	332	72.2
	Both	2	0.4

Dental Floss Use	Yes	139	30.2
	No	321	69.8
Tongue Cleaning	Yes	185	40.2
	No	275	59.8
Mouthwash Use	Yes	188	40.9
	No	272	59.1
Sugary food/drink consumption	Yes	233	50.7
	No	227	49.3
Dental Visit Frequency	Every 6 months	210	45.7
	Once a year	198	43.0
	Only when problem	52	11.3
Tooth Pain	Yes	208	45.2
	No	252	54.8
Bleeding Gums	Yes	193	42.0
	No	267	58.0
Swelling/Lumps/Sores	Yes	185	40.2
	No	275	59.8
Difficulty Eating	Yes	222	48.3
	No	238	51.7

Table 2 compares oral health practices and problems between public and private school students. Significant differences were observed between the two groups for several variables. Private school students were more likely to brush in the morning (40.5% vs 20.2%), while public school students predominantly brushed before bed (79.8% vs 58.3%) ($p < 0.001$). Dental floss use was significantly higher among private school students (39.9%) compared to public school students (24.9%) ($p = 0.001$). Conversely,

mouthwash use was more frequent in public schools (45.1%) than private schools (33.1%) ($p = 0.012$). Sugary food and drink consumption was significantly higher among public school students (55.9%) compared to their private school counterparts (41.1%) ($p = 0.002$). No significant differences were found between the two groups for brushing frequency, tongue cleaning, dental visit frequency, tooth pain, bleeding gums, swelling or sores, or difficulty eating ($p > 0.05$ for all).

Table 2. Comparison of Oral Health Practices and Problems Between Public and Private School Students

Characteristic	Category	Public	Private	p-value
Brushing Frequency	Once a day	222 (74.7)	119 (73.0)	0.820
	Twice a day	70 (23.6)	42 (25.8)	
	More than twice	5 (1.7)	2 (1.2)	

Brushing Time	Morning Before bed Both	60 (20.2) 237 (79.8) 0 (0.0)	66 (40.5) 95 (58.3) 2 (1.2)	<0.001
Dental Floss Use	Yes No	74 (24.9) 223 (75.1)	65 (39.9) 98 (60.1)	0.001
Tongue Cleaning	Yes No	126 (42.4) 171 (57.6)	59 (36.2) 104 (63.8)	0.193
Mouthwash Use	Yes No	134 (45.1) 163 (54.9)	54 (33.1) 109 (66.9)	0.012
Sugary food/drink	Yes No	166 (55.9) 131 (44.1)	67 (41.1) 96 (58.9)	0.002
Dental visit frequency	Every 6 months Once a year Only when problem	138 (46.5) 119 (40.1) 40 (13.5)	72 (44.2) 79 (48.5) 12 (7.4)	0.070
Tooth Pain	Yes No	143 (48.1) 154 (51.9)	65 (39.9) 98 (60.1)	0.088
Bleeding Gums	Yes No	129 (43.4) 168 (56.6)	64 (39.3) 99 (60.7)	0.386
Swelling/lumps/sores	Yes No	123 (41.4) 174 (58.6)	62 (38.0) 101 (62.0)	0.480
Difficulty Eating	Yes No	139 (46.8) 158 (53.2)	83 (50.9) 80 (49.1)	0.398

The comparison of DMFT scores between the two groups is presented in **Table 3**. The mean DMFT score for public school students was 4.95 (SD = 1.83), while for private school students it was 3.89 (SD = 2.38). The independent samples t-test revealed a statistically significant difference between the two groups ($t = 4.953$, $df = 269.08$,

$p < 0.001$), with public school students having significantly higher DMFT scores compared to their private school counterparts. The mean difference was 1.06 (95% CI: 0.64 to 1.49), indicating that public school students had approximately one more decayed, missing, or filled tooth on average than private school students.

Table 3. Comparison of DMFT Scores Between Public and Private School Students

School Type	N	Mean	SD	t-value	df	p-value	Mean Difference	95% CI
Public	297	4.95	1.83	4.953	269.08	<0.001	1.06	0.64 - 1.49
Private	163	3.89	2.38					

DISCUSSION

This study identified significant oral health disparities between public and private school students aged 12–15 years in Mingora, Swat. Public school students exhibited higher mean DMFT scores (4.95 ± 1.83) than private school students (3.89 ± 2.38), with a mean difference of 1.06 teeth ($p < 0.001$). These results are consistent with previous studies demonstrating socioeconomic inequalities in adolescent oral health in Pakistan and other developing countries. The observed difference in DMFT scores represents a clinically meaningful disparity. Studies from Karachi reported lower DMFT values (1.82 in private vs 1.48 in public schools, $p = 0.257$)^[12], likely reflecting urban–rural variations in access to dental services. Similarly, research from Bareilly, India, corroborated our findings, showing significantly higher caries experience and poorer oral hygiene indices among government school children aged 12–15 years^[7]. Similarly, Lahore studies documented higher caries and gum bleeding prevalence in public school students^[9], while Karachi special-needs schools showed caries prevalence of 70.3% in public versus 55.3% in private schools^[13]. These consistent patterns across South Asian populations confirm school type as a reliable proxy for socioeconomic determinants of oral health.

Private school students reported higher rates of morning brushing (40.5% vs 20.2%) and dental floss use (39.9% vs 24.9%), whereas public school students predominantly brushed before bedtime (79.8% vs 58.3%) and used mouthwash more frequently (45.1% vs 33.1%). The greater adoption of flossing among private school students likely reflects higher health literacy associated with elevated socioeconomic status^[14,15]. The low overall twice-daily brushing frequency (24.3%) across both groups highlights inadequate oral health knowledge, falling short of WHO recommendations^[1]. Significantly

higher sugary food consumption among public school students (55.9% vs 41.1%) represents a critical modifiable risk factor contributing to DMFT disparities. This pattern likely reflects lower nutritional knowledge, greater availability of inexpensive high-sugar snacks in public schools, and reduced parental supervision^[11,2]. Combined with suboptimal oral hygiene, frequent sugar exposure creates an acidic environment conducive to caries development^[1,5]. High prevalence of self-reported oral problems such as tooth pain (45.2%), bleeding gums (42.0%), and eating difficulty (48.3%) indicates substantial unmet treatment needs across both groups. The lack of significant differences between public and private school students was unexpected given the DMFT disparities, suggesting either a comparable symptomatic burden among private school students or potential under-reporting among public school students due to normalized pain tolerance. Clinical assessments reveal oral health disparities not fully captured by self-report^[12]. Similar dental attendance patterns, with 45.7% visiting every six months, may reflect limited service availability in Mingora affecting both groups, or over-reporting influenced by social desirability bias.

These disparities are rooted in socioeconomic inequalities, as private school enrolment in Pakistan generally reflects higher household income, parental education, and health literacy^[8,15,16]. Socioeconomic status influences oral health through multiple pathways, including economic access to preventive products and dental care, parental education shaping health knowledge, time available for health behaviours, and neighbourhood factors such as school food environments and service availability^[12,11,17]. Studies across Pakistani cities consistently document these gradients^[12,9,8]. Findings underscore the need for targeted school-based interventions prioritizing public school

students. Evidence-based strategies should include supervised fluoride brushing programs, oral health education with dietary counselling, sealant applications, school-linked dental services or mobile units, and parental engagement to enhance oral health literacy^[7,6,3]. Integration with existing government school health programs is essential, with adequate resourcing and periodic screening systems to address the high symptomatic disease burden.

CONCLUSION

This study highlights significant oral health disparities between public and private school students in Mingora, Swat, Pakistan. Public school students exhibited higher dental caries burden (mean DMFT 4.95 vs 3.89) and less favourable preventive behaviours, including lower floss use, reduced morning brushing, and higher consumption of sugary foods. High rates of tooth pain, gingival bleeding, and functional difficulties across both groups indicate substantial unmet treatment needs. These findings underscore the influence of socioeconomic factors on adolescent oral health and emphasize the urgent need for school-based interventions, including supervised oral hygiene programs, dietary counselling, and improved access to dental care, to reduce inequities in this semi-urban population.

LIMITATION OF THE STUDY

The cross-sectional design limits causal inference, and inclusion of only male students restricts generalizability. Purposive sampling and self-reported data may introduce selection and reporting biases. Findings are specific to Mingora, Swat, but the large sample and validated DMFT index support the reliability of core results.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest related to this study.

AUTHORS' CONTRIBUTION

Amjad Ali Khan, Iftikhar Ahmad, Muhammad Abbas Rahim, Syed Muhammad Salman, Bismillah Khan, Shahid Ali, Yusra Tabassum: Conceptualization, planning, data

curation, data analysis, drafting, and final approval.

Junaid Ali: Conception, drafting, data curation, data analysis, and overall leadership of the study; final approval of the manuscript.

DATA AVAILABILITY

Can be available from corresponding author on reasonable request

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None

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