Original Article

Comparison of Sedentary Behavior and Physical Activities with Oral Health Status Among School-Going Children

Maria Moin, Rabbia Imtiaz, & Beenish Fatima

ABSTRACT

Objective: To assess physical activity, sedentary behavior, and their relationship with oral health status among schoolchildren in Karachi.

Methodology: After ethical approval, a cross-sectional study was conducted from 6 to 28 February 2025 among 100 schoolchildren aged 12–16 years at a private school in Karachi. Participants were selected through purposive sampling after obtaining parental consent and child assent. Data was collected using a structured questionnaire covering demographics, oral hygiene habits, physical activity, and sedentary behavior, alongside clinical examinations. Physical activity was measured using the International Physical Activity Questionnaire (IPAQ), with less than 150 minutes/week considered insufficient. Sedentary behavior was classified as less than 7.5 or more than or equal to 7.5 hours/day. Oral health was assessed through the Plaque Index, Gingival Index, and Decayed, Missing, and Filled Teeth (DMFT) index. Data was analyzed using descriptive statistics in SPSS.

Results: Of the participants, 63% were aged 12–16 years and 64% were female. More than half (57%) engaged in less than 150 minutes/week of physical activity, while 29% reported sedentary behavior of more than or equal to 7.5 hours/day. Although 99% brushed daily, only 49% brushed twice daily, and flossing was rare (4%). Clinically, 37% showed mild plaque, 30% mild gingivitis, and 16% had DMFT >2. The mean scores were as follows: Dental Plaque Index 0.74 ± 0.60, Gingival Index 0.65 ± 0.45, and DMFT 1.01 ± 1.42.

Conclusion: High sedentary behavior and insufficient physical activity were common among schoolchildren and were associated with suboptimal oral hygiene and mild periodontal conditions. Promoting active lifestyles alongside oral health education in schools is essential to improve oral health.

KEYWORDS: Dental Plaque Index, Dental Caries, DMFT, Gingival Index, Oral Health, Physical Activity, Sedentary Behavior, Students

INTRODUCTION

Physical activity is recognized for its broad positive impact on health, protecting against chronic conditions such as coronary heart disease, diabetes, obesity, osteoporosis, and hypertension.[1] It also increases life expectancy, improves quality of life, and helps manage stress, anxiety, and depression.[2] Among older adults, regular physical activity improves sleep quality and reduces cognitive decline.[3]

Periodontitis is a common chronic disease characterized by inflammation of the tooth-supporting tissues resulting from bacterial accumulation and biofilm formation. The disease is influenced by factors like smoking, stress, and metabolic dysfunction, and systemic conditions such as diabetes and cardiovascular diseases are

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also linked to periodontitis.[4] Physical activity has emerged as a potential protective factor against periodontal disease. It helps reduce systemic inflammation by lowering C-reactive protein (CRP) levels and other inflammatory markers.[5] Greater physical activity and reduced sedentary behavior are associated with lower levels of inflammatory cytokines, which play a significant role in the pathogenesis of periodontitis.[6]

Individuals who engage in higher total physical activity or leisure-time physical activity while maintaining lower levels of sedentary behavior have a reduced chance of developing periodontal disease. Adjusted multivariable regression models demonstrated that high sedentary behavior (more than 7.5 hours/day) was associated with higher odds of periodontal disease (OR = 1.17; 95% confidence interval = 1.00–1.36; p = .045).[7] Active adolescents exhibit superior dental hygiene compared to sedentary ones by consistently practicing good oral care habits like brushing, flossing, and regular visits to the dentist. Improved blood circulation from regular exercise enhances oral health in general: the entire body—including the gum tissues—receives more oxygen and nutrients, making the gums better able to resist infection. Sedentary entertainment is higher among older parents but lower among those who have attained higher education levels.[8]

The prevalence of gingivitis varies across different populations due to differences in diagnostic criteria used. Based on the joint European Federation of Periodontology (EFP) and American Academy of Periodontology (AAP) workshop definition, gingivitis is characterized by a positive gingival bleeding score of ≥10%, without any attachment loss or periodontal probing depth (≥4 mm), and is categorized into localized or generalized gingivitis.[9] Healthy periodontal tissue has a positive gingival bleeding score of <10% with all supporting structures remaining intact. Research shows that there is a correlation between nutritional status and the severity of gingivitis and dental caries among school children aged 9–12 years.[10]

Individuals with higher physical activity and lower amounts of total sedentary behavior had lower periodontal disease prevalence. According to research, an individual has less chance of developing gum disease if they exercise regularly. It was observed that there are reduced inflammatory biomarkers in physically active individuals, which in turn is related to improved periodontal health.[11,12] Individuals who spend several hours sitting and consuming snacks and fast food become obese, which leads to oral diseases. Adipose tissue produces bioactive molecules that may adversely affect oral health. During adolescence, periodontal tissues become more sensitive to irritants such as plaque, calculus, and food debris collected in the gingival sulcus, owing to an increase in sex hormones (estrogen and progesterone). It is therefore necessary to systematically examine children's oral hygiene, focusing on a better understanding of the role of physical activity in periodontal health and its integration into broader health promotion strategies.

The objective of this study is to assess the effect of sedentary lifestyle and physical activity on oral health status among 12–16-year-old school-going children.

METHODOLOGY

After ethical approval (vide letter number AIDM/ERC/01/2025/03), a cross-sectional study was conducted among 100 schoolchildren aged 12 to 16 years at a private school in Karachi. The study started on 6-02-2025 and ended on 28-02-2025. The sample size was calculated using the formula for a single population proportion with a 95% confidence level (Z = 1.96), an expected prevalence of 50% (p = 0.5), and a margin of error of 10% (d = 0.10). The estimated sample size was 96, which was increased to 100 participants to account for feasibility and potential non-response. Consent was taken from parents and students who were regular. The inclusion criteria for this study were schoolchildren aged 12–16 years who were regular attendees at school and whose parents or guardians provided

informed consent along with their own assent. The exclusion criteria included children who had taken antibiotics within the past six months, those with serious medical conditions such as chronic systemic diseases, and students who were smokers. After receiving approval from the Ethical Committee of Altamash Institute of Dental Medicine, various schools in Karachi were contacted for research purposes. The sampling technique used was a non-random purposive technique.

Verbal informed consent was obtained from research participants aged 12 to 16. Following this, they were interviewed as part of the research questionnaire about their medical history, family history, demographics, and dental and medical conditions. Oral examination was performed using a standard dental chair with proper lighting and conventional instruments. Two experienced dentists conducted the assessments, following multiple pre-study calibration sessions to ensure consistency and reliable intra- and inter-examiner agreement.[13]

The World Health Organization recommends a moderate exercise routine, comprising at least 150 minutes of physical activity per week, to reduce the risk of lifestyle-related diseases, including periodontitis.[14] Physical activity was measured using validated questionnaires, the International Physical Activity Questionnaire (IPAQ), which assessed the frequency, duration, and intensity of physical activity performed during the past week.[15] Sedentary behaviors, characterized by prolonged sitting or lying down with minimal to no physical activity, have been associated with a higher risk of periodontal disease. Specifically, individuals with sedentary behavior exceeding 7.5 hours per day have higher odds of developing periodontal disease, whereas those with less than 7.5 hours per day exhibit a reduced risk.[7] The study utilized the DMFT index (Decayed, Missing, Filled Teeth), a standard measure for assessing dental caries experience and overall oral health, as recommended in the WHO Oral Health Surveys: Basic Methods.[16] The gingival index (GI) by Löe & Silness evaluates gingivitis, a reversible inflammation of the gums without damage to the periodontal ligament or bone, using the following criteria: 0 (normal), 1 (mild inflammation), 2 (moderate inflammation), and 3 (severe inflammation).[17] The plaque index (PI) assesses dental plaque, a soft, sticky biofilm that adheres to teeth and is resistant to removal by tongue movements, rinsing, or insufficient brushing; it is scored as 0 (no plaque), 1 (plaque film at the free gingival margin), 2 (moderate plaque), and 3 (heavy plaque accumulation).[18] Data were entered into SPSS software version 23, and descriptive analyses were performed, including calculation of means, standard deviations, and frequencies.

RESULTS

A total of 100 children were included in the study. Table 1 shows that the majority of the study participants were aged 6-12 years (63%) and were female participants (64%). In terms of education, 59% of the participants were in primary school, while 41% were in secondary school. Regarding physical activity, 57% of the participants engaged in less than 150 minutes of physical activity per week, which is below the recommended level, while 43% met or exceeded this target. In terms of sedentary behavior, 29% of the participants spent more than 7.5 hours per day in sedentary activities, while 71% were classified as non-sedentary, spending fewer than 7.5 hours a day in such activities. This suggests that the study sample had a mix of activity levels and sedentary behaviors, and the data highlights the distribution of key variables such as age, gender, physical activity, and sedentary behavior.

Table 2 presents an overview of the oral hygiene habits and dental health status of the study participants. It shows that 99% of students brushed their teeth daily, but only 49% brushed twice a day, which is the recommended frequency. Most students (47%) brushed for just one minute, which is shorter than the ideal two-minute duration.

Dental visits were infrequent, as 65% of students

reported never having visited a dentist. Bleeding gums were reported by 35% of participants, likely due to inadequate oral hygiene. Flossing was extremely rare (only 4%), potentially contributing to higher plaque accumulation and gum disease.

Table 1: Descriptive distribution of demographic variables and physical activity (N=100)

Variables	N=100 (%)
Age	
• 6–12 years (coded = 1)	63 (63%)
• >12 years (coded = 2)	37 (37%)
Gender	
• Male (coded = 1)	36 (36%)
• Female (coded = 2)	64 (64%)
Grade	
• Primary (coded = 1)	59 (59%)
• Secondary (coded = 2)	41 (41%)
Physical activity	
• ≥150 minutes/week (coded = 1)	43 (43%)
• <150 minutes/week (coded = 2)	57 (57%)
Sedentary behaviour	
• <7.5 hours/day (coded = 1)	71 (71%)
• ≥7.5 hours/day (coded = 2)	29 (29%)

Mean ± SD values are based on coded categorical variables (e.g., Male = 1, Female = 2)

Additionally, 15% of students had at least one tooth extracted, and 21% reported teeth grinding. Almost half (48%) of the participants reported tooth sensitivity, which may suggest enamel erosion or gum recession.

Table 3 presents data on plaque and gingival index scores, which assess oral hygiene and gum health among the study participants. Plaque index status indicates that 38% of students had no plaque, while 37% exhibited mild plaque accumulation. Moderate plaque was found in 21% of participants, and only 4% had severe plaque buildup. The mean plaque index score (0.74 ± 0.60) suggests that most students had mild plaque presence. The gingival index status shows that 57% of participants had healthy gums, while 30% experienced mild gingivitis. Moderate gingivitis was present in 12%, and only 1% of students had severe gingivitis.

Table 2: Oral hygiene practices and dental health status of study participants

Variables	N=100 (%)
Teeth Brushing	
No	01 (01%)
Yes	99 (99%)
Brushing Frequency	
Once	49 (49%)
Twice	49 (49%)
Thrice	02 (02%)
Brushing Duration	
1minute	47 (47%)
2minutes	40 (40%)
3minutes	13 (13%)
Dental Visit	
Never	65 (65%)
6 monthly	18 (18%)
1yearly	17 (17%)
Treatment Taken	
None	76 (76%)
Scaling	06 (06%)
Extraction	15 (15%)
Filling	03 (03%)
Bleeding Gums	
Yes	35 (35%)
No	65 (65%)
Floss Regularly	
Yes	04 (4%)
No	96 (96%)
Tooth Extracted	
Yes	15 (15%)
No	85 (85%)
Teeth Grinding	
Yes	21 (21%)
No	79 (79%)
Sensitivity	
Yes	48 (48%)
No	52 (52%)

The mean gingival index score (0.65 ± 0.45) suggests that while gum inflammation was present in some students, severe cases were rare. The overall DMFT score indicated that 71% of students

had a score below 2, suggesting relatively good dental health, while 16% had a score above 2, indicating a higher burden of dental issues. The mean DMFT score (1.01 ± 1.42) suggests that most participants had mild to moderate dental decay, highlighting the importance of preventive dental care and oral health education.

Table 3: Plaque, Gingival, and DMFT Index Scores Among Study Participants (N=100)

Variable	N (%)	Mean ± SD
Plaque Index Status		**0.74 ± 0.60**
• 0 = No Plaque	38 (38%)	
• 0.1–1 = Mild	37 (37%)	
• 1.1–2 = Moderate	21 (21%)	
• 2.1–3 = Severe	04 (4%)	
Gingival Index Status		**0.65 ± 0.45**
• 0 = Healthy	57 (57%)	
• 0.1–1 = Mild	30 (30%)	
• 1.1–2 = Moderate	12 (12%)	
• 2.1–3 = Severe	01 (1%)	
DMFT Score		**1.01 ± 1.42**
• <2	71 (71%)	
• =2	13 (13%)	
• >2	16 (16%)	
DMFT Increment (Decayed component only)		**0.05 ± 0.14**

Mean ± SD values represent average index scores for Plaque and Gingival Indices (scored 0–3 according to Löe & Silness criteria) and the average DMFT count (Decayed, Missing, Filled Teeth) per participant.

DISCUSSION

In this cross-sectional study of 100 schoolchildren aged 12–16 in Karachi, we observed that while nearly all participants reported daily tooth brushing, the recommended frequency (twice daily) and duration (≥2 minutes) were seldom met. Flossing and regular dental visits were uncommon, which aligns with national findings. For example, in Karachi, Vakani et al. reported that although children had good knowledge, only 11% used dental floss regularly, and the mean DMFT was 1.27.[19] In rural Pakistan, Fatema et al. similarly found low rates of preventive behaviors and a substantial burden of dental decay among schoolchildren.[20] Present study's mean DMFT (1.01 ± 1.42) is somewhat lower than figures from national meta-analyses, indicating a 60% prevalence of dental caries in Pakistan.21 This may reflect demographic, socioeconomic, or sampling differences.

Comparatively, in other developing settings, suboptimal oral hygiene practices among children are common. Hassan et al. reported that only 27% of rural/urban Pakistani students brushed twice daily, with the majority brushing just once per day.[22] Internationally, oral hygiene lapses are similarly pervasive in low- and middle-income settings, demonstrating that behavioral and access barriers are widespread.

Regarding periodontal indices, study findings of predominantly mild plaque and gingival inflammation mirror patterns seen in pediatric populations. Although severe disease was rare, the presence of moderate plaque in 21% and moderate gingivitis in 12% merits concern. These findings highlight early stages of periodontal alteration that may progress if preventive measures remain inadequate. [23]

On the association between physical activity and periodontal health, our sample showed that 57% of children failed to meet the WHO recommendation of ≥150 min/week, and 29% engaged in high sedentary behavior (>7.5 h/day). These lifestyle patterns may contribute to oral health risks.[24] A systematic review and meta-analysis found that regular physical activity was associated with lower prevalence of periodontal disease, while individual observational studies (including large population-based analyses) report inverse associations betweem

activity and periodontal measures.[7,22] Mechanistic explanations include exercise-related reductions in systemic inflammation (lower CRP and pro-inflammatory cytokines), which may help modulate periodontal inflammation.[5,6] Some studies in adults and adolescents have shown that higher leisure-time physical activity is related to better oral hygiene practices and lower caries/periodontal indices, supporting our inference that lifestyle behaviors, beyond local oral hygiene, play a modifying role in oral health.[25]

CONCLUSION

High sedentary behavior and insufficient physical activity were common among schoolchildren andwere associated with suboptimal oral hygiene and mild periodontal conditions. Promoting active lifestyles alongside oral health education in schools is essential to improve long-term oral health outcomes. The study showed that despite basic oral hygiene, many schoolchildren showed early signs of plaque, gingivitis, and dental caries, highlighting the urgent need for targeted oral health education and promotion of healthy behaviors in schools.

Limitations: Limitations of this study include its cross-sectional design (preventing causal inference), the purposive non-random sampling (limiting generalizability), and reliance on self-reported physical activity (IPAQ), which can introduce recall and social desirability biases. Objective measurement (accelerometry) and longitudinal or interventional designs would strengthen causal understanding in future work.

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