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REVIEW ARTICLE

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Oral health status and treatment needs among school children in Sana'a City, Yemen

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Abstract: Data on the oral health status and treatment needs among Yemeni children are lacking. *Objectives*: To assess caries prevalence, treatment needs and gingival health status among school children in Sana'a City and to examine how these are affected by age, gender and khat chewing. *Methods*: 1489 children (6- to 14-year old) were randomly selected from 27 schools representing all nine districts of Sana'a City. Dental caries and treatment needs were evaluated using standard WHO oral survey methods. The plaque index (PI), calculus index (CI) and the gingival index (GI), recorded at the six Ramfjord's teeth, were used to assess gingival health status. *Results*: 4.1% of the study subjects were caries-free. Prevalence of these was significantly higher among the males. Overall, mean dmfs, dmft, DMFS and DMFT scores were 8.45, 4.16, 3.59 and 2.25 respectively. The decayed component accounted for >85% of the scores. The highest dmfs/dmft means were found among the 6–8 years age group, while the highest DMFS/DMFT means were scored by the 12–14 years age group. The need for restorative treatment and extractions was high; the former was significantly higher among the females. All subjects had gingivitis; the mean PI, CI and GI were 1.25, 0.3 and 1.36 respectively. Khat chewing did not affect caries experience; however, it was significantly associated with higher PI, CI and GI scores. *Conclusions*: The prevalence of caries, gingivitis and treatment needs among children in Sana'a city is high. More surveys in other Yemeni cities to generate comprehensive data are required.

Key words: children; dental caries; epidemiology; indices; oral health, periodontal; Yemen

Introduction

Dental caries and plaque-induced periodontal diseases are the most prevalent oral diseases in the world; the former is a disease of dental hard tissues, while the latter affects the tooth supporting structure, the periodontium (1). Both diseases represent opportunistic infections by specific, but different, oral bacteria present in dental biofilm (2).

The incidence of dental caries has its peak during childhood/early adolescence, which makes the disease most common among children (1). Periodontal diseases encompass all pathological conditions that affect the periodontium. Of these, plaque-induced gingivitis is the most prevalent among children; a prevalence of >90% has been reported (3). Plaque-induced gingivitis represents a reversible, non-specific inflammatory reaction to accumulation of dental plaque. It begins with primary dentition and reaches a pick around puberty. In addition to gingivitis, children may be affected by a number of early onset forms of periodontitis, characterized by loss of attachment. These are much less prevalent and include aggressive periodontitis and periodontitis as manifestation of systemic diseases (3, 4). Chronic periodontitis, which typically affects adults, may sometimes be seen in children in its mild forms (4).

Dental caries and periodontal diseases have different prevalence patterns, not only globally, but also within individual countries and within populations (1). In addition, there have been changes in trends of both diseases overtime. Developed countries initially had high prevalence of dental caries and gingivitis; however, there has been a continual decline in both diseases paralleled with improvement of oral hygiene thereafter (5, 6). Nevertheless, a high prevalence is still seen in certain high risk groups, e.g. immigrants. An opposite trend in prevalence of dental caries is believed to have occurred in developing countries (7); however, certain reports do not support this view (8). Little is known about the trends of periodontal diseases in developing countries.

Yemen is an Arabic country located south-west on the Arabic peninsula. Around 50% of the total population consists of children (0- to 14-year old) (9). Apart from a single study that assessed the periodontal status of a Yemeni population, including a 12–24 years age subgroup (10), there are as yet no data on oral health status and treatment needs of Yemeni children. Availability of such data is of paramount importance in planning educational programmes and public health services, evaluation of interventions and following up disease trends. The objective of the current study, therefore, was to assess dental caries prevalence, gingival health status and oral hygiene as well as oral treatment needs among a population of children in Sana'a City, the capital of Yemen and to evaluate if these are influenced by potential risk factors including age, gender and khat chewing. The latter refers to the habit of chewing the fresh leaves and twigs of plant *Catha edulis*, for their amphetamine-like stimulating effects, a highly prevalent habit in Yemen and East Africa. During a khat chewing session, 100–200 mg of fresh khat is chewed into a bolus that are kept on one side of the mouth for several hours. The habit is claimed to have adverse effects on oral mucosa, periodontium and dental hard tissues; however, reports are scarce and have been conflicting (11).

Study population and methodology

During the period between October 2002 and April 2003, 1489 children aged 6- to 14-year old were randomly selected after stratification by gender and age from 27 public schools randomly selected from the nine districts of Sana'a City. Systematic random sampling was used at all levels. Table 1 shows the distribution of the study population by age and gender.

Dental caries and treatment needs were assessed using the DMFT/dmft, DMFS/dmfs and treatment need indices as recommended by the WHO's oral health surveys (12). Gingival health status was evaluated using the gingival index (GI; 13), while the plaque index (PI; 14) and Ramfjord's calculus index (CI; 15) were employed to ascertain oral hygiene status; recordings were performed for the buccal, mesial, lingual and distal surfaces of the six Ramfjord teeth (15). History about use of khat was obtained from all participants. All examinations were performed by a single pre-calibrated examiner (Al-Haddad KA).

Descriptive statistics were calculated for the study population and subgroups (by gender, age, and khat chewing history). Significance of differences in outcomes among subgroups was sought using the *t*-test, ANOVA or chi-square as appropriate. A significance level of 0.5 was considered.

Results

The study population was equally distributed among the age and gender subgroups; however, khat chewers constituted only 11.2% (165 subjects).

Table 1. **Distribution of study population by age and gender**

Age (years)	Female		Male		Total	
	n	%	*n*	%	*n*	%
6–8	247	32.2	243	33.7	490	32.9
9–11	246	32.1	246	34.1	492	33.0
12–14	274	35.7	233	32.3	507	34.0
Total	767	100.0	722	100.0	1489	100.0

The prevalence of caries-free subjects varied among the study subgroups (see Table 2). Overall, prevalence of caries-free subjects in the study population was 4.1%. Significantly more caries-free subjects were found among the males (6.2%) compared with the females (2.1%). Higher prevalence was seen in the 6–8 years age group compared with the other age subgroups and among the khat chewers compared with the khat non-chewers; however, the differences were not significant. When individual tooth surfaces were analysed, 50.5% of the subjects were found to have no caries on their lingual surfaces, while only 4.4% had no caries on their occlusal surfaces.

Dental caries experience in deciduous teeth is presented in Tables 3 and 4. Mean dmfs and dmft scores in the study population were 8.45 ± 8.39 and 4.16 ± 3.64 respectively. The decayed component (ds/dt) accounted for more than 87% of these values. There were significant differences in mfds and mfdt means among the age subgroups, with the highest means scored by the 6–8 years age group (13.12 and 6.68, respectively). There were no significant differences in mean dmfs between the males and the females; however, the females had significantly higher dmft mean than the males. Taking individual index components, the females showed significantly higher ds/dt means, while the males demonstrated higher ms/mt and fs/ft means.

Less caries was seen in permanent teeth as shown in Tables 5 and 6. Mean DMFS and DMFT were 3.59 ± 3.78 and 2.25 ± 1.9 respectively. Again, DS and DT accounted for >85% of the scores. Significant differences were also found

Table 2. **Prevalence of caries-free subjects by tooth surface, age, gender and khat chewing history**

	% Caries-free subjects				
	Occlusal surface	Proximal surfaces	Buccal surface	Lingual surface	All surfaces
Age[NS] (years)					
6–8 (*n* = 490)	5.9	13.1	42.2	65.7	5.5
9–11 (*n* = 492)	3.3	18.3	46.7	52.6	3.0
12–14 (*n* = 507)	4.1	23.7	33.5	34.1	3.7
Gender*					
Female (*n* = 767)	2.2	14.7	37.0	46.5	2.1
Male (*n* = 722)	6.8	22.3	44.7	55.0	6.2
Khat chewing history[NS]					
Negative (*n* = 1303)	4.0	17.9	40.8	51.3	3.8
Positive (*n* = 165)	7.9	22.4	40.6	43.6	6.7
Overall	4.4	18.4	40.8	50.5	4.1

NS, differences not significant.
*Significant differences ($P < 0.001$), chi-squared test.

Table 3. **The dmfs and its components scores (mean ± SD) by age and gender**

	Age (years)				Gender		
	6–8 (*n* = 490)	9–11 (*n* = 485)	12–14 (*n* = 321)	*P*-value*	Female (*n* = 640)	Male (*n* = 656)	*P*-value†
ds	11.88 ± 8.65	6.40 ± 6.03	2.14 ± 3.23	<0.001	7.70 ± 7.50	7.14 ± 7.88	0.02
ms	01.14 ± 3.35	1.21 ± 3.48	0.33 ± 1.57	<0.001	0.72 ± 2.38	1.21 ± 3.63	<0.001
fs	00.10 ± 0.57	0.07 ± 0.44	0.03 ± 0.32	0.05	0.06 ± 0.45	0.08 ± 0.50	0.03
dmfs	13.12 ± 9.18	7.68 ± 6.93	2.49 ± 3.72	<0.001	8.48 ± 8.03	8.43 ± 8.74	0.7

*ANOVA.
†*t*-test.

Table 4. **The dmft and its components scores (mean ± SD) by age and gender**

	Age (years)				Gender		
	6–8 (*n* = 490)	9–11 (*n* = 485)	12–14 (*n* = 321)	*P*-value*	Female (*n* = 640)	Male (*n* = 656)	*P*-value†
dt	6.37 ± 3.85	3.32 ± 2.50	1.05 ± 1.40	<0.001	4.10 ± 3.62	3.73 ± 3.55	0.01
mt	0.23 ± 0.67	0.24 ± 0.70	0.07 ± 0.31	0.002	0.14 ± 0.48	0.24 ± 0.73	<0.001
ft	0.08 ± 0.39	0.05 ± 0.28	0.01 ± 0.14	0.002	0.04 ± 0.30	0.06 ± 0.30	0.01
dmft	6.68 ± 3.80	3.62 ± 2.56	1.13 ± 1.48	<0.001	4.28 ± 3.67	4.04 ± 3.61	0.04

*ANOVA.
†*t*-test.

Table 5. **The DMFS and its components scores (mean ± SD) by age and gender**

	Age (years)				Gender		
	6–8 (*n* = 474)	9–11 (*n* = 492)	12–14 (*n* = 507)	*P*-value*	Female (*n* = 760)	Male (*n* = 713)	*P*-value†
DS	1.58 ± 2.45	3.14 ± 2.81	4.54 ± 3.47	<0.001	3.70 ± 3.39	2.50 ± 2.84	<0.001
MS	0.03 ± 0.40	0.42 ± 1.86	0.70 ± 2.19	<0.001	0.37 ± 1.66	0.41 ± 1.76	0.95
FS	0.02 ± 0.13	0.04 ± 0.28	0.20 ± 0.65	<0.001	0.09 ± 0.43	0.08 ± 0.42	0.34
DMFS	1.63 ± 2.50	3.59 ± 3.44	5.43 ± 4.15	<0.001	4.16 ± 3.92	2.99 ± 3.53	<0.001

*ANOVA.
†*t*-test.

Table 6. **The DMFT and its components scores (mean ± SD) by age and gender**

	Age (years)				Gender		
	6–8 (*n* = 474)	9–11 (*n* = 492)	12–14 (*n* = 507)	*P*-value*	Female (*n* = 760)	Male (*n* = 713)	*P*-value†
DT	1.15 ± 1.50	2.19 ± 1.58	2.90 ± 1.90	<0.001	2.45 ± 1.82	1.72 ± 1.75	<0.001
MT	0.01 ± 0.08	0.08 ± 0.37	0.14 ± 0.44	<0.001	0.07 ± 0.33	0.08 ± 0.35	0.9
FT	0.02 ± 0.13	0.03 ± 0.21	0.18 ± 0.55	<0.001	0.08 ± 0.38	0.07 ± 0.34	0.22
DMFT	1.17 ± 1.52	2.30 ± 1.63	3.22 ± 1.92	<0.001	2.61 ± 1.87	1.88 ± 1.85	<0.001

*ANOVA.
†*t*-test.

here between the age subgroups but in the opposite direction; the 12–14 years age group scored the highest means (5.43 and 3.22, respectively). The females scored significantly higher than did the males in the DS/DT component; no significant differences were noted with respect to the other components.

The mean number of deciduous and permanent teeth per child that did not require any treatment was 6.4 ± 4.7 and 13.9 ± 7.0 respectively. Figure 1 presents the treatment needs in the study population. The need for restorative treatment was high; 84% of the study subjects had at least one tooth that required one surface filling and 60% of them had at least one tooth that required two or more surface filling. The need for extraction of at least one tooth came next (37%) followed by the need for preventive treatment (19%). The females had higher restorative and preventive needs than the males did.

Table 7 describes oral hygiene and gingival health status of the study population. Gingivitis was found in all subjects. Mean PI, CI and GI scores were 1.25 ± 0.3, 0.01 ± 0.05 and 1.36 ± 0.3 respectively. Means of all three indices significantly differed among the age subgroups, being the highest in the 12–14 year age group. The males showed significantly higher PI and IG means than the females did.

The khat chewers had a significantly higher DS mean than did the non-chewers (Table 8); otherwise, khat chewing history did not affect dental caries experience in both dentitions. However, khat chewing was significantly associated with higher PI, CI and GI scores (Table 9).

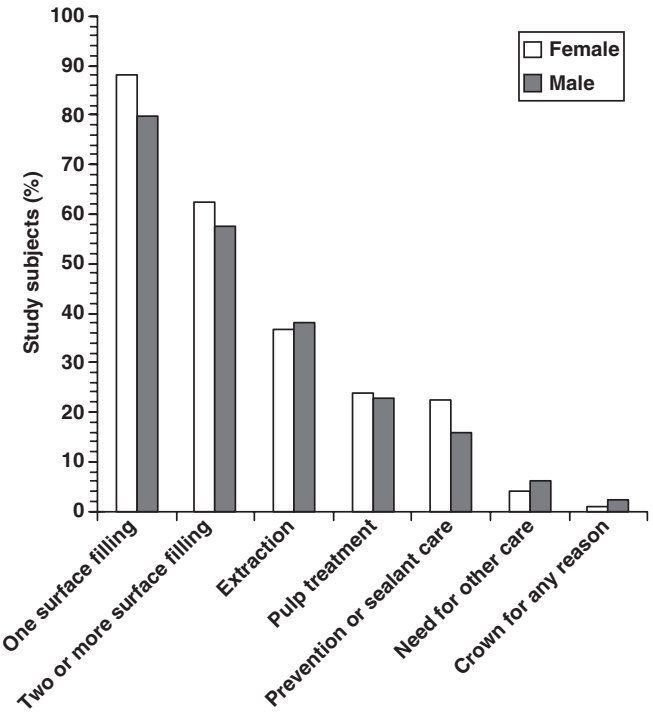

Fig. 1. Clustered bars showing the percentage of the study population in need of various treatments, by gender.

Discussion

To the best of our knowledge, this is the first study to provide data on oral health status and treatment needs among children in Yemen. The study population was randomly selected from

Table 7. **Mean (±SD) scores of plaque index (PI), calculus index (CI) and gingival index (GI) by age and gender**

	Age (years)				Gender		
	6–8 (*n* = 490)	9–11 (*n* = 492)	12–14 (*n* = 507)	*P*-value*	Female (*n* = 767)	Male (*n* = 722)	*P*-value†
PI	1.20 ± 0.27	1.296 ± 0.32	1.28 ± 0.32	<0.001	1.20 ± 0.25	1.30 ± 0.35	<0.001
CI	0.01 ± 0.04	0.01 ± 0.05	0.02 ± 0.06	<0.001	0.01 ± 0.04	0.01 ± 0.05	0.13
GI	1.30 ± 0.27	1.36 ± 0.31	1.40 ± 0.31	<0.001	1.32 ± 0.27	1.39 ± 0.32	<0.001

*ANOVA.
†*t*-test.

Table 8. **The DMFS and its components scores (mean ± SD) by khat chewing history**

	Khat chewers (*n* = 165)	Khat non-chewers (*n* = 1303)	*P*-value*
DS	3.10 ± 2.85	3.10 ± 3.19	0.61
MS	0.76 ± 2.39	0.35 ± 1.61	<0.001
FS	0.06 ± 0.26	0.09 ± 0.45	0.35
DMFS	3.92 ± 3.98	3.54 ± 3.72	0.27

**t*-test.

Table 9. **Mean (±SD) scores of plaque index (PI), calculus index (CI) and gingival index (GI) by khat chewing history**

	Khat chewers (*n* = 165)	Khat non-chewers (*n* = 1303)	*P*-value*
PI	1.42 ± 0.38	1.22 ± 0.29	<0.001
CI	0.02 ± 0.07	0.01 ± 0.04	<0.001
GI	1.50 ± 0.33	1.34 ± 0.29	<0.001

**t*-test.

27 public schools representing all districts in Sana'a City. The sample is therefore representative of school children in Sana'a City. Private school children represent a minority and their exclusion probably does not affect the external validity of the study. Because Yemen is culturally diverse, it may be not appropriate to claim that the study sample is representative of all Yemeni school children.

The percentage of caries-free school children was found to be 4.1% (range 3.7–5.5%). Figures obtained from Iraq (16) are somewhat comparable to this. However, the figure is considered very low compared to figures for school children from many other courtiers, e.g. a prevalence of 24% in Jordan (17), 26% in Saudi Arabia (18), 41% in Sultanate of Oman (19) and up to 80% in India (20). Consistently, dmfs/dmft and DMFS/DMFT scores from these areas are also generally lower than reported in this study; however, somewhat higher scores have been reported from Saudi Arabia after exclusion of caries-free subjects (18).

The decayed components constituted the major fractions. The mt:dmft and MT:DMFT ratios were found to be 4.57% and 3.55% respectively. This means that the occurrence of missing teeth due to caries on the average was not common. The MT:DMFT ratio slightly increased with age, which is consistent with previous findings (16, 21), and may be explained by changes in diet, habits in between meals and the amount of sugar intake. The ft:dmft and FT:DMFT ratios were 1.20% and 3.55%, respectively, which reflects that a vast majority of the children suffering from dental caries do not undergo restorative treatment, which explains the high need for restorative treatments and extractions among the study population. This may be attributable to poor oral health knowledge and/or attitudes, poverty or/and reduced access to public health facilities.

The DMFS/DMFT scores in the present study significantly increased with age. This is due to irreversibility and accumulative nature of the disease. On the contrary, dmfs/dmft scores decreased with age, which is obviously natural because the number of primary teeth decreases with time.

The higher prevalence of dental caries among females is almost a universal phenomenon, and results from the current study were not an exception. This has classically been explained by the fact that teeth in females erupt earlier than in males and that females have easier access to food and frequent snakes; however, there is recently some evidence to suggest that the higher caries susceptibility among females may also be attributable to changes in salivary rates and composition induced by hormonal fluctuations among females (22).

Occlusal surfaces were most susceptible to dental caries; only 4.4% of the study subjects had no caries on their occlusal surfaces. The figure is very close to the prevalence of totally caries-free subjects (4.1%), which suggests that the occlusal surface may be used as an index surface to screen for caries-free subjects.

All subjects had gingivitis; mean PI, CI and GI significantly increased with age. These findings are consistent with most findings worldwide and the natural course of gingivitis among children (3, 4). The males in all age groups had significantly higher PI and GI means than did the females. This is

consistent with results from many other studies and has been explained by better oral hygiene practices by females.

Khat chewing was included as a variable in this study. The habit was not associated with higher caries scores; on the contrary, more caries-free subjects were found among the khat chewers (6.7%) compared with the khat non-chewers (3.8%); however, the difference was not statistically significant probably because the number of the khat chewers was low. In addition, khat is usually used by older children (>12 year) and therefore it is not reliable to assess the effect of the habit on dental caries among younger children. Nevertheless, there have been reports that suggest that khat has some anticariogenic properties (23–25). On the other hand, khat chewing was significantly associated with higher GI scores. This may simply be explained by the significantly higher PI and CI among the chewers; however, an additional effect by khat chewing, *per se* cannot be excluded. In fact, there has been controversy in the literature concerning the effect of khat chewing on periodontal health (11).

In conclusion, the present study demonstrated that school children in Sana'a City suffer from high prevalence of dental caries and treatment needs as well as poor oral hygiene and gingival health status. As this study is probably not representative of all Yemeni children, studies that would cover more Yemeni cities are recommended. Additional variables such as oral health knowledge and attitudes, patterns of sugar consumptions, oral hygiene behaviour, social habits and fluoride intake may be included.

References

1 Greene JC, Suomi JD. Epidemiology and public health aspects of caries and periodontal disease. *J Dent Res* 1977; **56:** C20–C26.

2 Loesche W. Dental caries and periodontitis: contrasting two infections that have medical implications. *Infect Dis Clin North Am* 2007; **21:** 471–502, vii.

3 Jenkins WM, Papapanou PN. Epidemiology of periodontal disease in children and adolescents. *Periodontol 2000* 2001; **26:** 16–32.

4 Albandar JM, Rams TE. Global epidemiology of periodontal diseases: an overview. *Periodontol 2000* 2002; **29:** 7–10.

5 Hugoson A, Norderyd O. Has the prevalence of periodontitis changed during the last 30 years? *J Clin Periodontol* 2008; **35 (8 Suppl.):** 338–345.

6 Marthaler TM. Changes in dental caries 1953–2003. *Caries Res* 2004; **38:** 173–181.

7 Winter GB. Epidemiology of dental caries. *Arch Oral Biol* 1990; **35 (Suppl.):** 1S–7S.

8 Cleaton-Jones P, Fatti P, Bonecker M. Dental caries trends in 5- to 6-year-old and 11- to 13-year-old children in three UNICEF designated regions – Sub Saharan Africa, Middle East and North Africa, Latin America and Caribbean: 1970–2004. *Int Dent J* 2006; **56:** 294–300.

9 Central Statistical Organization RoY. *Yemen in Figures*. Sana'a, Central Statistical Organization, 2000, 5–16.

10 Mengel R, Eigenbrodt M, Schunemann T, Flores-de-Jacoby L. Periodontal status of a subject sample of Yemen. *J Clin Periodontol* 1996; **23:** 437–443.

11 Al-Hebshi NN, Skaug N. Khat (*Catha edulis*) – an updated review. *Addict Biol* 2005; **10:** 299–307.

12 World Health Organization. *Oral Health Surveys: Basic Methods*, 4th edn. Geneva, World Health Organization, 1997.

13 Loee H, Silness J. Periodontal disease in pregnancy. I. Prevalence and severity. *Acta Odontol Scand* 1963; **21:** 533–551.

14 Silness J, Loee H. Periodontal disease in pregnancy. II. Correlation between oral hygiene and periodontal condition. *Acta Odontol Scand* 1964; **22:** 121–135.

15 Ramfjord SP. Indices for prevalence and incidence of periodontal disease. *J Periodontol* 1959; **30:** 51–59.

16 Al-Alousi W, Al-Sayyab M. Plaque, gingival condition and brushing behavior in 15-years old Iraqi school children in central region of Iraq. *Iraqi Dent J* 1996; **8:** 127–134.

17 El-Qaderi SS, Quteish Ta'ani D. Dental plaque, caries prevalence and gingival conditions of 14–15-year-old schoolchildren in Jerash District, Jordan. *Int J Dent Hyg* 2006; **4:** 150–153.

18 Alamoudi N, Salako NO, Massoud I. Caries experience of children aged 6–9 years in Jeddah, Saudi Arabia. *Int J Paediatr Dent* 1996; **6:** 101–105.

19 Al-Ismaily M, Al-Khussaiby A, Chestnutt IG *et al*. The oral health status of Omani 12-year-olds – a national survey. *Community Dent Oral Epidemiol* 1996; **24:** 362–363.

20 Saravanan S, Anuradha KP, Bhaskar DJ. Prevalence of dental caries and treatment needs among school going children of Pondicherry, India. *J Indian Soc Pedod Prev Dent* 2003; **21:** 1–12.

21 Casanova-Rosado AJ, Medina-Solis CE, Casanova-Rosado JF, Vallejos-Sanchez AA, Maupome G, Avila-Burgos L. Dental caries and associated factors in Mexican schoolchildren aged 6–13 years. *Acta Odontol Scand* 2005; **63:** 245–251.

22 Lukacs JR, Largaespada LL. Explaining sex differences in dental caries prevalence: saliva, hormones, and "life-history" etiologies. *Am J Hum Biol* 2006; **18:** 540–555.

23 Al-Hebshi NN, Nielsen O, Skaug N. In vitro effects of crude khat extracts on the growth, colonization, and glucosyltransferases of *Streptococcus mutans*. *Acta Odontol Scand* 2005; **63:** 136–142.

24 Hill CM, Gibson A. The oral and dental effects of q'at chewing. *Oral Surg Oral Med Oral Pathol* 1987; **63:** 433–436.

25 Luqman W, Danowski TS. The use of khat (*Catha edulis*) in Yemen. Social and medical observations. *Ann Intern Med* 1976; **85:** 246–249.

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