Prevalence of dental caries in primary and permanent teeth and its relation with tooth brushing habits among schoolchildren in Eastern Saudi Arabia

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ABSTRACT

الأهداف: تحديد مدى انتشار تسوس الأسنان في الأسنان اللبنية والدائمة، وتقييم عادات التنظيف لأطفال المدارس في مدينة الدمام، المملكة العربية السعودية.

الطريقة: أجريت هذه الدراسة المقطعية في مدينة الدمام، المملكة العربية السعودية. وقد أجريت الدراسة عن طريق الفم من المشاركين من فبراير حتى مايو 2014م. وقد شملت هذه الدراسة 711 شخص. وكان هناك 397 طفلاً تتراوح أعمارهم ما بين 6 إلى 9 سنوات، والذين تم فحصهم لتسوس الأسنان اللبنية. بالإضافة إلى ذلك فقد كان هناك 314 طفلاً ممن تتراوح أعمارهم ما بين 12–10 سنة والذين تم فحص تسوس الأسنان الدائمة لديهم. ولقد تمت دراسة على الأسنان الأساسية والدائمة المسوسة والمفقودة والمحشوة [DMFT (الأسنان الأساسية) / DMFT (الأسنان الدائمة)].

النتائج: أشارت نتائج الدراسة إلى أن معدل انتشار تسوس الأسنان في الأسنان اللبنية والدائمة تقريباً قد كان 73% (العدد = 711). وكان معدل انتشار التسوس لدى المرحلة العمرية 9-6 عاماً حوالي 78% (العدد=397)، في حين كان عمر الأطفال بين 12-10 سنة، حوالي 68% (العدد = 314). وكان معدل قيمة DMFT لدى الفئة العمرية 9–6 عاماً 3.66 ± 3.13 حيث كان معدل عامل التسوس (d) 3.28±2.92، وكان عامل الأسنان المفقودة (m) 0.11±0.69، وأخيراً كان معدل عامل الأسنان المحشوة (f) 0.26±0.9. فيما كان معدل قيمة DMFT لدى الفئة العمرية 12-10 عاماً 1.94±2.0 حيث كان معدل عامل التسوس (D) 1.76±1.85، وكان عامل الأسنان المفقودة (M) 0.03±0.22، وأخيراً كان معدل عامل الأسنان المحشوة (F) 0.15±0.73. وقد كان لتفريش الأسنان بالفرشاة يومياً أثرا إيجابياً على الوقاية من التسوس، وهذا التأثير كان له دلالة إحصائية في تسوس الأسنان اللبنية.

الخاتمة: على الرغم من انتشار تسوس الأسنان في الأسنان اللبنية والدائمة لم يكن مرتفعاً مقارنة بما أفاد به الدراسات الأخرى من مدن مختلفة من المملكة العربية السعودية إلا أنه انتشار التسوس مازال يؤخذ بعين الاعتبار في من قبل منظمة الصحة العالمية (WHO) وأهداف صحة الفم والأسنان في المستقبل. ولذلك فينبغي توعية الطلاب وكذلك المعلمين وأولياء الأمور حول أهمية تفريش الأسنان بالفرشاة جيداً والزيارات المنتظمة لطبيب الأسنان.

Objectives: To determine the prevalence of dental caries in the primary and permanent teeth, and evaluate the brushing habits of school children in Dammam, Kingdom of Saudi Arabia (KSA).

Methods. This study was conducted at Dammam, KSA. Oral examination of the participants was conducted from February to May 2014. The total sample size for this cross-sectional study was 711. There were 397 children between the age of 6-9 years, who were examined for primary teeth caries, and 314 between the age 10-12 years were examined for permanent teeth caries. Primary and permanent dentitions were studied for decayed, missing, and filled teeth (dmft [primary teeth], DMFT [permanent teeth]).

Results: The overall prevalence of dental caries in primary and permanent teeth was almost 73% (n=711). Among the 6-9-year-old, the prevalence of caries was approximately 78% (n=397) whereas, among the 10-12-year-old children, it was approximately 68% (n=314). Mean dmft value among the 6-9-year-olds was 3.66±3.13 with decayed (d) component of 3.28±2.92, missing (m) component of 0.11±0.69, and filled (f) component of 0.26±0.9. Mean DMFT value among the 10-12-year-old children was 1.94±2.0 with decayed (D) component of 1.76±1.85, missing (M) component of 0.03±0.22, and filled (F) of component 0.15±0.73. Daily tooth brushing had a positive effect on caries prevention, and this effect was statistically significant for caries in primary teeth.

Conclusion: Although the prevalence of dental caries in primary and permanent teeth was not found to be as high as other researchers reported from different cities of KSA, still the prevalence was high considering the World Health Organization future oral health goals. Awareness should be provided to students, as well as, teachers and parents regarding the importance of good brushing habits and regular dental visits.

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Dental caries is one of the most common cause of extraction of primary teeth in Saudi Arabia.[1] In the past few decades, an increase in the prevalence of dental caries has been observed, which can be attributed to a change in lifestyle of Saudis, involving increased consumption of sugary food, carbonated drinks, and lack of awareness towards proper oral health maintenance.[2,3] Generally, the prevalence of dental caries in developed countries is decreasing, while in underdeveloped and developing countries, the prevalence is on the rise.[4] According to the statistics available from the World Health Organization (WHO), caries prevalence among the 12-year-old children from many European Union states (EU) has decreased considerably from 1970's to 2006.[5] This decline in the caries' prevalence among EU countries over a period of 35 years could be attributed to an increased awareness of oral hygiene maintenance, and use of fluoridated toothpaste.[6] However, among underdeveloped countries where fluoridated toothpaste is not easily available, or not affordable in some cases, caries prevalence is still high.[7] The area of dental caries prevalence is of great interest to local and international researchers, which can be indicated by a number of studies that have been performed in developed and developing countries regarding caries' prevalence.[8-10] A study conducted in the urban and rural areas of Lahore, Pakistan to determine whether urbanization and family earnings are related to dental caries reported caries prevalence of 40.5%, and decayed (d), missing (m), and filled (f) teeth (dmft [primary teeth]) score of 1.85 ± 3.26 in preschool children aged 3-5 years,[11] while another cross-sectional study performed in Chikar, Pakistan with convenience sampling of 311 schoolchildren revealed an overall DMFT (permanent teeth) score of 3.3 in 5-20-year-olds.[12] Several studies have been conducted in different parts of the Kingdom of Saudi Arabia (KSA) to report the prevalence of dental caries in schoolchildren. A study performed in Riyadh reported a dmft score of 6.1, decayed factor of 4.6, and no significant difference in the prevalence of caries in relation to gender among 789 pre-school children.[13] Farsi[14] conducted a study to develop an association between enamel defects and caries occurrence in Jeddah, KSA, and reported a dmft score of 3.9, and a strong association between enamel defects and caries prevalence among 4-5-year-olds.[14] In 2012, caries prevalence in the maxillary and mandibular first molar in the age group of 7-10 years schoolchildren was determined in Abha city, and a mean DMFT of 2.74 was reported.[15] It was also concluded in the same study that caries prevalence in the first permanent molars from this region is higher than the recommended standards of the WHO.[15] Extensive literature search was carried out to find studies regarding caries' prevalence from Dammam, KSA. The search resulted in only one study, which was conducted in 2008 on children with cleft lip and palate aged 1-6 years, and it reported a high dmft of 10.54 from Dammam region.[16] Since Dammam is one of the largest cities of the Eastern province of KSA, it would be interesting to observe caries' prevalence among schoolchildren from this city. Therefore, the aim of the present study was to determine the prevalence of dental caries in schoolchildren aged 6-12 years in Dammam, KSA using the dmft/DMFT index of dental caries.

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Methods. This study was conducted at the Schools in Dammam, Saudi Arabia. Ethical approval was obtained from the Deanship of Scientific Research, University of Dammam, KSA before commencing the study. The participants for this study were chosen randomly from different schools of Dammam, and the schools were pre-informed regarding the objectives of the study. A written informed consent was obtained from the school administration and parents of children involved in the study. A team of 7 members was created, which comprised of 4 dentists and 3 dental assistants. All the dentists had previous experiences in the field of epidemiology. Three of the 4 dentists were involved in the examination of the participants, and the fourth conducted lectures regarding oral health awareness to the students after examination. Dental assistants recorded the data on a WHO form.[17] Team member training started with a theoretical discussion after a power point presentation, and was followed by a pilot study, which was performed on 20 students that were not included in the study. This cross-sectional study was performed using stratified random sampling to calculate the sample. Seven hundred and eleven schoolchildren representing the age group 6-12 years, and belonging to the school-going population of Dammam were subjected to dental examination according to the WHO diagnostic criteria. Oral examination of the participants was conducted

from February to May 2014. All participants were examined with disposable mirror, disposable probe, and disposable tweezers along with disposable masks and gloves. The examination procedure and forms used were based on WHO criteria. The inclusion criteria for the study were students between 6-12 years old, and residents of Dammam and Khobar municipality, as confirmed by the school registry. Each participant was asked questions regarding their age and brushing habits, and DMFT index was used to record the data, and the teeth, which were congenitally missing, or removed for orthodontic purposes were not considered as missing. To calculate the prevalence of dmft in primary teeth, the sum of dmft was divided by the sample size of 6-9-year-old children. The same procedure was carried out to calculate the DMFT for permanent teeth for age between 10-12 years.

The IBM Statistical Package for Social Sciences version 19 for Windows (IBM Corp, Armonk, NY, USA) was used for data entry and analysis. Descriptive and inferential statistics were performed to analyze the data. T-test was used to analyze any statistically significant difference between gender, nationality, and brushing habits with prevalence of caries. The analysis of variance (ANOVA) was employed to check the significance between age and caries prevalence. The level of significance was set at 0.05. Post hoc test was also used to check for any significant increase, or decrease in dental caries due to increase in age. Inter-examiner agreement was analyzed using Kappa statistics, and a high degree of agreement (Kappa index: 89.7%) was observed between the 2 examiners.

Results. *Prevalence of primary teeth caries.* The overall prevalence of dental caries in primary and permanent teeth was 73.3% among the total number of children examined for the present study. Among the 6-9-year-olds, the prevalence of caries was 77.8%. Among the age group 6-9 years (mean age: 7.63 ± 1.1), 397 students (218 male, 179 female, and 160 Saudis, 237 non-Saudi) were examined for the prevalence of caries. The mean dmft among 6-9-year-old children was 3.66 ± 3.13 with a "d" component of 3.28 ± 2.92, "m" component of 0.11 ± 0.69, and "f" component of 0.26 ± 0.9. There was no significant effect in age, gender, or nationality on the prevalence of caries. Prevalence of caries in males was 3.56 ± 3.09 with "d" component of 3.13 ± 2.8, "m" component of 0.14 ± 0.85, and "f" component of 0.29 ± 0.96. While in females, it was found to be 3.78 ± 3.17 with a "d" component of 3.47 ± 3.1, "m" component of 0.08 ± 0.4, and "f" component 0.22 ± 0.83. Among male Saudis, the average dmft score was 3.92 ± 3.25, while among non-Saudis, the score was 3.48 ± 3.04. Children were also asked whether they brush their teeth regularly. Three hundred and twenty one replied affirmatively, 72 replied negatively, and 4 did not answer the question. Children who brushed daily had a mean dmft of 3.42 ± 3.00, and those who did not brush daily had a mean dmft of 4.79 ± 3.44, and the difference in mean was found to be statistically significant (p<0.001). Variation in sample is shown in **Figure 1**, and variation in caries prevalence according to age of the children is presented in **Table 1**.

Prevalence of permanent teeth caries. Among 10-12-year-olds, the prevalence of caries was 68%. In the age group 10-12 years (mean age: 10.94 ± 0.833), 314 students (188 male; 126 female and 117 Saudi; 197 non-Saudi) were examined for the prevalence of caries. Mean DMFT was found to be 1.94 ± 2.0 with a "D" component of 1.76 ± 1.85, "M" component of 0.03 ± 0.22, and "F" component of 0.15 ± 0.73. The DMFT among males was 2.06 ± 2.08, while in females it was 1.76 ± 1.86. Effect of the variable nationality was also considered, and DMFT was calculated for Saudi and non-Saudi children. Mean DMFT for Saudi children was 2.23 ± 2.14, whereas among non-Saudis, it was 1.77 ± 1.89, and the difference in caries' prevalence among

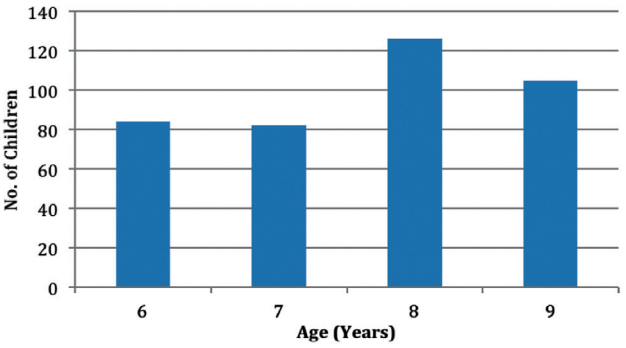

Figure 1 - Distribution of sample for primary teeth caries according to age in a group of schoolchildren from Dammam, Saudi Arabia.

Table 1 - Prevalence of dental caries in primary dentition by age of schoolchildren from Dammam, Saudi Arabia (N=397).

Age	Decayed	Missing	Filled	Mean dmft
6	3.27 ± 3.5	0.01 ± 0.11	0.23 ± 0.72	3.5 ± 3.52
7	3.65 ± 3.1	0.21 ± 1.3	0.24 ± 1.02	4.1 ± 3.6
8	3.36 ± 2.6	0.1 ± 0.5	0.25 ± 0.9	3.7 ± 2.8
9	2.99 ± 2.65	0.14 ± 0.49	0.30 ± 0.94	3.43 ± 2.8)
Total	**3.28 ± 2.92**	**0.11 ± 0.69**	**0.26 ± 0.90**	**3.66 ± 3.17**

dmft - decayed, missing, and filled teeth (primary teeth)

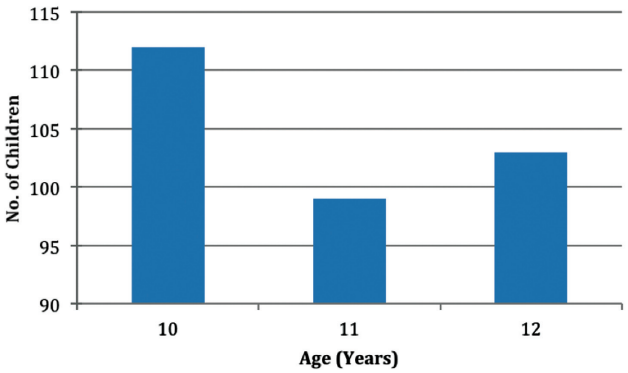

Figure 2 - Distribution of sample for permanent teeth caries according to age in a group of schoolchildren from Dammam, Saudi Arabia.

Table 2 - Prevalence of dental caries in permanent dentition by age of children from Dammam, Saudi Arabia (N=314).

Age	Decayed	Missing	Filled	Mean DMFT
10	1.26 ± 1.41	0.02 ± 0.13	0.03 ± 0.16	1.3 ± 1.44
11	1.57 ± 1.74	0.06 ± 0.37	0.22 ± 0.89	1.85 ± 2.04
12	2.59 ± 2.12	0.0 ± 0.0	0.24 ± 0.93	2.82 ± 2.22
Total	**1.76 ± 1.85**	**0.03 ± 0.22**	**0.15 ± 0.73**	**1.94 ± 2.0**

DMFT - decayed, missing, and filled teeth (permanent teeth)

Saudi and non-Saudi students was found statistically significant (p=0.046). Post-hoc test (Tukey test) was employed to find a statistical significance between ages and caries' prevalence, and it was found that the increase in caries' prevalence between 10-12 years was statistically significant (p<0.001). Eighty-two percent of children among this group used to brush their teeth daily but no statistical influence was found on caries' prevalence. Mean DMFT among those who brushed their teeth daily was 1.87 ± 1.97 with a "D" component of 1.72 ± 1.87, "M" component of 0.01 ± 0.09, and "F" component of 0.015 ± 0.67. On the other hand, mean DMFT of 2.26 ± 2.14 with a "D" component of 1.97 ± 1.74, "M" component of 0.1 ± 0.48, and "F" component of 0.19 ± 0.96 was found among students who did not brush daily. Variation in sample (**Figure 2**) and variation in caries prevalence according to age of the children is presented in **Table 2**.

Discussion. The overall prevalence of dental caries in primary and permanent teeth was 73.3% among the total number of children examined for the present study. Among the 6-9-year-old, the prevalence of caries was 77.8%, whereas among the 10-12-year-old, it was approximately 68%. The WHO/FDI (World Dental Federation) oral health goals to be achieved by the year 2000 reported that prevalence of caries in 5-6-year-olds should be less than 50%, and number of teeth affected from caries at the age of 12 should not be more than 3.[18] The results of this study revealed that approximately 68% of 6-year-olds were suffering from caries, and this figure was quite high compared with the WHO oral health goals.[18] Mean DMFT was 2.82 for 12-year-olds, which was under the desirable range set by the WHO.[18] Khan et al[19] performed another literature search in 2013 in KSA, in which studies published during 1999-2008 were reviewed. The prevalence of primary teeth caries in KSA reported by this study[19] during 1999-2008 was 5.38, and for the permanent teeth it was 3.34.[19] This study reported high caries' prevalence in KSA compared with the present study. Various other researchers reported high caries prevalence from different cities of KSA in contrast with the present study results,[13,20-24] however, some studies have also reported decreased caries prevalence in primary and permanent teeth[25-30] than the results reported in the current study.

Khan et al[31] published a review on the prevalence of dental caries in the Arab League, and the study reported caries prevalence of 4.34 in primary dentition, and 1.77 in permanent dentition.[32] The population of Dammam city had better dental health of primary teeth found in this study compared with Khan et al's[19] study results. Azizi[32] performed a study in the Northern Palestine reporting that the prevalence of caries among 5-6-year-olds was approximately 76%, which is higher than what was reported in Dammam, KSA. Hashim et al[33] performed a study in the United Arab Emirates to assess caries prevalence in primary dentition, and they detected caries among 73% of the screened children. We can conclude that in comparison with studies conducted in various countries of the Arab League revealed that the prevalence of caries among 6-12-year-olds living in Dammam, KSA was lower than the rest. Furthermore, children were asked regarding their tooth brushing habits. Approximately 81% (n=576) of the children brushed their teeth daily, and among those, 61% (n=353) stated that they clean their teeth more than one time a day. In primary and permanent teeth, the trend was the same for brushing habits that caries incidence was low with daily brushing habit. Statistically the data was significant for primary, and insignificant for permanent dentition. Schools provide a perfect initial setting for children to get educated regarding proper oral hygiene maintenance, and to learn regarding prevention strategies, and acquiring oral health education at this stage would help them to develop lifelong skills to maintain and improve their oral health.

The present study had certain limitations, such as the sample size, which was not large enough to generalize the results. Dietary habits, socio-economic status, and education of parents also proved useful as important determinants of dental caries.

In conclusion, it was found that the prevalence of primary and permanent teeth caries was not as high as other researchers reported from different cities of KSA,[23-28] however, the figures were still high according to WHO/FDI oral health goals.[18] Results revealed the positive impact of tooth brushing habits on caries, so it is highly recommended to make the students, as well as, teachers and parents be aware on the importance of brushing habits. Knowledge regarding the risk factors of dental caries will also help to control and reduce dental caries. Authors recommend to conduct further studies in which factors associated with caries will be studied. it is also recommended to repeat this kind of studies after few years so that the updated status of population's dental health would be reported.

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