

Prevalence of dental caries among schoolchildren in Saudi Arabia

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Abstract

Background: Dental caries is common among children, however, there is limited data on its prevalence among schoolchildren in the rural areas of Saudi Arabia.

Aim: To determine the prevalence of dental caries and its association with selected demographic factors among schoolchildren in rural areas of Riyadh Province, Saudi Arabia.

Methods: We extracted dental clinic data of 2864 schoolchildren aged 6–17 years for January 2021 to June 2022, from the electronic medical records of selected rural public hospitals and primary health centres in Riyadh Province, Saudi Arabia. We analysed the data using SPSS version 26 and used chi-square tests and logistic regression to analyse the associations with sex, age and schooling level. $P < 0.05$ was considered statistically significant.

Results: Of all the 2864 schoolchildren, 13.9% (95% confidence interval: 12.6–15.1) had dental caries. Prevalence was higher among males (22.4%) than females (10.3%) ($P < 0.001$) and was more common among high school students (20.0%) than among elementary (12.9%) and intermediate (10.3%) school students.

Conclusion: Our findings have important implications for oral health policy, prevention and research in Saudi Arabia. The high prevalence indicates a high burden of dental caries among rural populations in the country and the need for stronger and more extensive preventive interventions, including school-based education and early screening for children.

Keywords: dental caries, oral health, schoolchildren, rural area, Saudi Arabia

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Introduction

Dental caries is a common oral health condition among children. It is a chronic disease that leads to progressive destruction of tooth structure (1). Dental caries results from the metabolic activity of cariogenic bacteria that produce acids, leading to demineralisation of tooth enamel (2,6). It is a leading cause of oral morbidity and tooth loss (3). Dental caries affects individuals across the life course (4,5). Caries development reflects an imbalance between oral bacteria and tooth mineralisation processes. If untreated, dental caries may progress to pulpal and periapical infections and serious complications.

Dental caries is influenced by several factors, including biological, behavioural and socioeconomic determinants. Key risk factors include poor oral hygiene, inadequate fluoride exposure, increased levels of cariogenic bacteria, and low socioeconomic status (7). Dietary practices, particularly the frequency of sugar intake, play an important role in caries development. High consumption of sugary foods and beverages and sugar-containing oral medications increases the risk of dental caries (8,9).

Oral hygiene and nutritional habits are among the most frequently reported risk factors for dental caries

in children, alongside maternal and bacterial factors (10). Untreated dental caries may adversely affect general health, learning, and growth (11). Schoolchildren are generally defined as children aged 6–17 years enrolled in primary, intermediate and secondary education (12). Dental caries is more prevalent among children with a family history of the condition (13).

Dental caries is not self-limiting but may be prevented or reversed in its early stages. Preventive interventions are therefore central to oral health promotion (14,15). Globally, dental caries remains a major public health concern (16). Untreated dental caries affects more than 2 billion people worldwide, making it the most common health condition. Approximately 514 million children have untreated caries in deciduous teeth (17). Dental caries continues to affect the well-being of individuals and communities and has a substantial impact on quality of life, including reduced oral function and loss of school or work days (17,20,21).

Saudi Arabia has a high prevalence of dental caries, estimated at 76% among elementary schoolchildren (18). High prevalence has been reported among adults and older populations, although most published studies focus on the prevalence of dental caries among preschool and elementary schoolchildren (16,19). In Saudi Arabia, studies have examined the prevalence and severity of dental

caries among children across different administrative regions (16). However, evidence-based policies addressing dental caries among school-aged children, particularly in rural areas, remain limited.

Therefore, this study aimed to determine the prevalence of dental caries among schoolchildren in rural areas of Saudi Arabia and examine its association with demographic factors.

Methods

Study design

This study was conducted in rural areas of the Riyadh Province in Saudi Arabia. A retrospective cross-sectional design was used, with data extracted from dental clinic records in public hospitals and primary health care centres between January 2021 and June 2022. The study included all available records of school-aged children attending public dental clinics in hospitals and primary health care centres during the study period, all of whom attended schools in the same rural areas. A convenience sampling approach was used. Based on the Cochran formula, the minimum required sample size was 385. The final sample included 2864 participants.

Data collection and variables

Data were extracted from electronic medical record systems used in participating hospitals and primary health care centres. The research team coordinated with health information management departments to facilitate data access. A standardised data collection form was developed based on the variables of interest.

Dental caries diagnosis was based on WHO diagnostic criteria, which are routinely used by dental professionals at the participating facilities. Trained data abstractors reviewed records to ensure completeness and accuracy. Records were included if they contained a confirmed diagnosis of dental caries and relevant demographic information.

Calibration sessions were conducted for data abstractors to ensure consistent application of WHO diagnostic criteria for dental caries, which are routinely used by dental professionals across the participating institutions (22). To minimise variability, only records with complete documentation and diagnoses made by licensed dentists were included. Ambiguous or incomplete records were excluded.

Data were used to assess the prevalence of dental caries and its association with factors, such as age, sex and school level.

Inclusion and exclusion criteria

The inclusion criteria were children aged 6–17 years, enrolled in primary, intermediate or secondary schools, availability of complete dental records within the study period, and residence in rural areas of Saudi Arabia. The exclusion criteria were children younger than 6 years or older than 17 years at the time of data collection,

incomplete or missing dental records, and residence outside rural areas.

Statistical analysis

The data were analysed using SPSS version 26. Categorical variables were summarised using frequencies and percentages. Dental caries was the dependent variable. The independent variables included sex, age, and school level (elementary school: 6–11 years, intermediate: 12–14 years, high school: 15–17 years).

Associations between independent variables and dental caries were assessed using the chi-square test. A value of $P < 0.05$ was considered statistically significant. Binary and multivariable logistic regression analyses were conducted to estimate adjusted odds ratios for associations between independent variables and dental caries.

Ethics considerations

Ethics approval was obtained from the Institutional Review Board at King Abdullah International Medical Research Center. The approval number was SP22R/048/04. The study was conducted in accordance with applicable ethical standards and regulations. All data were anonymised before analysis, and no personally identifiable information was accessed or recorded.

Results

Table 1 presents the baseline characteristics of the study participants (2864 schoolchildren), 70.7% of whom were female. More than half of the schoolchildren were enrolled in elementary school (51.1%), followed by intermediate (26.0%) and high school (22.8%). Age distribution was relatively even across the 6–17-year age groups.

Table 2 shows the prevalence of dental caries among schoolchildren by sex, school level and age. The overall prevalence of dental caries was 13.9% (95% CI: 12.6–15.1). Prevalence was higher among males than females (22.4% versus 10.3%; $P < 0.001$). Schoolchildren enrolled in high school had a higher prevalence of dental caries than those in elementary and intermediate school (20.0% versus 12.9% and 10.3%, respectively; $P < 0.001$). The prevalence of dental caries was higher in older age groups ($P < 0.001$).

Table 3 shows the association between dental caries and baseline characteristics of schoolchildren. The male study population had higher odds of dental caries than female schoolchildren (odds ratio [OR] = 2.50; 95% CI: 2.02–3.11; $P < 0.001$). Schoolchildren enrolled in high school had higher odds of dental caries than those in elementary school (OR = 1.69; 95% CI: 1.32–2.16; $P < 0.001$), whereas no statistically significant difference was observed between intermediate and elementary schoolchildren. Compared with 17-year-old schoolchildren, lower odds of dental caries were observed among several younger age groups, particularly those aged 10–14 years.

Table 1 Sociodemographic characteristics of study participants

Variable	Category	Total N (%)	Schoolchildren with caries N (%)	Schoolchildren without caries N (%)
Gender	Male	840 (29.3)	188 (47.4)	652 (26.4)
	Female	2024 (70.7)	209 (52.6)	1815 (73.6)
Schooling level	Elementary	1464 (51.1)	189 (47.6)	1275 (51.7)
	Intermediate	746 (26.0)	77 (19.4)	669 (27.1)
	High school	654 (22.8)	131 (33.0)	523 (21.2)
Age (years)	6	213 (7.4)	38 (9.6)	175 (7.1)
	7	217 (7.6)	26 (6.5)	191 (7.7)
	8	264 (9.2)	36 (9.1)	228 (9.2)
	9	210 (7.3)	33 (8.3)	177 (7.2)
	10	251 (8.8)	25 (6.3)	226 (9.2)
	11	309 (10.8)	30 (7.6)	279 (11.3)
	12	229 (8.0)	24 (6.0)	205 (8.3)
	13	253 (8.8)	23 (5.8)	230 (9.3)
	14	264 (9.2)	30 (7.6)	234 (9.5)
	15	172 (6.0)	38 (9.6)	134 (5.4)
	16	215 (7.5)	38 (9.6)	177 (7.2)
17	267 (9.3)	56 (14.1)	211 (8.6)	

Table 2 Prevalence of dental caries among schoolchildren by sex, schooling level and age

Variable	Category	Prevalence (%)	95% CI		P
			Lower	Upper	
Gender	Male	22.4	19.6	25.2	< 0.001
	Female	10.3	9.0	11.7	
Schooling level	Elementary	12.9	11.2	14.6	< 0.001
	Intermediate	10.3	8.1	12.5	
	High school	20.0	17.0	23.1	
Age (years)	6	17.8	12.3	22.4	< 0.001
	7	12.0	7.3	15.9	
	8	13.6	9.1	17.3	
	9	15.7	10.2	19.9	
	10	10.0	5.9	13.2	
	11	9.7	6.1	12.6	
	12	10.5	6.1	13.8	
	13	9.1	5.2	12.1	
	14	11.4	7.0	14.5	
	15	22.1	14.3	26.3	
	16	17.7	11.5	21.4	
17	21.0	14.9	24.5		
Total		13.9	12.6	15.1	

Table 3 Association between dental caries and sociodemographic characteristics of schoolchildren

Variable	Category	Caries		No caries		OR (95% CI)	P
		N	%	N	%		
Sex	Male	188	22.4	652	77.6	2.50 (2.02–3.11)	< 0.001
	Female	209	10.3	1815	89.7	1	
Schooling level	High school	189	20.0	1275	80.0	1.69 (1.32–2.16)	< 0.001
	Intermediate	77	10.3	669	89.7	0.78 (0.59–1.03)	0.078
	Elementary	131	12.9	523	87.1	1	
Age	6	38	17.8	175	82.2	0.82 (0.52–1.29)	0.391
	7	26	12.0	191	88.0	0.51 (0.31–0.85)	0.010
	8	36	13.6	228	86.4	0.60 (0.38–0.94)	0.026
	9	33	15.7	177	84.3	0.70 (0.44–1.13)	0.144
	10	25	10.0	226	90.0	0.42 (0.25–0.69)	0.001
	11	30	9.7	279	90.3	0.41 (0.25–0.65)	< 0.001
	12	24	10.5	205	89.5	0.44 (0.26–0.74)	0.002
	13	23	9.1	230	90.9	0.38 (0.22–0.63)	< 0.001
	14	30	11.4	234	88.6	0.48 (0.30–0.78)	0.003
	15	38	22.1	134	77.9	1.07 (0.67–1.70)	0.780
	16	38	17.7	177	82.3	0.81 (0.51–1.28)	0.364
17	56	21.0	211	79.0	1		

Discussion

This study found that 13.9% of schoolchildren in rural areas of Saudi Arabia had dental caries. Although lower than estimates reported in national and regional studies, this prevalence has important implications for oral health policy and prevention strategies targeting rural populations. A meta-analysis of studies conducted across Saudi Arabia reported a pooled dental caries prevalence of 80% (19). Differences in study design, data sources and population coverage are likely to contribute to this variation. Unlike examination-based studies, clinic-based records primarily capture diagnosed or symptomatic cases. This study therefore provides a recent, region-specific estimate based on routine care data from rural settings.

Our findings also indicate that dental caries prevalence was higher among older schoolchildren than among younger age groups, extending patterns reported in previous studies from Saudi Arabia (23). Comparable burdens have been reported in other settings. For example, in the United Arab Emirates, a cohort study among 11–17-year-old students reported dental caries among 75% of participants (24). In China, a cross-sectional study among students aged 12–14 years reported a dental caries prevalence of 44%, with higher prevalence among females (25). Together, these findings underscore the substantial global burden of dental caries among schoolchildren.

Dental caries remains a major public health condition. Changes in dietary patterns associated

with modernisation have increased access to sugar-rich products. Tooth decay, particularly in children, is accelerated by frequent consumption of sweetened foods and beverages. Variations in prevalence across population groups reflect differences in lifestyle, dietary habits and broader social determinants of health (26). Dental caries is a multifactorial condition influenced by biological, behavioural and social factors (33).

Our findings show that males were approximately 2.5 times more likely to have dental caries than females. Sex differences in prevalence of dental caries have been reported previously, although findings are not consistent across settings. The higher prevalence among males observed in this study is consistent with findings reported in a study conducted in Costa Rica (27). In contrast, higher prevalence among females has been reported in other studies (28).

Proposed explanations for sex differences include biological and behavioural factors, such as differential exposure to cariogenic oral environments (29). Similar patterns have been observed in other settings (30). Behavioural factors may also contribute, as females generally demonstrate higher oral health literacy and more favourable oral hygiene practices (31,32). In this study, the higher prevalence observed among male schoolchildren may reflect differences in oral hygiene behaviours, dietary practices and patterns of dental care utilisation.

The prevalence of dental caries was highest among adolescents aged 15–17 years. These findings are

consistent with evidence from a Swedish prospective cohort study, which reported higher incidence and faster progression of carious lesions during adolescence than in early adulthood (34). Age-related changes in diet and health behaviours may contribute to this pattern. Previous studies have reported reduced consumption of fruits, vegetables and milk and increased intake of refined carbohydrates with increasing age (24). Commercial determinants of health may further influence oral health outcomes, including the marketing of sugar-sweetened products targeting children and adolescents.

Taken together, these factors may contribute to the higher prevalence of dental caries observed among schoolchildren. Strengthening preventive interventions, including school-based oral health education and early screening delivered through coordination between education and health sectors, may help reduce the burden of dental caries in rural populations.

These findings could inform future research on dental caries across different demographic groups in Saudi Arabia.

Study limitations

Several factors may affect the generalisability of the study findings. First, data were collected only from rural areas in Riyadh Province and not from all provinces in Saudi Arabia. As a result, the prevalence estimates and demographic associations may reflect the oral health situation in rural Riyadh rather than the national context.

Second, the study focused on the prevalence of dental caries and its association with demographic characteristics among schoolchildren. Key determinants

of oral health, including exposure to fluoride, access to oral health care, dietary habits, and parental perceptions of dental care services, were not examined. The exclusion of these factors may limit interpretation of the observed associations.

Third, reliance on retrospective data from dental clinics may have introduced selection bias. Children attending dental clinics may not be representative of all schoolchildren and may differ in symptom severity, health-seeking behaviour or socioeconomic characteristics.

Conclusion

Dental caries remains prevalent among schoolchildren in rural areas of Saudi Arabia, with higher prevalence observed among males and older schoolchildren. These findings indicate a persistent burden of dental caries in rural populations and support the need for strengthened preventive oral health interventions, including school-based education and early screening delivered through coordination between education and health sectors. Further research is needed to assess the prevalence of dental caries among schoolchildren across all provinces in Saudi Arabia and to examine key determinants of oral health, such as exposure to fluoride, access to oral health care, dietary habits, and parental perception of dental care services and socioeconomic factors.

Funding: None.

Competing interests: None declared.

Prévalence des caries dentaires chez les enfants d'âge scolaire en Arabie saoudite

Résumé

Contexte : Les caries dentaires sont courantes chez les enfants, mais les données sur leur prévalence parmi les enfants d'âge scolaire dans les zones rurales d'Arabie saoudite sont limitées.

Objectif : Déterminer la prévalence des caries dentaires et leur association avec certains facteurs démographiques chez les enfants scolarisés dans les zones rurales de la province de Riyad (Arabie saoudite).

Méthodes : Nous avons extrait les données cliniques dentaires de 2864 enfants âgés de 6 à 17 ans entre janvier 2021 et juin 2022 dans les dossiers médicaux électroniques de certains hôpitaux publics ruraux et centres de santé primaires de la province de Riyad. Nous avons analysé les données à l'aide du logiciel SPSS version 26 et avons utilisé des tests du khi carré et une régression logistique pour analyser les associations avec le sexe, l'âge et le niveau de scolarité. Une valeur p inférieure ou égale à 0,05 était considérée comme statistiquement significative.

Résultats : Sur l'ensemble des 2864 enfants scolarisés, 13,9 % (intervalle de confiance à 95 % : 12,6-15,1) avaient des caries dentaires. La prévalence était plus élevée chez les garçons (22,4 %) que chez les filles (10,3 %) [$p < 0,001$] et était plus fréquente chez les élèves du lycée (20,0 %) que chez ceux des niveaux primaire (12,9 %) et intermédiaire (10,3 %).

Conclusion : Nos conclusions ont des implications importantes pour les politiques, la prévention et la recherche en santé bucco-dentaire en Arabie saoudite. La forte prévalence indique un fardeau élevé des caries dentaires dans les populations rurales du pays et la nécessité de mettre en œuvre des interventions de prévention renforcées et plus étendues, notamment des programmes d'éducation en milieu scolaire et de dépistage précoce des enfants.

انتشار تسوس الأسنان بين أطفال المدارس في المملكة العربية السعودية

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الخلاصة

الخلفية: يشيع تسوس الأسنان بين الأطفال، لكن هناك بيانات محدودة عن انتشاره بين أطفال المدارس في المناطق الريفية بالمملكة العربية السعودية. الأهداف: هدفت هذه الدراسة الى تحديد مدى انتشار تسوس الأسنان وارتباطه بعوامل سكانية مختارة بين أطفال المدارس في المناطق الريفية من محافظة الرياض بالمملكة العربية السعودية.

طرق البحث: استخلصنا بيانات 2864 من أطفال المدارس ممن تتراوح أعمارهم بين 6 و17 عامًا من عيادات طب الأسنان في الفترة من يناير/كانون الثاني 2021 إلى يونيو/حزيران 2022، مأخوذة من السجلات الطبية الإلكترونية لمجموعة مختارة من المستشفيات العامة ومراكز الصحة الأولية الريفية في محافظة الرياض، المملكة العربية السعودية. وقد حللنا البيانات بالإصدار السادس والعشرين من برنامج SPSS، واستخدمنا اختبار مربع كاي والانحدار اللوجستي لتحليل الارتباط بين نوع الجنس والسن ومستوى التعليم. وقد عُدت قيمة الاحتمال > 0.05 ذات دلالة إحصائية.

النتائج: من بين جميع أطفال المدارس البالغ عددهم 2864، كان لدى 13.9% (فاصل ثقة 95% : 12.6–15.1) تسوس أسنان. وكان معدل الانتشار أعلى بين الذكور (22.4%) منه بين الإناث (10.3%) (قيمة الاحتمال > 0.001)، وكان أكثر شيوعًا بين طلاب المدارس الثانوية (20.0%) منه بين طلاب المدارس الابتدائية (12.9%) والمتوسطة (10.3%).

الاستنتاجات: للنتائج التي توصلنا إليها أثر مهم على نطاق سياسات صحة الفم والوقاية والبحوث في المملكة العربية السعودية. إذ يشير ارتفاع معدل الانتشار إلى زيادة العبء الناجم عن تسوس الأسنان بين سكان المناطق الريفية في البلاد، وإلى الحاجة إلى تنفيذ تدخلات وقائية أقوى وأوسع نطاقًا، بما في ذلك التثقيف المدرسي والفحص المبكر للأطفال.

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