Oral Health in Kuwait before the Gulf War

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Key Words

Oral health · Dentistry · Survey · Oral epidemiology

Abstract

Objective: The aim of this oral health survey was to determine the oral health status and oral health behavior in the whole population in Kuwait. This survey was part of the Kuwait Health Survey, which was conducted by the Ministry of Public Health. The original data were destroyed during the Gulf War (1990/1991), but the aim of this report is to publish the main findings concerning oral health and related factors. **Methodology:** The data were collected between April 1984 and April 1985. The sample consisted of 3,358 households and 26,530 individuals. The survey consisted of interviews and clinical examinations (>12-year-olds). WHO (1977) criteria were used for examinations. **Results:** Females were more often brushing their teeth at least once a day than males and non-Kuwaitis slightly more often than Kuwaitis. Over one third (39%) had visited a dentist during the previous 12 months. The proportion of subjects with soft deposit was 66%, calculus 45%, intensive gingivitis 46% and advanced periodontitis 18%. The caries experience was prevalent (52%) in primary dentition (<8-year-olds)

and in permanent dentition, highest (95%) among the 60- to 64-year-olds. **Conclusion:** Preventive programs for periodontal diseases and for dental caries are urgently needed. The coverage of curative care of both diseases also needs to be improved. Health behavior improvement should be targeted by oral health promotion activities.

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Introduction

Epidemiological oral health surveys with nationally representative data are relatively rare because they are expensive and time-consuming to conduct. National data, however, are an important prerequisite for proper planning and development of the oral health care system. The first national oral health surveys were conducted in the USA in 1960–1962, 1971–1974 and 1985 [1, 2]. Extensive national oral health surveys have also been conducted in the UK in 1968, 1970, 1973 and in 1980 [3–5]. Later on, several national oral health surveys were conducted in different countries [6–8]. Results of national surveys are, however, usually published in the language of the country concerned and so are frequently not widely

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used outside the country, e.g. the Japanese [6], the Swedish [7] and the Danish [8] surveys. Currently, the WHO Global Oral Health Data Bank keeps updated information on oral health in most of the countries of the world [9]. International comparisons are often difficult when different methods have been applied, but the International Collaborative Studies (ICS) I [10] and II [11] tried to overcome these restrictions by adopting the same methodology.

In Kuwait, national oral health surveys were conducted among 5- to 16-year-old children in 1982 [12] and among 4-, 6-, 12- and 15-year-olds in 1993 [13]. The dental caries experience in primary and secondary dentition (dmf/DMF) of 6-year-olds was 8.4/0.4 in 1982 and 6.2/0.2 in 1993, indicating a distinct decline in caries experience during the 1980s. Contrary to the caries experience of 6-year-olds, that of 12-year-olds seems to have increased between 1982 and 1993 from 2.0 to 2.6 [12, 13]. The largest part of decayed permanent teeth was left untreated, and extraction was twice more common than restorative treatment. Several national children's oral health surveys of different age groups have also been conducted in other Gulf countries including Oman [14, 15], Saudi Arabia [16, 17] and the United Arab Emirates [18]. Nationally representative oral health surveys among the adult population have been conducted neither in Kuwait nor in the other Gulf countries. However, one recent nonrepresentative oral health survey from Saudi Arabia reported tooth loss from specific age groups based on the WHO ICS II [19].

In Kuwait, the Ministry of Public Health initiated a national health survey (Kuwait Health Survey 1987) for establishing the health status and morbidity patterns of the total population, both Kuwaitis and residents. The oral health survey, whose aim was to find out the oral health status and oral health behavior in the whole population of Kuwait, was part of this extensive health survey. The preliminary report of the whole survey was submitted to the Ministry of Health in 1987. This report included the main findings, summary tables (491 pages) and the appendices (112 pages). Although this report was based on recovered data, it was stamped 'not for citation or quotation', and even the main findings were available as references. The original data were destroyed during the Iraqi invasion. This report aims to make use of the oral health survey in the future as a reference base for all the age and gender groups.

Table 1. Age, sex and nationality distribution of the Kuwait Health Survey population

Age group	Kuwaiti		Non-Kuwaiti		Total	
	n	%	n	%	n	%
Under 5 years					3,682	13.9
Male	774	2.9	1,084	4.1		
Female	825	3.1	999	3.8		
5-14 years					7,704	29.1
Male	1,570	5.9	2,313	8.7		
Female	1,583	6.0	2,238	8.4		
15-59 years					14,462	54.6
Male	2,616	9.9	4,559	17.2		
Female	2,834	10.7	4,453	16.8		
Over 60 years					652	2.4
Male	246	0.9	120	0.5		
Female	171	0.6	114	0.4		
Total					26,499	100.0
Male	5,206	19.6	8,076	30.5		
Female	5,413	20.4	7,804	29.5		

Material and Methods

The Sample

This study was a part of the Kuwait Health Survey. The data collection started in April 1984 and was completed in April 1985. The sample frame consisted of 3,607 households with an additional 710 households substituting those on the original list that could not be located by the interviewers. The random sample was stratified according to region and nationality (Kuwaiti, non-Kuwaiti). In the sample, 3,358 households represented 1.4% of all households or 26,530 individuals represented 1.6% of all people residing in Kuwait in 1984 (table 1). Kuwaitis made up 40% of the total population.

Interviews

The sampled households were contacted by a team of interviewers which consisted of two social workers, a male and a female, and one female nutritionist. The team was trained for this survey. Each member aged 12 and over of the households was interviewed; children younger than 12 years were asked some questions, while, for certain others, information was collected from the mother, particularly in case of children aged less than 6 years.

Clinical Examinations

The oral health survey consisted of household interviews and clinical oral examinations (17,906). Altogether, 18 calibrated dentists were responsible for the clinical oral examinations. The clinical examinations were mainly modified from the WHO criteria [20]. While assessing periodontal status, the oral cavity was divided into six sextants according to WHO criteria (1977). Each assessment was made independently and in such an order that all recording of plaque was completed before recording of calculus began, and all recording of calculus was completed before recording of intense gingivitis or

Fig. 1. Reported more-than-once-a-day toothbrushing frequency according to educational status and nationality.

Table 2. Percentages of subjects brushing their teeth at least once a day according to age, sex and nationality

Age group	Kuwaiti		Non-Kuwaiti		Total
	male	female	male	female	
6–11 years	41.9	56.1	62.5	68.1	59.6
12–29 years	59.9	83.0	68.9	84.6	76.1
30–59 years	76.1	76.9	73.6	85.5	78.2
>60 years	64.0	37.8	64.7	56.4	57.8
Total	58.2	73.8	69.7	80.2	72.1

advanced periodontal involvement. The examiners were instructed to cease all assessment in a particular sextant once a periodontal condition was detected in any of the teeth within that sextant. Dental plaque was identified with the help of a mouth mirror only. A periodontal probe was used to confirm whether a soft deposit had indeed calcified before deciding it was calculus. A person was defined to have intense or acute gingivitis, if at least one or more areas of papillary or marginal gingivae surrounding fully erupted teeth showed marked changes in color, or if firm digital palpation caused bleeding. Advanced periodontal involvement was defined to exist when there was definite tooth mobility, or a periodontal pocket of 3 mm or more existed together with conditions of intense gingivitis, pus or advanced gingival recession. Each tooth was evaluated to determine its caries status, and assigned an alphabetical code: S = sound tooth; D =

decayed tooth; F = filled tooth, caries-free; P = filled tooth with primary decay; R = filled tooth with secondary decay; M = extracted tooth; X = excluded from assessment since restoration for any reason other than caries had been conducted; U = unerupted tooth. The examiners were trained and calibrated for this survey, but the reproducibility figures are not available.

Statistical Methods

The raw data were computerized and the main findings made available in 1987, when the first preliminary report was submitted to the Ministry of Public Health. However, during the Iraqi invasion in 1990, all the magnetic tapes were destroyed and further analyses were not possible. Hence statistical testing of the results was not possible, because individual-based data were not available. This report includes the main oral health findings, the clinical examination results and the related background factors on the interview data.

Results

Toothbrushing Habits

More females reported that they brushed their teeth daily than males, except among people older than 60 years (table 2). Toothbrush and toothpaste were used by 88% of all daily brushers. Only 7% among Kuwaitis with above secondary education brushed daily, compared with 24% of the illiterate respondents. The respective percentages among non-Kuwaitis were 5 and 27%. Reported tooth-

brushing frequency also seemed to correlate strongly with the educational status of the respondents (fig. 1).

Dental Visits

One third of all respondents had visited a dentist during the previous 12 months (table 3). The main reason (among those who visited) was toothache (69%), repair (19%), toothcleaning (6%), regular check-up (4%) or previous appointment (2%). Females visited the dentists more often than males. The facilities of the first visit during the previous 12 months for Kuwaitis and non-Kuwaitis were, respectively: polyclinic 54 and 59%, school health clinic 20 and 14%, private clinic 9 and 10%, specialist clinic 7 and 76%, governmental hospital 4 and 5%, school health center 3 and 1% and outside Kuwait 3 and 5%.

Periodontal Status

Almost two thirds (66%) of the subjects had soft deposits, 45% had calculus, 46% had intensive gingivitis and 18% had advanced periodontal involvement (table 4). One tenth of the children at the age of 10 years had calculus as did more than half of those at the age of 16 years. The prevalence of calculus ranged from 51 to 89% among those aged 16–65 years. Intensive gingivitis increased according to age up to 80% among 40- to 44-year-olds and then decreased among the older age groups. Advanced periodontal problems had started early in life, being 3% among 12-year-olds. The number of sextants involved was associated with the prevalence of different indicators of periodontal diseases (table 5). The mean number of sextants increased according to age up to the age of 60 years.

Dental Caries

More than half of the children less than 9 years of age had one or more dmf teeth (table 6). The vast majority of the dmf score consisted of the d component. Among all children of less than 9 years, the average number of decayed teeth was 2.2, while that of filled and missing teeth was 0.08 and 0.06, respectively. One third of the children at the age of 3 years had one or more teeth decayed. This proportion increased up to 59% among 4-year-olds. Caries was also prevalent in permanent dentition (table 7) in 24% of children at the age of 7 years and 61% at the age of 12 years. More than 90% of all subjects over 35 years had experienced caries, and on the average 56% of all over 5 years had at least one carious tooth. The mean caries indices indicate a rapidly increasing caries pattern according to age (table 8). The mean number of

Table 3. Percentages of respondents who had visited the dentist during the 12 months prior to the survey by age, sex and nationality

Age group	Kuwaiti		Non-Kuwaiti		Total
	male	female	male	female	
<5 years	8.8	8.3	7.0	4.6	6.8
5–14 years	36.5	35.6	37.4	36.0	36.5
15–29 years	39.3	44.9	35.4	42.1	40.6
30–59 years	50.3	50.2	46.8	57.7	51.2
>60 years	31.0	34.0	45.5	57.7	40.8
Total	36.8	39.3	37.3	41.2	38.8

The percentages in this table are based on the 15,248 respondents who answered the question.

Table 4. Periodontal status: percentages of subjects affected according to age

Age years	n	Soft plaque	Calculus	Intense gingivitis	Pockets
<1	306	0.7	–	0.0	–
1	366	7.1	–	0.8	–
2	583	17.3	–	1.7	–
3	627	29.2	–	2.7	–
4	677	36.5	–	5.3	–
5	621	44.3	–	7.4	–
6	655	55.6	–	12.7	–
7	609	61.4	3.3	19.0	–
8	608	67.4	3.9	27.1	–
9	550	72.7	7.1	29.5	–
10	634	72.2	10.1	31.2	–
11	593	73.4	17.0	37.8	–
12	553	78.1	25.7	41.4	2.9
13	540	73.5	28.5	39.6	2.8
14	552	73.2	38.4	44.0	6.3
15	484	72.1	46.3	46.5	8.7
16	497	71.2	50.9	49.7	8.2
17	377	72.7	54.9	49.6	8.0
18	361	77.0	59.0	54.0	9.7
19	240	72.9	57.5	51.3	11.7
20–24	1,173	75.9	74.2	61.3	18.4
25–29	1,163	81.1	81.9	71.8	26.9
30–34	1,148	80.9	86.8	76.6	35.1
35–39	1,174	83.0	89.3	79.1	44.2
40–44	1,005	84.0	88.7	80.3	47.2
45–49	725	83.0	86.5	78.6	53.4
50–54	509	80.6	83.3	76.8	57.0
55–59	255	72.5	73.7	70.6	55.7
60–64	151	60.3	65.6	62.9	51.7
>65	170	47.6	48.2	46.5	40.0
Total	17,906	66.4	44.6	45.8	17.7

Table 5. Periodontal status: mean numbers of sextants involved according to age

Age years	n	Soft plaque	Calculus	Intense gingivitis	Pockets
<1	306	0.0	–	0.0	–
1	366	0.2	–	0.0	–
2	583	0.7	–	0.1	–
3	627	1.3	–	0.1	–
4	677	1.6	–	0.1	–
5	621	1.9	–	0.2	–
6	655	2.5	–	0.3	–
7	609	2.7	0.1	0.5	–
8	608	3.0	0.1	0.8	–
9	550	3.5	0.1	0.8	–
10	634	3.3	0.2	0.9	–
11	593	3.3	0.4	1.1	–
12	553	3.8	0.5	1.3	0.1
13	540	3.4	0.7	1.3	0.1
14	552	3.4	1.0	1.5	0.1
15	484	3.2	1.3	1.4	0.2
16	497	3.2	1.3	1.6	0.2
17	377	3.3	1.5	1.6	0.2
18	361	3.4	1.8	1.8	0.3
19	240	3.3	1.8	1.9	0.3
20–24	1,173	3.5	2.6	2.3	0.5
25–29	1,163	3.7	3.1	2.7	0.8
30–34	1,148	3.8	3.5	3.1	1.1
35–39	1,174	3.9	3.7	3.4	1.5
40–44	1,005	4.0	3.9	3.6	1.7
45–49	725	4.0	3.9	3.5	2.1
50–54	509	3.8	3.6	3.5	2.2
55–59	255	3.4	3.1	3.1	2.1
60–64	151	2.7	2.6	2.7	2.0
>65	170	1.9	1.8	1.8	1.4
Total	17,906	3.1	1.7	1.7	0.6

Table 6. Caries status of primary teeth among persons aged less than 9 years

Age years	n	dt ≥ 1 %	dmft ≥ 1 %	dt	mt	ft	dmft
<1	307	0.3	1.0	0.0	0.1	0.0	0.1
1	366	2.5	2.5	0.1	0.0	0.0	0.1
2	583	13.0	13.4	0.4	0.0	0.0	0.4
3	627	32.4	32.7	1.4	0.0	0.0	1.5
4	677	57.8	59.1	2.7	0.1	0.1	2.8
5	621	68.3	69.6	3.2	0.1	0.1	3.3
6	655	76.3	78.6	3.6	0.1	0.2	3.9
7	609	78.3	80.5	3.5	0.1	0.1	3.7
8	608	76.3	79.9	2.8	0.1	0.1	3.0
Total	5,053	50.4	51.8	2.2	0.1	0.1	2.3

Table 7. Caries status of permanent teeth among persons aged 5 years and above

Age, years	n	DT ≥ 1, %	DMFT ≥ 1, %	DMFT
5	621	2.7	2.7	0.1
6	655	7.8	8.2	0.2
7	609	22.7	24.1	0.5
8	608	29.3	31.6	0.6
9	550	38.2	40.9	0.9
10	634	45.9	48.9	1.2
11	593	51.4	56.7	1.5
12	552	52.9	60.7	1.8
13	540	61.9	67.4	2.3
14	552	62.1	68.8	2.5
15	484	65.3	71.3	3.0
16	497	66.2	73.6	3.2
17	377	69.2	76.9	3.5
18	361	67.3	76.2	3.7
19	240	66.7	77.9	3.8
20–24	1,173	72.0	84.2	4.5
25–29	1,163	72.4	85.8	6.0
30–34	1,148	72.3	89.4	7.0
35–39	1,174	74.0	91.5	8.1
40–44	1,005	70.4	92.3	9.2
45–49	725	67.9	94.8	11.2
50–54	509	60.7	94.9	12.7
55–59	255	60.8	94.9	16.3
60–64	151	55.0	95.4	18.7
>65	170	35.3	94.1	22.8
Total	15,346	56.4	68.8	5.1

filled teeth was quite low and only exceeded 1 tooth in the age groups from 25 to 39 years.

Use of Dentures

The proportion of subjects wearing dentures increased according to age, consistently being less than 10% among subjects under 40 years of age and more than 50% among subjects over 60 years of age (table 9).

Discussion

The Kuwait Health Survey was based on an exceptionally large sample representing 1.6% of all individuals residing in Kuwait in 1985. With this extensive data, several analyses would have been possible for providing explanatory information for the pattern of most common dental diseases, caries and periodontal diseases. However, further analytical epidemiology was not possible with

Table 8. The mean caries indices according to age

Age, years	n	DT	MT	FT	DMFT
5	621	0.1	0.0	0.0	0.1
6	655	0.1	0.1	0.0	0.2
7	609	0.4	0.0	0.0	0.5
8	608	0.5	0.2	0.0	0.6
9	550	0.8	0.0	0.1	0.9
10	634	1.0	0.1	0.1	1.2
11	593	1.2	0.1	0.2	1.5
12	552	1.4	0.1	0.3	1.8
13	540	1.9	0.2	0.2	2.3
14	552	2.0	0.2	0.2	2.5
15	484	2.3	0.4	0.3	3.0
16	497	2.4	0.4	0.3	3.2
17	377	2.5	0.4	0.5	3.5
18	361	2.6	0.5	0.6	3.7
19	240	2.7	0.5	0.7	3.8
20–24	1,173	2.9	0.9	0.7	4.5
25–29	1,163	3.0	1.9	1.0	6.0
30–34	1,148	3.0	2.8	1.2	7.0
35–39	1,174	3.2	3.8	1.1	8.1
40–44	1,005	2.9	5.4	0.9	9.2
45–49	725	2.6	7.9	0.7	11.2
50–54	509	2.4	9.9	0.5	12.7
55–59	255	2.3	13.7	0.3	16.3
60–64	151	2.1	16.5	0.1	18.7
>65	170	1.7	21.0	0.1	22.8
Total	15,346	2.1	2.5	0.5	5.1

these data, because the survey data on magnetic tapes were destroyed during the Iraqi invasion. Loss of original, individual-based data prevented detailed analyses, which with this huge sample would have benefited national and international communities. However, it was considered important to report these main findings with age-specific mean figures because they will allow later comparisons of any new epidemiological findings with these baseline figures from 1984–1985. For health care planning, estimation of the trends is often more important than the cross-sectional figures of morbidity.

There is always concern about the validity and reliability of the findings in large epidemiological surveys. In this study, all the interviewers and clinical examiners had detailed training and calibrating exercises before the survey, and a pilot study had been conducted before the survey. WHO oral health surveys (1977) were used. Only questions that had been shown to have high validity were asked in the interview. In clinical examinations, the meth-

Table 9. Percentage of respondents possessing and wearing dentures according to age

Age years	n	Full upper	Partial upper	Full lower	Partial lower	Total
20–24	1,173	0.1	0.7	0.0	0.0	0.8
25–29	1,163	0.2	2.6	0.3	0.9	4.0
30–34	1,148	0.6	3.2	0.2	1.4	5.4
35–39	1,174	0.3	4.1	0.3	2.3	7.1
40–44	1,005	2.8	5.4	1.8	3.3	13.2
45–49	725	5.2	7.4	4.4	4.6	21.7
50–54	509	9.8	5.9	7.9	4.7	28.3
55–59	255	15.3	3.5	14.1	3.5	36.5
60–64	151	24.5	7.3	23.2	5.3	60.3
>65	170	28.2	0.0	21.8	0.6	50.6
Total	7,473	3.4	3.8	2.8	2.2	12.1
Total includes upper and/or lower, partial and/or full dentures.						

ods did not contain measurement of loss of attachment. The CPITN index has had considerable criticism because of its shortcomings [21]. In addition to pockets, loss of attachment is an important variable in determining periodontal destruction, but it has been included in the latest criteria of the WHO.

In this paper, the main findings were compared mainly with the other nationally representative surveys and with the ICS II [11], which was conducted between 1988 and 1992 using the same methods in five different countries, Germany, Japan, New Zealand, Poland and the USA – i.e. Baltimore, Md., Navajo (IHS) and Lakota (IHS).

Toothbrushing

Although toothbrushing was not a very well-established practice in Kuwait in 1984/1985, the percentage of daily brushers appears also to be low in other countries [7, 8, 11, 22]. Kuwaiti respondents brushed on a daily basis less often than non-Kuwaitis (66%/75%). Females brushed at least once a day more often than males, except in the oldest age group. This evidently follows from the fact that females are more likely to adopt general health-promoting behavior than males [23]. Toothbrushing was strongly associated with educational background of the respondents. This has also been a common finding in the other surveys [7, 8, 11, 22]. The proportion of daily brushers was 76% among 12- to 29-year-olds corresponding very well with the respective proportion in one other study among 12-year-olds in Kuwait [24]. This means that

no progress in this oral health behavior of children has occurred after that.

Dental Visits

Annual dental visits of children were at a very low level internationally [11, 25, 26]. Among middle-aged adults, the percentage of those who had visited the dentist during the past 12 months was also low internationally. However, the annual dental attendance was even lower in Japan [11]. Among old people, annual dental visits are at a low level in many countries. In Kuwait, every third old person had visited a dentist during the year prior to the survey. Compared to this, lower proportions among old people were found in New Zealand, in Poland and in Indian population groups in the USA [11].

Periodontal Status

The prevalence of soft plaque increased gradually, exceeding 50% among 6-year-olds. The highest prevalence (80%) was found among 25- to 54-year-olds. The prevalence of calculus and gingivitis reached 50% in adolescents and continued to increase through the 35- to 49-year age group. The prevalence of pockets was recorded from the 12-year-olds upwards, and it increased up to 57% among the 50- to 54-year age group. In general, these periodontal findings correspond quite well with the situation elsewhere. Figures in general were higher than in the USA, in Poland and in Germany but were similar to those in Japan, New Zealand and the US Indian populations [11]. However, in the USA national survey (1988–1994), the prevalence was much higher: 92% [27]. Bleeding and pocket figures were also lower in the Kuwait Health Survey than in Yemen, where already among 15- to 19-year-olds bleeding appeared among 86% and pockets among 33% [28].

Dental Caries in Primary Teeth

The caries prevalence in primary dentition seemed to be very high, and almost all caries were untreated. The mean dmft for 6-year-olds was 3.9, whereas it had been 7.5 in another Kuwaiti study in 1982 [12] and later 1.4 in 1993 [13]. The caries experience in primary teeth of 6-year-olds was about the same in Oman (4.6) [15] and in one Saudi Arabian study (5.7) [29]. A study concerning one private school in Kuwait in 1993 revealed about the same caries experience figures for the age groups of 3–7 years [30].

Dental Caries in Permanent Teeth

The caries prevalence was also high in permanent dentition and these cases were largely untreated. The caries experience at the age of 6 was 0.2 compared to 0.4 in the earlier national survey in 1982 [12] and 0.2 in 1993 [13]. The respective DMFT figure among 12-year-olds was 1.8 in this study compared to 2.0 in 1982 [12] and 2.6 in 1993 [13]. In the neighboring countries, the DMFT figures of 12-year-olds were somewhat lower than in this study, e.g. 1.5 in Oman [14], or higher as in Saudi Arabia, 3.6 [29] and 2.9 [16].

In this study, DMFT among 12- to 14-year-olds was between 1.8 and 2.5 compared with the results of ICS II surveys where the DMFT score was higher in Yamanashi, Japan (5.6), in IHS Navajo, USA (3.7), and in Erfurt, Germany (3.1), but lower in Baltimore, USA (1.7), and in New Zealand (2.4) [11]. The DMFT among 35- to 44-year-olds was 8.6 and for 65-year-olds and over 22.8. These figures were much lower than in all sites of the ICS II survey, in which the DMFT for 35- to 44-year-olds varied from 11.7 to 20.6 and for 65- to 74-year-olds between 23.7 and 28.8.

When comparing the caries figures with the national surveys in the USA [31], the proportion of caries-free children is lower in Kuwait in primary dentition, but about the same in the age groups of 8–13 years. In the older age groups, the proportion of caries-free children is lower in Kuwait than in the USA. Likewise, the DMFT (1.8) of the WHO index age group of 12 years was lower than in the USA [31].

Prevalence of Dentures

The proportion of adults wearing dentures increased gradually from the 20- to 24-year age group (0.8%) up to the 60- to 64-year age group (60.3%). The total prevalence of dentures among adults over 20 years was 12.1% compared to 20% in the UK survey in 1978 [32]. The prevalence of dentures among 35- to 44-year-olds was 10.1%, whereas it was higher in Poland (25%), in New Zealand (24%) and in Germany (23%), and lower in IHS Navajo, USA (4%), in Japan (7%) and in Baltimore, USA (9%) [11]. In the oldest age group, the prevalence was 50.6%, where it was 36% in IHS Navajo, USA, 54% in IHS Lakota, USA, 63% in Baltimore, USA, 70% in Poland, 84% in Germany as well as in New Zealand. Evidently the need for prosthetic treatment in Kuwait will increase when the currently younger high-caries age groups will get older.

Conclusion

Based on the data of 1985, preventive programs for periodontal diseases and for dental caries appear to be urgently needed. The coverage of curative care of both diseases also needs to be improved. Health behavior improvement should be targeted by oral health promotion activities.

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References

- Graves RC, Stamm JW: Oral health status in the United States: Prevalence of dental caries. *J Dent Educ* 1985;49:341–353.
- Miller AJ, Brunelle JA, Carlos JP, Brown LJ, Loe H: Oral Health of United States Adults: National Findings. Washington, National Institute of Health Research, 1987, NIH Publication No 87-2868.
- Gray PG, Todd JE, Slack GL, Bulman JS: Adult Dental Health in England and Wales in 1968. London, Her Majesty's Stationary Office, 1970.
- Todd JE: Children's Dental Health in England and in Wales 1973. London, Her Majesty's Stationary Office, 1975.
- Todd J, Walker A, Dodd P: Adult Dental Health. London, Her Majesty's Stationary Office, 1982, vol 2: United Kingdom 1978.
- Medical Affairs Bureau, Ministry of Health and Welfare: Report on the Survey of Dental Diseases, 1963–1969. Tokyo, Japan Dental Association, 1971.
- Håkansson J: Dental Care Habits, Attitudes towards Dental Health and Dental Status among 20–60 Year Old Individuals in Sweden; thesis University of Lund, 1978.
- Kirkegaard E, Borgnakke WS, Gronbaek L: Tandsygdomme, behandlingshøj og tandpleje-vane hos et repræsentativt udsnit af den voksne danske befolkning. Århus, Århus Tandlegeskol, 1986.
- Barnes DE, Infirri JS: WHO activities in oral epidemiology. *Community Dent Oral Epidemiol* 1977;5:22–29.
- Arnlot HA, Barnes DE, Cohen LK, Hunter PBV, Ship II: Oral Health Care Systems: An International Collaborative Study Coordinated by the World Health Organization. London, Quintessence Publishing Co, 1985.
- Chen M, Andersen RM, Barnes DE, Leclercq M-H, Lyttle CS: Comparing Oral Health Care Systems: A Second International Collaborative Study. Geneva, World Health Organization, 1997.
- Glass RL: Kuwait National Dental Health Survey. Part I. The Oral Health of School Children 6–16 Years of Age in Kuwait 1982. Kuwait, Ministry of Health, 1982.
- Vigild M, Skougaard M, Hadi RA, Al-Zaabi F, Al-Yaseen I: Dental caries and dental fluorosis among 4-, 6-, 12- and 15-year-old children in kindergartens and public schools in Kuwait. *Community Dent Health* 1996;13:47–50.
- Al-Ismaily M, Al-Khussaiby A, Chestnutt IG, Stephen KW, Al-Riyami A, Abbas M, Knight M: The oral health status of Omani 12-year-olds – A national survey. *Community Dent Oral Epidemiol* 1996;24:362–363.
- Al-Ismaily M, Chestnutt IG, Al-Khussaiby A, Stephen KW, Al-Riyami A, Abbas M, Knight M: Prevalence of dental caries in Omani 6-year-old children. *Community Dent Oral Epidemiol* 1997;14:171–174.
- Al-Tamimi S, Petersen PE: Oral health situation of schoolchildren, mothers and school-teachers in Saudi Arabia. *Int Dent J* 1998;48:180–186.
- Akpata ES, Al-Shammery AR, Saeed HI: Dental caries, sugar consumption and restorative dental care in 12–13-year-old children in Riyadh, Saudi Arabia. *Community Dent Oral Epidemiol* 1992;20:343–346.
- Al-Mughery AS, Akkwood D, Blinkhorn A: Dental health of 5-year-old children in Abu Dhabi, United Arab Emirates. *Community Dent Oral Epidemiol* 1991;19:308–309.
- Al Shammery A, El Backly M, Guile EE: Permanent tooth loss among adults and children in Saudi Arabia. *Community Dent Health* 1998;15:227–280.
- WHO: Oral Health Surveys: Basic Methods. Geneva, World Health Organization, 1977.
- Holmgren CJ: CPITN – Interpretations and limitations. *Int Dent J* 1994;44:533–546.
- Vehkalahti M, Paunio IK, Nyyssönen V, Aromaa A: Oral Health in the Adult Finnish Population and Associated Factors. Helsinki and Turku, Publications of the Social Insurance Institution, 1991, AL:34, pp 252.
- Verbrugge LM: The twain meet: Empirical explanations of sex differences in health and mortality. *J Health Soc Behav* 1989;30:282–304.
- Vigild M, Petersen PE, Hadi R: Oral health behaviour of 12-year-old children in Kuwait. *Int J Paediatr Dent* 1999;9:23–29.
- Honkala E, Kuusela S, Rimpelä A, Rimpelä M, Jokela J: Dental services utilization between 1977 and 1995 by Finnish adolescents of different socioeconomic levels. *Community Dent Oral Epidemiol* 1997;25:385–390.
- Ahacic K, Barenthin I, Thorslund M: Changes in Swedish dental health 1968–91. *Swed Dent J* 1998;22:211–222.
- Albandar JM, Kingman A: Gingival recession, gingival bleeding, and dental calculus in adults 30 years of age and older in the United States, 1988–1994. *J Periodontol* 1999;70:30–43.
- Mengel R, Eigenbrodt M, Schünemann T, Florés-de-Jacoby L: Periodontal status of a subject sample of Yemen. *J Clin Periodontol* 1996;23:437–443.
- Magbool G: Prevalence of dental caries in school children in Al-Khobar, Saudi Arabia. *ASDC J Dent Child* 1992;59:384–386.
- Murtomaa H, Al Za'abi F, Morris RE, Metsäniitty M: Caries experience in a selected group of children in Kuwait. *Acta Odontol Scand* 1995;53:389–391.
- Caplan DJ, Weintraub JA: The oral health burden in the United States: A summary of recent epidemiologic studies. *J Dent Educ* 1993;57:853–862.
- Todd JE, Walker AM: Adult Dental Health. London, Her Majesty's Stationary Office, 1980, vol 1: England and Wales 1968–1978.