

Prevalence and severity of dental caries among public school students aged 16-18 in Hai'l, Kingdom of Saudi Arabia

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ISSN: 1658-3639

PUBLISHER: Qassim University

ABSTRACT

Objective: The objective of the study was to determine the prevalence and severity of dental caries among school students aged 16-18 in Ha'il urban city, Kingdom of Saudi Arabia (KSA).

Methods: This cross-sectional study randomly selected 480 students from eight secondary schools in Ha'il urban city from September to October 2015. Three calibrated examiners used the decayed, missing and filled teeth index (DMFT), based on the World Health Organization criteria, to examine the students. Data analyses were subsequently performed.

Results: The overall prevalence of dental caries in secondary school students in Ha'il city was 78.9% ($n = 379$). The mean DMFT value was 3.49 ± 2.78 , the decayed component was 2.68 ± 2.21 , the missing component was 0.10 ± 0.34 , and the filled component was 0.71 ± 1.09 .

Conclusion: The results of this study provide evidence of a high prevalence of caries in students aged 16-18 years in Ha'il city, KSA. Thus, the oral health of adolescents should receive more consideration in Saudi Arabia.

Keywords: Adolescents, dental caries, decayed, missing and filled teeth index, Ha'il, Kingdom of Saudi Arabia, school students

Introduction

Dental caries is a major health concern in most developing countries. It affects 60-90% of school students and most adults. The prevalence of dental caries is higher in developing countries than in developed ones.¹ Dental caries is still a major public health concern globally, even with fluoride intervention, and it is the most common chronic disease of all time.² The distribution and severity of dental caries varies in different parts of the world and within the same region or country.¹

In Kingdom of Saudi Arabia (KSA), many studies on the prevalence of dental caries have been published. Most of these studies provided data for preschool and primary school students.³ In a meta-analysis study, Khan *et al.*³ indicated a high percentage of decayed, missing and filled teeth (DMFT) in every age group in different parts of KSA. In Ha'il city, KSA, one study was published regarding dental caries prevalence in 1997.⁴ It was based on dental fluorosis and DMF status among 12-15-year-old rural students that were exposed to well-drinking water. Likewise, in 2010, another study was published. It showed the caries experience in relation to fluoride level in drinking water in 11 regions of Saudi Arabia including the Ha'il region.⁵

However, to the best of our knowledge, no study on the prevalence of dental caries among secondary school students in the Ha'il region has been published. This study aimed to provide data about the prevalence and severity of dental caries in public school students aged 16-18 years in Ha'il city, KSA.

Methods

A cross-sectional survey was conducted among students of public secondary schools in the Ha'il region, KSA, from September to October 2015. The total number of secondary schools in Ha'il city was 46, 22 for males and 24 for females. The total number of secondary school students in Ha'il was 12,199 (5996 males and 6203 females).⁶ The sample of this study included 480 students: 242 (50.41%) male and 238 (49.58%) female 16-18-year-olds. The sample was selected using a two-stage sampling technique. In the first stage, the public secondary schools in the Ha'il city were divided into four sections according to the geographic location: North, east, west, and south. Two schools (one for females and the other for males) were randomly selected from each section to get a sample of eight schools. In the second stage, a convenience

sample of approximately 160 students from each age group with equal gender distribution was obtained for the study.

Ethical approval was obtained from the ethical committee at the University of Ha'il. The selected schools were sent a letter explaining the purpose and the procedures of the study and that data privacy and confidentiality would be maintained. Informed consent to participate was obtained from the students and their parents before starting examinations. A day was set for each school to collect the data.

The examination of dental caries was conducted and recorded according to the World Health Organization (WHO) criteria.⁷ The students were examined using a disposable mouth mirrors, probes, masks, and gloves in their schools on a regular classroom chair using daylight. Early caries that was not certainly diagnosed was excluded from the study. The examination form contained information for each student about the case number, the school's name, gender, age, and the presence or absence of caries. The form also contained DMF scores of the number of decayed, missing, and filled teeth. Two examiners carried out the examinations of the males. For female students, a female dentist was trained and calibrated to perform the examination for DMFT using WHO criteria. To determine the reliability of caries measurements, 30 students, who were not included in the final sample, were examined by the test-retest method according to Rugg-Gunn and Holloway.⁸ Inter- and intraexaminer agreement was measured using the Kappa test. The percentages of interexaminer agreement ranged from 75.4% to 93.7% and intraexaminer agreement ranged from 81.4% to 93.8%. The percentage of female to male agreement was ranged from 75% to 87%. These values are acceptable according to the WHO criteria.⁷

The DMFT value was calculated for each participant. First, the number of decayed (D), missing (M) and filled permanent teeth (F) due to dental caries was recorded separately. Then, the DMF as a whole (D+M+F) for the same participant was recorded giving the individual a DMFT score. The overall mean DMF score was computed by dividing the sum of the individual DMFT value by the total number in the sample. Any missing teeth not caused by dental caries were excluded from the study.

Data analysis

Data were processed and analyzed using the Statistical Package of the Social Sciences (SPSS Inc., version 20, Chicago, Illinois, USA). Descriptive statistics were used, presented in the form of mean (standard deviation), frequencies and percentages. Nonparametric tests were used as the data of dental caries variables such as the DMFT were not normally distributed. To identify any significant difference between gender and various age groups for DMFT index scores, the Mann-Whitney and Kruskal-Wallis tests were used, respectively. A *post-hoc* test was applied to specify differences for each age group.

Significant differences between the DMFT of males and females were measured using the Mann-Whitney test. A Chi-square test was applied to measure the significant association between the presence and absence of caries for males and females. A $P < 0.05$ was considered significant.

Results

Demographic status

The study population was composed of 163 (34%) 16-year-old, 158 (32.9%) 17-year-old, and 159 (33.1%) 18-year-old students. Table 1 summarizes the demographic data by age and gender.

Prevalence and severity of dental caries

In this study, dental caries prevalence was 379 (78.9%) and the number of caries-free students was 101 (21%). No significant difference in dental caries prevalence was observed between genders or in different age groups (Table 2). The mean DMFT value for the total participants was 3.49 ± 2.78 . The mean DMFT values for 16-, 17-, and 18-year-old students were 3.20 ± 2.8 , 3.32 ± 2.50 , and 4 ± 3 , respectively (Table 3). Using the Kruskal-Wallis test and a *post-hoc* test, between DMFT scores of different age groups showed a significant difference between the 17- and 18-year-old and 16- and 18-year-old age groups at $P < 0.05$. However, no significant difference existed between 16- and 17-year-old age groups at $P < 0.05$ (Table 3). Regarding the severity of caries, the Mann-Whitney U-test showed that female students exhibited a significantly higher DMFT mean value 3.95 ± 2.74 than male students 3.05 ± 2.74 at $P < 0.05$ (Table 3).

DMFT analysis showed that the overall decayed (D) component was 2.68 ± 2.21 , missing (M) was 0.10 ± 0.347 and filled (F) 0.71 ± 1.09 . The mean DT values were 2.55 ± 2.22 , 2.58 ± 2.1 , and 2.92 ± 2.29 for 16-, 17-, and 18-year-old students, respectively. The mean MT values were 0.09 ± 0.34 , 0.10 ± 0.36 , and 0.10 ± 0.34 for 16-, 17-, and 18-year-olds, respectively. The mean FT values were 0.56 ± 0.89 , 0.65 ± 1.13 , and 0.92 ± 1.2 for 16-, 17-, and 18-year-old students, respectively. It is clear that the DT component was the main constituent of the DMFT index. According to the Mann-Whitney U-test, females had a significantly higher decayed teeth index than males at $P < 0.05$. However, there

Table 1: Distribution of demographic characteristics by age and gender

Variables	n (%)		
	Female	Male	Total
Age (years)			
16	80 (33.6)	83 (34.3)	163 (34)
17	78 (32.8)	80 (33.1)	158 (32.9)
18	80 (33.6)	79 (32.6)	159 (33.1)
Total	238 (49.6)	242 (50.4)	480 (100)

Table 2: Prevalence of caries by age and gender among secondary school students in Ha'il, Saudi Arabia ($n=480$)

Age	Sex	n (%)		χ^2	P value
		With caries	Caries-free		
16	Female*	67 (13.9)	13 (2.7)	1.13	0.28
	Male	61 (3.4)	19 (3.9)		
17	Female*	58 (12.1)	20 (4.1)	1.08	0.29
	Male	65 (13.5)	15 (3.1)		
18	Female*	65 (13.5)	15 (3.1)	0.66	0.41
	Male	60 (12.5)	19 (3.9)		
Subtotal					
Female		190 (39.3)	48 (10)	0.22	0.64
Male		189 (38.5)	53 (11)		
Total		379 (78.9)	101 (21)		

Table 3: Mean caries indices by age and gender among secondary school students in Ha'il, Saudi Arabia ($n=480$)

Variables	Mean±SD			
	Decayed	Missing	Filled	DMFT
Age (years)*				
16	2.55±2.22	0.09±0.34	0.56±0.89	3.2±2.78‡
17	2.58±2.1	0.10±0.36	0.65±1.13	3.32±2.51†
18	2.92±2.29	0.10±0.34	0.92±1.2	3.97±2.98††
Gender**				
Female ($n=238$)	3.06±2.9**	0.08±0.30	0.8±1.2	3.95±2.74**
Male ($n=242$)	2.3±2.06	0.11±0.38	0.62±0.96	3.05±2.76
Total	2.68±2.21	0.10±0.34	0.71±1.09	3.49±2.78

* $P<0.05$; Kruskal–Wallis test was significant between age groups. † $P<0.05$; *post hoc* test was significant between the 17- and 18-year-old age groups of DMFT index. ‡ $P<0.05$; *post hoc* test was significant between 16- and 18-year-old age groups of DMFT index. ** $P<0.05$; Mann–Whitney U-test was significant between males and females of decayed and DMFT indices. DMFT: Decayed, missing and filled teeth, SD: Standard deviation

was no significant difference between females and males for missing and filled teeth at $P < 0.05$. Table 3 summarizes the mean caries indices by age and gender.

Discussion

This preliminary study aimed to measure the prevalence and severity of dental caries among 16-18-year-old school students in Ha'il city, KSA. To the best of our knowledge, this is the first study aimed at assessing caries prevalence and severity among 16-18-year-old school students in Ha'il city, KSA. There has been a lack of dental caries studies concerning this population group in Ha'il city, KSA.⁹ In KSA, few epidemiologic studies on caries among adolescents have been published.^{3,9-12} As caries continues throughout the life course,¹³ discovering dental caries epidemiology in different age groups is crucial for understanding the behavior of the disease and for planning preventive and treatment measures.¹⁴

The prevalence of dental caries in this study was 78.9%, which is in line with similar studies performed in other areas in KSA such as Makkah and Al-Khobar^{15,16} but not with studies from the central province.¹⁷ The findings of this study were also consistent with a similar report from Iraq.¹⁸ In addition, the prevalence among adolescents in this study was high in general compared with findings from Pakistan and India.^{19,20}

AlDosari *et al.*⁵ have shown that the mean DMFT index value was 3.12 (2.24-7.35) for 15-18-year-old adolescents in a study of 11 regions in KSA. This result is consistent with our results (mean DMFT value is 3.49). Conversely, studies from the east and west of KSA showed higher DMFT index scores. Qutob¹⁵ reported a higher mean DMFT value (4.66) for 16-year-old adolescents in the Makkah region. Likewise, Hassan *et al.*¹⁰ reported that the DMFT was 4.31 for 16-18-year-old adolescents in Jeddah city. In addition, Magbool¹⁶ reported that the DMFT was 4.59 for 16-17-year-old adolescents in Al-Khobar. This might be attributed to the use of desalinated water for domestic purposes in Jeddah, Makkah and Al-Khobar, KSA, which may affect mineral levels in the water. However, Ha'il is still supplied by well water.⁴ In comparison with findings from India, Pakistan and Iran, the mean DMFT index value in this study was much higher in the same age group.¹⁹⁻²¹ Furthermore, the mean DMFT value in this study is higher than in different countries of the world such as Brazil and Italy.^{22,23} Moreover, the DMFT score of this study is within the WHO (2000) "moderate" category, i.e., DMFT 2.7-4.4 for 12-year-old children.²⁴

Analysis of the DMFT components in this study shows that the decayed teeth index (DT) mean value comprises 77% of the DMFT mean value, while the missing and filled indices (DM, DF) comprise 20% and 2.8%, respectively. These findings indicate that the majority of students had decayed teeth. This might be related to the lack of oral hygiene knowledge and practices or difficulties in accessing dental services. We suggest further research to look in greater depth at the reasons for the higher DT and much lower FT.

The results of this study indicated that females showed a significantly higher DMFT mean value than males. The observation of higher caries risk among females might conjointly be connected to fluctuating hormonal levels during puberty.²⁵ This result is consistent with a study in Jeddah KSA.¹⁰ Moreover, the FDI (1988) reported higher caries experience in girls due to earlier permanent teeth eruption than in boys.²⁶

Conclusion

This epidemiological study indicated that dental caries is an existing health problem in Ha'il city, KSA, among school students aged 16-18 because of its high prevalence and moderate level of severity. Moreover, the results of this study emphasize that preventive and therapeutic measures should be

considered in this age group, as part of the community-based preventive and therapeutic oral health programs. Further studies are needed to figure out the contributing factors related to dental caries in this age group.

Study Limitations

This study is a cross-sectional study and therefore cannot monitor dental caries incidence. Another disadvantage is the use of the DMFT index to measure dental caries.²⁷ The DMFT does not specify what tooth surfaces are affected by dental caries, cannot show whether dental caries is active or arrested, and cannot define the stage the dental caries is in. Furthermore, this study did not study the factors that may have a cause-effect relationship with dental caries.

Acknowledgments

The author is grateful for the support provided by the administration of all the participating schools in the city of Ha'il, KSA. The author is also grateful to all the secondary school students who participated in this study.

The University of Ha'il (UOH), Ha'il, KSA funded this study (Grant no. BA-1403).

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