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ORIGINAL RESEARCH

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# Prevalence of dental caries among children in public schools in Jeddah, Saudi Arabia

Dalia Meisha[1], Lina Bahanan[1], Heba Ashi[1], Abdulraheem Alwafi[1], Nada Farsi[1,*], Alaa Kabbarah[1], Layla Abuljadayel[1], Dania Sabbahi[1], Meyassara Samman[1], Mona Rajeh[1], Mohamed Bamashmous[1]

[1]Department of Dental Public Health, Faculty of Dentistry, King Abdulaziz University, 21589 Jeddah, Saudi Arabia

***Correspondence**
njfarsi@kau.edu.sa
(Nada Farsi)

## Abstract

**Background**: Dental caries is a chronic disease that affects children globally. This study aimed to assess the prevalence and distribution of dental caries among public school children in Jeddah, Saudi Arabia, stratified according to sex and school level. **Methods**: This retrospective cross-sectional study used a stratified random sampling method and included 8215 schoolchildren from 66 public schools. Oral examinations were conducted to assess oral hygiene, gingivitis prevalence, urgency for dental care, care index and dental caries experience using the Decayed, Missing, and Filled Teeth (dmft/DMFT) index. Statistical analysis was performed using the chi-square test for categorical variables and the Mann-Whitney U and Kruskal-Wallis tests for non-normally distributed continuous variables. **Results**: The overall prevalence of dental caries in primary and permanent teeth was 91.2%, with 86.1% of schoolchildren having untreated decay, particularly elementary schoolchildren (87.1%; $p < 0.0001$). The mean dmft index was significantly higher in females ($4.22 \pm 4.00$) than in males ($4.02 \pm 3.89$) ($p = 0.04$). However, the mean DMFT index did not differ significantly between sexes ($p = 0.7$). **Conclusions**: Despite advancements in dental care, dental caries remains a significant public health concern among schoolchildren in Saudi Arabia. Targeted public health interventions are crucial to address this ongoing problem.

## Keywords

Oral health; Dental caries; Gingivitis; Child; Saudi Arabia; Epidemiology

## 1. Introduction

Dental caries ranks among the most prevalent chronic diseases affecting children and adolescents worldwide [1]. The World Health Organization's Global Oral Health Status Report comprehensively evaluated the global burden of oral diseases and identified caries as the most common disease affecting deciduous and permanent teeth [2]. This multifactorial disease negatively impacts oral and general health, and causes pain, infection, dietary restrictions, impaired activities of daily living, poor self-esteem and reduced quality of life [3].

Despite global advancements in dental care and prevention, dental caries remains alarmingly prevalent [2]. The high prevalence of dental caries across all age groups in Saudi Arabia presents a significant healthcare challenge [4, 5]. A recent meta-analysis revealed that dental caries remains a significant public health challenge, especially among children [6]. A synthesis of findings from numerous studies across the country revealed that the prevalence of dental caries among children is as high as 84% and 72% among those aged 5–7 and 12–15 years, respectively [6]. However, few studies have determined the caries prevalence among children in Jeddah [7–10].

Assessing regional variations in caries prevalence is critical to identifying more tailored dental public health approaches. Although previous studies indicate a substantial burden of dental caries among children in Jeddah, Saudi Arabia, these studies are dated [7–12], and new studies are needed to confirm these trends and guide effective interventions. Therefore, this study examined the dental caries prevalence and its distribution according to sex and school level among schoolchildren in Jeddah, Saudi Arabia.

## 2. Materials and methods

### 2.1 Study design and participant selection

This retrospective study analyzed data collected during an oral health promotion campaign. Stratified random sampling was performed across public schools in the governorate of Jeddah, comprising 15 districts [13]. Two schools were randomly selected in each district, one each for recruiting participants of each sex. Schools were selected based on geographic representation and availability, ensuring the equal representation of male and female students across municipalities. This study was approved by the Ethical Research Committee, Faculty of Dentistry at King Abdulaziz University (#17–01-24)

and adhered to the guidelines outlined in the Declaration of Helsinki. Additionally, the study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist to ensure comprehensive reporting of the study design, methodology and findings. Approval to visit the schools was obtained through formal correspondence with the Ministry of Education authorities.

Before the official school visits, preliminary visits to each school were conducted to assess the school administration's willingness to participate and to arrange the setup logistics for the oral health promotion campaign. Female and male schoolchildren were recruited from 36 female and 30 male schools, respectively, as there were fewer public schools for males than for females [13]. The dental examinations in this study were conducted as part of an oral health promotion campaign targeting public school children in the governorate of Jeddah. Data were collected over three consecutive years (2021–2023). All schoolchildren aged 6–17 years from selected schools in Jeddah who participated in the oral health campaign were included. Children were excluded if they refused the oral examination, had incomplete clinical or demographic data.

## 2.2 Data collection and examination

Demographic details such as sex, age and grade were collected. Oral examinations were conducted by trained senior dental students. The clinical assessments included the students' dental caries experience, using the Decayed, Missing, and Filled Teeth (dmft/DMFT) and Oral Hygiene indices, according to the World Health Organization Oral Health Survey Methods [14]. Oral hygiene was assessed using the Simplified Oral Hygiene Index (OHI-S) by Greene and Vermillion [15], which classifies oral hygiene status as good, fair or poor. Gingivitis was assessed and categorized as a dichotomous variable (present/absent) based on visible gingival inflammation and bleeding upon gentle probing [15]. The urgency of dental care was categorized into three levels: no obvious problem/routine care, early care needed and urgent care needed [16].

Calibration sessions were conducted to ensure consistency and accuracy among the trained senior dental students conducting the examinations. Inter-rater and intra-rater reliabilities for gingivitis and oral hygiene assessments were determined using Cohen's Kappa, and Kappa values $>0.75$ were considered "excellent" agreement based on the study by Hunt [17]. Additionally, the inter- and intra-rater reliabilities for the DMFT index were evaluated using the intraclass correlation coefficient (ICC). Using Landis and Koch cutoffs, an ICC $>0.8$ was considered almost perfect agreement.

## 2.3 Statistical analyses

The prevalence of untreated decay, caries experience and the caries care index were calculated. Descriptive statistics, including frequencies and percentages, were used to summarize categorical variables. Means, standard deviations, and medians were computed for continuous variables, such as age and DMFT index. Associations of categorical variables, such as sex and school level, with gingivitis, were assessed using chi-square tests. The Kolmogorov-Smirnov test revealed that data were not normally distributed ($p < 0.0001$). Therefore, the Mann-Whitney U and Kruskal-Wallis tests were used to compare DMFT indices between sexes and school levels, with pairwise comparisons using Dunn's test adjusted by a Bonferroni correction. The $p$-value and the corresponding effect size (Cohen's $d$, Rank-biserial correlation, or Eta-squared, as appropriate) were calculated. Outliers were identified through box plots, histograms, and $z$-scores. Outliers due to data-entry errors were corrected, while true extreme values were retained to maintain data integrity. All statistical tests were two-tailed, and statistical significance was set at $p \leq 0.05$. Data were analyzed using SPSS Statistics version 28 (IBM Corp., Armonk, NY, USA).

# 3. Results

In total, 8215 schoolchildren, aged 6–17 years, from elementary to high school levels in public schools in Jeddah were enrolled in this study. The calculated minimum sample size was met from 52 schools, which ensured comprehensive coverage and representation of the diverse school population across the 15 districts. The ICCs for the DMFT index scoring for inter-rater and intra-rater reliabilities were 0.82 (95% confidence interval (CI): 0.79, 0.85) and 0.91 (95% CI: 0.89, 0.93) respectively. The Cohen kappa values for inter-rater and intra-rater reliabilities for gingivitis and oral hygiene assessments ranged from 0.83 to 0.98

Our study included 8215 schoolchildren from the Jeddah governorate, Saudi Arabia (Table 1). The sex distribution of included schoolchildren was 60.8% female (n = 4992) and 39.2% male (n = 3223). Most participants were from elementary schools (79.1%, n = 6496), with smaller proportions from middle schools (11.5%, n = 948) and high schools (9.4%, n = 771). The average ages of participants according to school levels were 8.3 years (standard deviation (SD) = 1.7) for elementary students, 14.5 years (SD = 0.9) for middle school students and 16.5 years (SD = 0.6) for high school students.

The geographic distribution of schools included in our study is presented in Fig. 1 and classified according to the United Nations Human Settlements Programme urban-density classification [18]. In moderate-density areas, we visited 10 schools, including 4 female-only schools and 6 male-only schools. In high-density areas, we visited 28 schools, including 18 female-only schools and 10 male-only schools. In very high-density areas, we visited 28 schools, including an equal distribution of 14 female-only and 14 male-only schools.

Table 2 presents data regarding the presence of gingivitis, participants' oral hygiene, and the urgency of dental care needs, stratified according to sex and school level. Good oral hygiene was observed in 18.9% of the schoolchildren, whereas fair to poor oral hygiene was more prevalent (81.1%). Oral hygiene status varied according to sex, with females (19.5%) slightly surpassing males (17.9%) in exhibiting good oral hygiene ($p = 0.02$). However, the prevalence of gingivitis in children differed significantly according to sex. Specifically, 35.0% of schoolchildren exhibited symptoms of gingivitis, defined as redness of the gingival tissue. The risk of gingivitis was higher in males than in females (odds ratio, 1.4; 95% confidence interval, 1.3–1.5; $p < 0.001$). However, no significant

**TABLE 1. Characteristics of study participants (n = 8215).**

| Variable | n (%) |
|---|---|
| Sex | |
| Female | 4992 (60.8%) |
| Male | 3223 (39.2%) |
| School level | |
| Elementary school | 6496 (79.1%) |
| Middle school | 948 (11.5%) |
| High school | 771 (9.4%) |
| Age (yr) | Mean ± SD |
| Elementary school | 8.3 ± 1.7 |
| Middle school | 14.5 ± 0.9 |
| High school | 16.5 ± 0.6 |
| Area density according to UN-Habitat | |
| Moderate density | 1237 (23.7%) |
| High density | 1935 (37.1%) |
| Very high density | 2046 (39.2%) |

*SD, standard deviation; UN-Habitat, The United Nations Human Settlements Programme.*

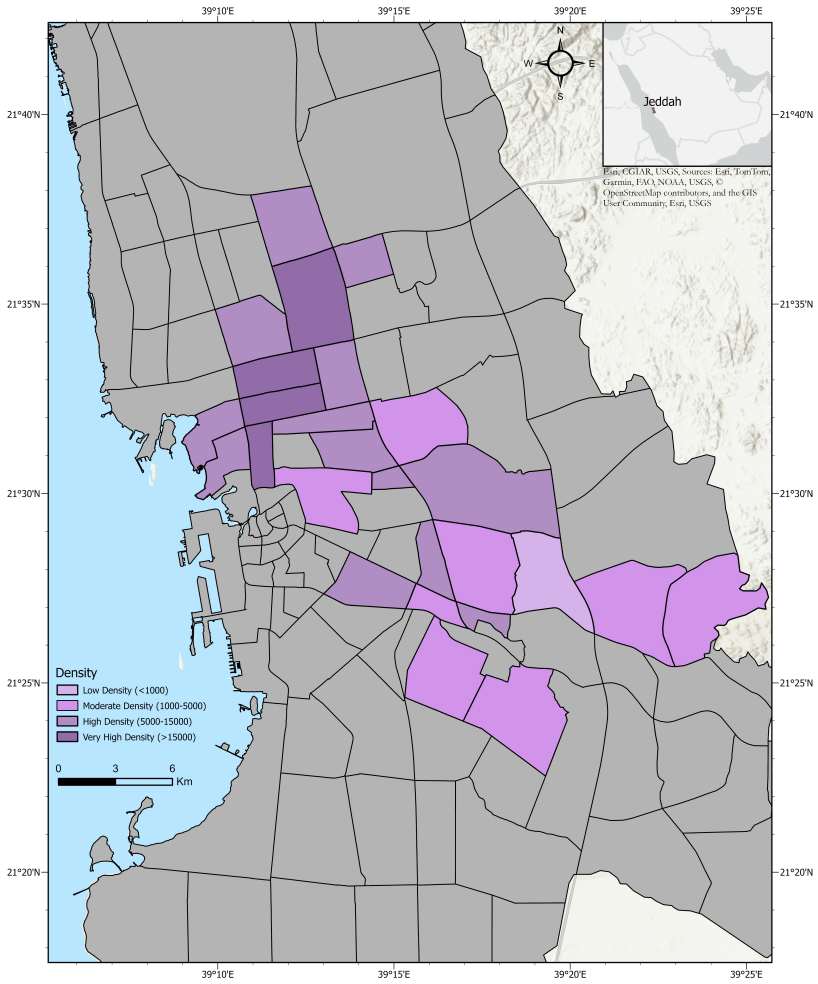


**FIGURE 1. Geographic distribution of visited schools in Jeddah classified according to the population density**. Produced using Esri. ArcGIS Pro. Version 3.4.0. Redlands, CA: Environmental Systems Research Institute; 2024.

**TABLE 2. Oral hygiene, gingivitis and urgency of need for dental care stratified according to sex and school level.**

| Variable | Sex n (%) | | | School level n (%) | | | | Total n (%) |
|---|---|---|---|---|---|---|---|---|
| | Male | Female | *p*-value | Elementary school | Middle school | High school | *p*-value | |
| Oral hygiene: | | | | | | | | |
| Good | 493 (17.9%) | 912 (19.5%) | | 1084 (18.6%) | 175 (19.1%) | 146 (21.1%) | | 1405 (18.9%) |
| Fair | 1180 (42.8%) | 2062 (44.2%) | 0.02* | 2485 (42.7%) | 427 (46.6%) | 330 (47.8%) | <0.001* | 3242 (43.7%) |
| Poor | 1084 (39.3%) | 1691 (36.2%) | | 2245 (38.6%) | 315 (34.4%) | 215 (31.1%) | | 2775 (37.4%) |
| Gingivitis | | | | | | | | |
| Have gingivitis | 1079 (39.9%) | 1479 (32.2%) | <0.001* | 1578 (27.7%) | 555 (61.1%) | 425 (62.0%) | <0.001* | 2558 (35.0%) |
| Urgency of need for dental care: | | | | | | | | |
| No obvious problem/routine dental care | 447 (13.9%) | 639 (12.8%) | | 799 (12.3%) | 164 (17.3%) | 123 (16.0%) | | 1086 (13.2%) |
| Early dental care needed | 1647 (51.1%) | 2666 (53.4%) | 0.1 | 3287 (50.6%) | 576 (60.8%) | 450 (58.4%) | <0.001* | 4313 (52.5%) |
| Urgent need for dental care | 1129 (35.0%) | 1687 (33.8%) | | 2410 (37.1%) | 208 (21.9%) | 198 (25.7%) | | 2816 (34.3%) |

*p-value of Chi-square tests, *statistical significance at $p \leq 0.05$.*

sex differences were found regarding the urgency of dental care needs.

When stratified according to school level, the oral hygiene level, prevalence of gingivitis and treatment urgency varied significantly. Higher-grade schoolchildren had significantly better oral hygiene, compared with lower-grade schoolchildren ($p < 0.001$).

Regarding oral hygiene status, good hygiene was slightly more prevalent in high school children (21.1%) than in middle- (19.1%) and elementary school children (18.6%), with significant differences across school levels ($p < 0.001$). However, elementary school children had the lowest prevalence of gingivitis (27.7%), compared with middle- (61.1%) and high school children (62.0%) ($p < 0.001$). The urgency of the need for dental care varied significantly according to school level ($p < 0.001$), with 37.1% of elementary school children showing the most urgent need for dental care, compared with 21.9–25.7% of children from higher school levels.

The total caries experience and prevalence of untreated decayed teeth among the schoolchildren were 91.2% and 86.1%, respectively. Fig. 2 shows the caries experience and prevalence of untreated decay, stratified according to sex and school level. Although no significant sex differences in caries experience and untreated decay were observed, a significantly higher proportion of primary school children (87.1%) had untreated caries compared with middle- and high school children (81.6% and 83%, respectively) ($p < 0.0001$).

The care index indicated that 10.1% of carious teeth were treated, with females having a significantly higher care index, compared with males (12.6% *vs.* 8.5%; $p < 0.001$) (Table 3). The mean dmft index was significantly higher in females than in males (4.22 ± 4.00 *vs.* 4.02 ± 3.89; $p = 0.042$). When analyzing the components of the dmft index, the mean number of decayed (d) and filled (f) teeth were significantly higher in females than in males, whereas the opposite trend was observed for the mean number of missing (m) teeth ($p < 0.001$). The mean DMFT index was slightly higher in females (1.97 ± 2.860) than in males (1.88 ± 2.681); however, the difference was not statistically significant ($p = 0.71$). Regarding the components of the DMFT index, the mean number of decayed (D) teeth was comparable between the sexes ($p = 0.23$); however, significant differences were observed in the mean number of missing (M) and filled (F) teeth between the sexes. The observed effect sizes by sex were generally small; the largest was noted in the caries care index ($d = 0.13$), which was considered small.

The care index showed a notable increase with increasing school levels, rising from 8.5 to 22%. The mean dmft index for elementary school children was 5.23 ± 3.77, whereas that for middle- and high school children was 4.67 ± 3.41 and 5.76 ± 3.97, respectively (Table 4). The dmft index decreased with increasing school levels, while the DMFT index increased. The effect sizes reported in our study, using partial eta squared ($\eta^2$), highlighted significant variability among different school levels. The most notable differences were observed in the dmft index ($\eta^2 = 0.38$) and the DMFT index ($\eta^2 = 0.28$), indicating moderate to large effects and suggesting that the school level significantly influences these indices.

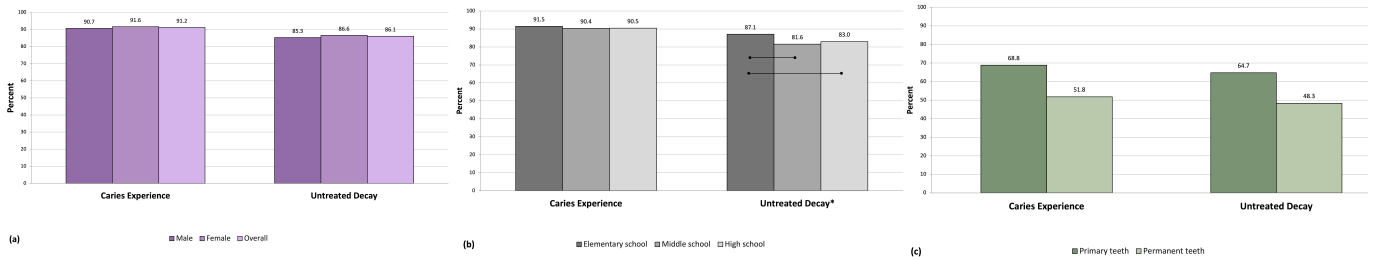


**FIGURE 2. Prevalence of untreated caries and caries experience stratified according to (a) sex, (b) school level and (c) dentition type.** *Statistically significant differences at $p \leq 0.05$. Connecting bars indicate statistically significant pair-wise comparisons ($p < 0.0001$).

**TABLE 3. Care index, dmft and DMFT indices stratified according to sex.**

| Variable | Sex | | Effect size (RBC) | *p*-value | Total |
|---|---|---|---|---|---|
| | Male | Female | | | |
| Caries care index (%) | 8.5 | 12.6 | 0.13 | <0.001* | 10.1 |
| dmft | | | | | |
| Mean ± SD (Min–Max) | 4.02 ± 3.89 (0–19) | 4.22 ± 4.00 (0–20) | 0.02 | 0.04* | 4.14 ± 3.90 (0–20) |
| Median | 4 | 4 | | | 4 |
| d of dmft | | | | | |
| Mean ± SD (Min–Max) | 3.34 ± 3.57 (0–19) | 3.54 ± 3.71 (0–20) | 0.02 | 0.03* | 3.46 ± 3.65 (0–20) |
| Median | 2 | 3 | | | 2 |
| m of dmft | | | | | |
| Mean ± SD (Min–Max) | 0.42 ± 1.16 (0–12) | 0.31 ± 0.92 (0–12) | 0.04 | <0.001* | 0.36 ± 1.02 (0–12) |
| Median | 0 | 0 | | | 0 |
| f of dmft | | | | | |
| Mean ± SD (Min–Max) | 0.26 ± 0.98 (0–10) | 0.37 ± 1.12 (0–11) | 0.07 | <0.001* | 0.33 ± 1.07 (0–11) |
| Median | 0 | 0 | | | 0 |
| DMFT | | | | | |
| Mean ± SD (Min–Max) | 1.88 ± 2.68 (0–22) | 1.97 ± 2.86 (0–23) | 0.004 | 0.7 | 1.94 ± 2.79 (0–23) |
| Median | 1 | 1 | | | 1 |
| D of DMFT | | | | | |
| Mean ± SD (Min–Max) | 1.63 ± 2.38 (0–20) | 1.62 ± 2.40 (0–18) | 0.01 | 0.2 | 1.62 ± 2.42 (0–20) |
| Median | 0 | 0 | | | 0 |
| M of DMFT | | | | | |
| Mean ± SD (Min–Max) | 0.10 ± 0.64 (0–10) | 0.05 ± 0.40 (0–14) | 0.03 | 0.003* | 0.07 ± 0.51 (0–14) |
| Median | 0 | 0 | | | 0 |
| F of DMFT | | | | | |
| Mean ± SD (Min–Max) | 0.16 ± 0.67 (0–8) | 0.30 ± 1.01 (0–11) | 0.08 | <0.001* | 0.24 ± 0.89 (0–11) |
| Median | 0 | 0 | | | 0 |

*p-value of Mann-Whitney U Tests, *statistical significance at ≤0.05.*
*SD, standard deviation; RBC, Rank-Biserial Correlation effect size; dmft, Decayed, Missing, and Filled Primary Teeth; DMFT, Decayed, Missing, and Filled Permanent Teeth; Min–Max, Minimum–Maximum.*

**TABLE 4. Care index, dmft and DMFT indices stratified according to school level.**

| Variables | Elementary School | Middle School | High School | Effect Size ($\eta^2$) | *p*-value |
|---|---|---|---|---|---|
| Caries care index (%) | 8.5 | 19.0$^{a}$ | 22.0$^{a}$ | 0.08 | <0.001* |
| dmft | | | | | |
| Mean ± SD (Min–Max) | 5.23 ± 3.77$^{ab}$ (0–20) | 0.05 ± 0.35$^{a}$ (0–5) | 0.01 ± 0.13$^{b}$ (0–3) | 0.38 | <0.001* |
| Median | 5 | 0 | 0 | | |
| d of dmft | | | | | |
| Mean ± SD (Min–Max) | 4.37 ± 3.60$^{ab}$ (0–20) | 0.04 ± 0.33$^{a}$ (0–5) | 0.01 ± 0.10$^{b}$ (0–2) | 0.34 | <0.001* |
| Median | 4 | 0 | 0 | | |
| m of dmft | | | | | |
| Mean ± SD (Min–Max) | 0.45 ± 1.13$^{ab}$ (0–12) | 0$^{a}$ | 0$^{b}$ | 0.05 | <0.001* |
| Median | 0 | 0 | 0 | | |
| f of dmft | | | | | |
| Mean ± SD (Min–Max) | 0.41 ± 1.19$^{ab}$ (0–11) | 0.00 ± 0.08$^{a}$ (0–2) | 0$^{b}$ | 0.04 | <0.001* |
| Median | 0 | 0 | 0 | | |
| DMFT | | | | | |
| Mean ± SD (Min–Max) | 1.09 ± 1.66$^{ab}$ (0–16) | 4.67 ± 3.41$^{ac}$ (0–23) | 5.76 ± 3.97$^{bc}$ (0–22) | 0.28 | <0.001* |
| Median | 0 | 4 | 6 | | |
| D of DMFT | | | | | |
| Mean ± SD (Min–Max) | 1.00 ± 1.57$^{ab}$ (0–14) | 3.73 ± 3.26$^{a}$ (0–20) | 4.32 ± 3.52$^{ab}$ (0–20) | 0.20 | <0.001* |
| Median | 0 | 3 | 4 | | |
| M of DMFT | | | | | |
| Mean ± SD (Min–Max) | 0.03 ± 0.31$^{ab}$ (0–8) | 0.17 ± 0.63$^{a}$ (0–10) | 0.28 ± 1.20$^{ab}$ (0–14) | 0.04 | <0.001* |
| Median | 0 | 0 | 0 | | |
| F of DMFT | | | | | |
| Mean ± SD (Min–Max) | 0.06 ± 0.35$^{ab}$ (0–6) | 0.78 ± 1.42$^{ac}$ (0–9) | 1.16 ± 1.85$^{bc}$ (0–11) | 0.22 | <0.001* |
| Median | 0 | 0 | 0 | | |

*p-value of Kruskal-Wallis test: *statistical significance at $p \leq 0.05$.*
*Each pair of similar superscripted letters ($^{abc}$) indicates a statistically significant pair-wise comparison: p-value < 0.0001.*
*SD, standard deviation; $\eta^2$, Eta-squared effect size; dmft, Decayed, Missing, and Filled Primary Teeth; DMFT, Decayed, Missing, and Filled Permanent Teeth; Min, Minimum; Max, Maximum.*

## 4. Discussion

This study revealed a high prevalence of dental caries among public school children in Jeddah, indicating a significant burden, with 86%–91% of children having untreated decay. Our findings align with those of Adam *et al.* [6], who reported a caries prevalence of 72%–84% in Saudi Arabian children across different regions. Similarly, a systematic review by Al Agili reported a caries prevalence of 80% and 70% in the primary and permanent dentitions, respectively [5]. Nevertheless, a Saudi nationwide study reported a lower caries prevalence of 65.6%, which is also high [4]. The high prevalence of untreated decay in this study and Saudi Arabia generally, is multifactorial and could be attributed to the underutilization of dental services, poor awareness of oral health, poor preventive dental care practices [19–21], poor oral hygiene behavior among children such as irregular brushing and high sugar consumption [22, 23], high reported dental fear and anxiety among children associated with an avoidance of routine dental care [24], low level of oral health literacy [25], cultural attitudes towards dental health influenced by factors such as mother's education levels [12] and mother's sugar intake [26], and reactive health-seeking behavior [27].

This study revealed differences in the oral hygiene status according to sex, with female schoolchildren generally having better oral hygiene than male schoolchildren. This aligns with the findings in a previous study that male adolescents exhibited poorer oral hygiene behaviors and were more likely to develop gingivitis, compared with female adolescents, underscoring the influence of sex on oral health outcomes [28]. In another study conducted across various regions of Saudi Arabia, the prevalence of gingivitis among high school children was higher in males than in females [29]. The higher prevalence of gingivitis in males may be attributed to heightened innate immune responses, increased pro-inflammatory cytokine production (*e.g.*, Interleukin-6), and immunomodulatory effects of testosterone, which can suppress humoral immunity, collectively leading to a more pronounced inflammatory response to

microbial pathogens [30]. Our results showed that elementary school children were the least likely to develop gingivitis, with a significant increase in prevalence among middle- and high school children. This finding that the prevalence of gingivitis in children increases with age is consistent with that of a previous study [31].

Our study revealed a significantly greater proportion of untreated dental caries among primary school children than in middle- and high school children with a moderate to large size effect in the dmft and DMFT indices, suggesting that the school level significantly influences dental caries prevalence. These notable effect sizes are indicative of a substantial practical significance, particularly in customizing preventative care and treatment needs based on the school level. This finding is consistent with that of a Saudi nationwide study, in which a higher prevalence of caries was observed among 6-year-old children (72.1%), followed by 15-year-old (66.5%) and 12-year-old (57.9%) children [4]. These findings suggest a critical need for targeted dental health interventions starting in early childhood in Saudi Arabia. Additionally, a cross-sectional study among children in Almadinah Almunawwarah City found that caries prevalence was high among 6-year-old (86%) children but decreased at the age of 12 years (68%) [32]. Similarly, in a study conducted in schools in Riyadh, the incidence of dental caries in 6-, 12- and 15-year-old children was 85.77%, 64.98% and 71.35%, respectively [20]. Our findings are consistent with those of previous studies, which indicated that dental caries is more prevalent in the primary dentition than in the permanent dentition, although the difference is not statistically significant [4–6, 10, 12, 32]. This pattern underscores the critical need for targeted dental interventions at an early age.

In our study, the mean dmft index was higher in female schoolchildren than in male schoolchildren. However, the observed effect sizes by sex were generally small, indicating minimal practical significance despite statistical significance. A possible explanation for the higher dmft index among female schoolchildren compared to male schoolchildren may be that females experience the earlier eruption of teeth and are more likely to seek dental services as evidenced by the higher filling component of the dmft index for females [33]. A previous national study reported that the dmft index was higher in male schoolchildren than in female schoolchildren [4], whereas another study among schoolchildren in the eastern region of Saudi Arabia reported no significant difference in the dmft index between the sexes [34]. Our findings align with those of a study conducted in Almadinah Almunawwarah City, which reported that among 6-year-old children, the mean number of decayed teeth (d component) was higher in girls than in boys [32]. In our study, we found no significant differences in the mean DMFT index between the sexes, which is consistent with the findings in a study conducted in the Hail and Tabuk regions [35]. Consistent with our findings, a national study found that among Saudi children aged 12–15 years, females had a higher mean number of filled teeth (F component) and a higher care index compared with males [4]. This can be explained by the high rate of dental visits among female children [36].

While no single factor fully explains the regional discrepancies in caries prevalence, several interrelated factors may contribute to the high prevalence of dental caries among Saudi children. A study on dental service accessibility in Saudi Arabia identified several obstacles, including extensive waiting times, availability of only basic treatments, and perceived lower quality of care in government dental clinics than in private clinics [37]. Moreover, this high prevalence may be influenced by cultural dietary habits, such as the frequent consumption of sugary food and carbonated drinks [34]. Additionally, a lack of parental oral health awareness was a common reason for children not receiving dental care, especially among those who had never visited a dentist [38].

The World Health Organization's (WHO) Global Oral Health Action Plan (2023–2030) aims to achieve universal health coverage for oral health by 2030, ensuring that at least 80% of the global population has access to essential oral health services [39]. However, the high prevalence of untreated dental caries observed in this study indicates that considerable efforts are needed to bridge this gap, particularly among school-aged children in Saudi Arabia, to align with the WHO's goal of reducing the global burden of oral diseases by 10% [39].

Early detection and intervention for dental issues among schoolchildren are essential to preventing more severe dental problems [40]. Enhanced training and education of schoolteachers can improve their ability to detect dental caries and facilitate timely referrals of children to dental services [41]. Consequently, children at risk of developing caries can receive appropriate care, thereby reducing the long-term health effects of untreated dental conditions [40].

Several studies have demonstrated the effectiveness of dental sealants, emphasizing their importance in preventive dental care [42]. Implementing school-based dental sealant programs can significantly reduce the prevalence of dental caries among schoolchildren. Moreover, by integrating dental sealant programs within schools, socioeconomically disadvantaged children can be reached [43]. In addition to addressing immediate health needs, this strategy helps close the gap in oral health disparities over time [43].

This study had some limitations. First, the cross-sectional design limited the ability to establish causality, offering only a snapshot of caries prevalence at one point in time. Second, this study did not assess potential confounding factors such as socioeconomic status, dietary habits, oral hygiene practices, dental care access and fluoride exposure. The absence of these factors may limit the ability to fully interpret disparities observed in the study. Third, this study focused on schoolchildren in the Jeddah governorate and did not capture oral health across Saudi Arabia. Fourth, the sample included a greater proportion of female schoolchildren (60.8%) than male schoolchildren and included more elementary school students (79.1%) than middle school and high school students. The greater number of female-only schools (36) compared to male-only schools (30) was owing to lower participation from male-only schools. This may introduce selection bias, as participation could be influenced by school policies or administrative willingness. While no statistical adjustments were made, the study's stratified sampling and large sample size improved representativeness. Fifth, although dental students receive calibration training, the subjective nature of clinical assessment may introduce assessment bias, potentially

affecting oral health status evaluations. Finally, the study was conducted only in public schools and did not use weighted sampling, which restricts the generalizability of the findings. Despite these limitations, this study's large sample size and updated data provide a comprehensive snapshot of the current trends in dental caries prevalence among schoolchildren in Jeddah, Saudi Arabia. Longitudinal studies examining the impact of fluoride use, dietary patterns, and dental care access could offer deeper insights into caries progression and guide targeted public health interventions.

## 5. Conclusions

In conclusion, the prevalence of dental caries among Saudi schoolchildren continues to be a significant public health concern. This study enhances our understanding of the current prevalence of dental caries in schoolchildren in Jeddah and highlights the need to revamp dental public health approaches for prevention. Furthermore, early preventive interventions should be tailored to the needs of the high-risk groups identified in this study. Our findings provide evidence-based guidance for health policymakers, enabling them to make informed decisions and shape effective oral health strategies. Future studies should continue to monitor these trends over time and assess the effectiveness of existing and emerging preventive programs designed to reduce the incidence of dental caries among children.

### ABBREVIATIONS

CI, confidence interval; dmft/DMFT, decayed, missing, and filled teeth; ICC, intraclass correlation coefficient; SD, standard deviation; $\eta^2$, Eta-squared effect size; RBC, Rank-Biserial Correlation effect size; STROBE, Strengthening the Reporting of Observational Studies in Epidemiology; WHO, World Health Organization; UN-Habitat, The United Nations Human Settlements Programme; OHI-S, Simplified Oral Hygiene Index.

### AVAILABILITY OF DATA AND MATERIALS

The datasets used during the current study are available from the corresponding author on reasonable request.

### AUTHOR CONTRIBUTIONS

DM and LB—designed the research study, analyzed the data. DM, LB, HA, AA, NF, AK, LA, DS, MS, MR and MB—performed the research, wrote the manuscript. DS, LB, MR and MB—helped with preparation for school visits. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

### ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by the Ethical Research Committee, Faculty of Dentistry at King Abdulaziz University (#17–01-24) and adhered to the guidelines outlined in the Declaration of Helsinki. Approval to visit the schools was obtained through formal correspondence with the Ministry of Education authorities. Parental consent was obtained using an opt-out method, where parents were informed about the study and had the opportunity to decline participation. To protect participants' privacy, no personally identifiable information was collected, and all data were recorded anonymously. Consent forms and data records were stored securely and were accessible only to authorized researchers.

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### CONFLICT OF INTEREST

The authors declare no conflict of interest.

### REFERENCES

[1] Kaur P, Vyas M, Verma S. Dental caries: a review on etiology, therapeutic approaches, novel formulations, and marketed preparations. ECS Transactions. 2022; 107: 8035–8048.

[2] Cherian JM, Kurian N, Varghese KG, Thomas HA. World Health Organization's global oral health status report: paediatric dentistry in the spotlight. Journal of Paediatrics and Child Health. 2023; 59: 925–926.

[3] Oliveira TT, Menegaz AM, do Rosário AM, Romano AR, Schardosim LR, Mendes FM, *et al*. Impact of dental caries severity and activity on oral health-related quality of life among children aged 8–11 years. Brazilian Oral Research. 2023; 37: e41.

[4] Orfali SM, Alrumikhan AS, Assal NA, Alrusayes AM, Natto ZS. Prevalence and severity of dental caries in school children in Saudi Arabia: a nationwide cross-sectional study. Saudi Dental Journal. 2023; 35: 969–974.

[5] Al Agili DE. A systematic review of population-based dental caries studies among children in Saudi Arabia. Saudi Dental Journal. 2013; 25: 3–11.

[6] Adam TR, Al-Sharif AI, Tonouhewa A, AlKheraif AA. Prevalence of caries among school children in Saudi Arabia: a meta-analysis. Advances in Preventive Medicine. 2022; 2022: 7132681.

[7] Alkarimi HA, Watt RG, Pikhart H, Sheiham A, Tsakos G. Dental caries and growth in school-age children. Pediatrics. 2014; 133: e616–e623.

[8] Alamoudi N, Salako NO, Massoud I. Caries experience of children aged 6–9 years in Jeddah, Saudi Arabia. International Journal of Paediatric Dentistry. 1996; 6: 101–105.

[9] Gandeh MB, Milaat WA. Dental caries among schoolchildren: report of a health education campaign in Jeddah, Saudi Arabia. Eastern Mediterranean Health Journal. 2000; 6: 396–401.

[10] Qutob A. A needs-based approach for health human resources planning for dentistry in Jeddah, Saudi Arabia. 2009. Available

at: https://utoronto.scholaris.ca/items/28226fba-3f35-42bb-8554-2e60ccb567f6 (Accessed: 11 May 2024).
[11] Al-Malik MI, Rehbini YA. Prevalence of dental caries, severity, and pattern in age 6 to 7-year-old children in a selected community in Saudi Arabia. Journal of Contemporary Dental Practice. 2006; 7: 46–54.
[12] Al Agili DE, Alaki SM. Can socioeconomic status indicators predict caries risk in schoolchildren in Saudi Arabia? A cross-sectional study. Oral Health and Preventive Dentistry. 2014; 12: 277–288.
[13] General Authority for Statistics. Saudi census portal. 2022. Available at: https://www.stats.gov.sa/en/ (Accessed: 08 September 2024).
[14] World Health Organization. Oral health surveys: basic methods-5th edition. 2013. Available at: https://www.who.int/publications/i/item/9789241548649 (Accessed: 25 June 2024).
[15] Greene JC, Vermillion JR. The simplified oral hygiene index. Journal of the American Dental Association. 1964; 68: 7–13.
[16] Association of State and Territorial Dental Directors. Basic screening survey: an approach to assessing dental health among children. 2020. Available at: https://www.astdd.org/basic-screening-survey-tool/ (Accessed: 09 September 2024).
[17] Hunt RJ. Percent agreement, Pearson's correlation, and kappa as measures of inter-examiner reliability. Journal of Dental Research. 1986; 65: 128–130.
[18] United Nations human settlements programme (UN-habitat). New urban agenda illustrated handbook. UN-Habitat. 2020. Available at: https://unhabitat.org/the-new-urban-agenda-illustrated (Accessed: 11 February 2024).
[19] Qadir Khan S, Alzayer HA, Alameer ST, Ajmal Khan M, Khan N, AlQuorain H, *et al*. SEQUEL: prevalence of dental caries in Saudi Arabia: a systematic review and *meta*-analysis. Saudi Dental Journal. 2024; 36: 963–969.
[20] Al-Rafee MA, AlShammery AR, AlRumikan AS, Pani SC. A comparison of dental caries in urban and rural children of the Riyadh region of Saudi Arabia. Frontiers in Public Health. 2019; 7: 195.
[21] Togoo RA, Al-Rafee MA, Kandyala R, Luqam M, Al-Bulowey MA. Dentists' opinion and knowledge about preventive dental care in Saudi Arabia: a nationwide cross-sectional study. Journal of Contemporary Dental Practice. 2012; 13: 261–265.
[22] Sabbagh HJ, Alzain IO. Oral Health care among children in Saudi Arabia: a cross-sectional study. BMC Oral Health. 2024; 24: 1118.
[23] Quadri MF, Shubayr MA, Hattan AH, Wafi SA, Jafer AH. Oral hygiene practices among Saudi Arabian children and its relation to their dental caries status. International Journal of Dentistry. 2018; 2018: 3234970.
[24] Nassar AA, Rawah SA, Hariri RA, Bakhsh MA, Bassyoni LJ. Fear and anxiety in patients seeking dental care in the Makkah region of Saudi Arabia. Journal of Research in Medical and Dental Science. 2022; 10: 1–7.
[25] Alzeer M, AlJameel A, Rosing K, Øzhayat E. The association between oral health literacy and oral health-related behaviours among female adolescents in the Kingdom of Saudi Arabia: a cross-sectional study. Saudi Dental Journal. 2024; 36: 1035–1042.
[26] Bakhurji A, El Tantawi MM, Gaffar BO, Al-Khalifa KS, Al-Ansari AA. Carious lesions of permanent molars and oral health practices of parents and peers in Saudi male adolescents. Saudi Medical Journal. 2017; 38: 748–754.
[27] Meisha DE, Alsolami AM, Alharbi GM. Social determinants of seeking emergency and routine dental care in Saudi Arabia during the COVID-19 pandemic. BMC Oral Health. 2021; 21: 212.
[28] Abe M, Mitani A, Hoshi K, Yanagimoto S. Large gender gap in oral hygiene behavior and its impact on gingival health in late adolescence. International Journal of Environmental Research and Public Health. 2020; 17: 4394.
[29] AlGhamdi AS, Almarghlani AA, Alyafi RA, Kayal RA, Al-Zahrani MS. Gingival health and oral hygiene practices among high school children in Saudi Arabia. Annals of Saudi Medicine. 2020; 40: 126–135.
[30] Shiau HJ, Reynolds MA. Sex differences in destructive periodontal disease: exploring the biologic basis. Journal of Periodontology. 2010; 81: 1505–1517.
[31] Liu X, Xu J, Li S, Wang X, Liu J, Li X. The prevalence of gingivitis and related risk factors in schoolchildren aged 6–12 years old. BMC Oral Health. 2022; 22: 623.
[32] Mahrous MS, Bhayat A, Hifnawy T, Bakeer H, Ahmad MS. Can the prevalence of dental caries be used as an indicator of the quality of dental services? A cross-sectional study among children in Almadinah Almunawwarah, KSA. Journal of Taibah University Medical Sciences. 2016; 11: 41–45.
[33] Aqeeli A, Alsharif AT, Kruger E, Tennant M. Factors influencing children's regular attendance at dental clinics in Al Madinah, Saudi Arabia. Saudi Journal of Health Systems Research. 2021; 1: 140–146.
[34] Farooqi FA, Khabeer A, Moheet IA, Khan SQ, Farooq I, ArRejaie AS. Prevalence of dental caries in primary and permanent teeth and its relation with tooth brushing habits among schoolchildren in Eastern Saudi Arabia. Saudi Medical Journal. 2015; 36: 737–742.
[35] Aljanakh M. Prevalence and severity of dental caries among public school students aged 16–l8 in Hai'l, Kingdom of Saudi Arabia. International Journal of Health Sciences. 2017; 11: 50–53.
[36] Alhareky M, Nazir MA. Dental visits and predictors of regular attendance among female schoolchildren in Dammam, Saudi Arabia. Clinical, Cosmetic and Investigational Dentistry. 2021; 13: 97–104.
[37] Alshahrani A, Raheel S. Health-care system and accessibility of dental services in Kingdom of Saudi Arabia: an update. Journal of International Oral Health. 2016; 8: 883–887.
[38] Al Agili DE, Farsi NJ. Need for dental care drives utilisation of dental services among children in Saudi Arabia. International Dental Journal. 2020; 70: 183–192.
[39] World Health Organization. Draft global oral health action plan (2023–2030). 2023. Available at: https://www.who.int/publications/m/item/draft-global-oral-health-action-plan-(2023-2030) (Accessed: 11 February 2024).
[40] Chou R, Pappas M, Dana T, Selph S, Hart E, Fu RF, *et al*. Screening and interventions to prevent dental caries in children younger than age five years: a systematic review for the U.S. preventive services task force. Journal of American Medical Association. 2021; 326: 2172–2178.
[41] Edomwonyi AI, Adeniyi AA, Adedigba MA, Oyapero A. Use of teachers as agents of oral health education: intervention study among public secondary school pupils in Lagos. Journal of Family Medicine and Primary Care. 2020; 9: 2806–2813.
[42] Patel N, Griffin SO, Linabarger M, Lesaja S. Impact of school sealant programs on oral health among youth and identification of potential barriers to implementation. Journal of the American Dental Association. 2022; 153: 970–978.e4.
[43] Carpino R, Walker MP, Liu Y, Simmer-Beck M. Assessing the Effectiveness of a school-based dental clinic on the oral health of children who lack access to dental care. Journal of School Nursing. 2017; 33: 181–188.

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