Oral health status of 12-year-old male schoolchildren in Medina, Saudi Arabia

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الحالة الصحية للفم لدى الذكور من أطفال المدارس البالغين من العمر 12 عاماً في المدينة المنورة بالمملكة العربية السعودية

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الخلاصة: أفادت دراسات من المملكة العربية السعودية بأن انتشار تسوس الأسنان بين الأطفال يرتفع نسبياً بالمقارنة مع بلدان نامية أخرى. لذا، فإن الهدف من هذه الدراسة هو تحديد حالة نظافة الفم ومؤشر التسوس البليغ لدى الذكور البالغين من العمر 12 عاماً في المدينة المنورة. ففي دراسة تحليلية مستعرضة شارك فيها 360 طالباً من 4 مدارس للبنين تم تسجيل تسوس الأسنان، ووجود لويحات، والتهاب اللثة، والتسمم بالفلور، وسوء الإطباق، باستخدام طرق ومؤشرات معيارية. فكان متوسط الدرجات المحرزة لمؤشر الأسنان المنخورة والمقلوعة والمَحشوَّة هو 1.53 (1.88±). وكان انتشار التسوس منخفضاً (57.2٪)، لكن وسطي مؤشر التسوس البليغ كان مرتفعاً نسبياً [3.63 (1.66±)]. وكان انتشار اللويحات والتهاب اللثة مرتفعاً (82.8٪ و70.8٪ على التوالي). وكان أعلى معدل للتسوس في الأرحاء (الأضراس) السفلية. ولم يتضح تسمم الأسنان بالفلور لدى أي من الأطفال، وكان لدى 82.5٪ منهم علاقة بين الفكين من الصنف الأول. وينصح الباحثون بوضع برامج توعية عن نظافة الفم في المدارس – إلى جانب برامج عن استعمال الفرشاة والخيط – بغية الحفاظ على صحة الفم وتحسينها لدى الأطفال الصغار في المملكة العربية السعودية.

ABSTRACT Studies from Saudi Arabia have reported that the prevalence of dental caries among children is relatively high compared with other developing countries The aim was to determine the oral hygiene status and significant caries (SiC) index of 12-year-old males in Medina . In a cross-sectional, analytical study 360 students participated from 4 boys' schools. Dental caries, plaque, gingivitis, fluorosis and malocclusion were recorded using standard methods and indices. The mean DMFT score was 1.53 (SD 1.88). Caries prevalence was low (57.2%) but the mean SiC index was relatively high [3.63 (SD 1.66)]. The prevalences of plaque and gingivitis were high (82.8% and 70.8% respectively). Lower molars had the highest rate of caries. No children presented with dental fluorosis and 82.5% had a class I jaw relationship. Oral hygiene awareness programmes at schools, together with brushing and flossing programmes, are recommended in order to maintain and improve the oral health of young children in Medina

Santé bucco-dentaire chez des garçons âgés de 12 ans à Médine (Arabie saoudite)

RÉSUMÉ Selon des études menées en Arabie saoudite, la prévalence de la carie dentaire chez l'enfant est relativement élevée par rapport à d'autres pays en développement. L'objectif était de déterminer l'état de santé bucco-dentaire et les valeurs d'indice de sévérité de l'atteinte carieuse (SiC, pour *Significant Caries index*) chez des garçons de 12 ans à Médine ; 360 élèves de quatre écoles de garçons ont participé à une étude transversale analytique. Les caries dentaires, le tartre, la gingivite, la fluorose et les malocclusions ont été enregistrés à l'aide de méthodes et indices standards. L'indice de dents cariées, absentes ou obturées (ou DCAO) moyen était de 1,53 (ET 1,88). La prévalence des caries était faible (57,2 %) mais l'indice SiC moyen était relativement élevé [3,63 (ET 1,66)]. La prévalence du tartre et de la gingivite était importante (82,8 % et 70,8 %, respectivement). Les molaires inférieures avaient le taux le plus élevé de caries. Aucun enfant ne souffrait de fluorose tandis que 82,5 % présentaient une malocclusion de classe I. Des programmes de sensibilisation à l'hygiène bucco-dentaire dans les établissements scolaires, associés à des programmes de brossage des dents et d'utilisation de fil dentaire sont recommandés afin de préserver mais aussi d'améliorer la santé bucco-dentaire des jeunes enfants en Arabie saoudite.

Introduction

Good oral health is essential for the well-being and development of young children (*1*). The most common oral health disease affecting young children is dental caries, which is responsible for pain, speech impairment, sleep disturbances and eating and growth disorders (*2*). Studies from Saudi Arabia have reported a high prevalence of dental caries among children compared with other developing countries (*3*). In addition, these and other studies also reported high levels of oral diseases and poor oral hygiene and an urgent need for the introduction of therapeutic and preventive measures (*4,5*). Al-Malik and Rehbini showed high levels of dental caries and recommended the introduction of an effective oral health programme for schoolchildren (*6*).

The significant caries (SiC) index was developed as an adjunct to the decayed, missing and filled teeth (DMFT) index for the measurement of dental caries. Much of the literature has shown that the mean DMFT score does not accurately describe the prevalence of dental caries and often underestimates the burden of disease (*7–9*). Although there is a linear relationship between the mean DMFT and SiC indices, countries with mean DMFT between 1.0 and 8.5 were found to have mean SiC between 2.8 and 13.7 (*9*). This confirmed that, although the DMFT score of communities may meet some of the World Health Organization (WHO) guidelines, such as a DMFT < 3 for 12-year-olds, many of the included participants still have multiple carious lesions and require extensive dental treatment. Therefore, the mean DMFT does not always reflect the true level of dental caries and this could lead to the incorrect assumption that the rate of caries is low and there is no need for the implementation of oral health programmes. Hence the SiC index was developed to identify communities/populations with skewed DMFT scores

and to help in the planning and monitoring of dental services and dental caries within communities (*7*).

No studies have reported on the oral health status of male 12-year-old children in Medina, Saudi Arabia, and this study aimed to provide baseline data which could assist in the planning of future oral health programmes. In addition, this was the first study to calculate the SiC index in 12-year-old male schoolchildren in Medina.

Methods

Study design and sampling

This was a cross-sectional study conducted on 12-year-old male schoolchildren. It was done between February 2013 and April 2013.

The sample size was calculated using an estimated population of 10 000 12-year-old children in Medina, of which 5000 were males. These estimates were calculated based on the number of schools present in Medina. The calculation was done with a confidence interval of 95% and a margin of error of 5% with an estimated prevalence of 80%. The total sample required was 357 children. It was assumed that each school would have approximately 100 children aged 12 years and therefore 4 schools were required. A list of schools was obtained from the Ministry of Education and the boys' schools were identified and stratified according to government and private funding. Two schools were then randomly selected from each stratum.

Ethical approval was obtained from the Taibah University Ethics Committee. The principal of each school was contacted and the details of the study were discussed. Once permission had been obtained, consent forms, together with a covering letter detailing the rationale of the study, were given to the children to give to their parents to sign at home. All those with signed consent were included and all information was

confidential; no names were recorded on the data capture sheets.

Data collection

The clinical oral examinations were carried out in classrooms and performed under florescent room lighting with the subject sitting on a regular chair. A mirror or wooden spatula together with a round-ended probe was used according to the WHO criteria (*10*). The probe was only used when there was uncertainty regarding the presence of caries, as studies have shown that the use of a sharp probe could create cavitated lesions (*11*). For caries measurements, the DMFT index was used. If anyone had primary teeth present, these were not recorded as they were usually mobile and close to exfoliation. Plaque was recorded using the visible plaque index described by Ainamo and Bay (*12*). There were 2 categories, plaque absent or plaque clearly visible, scored as (0) or (1) respectively. Gingivitis was recorded using the Silness–Löe index (*13*). As no students had severe gingivitis and only 2 had moderate levels of gingivitis, these groups were combined with mild gingivitis. As a result, 2 groups were created, those with gingivitis present and those without gingivitis. Fluorosis was recorded using the Dean index (*14*) and malocclusions were classified according to Angle's classification (*15*). The SiC index was calculated in order to determine the mean DMFT score for the highest third of the sample (*7*).

There were 6 calibrated examiners and the inter- and intra-examiner reliability was measured by re-examining every 10th patient. The intra-examiner reliability was ≥ 0.95 while the inter-examiner reliability ranged between 0.85 and 0.96. All pupils received a referral form indicating the type of treatment that they required based on the results of the clinical examination. This included oral hygiene instructions, regular follow-up visits with the dentist, restorations, extractions and polishing.

Data analysis

The data were analysed using *SPSS*, version 15 software package. The descriptive analysis included means, medians and standard deviation (SD) together with frequencies and proportions.

Results

A total of 420 pupils received consent forms and of these 360 (85.7%) completed them and were included in the study. All participants were males, the mean age was 12.1 (SD 0.97) years and just over half (190, 52.7%) were from private schools. The mean DMFT score was 1.53 (SD 1.88) and the median was 1.00. The prevalence of caries was 57.2% and the combined mean SiC score was 3.63 (SD 1.66). There was a statistically significant difference between the mean SiC scores of the the government- and private-school children ($P < 0.001$) (Table 1). There was also a significant difference between the government- and private-school children in the number of decayed and filled teeth and total DMFT scores, but not in the number of missing teeth. Children in government schools had more caries and higher total DMFT scores, but fewer filled teeth compared with children in private schools.

Both government- and private-school children showed similar patterns of caries on molars (Figure 1). The caries rate was higher on the lower molars (36 and 46) than on the upper molars and there were significantly more children with caries on molar 26 in the government compared with private schools ($P = 0.04$).

Most of the pupils presented with plaque (82.8%) and gingivitis (70.8%). A significant majority of respondents had a class I jaw relationship (82.5%) ($P = 0.04$). None of the students were diagnosed with fluorosis (Table 2).

There was a strong association between the presence of plaque and gingivitis ($P < 0.001$) (Table 3).

Discussion

The prevalence of caries in this study (57.2%) was within the range reported by Al Agili in a review of caries prevalence in Saudi Arabia (56–84%) (3). A disturbing result is that almost 60% of children examined had at least one decayed tooth in their mouth. This has serious implications for the future in terms of treatment and rehabilitation. Preventive programmes should be implemented early in the school years in order to reduce this level.

The mean DMFT score in this study (1.53) was much lower than the range reported in the systematic review by Al Agili (1.67–2.89) (3). Possible reasons for this low score could be that the studies in his review were done more than 5 years ago. Since then much has changed as a result of social and political developments and economic growth in Saudi Arabia. This has possibly resulted in more people being able to access health services, an increase in the utilization of fluoridated toothpaste and an improvement of the public's oral health knowledge. These factors could have led to an improvement in oral hygiene and dietary intake which could have reduced the burden of oral diseases. Another possible reason is that previous research included males and females, whereas the current study was limited to males only. Studies have shown that females tend to have more dental caries than males (*16*) and the exclusion of females from the current study could have resulted in the lower DMFT score. The DMFT score of 1.53 was similar to other Middle Eastern countries such as Libya [1.68 (SD 1.86)] (*16*) and different parts of Islamic Republic of Iran [0.7 (SD 1) to 1.5 (SD 1.8)] (*17*).

Although this population had a mean DMFT < 3, the SiC index was 3.63. This shows that although the mean DMFT seemed to be low, there were still some individuals with very high DMFT scores. If the SiC index were not calculated, and only the DMFT index was used, it could have given a false impression of the caries status of this population and underestimated the actual need for dental treatment in this cohort of pupils. Other countries that have achieved the WHO goal of a DMFT < 3 have also reported high

Table 1 Mean decayed, missing and filled teeth (DMFT) index and significant caries (SiC) index of 12-year-old boys by type of school attended

Variable	Total (*n* = 360)	Private school (*n* = 190)			Government school (*n* = 170)			*P*-value
DMFT index	**Mean (SD)**	**Mean (SD)**	**Median**	**Range**	**Mean (SD)**	**Median**	**Range**	
Decayed	1.30 (1.82)	0.98 (1.47)	0	7	1.65 (2.10)	1	12	< 0.001[a]
Missing	0.02 (0.17)	0.02 (0.16)	0	2	0.02 (0.19)	0	2	0.567[a]
Filled	0.21 (0.64)	0.28 (0.73)	0	4	0.14 (0.51)	0	4	0.016[a]
Total	1.53 (1.88)	1.28 (1.55)	1	12	1.81 (2.15)	1	12	0.045[a]
SiC index	3.63 (1.66)	3.09 (1.21)	3	5	4.24 (1.89)	4	10	0.001[b]

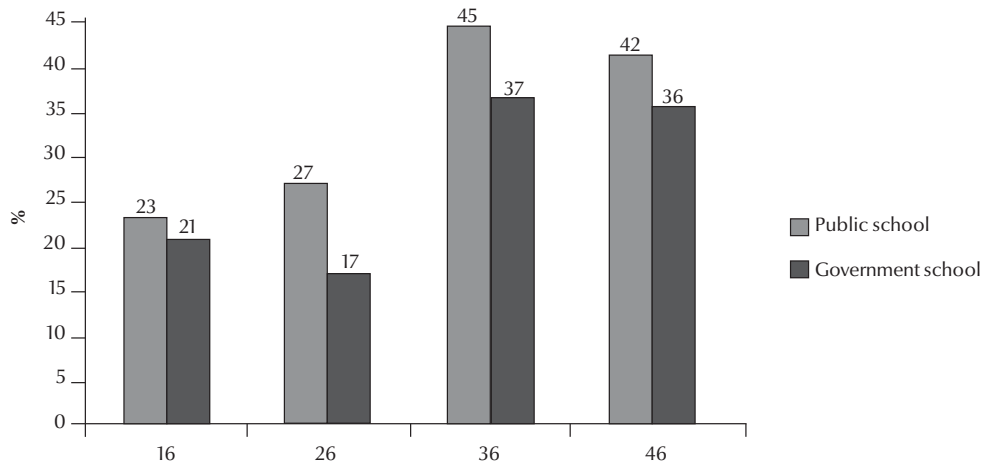*[a]Mann-Whitney test; [b]Student t-test.*
SD = standard deviation.

Figure 1 Prevalence of caries on first permanent molars of 12-year-old boys according to type of school attended (*n* = 360)

SiC score and this illustrates one of the weaknesses of the DMFT index as confirmed by Nishi et al. (*9*). A possible reason for the SiC index not being used previously in other Saudi Arabian studies could be that the DMFT score was > 3. Hence there was no need to calculate the SiC index and therefore comparisons of SiC scores between the current study and other Saudi studies are not possible.

The students who attended private schools had significantly lower levels

of caries than those attending government schools. This could be attributed to the better home environment, levels of knowledge, access to dental services and oral hygiene practices in these schoolchildren, as reported by other authors (*18,19*). The decayed component was significantly higher in government-school children while the filled component was significantly higher in the private cohort. This implied that those attending the private schools had more access to dental services and received

more restorations compared with government-school children. Studies done in Saudi Arabia and abroad have shown a direct relationship between utilization of dental services and the socioeconomic status and educational level of the parents (*20,21*). As a result, private-school children visited the dentist more often and received treatment for their carious teeth in the form of fillings. This reduced their decayed component and increased their filled component of the DMFT index. The SiC index was also significantly

Table 2 Prevalence of oral conditions in 12-year-old boys by type of school attended

Variable	Total (*n* = 360)		Private school (*n* = 190)		Government school (*n* = 170)		χ^2	*P*-value
	No.	%	No.	%	No.	%		
Plaque								
Absent	62	17.2	26	13.7	36	21.2	3.53	0.06
Present	298	82.8	164	86.3	134	78.8		
Gingivitis								
Absent	105	29.2	59	31.1	46	27.1	0.69	0.41
Present	255	70.8	131	68.9	124	72.9		
Malocclusion								
Class I	297	82.5	153	80.5	144	84.7	0.72	0.04
Class II	33	9.2	22	11.6	11	6.5		
Class III	30	8.3	15	7.9	15	8.8		
Fluorosis								
Absent	360	100.0	190	100.0	170	27.6		
Present	0	0.0	0	0.0	0	0.0	0.89	0.34

Table 3 Association between the presence of plaque and gingivitis in 12-year-old boys (*n* = 360)

Plaque	Gingivitis			
	Absent		Present	
	No.	%	No.	%
Absent	53	14.7	9	2.5
Present	52	14.4	246	68.3

$\chi^2 = 114.98; P < 0.001.$

higher among the government-school children; this indicates that the caries among these children was more severe compared with private-school children.

The prevalences of plaque (82.8%) and gingivitis (70.8%) were similar to another Saudi study and this could be due to poor oral hygiene practices and irregular brushing patterns by students (22). The strong association between those with plaque and gingivitis could be explained by the fact that those with higher plaque levels would have more inflammation and hence a higher likelihood of gingivitis.

The lower molars were more commonly affected by caries than the upper molars and this was consistent with another study (23). Possible reasons include their early eruption, the presence of deep pits and fissures, their larger occlusal surface and gravity (24).

The vast majority of respondents had a class I jaw relationship (82.5%) and this was similar to other studies, which reported a prevalence of between 77% and 90% (25,26). It must be noted, however, that these and most other studies that determined the prevalence of malocclusion were done on children attending orthodontic clinics. Hence direct comparisons cannot be made.

No child was diagnosed with fluorosis and this could be due to the fact that most of the population of Medina consumes bottled water.

There were some limitations to the study. A total of 360 pupils agreed to participate out of 420. Many of the pupils were absent on the days of the screening and hence could not be included in the study. At one of the schools, the scheduled screening date was set for the last week before the midterm vacation; hence many pupils were absent. This could be one explanation for not having a higher response rate. Schools in Saudi Arabia are segregated according to sex. Males are not allowed to enter the female schools and vice versa. Since the examiners were males, the sample consisted of males and these results are therefore not representative of all 12-year-olds in Medina. Since the DMFT index only measures frank caries, early lesions or white spots were not classified as carious and this could have underestimated the burden of dental caries in this population.

Conclusions

Although the caries prevalence was low compared with other Saudi Arabian studies, the SiC index was relatively high. Many students had poor oral hygiene, which was confirmed by the high prevalence of plaque and gingivitis. The lower molars were more commonly affected by caries compared with the upper molars. Children in government schools had significantly more caries than their counterparts in private schools. No children were diagnosed with fluorosis.

We recommend conducting a similar study for female schoolchildren in Medina to identify the burden of disease among them. The results also indicate that there is a need for oral hygiene awareness programmes at schools, together with brushing and flossing programmes, in order to maintain and improve oral health of young children in Saudi Arabia. Teachers should be informed about the importance of oral hygiene so that they can monitor and maintain oral hygiene programmes.

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