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# Dental caries experience of Kuwaiti schoolchildren

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***Objective*** This study was designed to measure the dental caries experience of Kuwaiti schoolchildren. ***Methods*** A national epidemiologic survey of the 5-14 year old children (n = 4,588) was conducted in the 5 governorates of Kuwait in 2001. Eight trained and calibrated dentists examined the children. Dental caries was scored using WHO criteria. ***Results*** In the primary dentition, the percentage of 5- and 6-year-old children with dft = 0 was 12.6% and 14.4% respectively. The corresponding mean dft/dfs for 5- and 6-year-olds were 4.6/9.7 and 4.6/9.9. For the permanent dentition, the percentage of 12- and 14-year-old children with DMFT = 0 was 26.4% and 21.7% respectively. The corresponding mean DMFT/DFS figures for 12- and 14-year-olds were 2.6/3.4 and 3.9/4.2. The d/D component was the major contributor to these mean scores. Poor oral hygiene (OR = 2.0; 95% CI = 1.7 - 2.4) and increasing age (OR = 1.4; 95% CI = 1.3 - 1.5) were significantly associated with caries risk in the permanent dentition. ***Conclusions*** Caries levels are similar to those in neighbouring and other Middle East countries. There is a clear need for expanding the national school oral health programme to reach those children who are not yet receiving systematic preventive and curative services. Further studies are required to monitor the effect of the extensive caries preventive programme now in place in Kuwait.

*Key words: dental caries, Kuwait, schoolchildren*

## Introduction

According to the United States surgeon general's report, dental caries continues to be the most common chronic disease of childhood and one of the major causes of tooth morbidity (U.S. Department of Health and Human Services, 2000). In many developing countries, the prevalence of dental caries has been increasing including the Middle East (Petersen, 2004). However, there has been a dramatic decline in caries experience of children in most of the industrialized countries during the last two decades (WHO, 2006). A general trend towards further caries decline has been shown in a review of caries levels in Europe between 1990 and 1995 (Marthaler et al., 1996), in USA (Beltrán-Aguilar *et al.*1999), Canada (Speechley and Johnston, 1996) and Australia (Davies et al., 1997). Caries decline has been attributed to the various preventive regimens, including community water fluoridation, widespread use of fluoride toothpastes and rinses coupled with changing living conditions, life styles and improved self-care practices (Petersen, 2004.). Though there have been continuing reductions in dental caries in permanent teeth among children and adolescents over the past few decades, caries prevalence in the primary dentition may have stabilized or increased slightly in some population groups (Petersson and Bratthall, 1996).

In Kuwait, the population is currently 2.8 million, of which 1 million are native Kuwaitis out of which 40.5% are Kuwaiti children under 15 years (Public Authority for Civil Information, 2004). There is a national system of health care; all the children have access to oral health care located in clinics, polyclinics, specialist centres and hospitals. Simultaneously dental care is also expanding in the private sector. In addition, the Ministry of Health has implemented a school-based WHO systematic oral health care programme for kindergarten and the primary grade Kuwaiti schoolchildren. Specific dental preventive projects targeted to the children were initiated in the mid -1980's and were expanded after the Gulf war, in 1991. The national oral service of Kuwait was curative/extraction-based prior to 1992 and only limited prevention programmes were available to schoolchildren before 1994. All the 6 governorates of the country now have children's oral health programmes labelled as the National School Oral Health Programme. This programme now covers approximately 250,000 children between 5- 15 years and involves oral health education, oral hygiene instructions, supervised toothbrushing, application of topical fluorides, fissure sealants and as well as restorative measures treating established caries lesions in school based clinics and programme centres throughout the country.

Kuwait is one of the few countries in the Gulf region, where national oral health surveys have been conducted. The first comprehensive national oral health survey (n = 4,853) was conducted in 1982 among 5- to 16-year-old children (Glass, 1982), and the second data set is from the national health survey in 1985 which covered 7,704, 5-14 year-olds (Behbehani and Shah, 2002). The third national oral health survey in 1993 (n = 3,484) covered 4-, 6-, 12- and 15-year-olds (Vigild *et al.,* 1996). Several regional studies have also been conducted by different school oral health programmes and their main purpose has been monitoring the service system in each governorate. Some children's oral health surveys of different age groups have also been conducted in the other Middle-East countries including Oman (Al-Ismaily *et al.,* 1996; 1997),

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Saudi Arabia (Al-Shammery *et al.,* 1990; Al-Khateeb *et al.,* 1991; Akpata *et al.,* 1992; Magbool, 1992; Al-Tamimi and Petersen, 1998; Al-Shammery, 1999) and the United Arab Emirates (Al Mughery *et al.,* 1991).

The aim of this national dental survey was to determine the caries-free proportions, caries experience and restorative care among Kuwaiti schoolchildren in government schools in the five different governorates (Ahmadi, Farwaniya, Hawally, Jahra, Capital). A second aim was to compare these findings with those reported from previous national and international surveys.

## Methods

The survey was conducted in 2001. Ethical approval for this study was obtained from the Forsyth Institute Institutional Review Board for human subjects. Informed consent was signed by the parents/guardians of the children in the sample. The target population included all Kuwaiti children in the primary and intermediate grades with an age range of 5 to 14 years. A stratified, multistage, probability sample of 2.5% of the target population was drawn from each census region. In total 4,588 schoolchildren (2,303 boys and 2,285 girls) were clinically examined. The percentage of subjects drawn from each governorate ranged from 17.6% in the Capital to 27.4% in Hawally, depending upon the number of children in each governorate. In Kuwait, however not all children in the 5- and 14-year-old age groups attend school, hence the sample numbers selected in these age groups were low and representative of Kuwaiti children attending schools in these age groups (Table 1).

The field staff consisted of eight teams and a coordinator. Each team included an examining dentist, a recorder who was a dental hygienist, and a dental assistant. A specially created optical scan recording form was utilized and written diagnostic criteria as well as standardized examination procedures were adopted. Each examination team worked independently in the various schools. The examinations were carried out in the school dental clinic or in a school health room utilizing portable equipment. Dental caries was diagnosed using a WHO ball tip probe and a mouth mirror utilising the criteria recommended by WHO (WHO, 1997) and recorded using the tooth and surface based indices for the primary dentition (dft and dfs) and for the permanent dentition (DMFT and DFS). The restorative care index was defined as the proportion of the dft/DMFT attributable to the f/F component. No radiographs were taken. Oral hygiene status was recorded using the simplified oral hygiene index (OHI-S) and the Debris index (DI-S) of Green and Vermillion (1964) .

Prior to the initiation of the survey the examiners and recorders were trained and calibrated by a consultant examiner from the Forsyth Institute (PS) according to WHO criteria (WHO, 1997). Examiners and assistants were standardized through a series of training exercises to finalise the diagnostic criteria. Intra and inter-examiner reliability of the caries diagnoses measured by the kappa statistic was 0.85. During the course of the survey, a coordinator visited the various examination teams on a regular basis to review the diagnostic criteria and examination procedures, and to discuss any problems which may have arisen. Duplicate examinations were completed by each examiner on about 10 percent of their subjects during survey and the kappa statistic was 0.85.

Data were analysed using the statistical software SPSS, Windows version 12.0. Descriptive statistics including means and standard deviations were calculated for the caries indices. Kruskal Wallis test was used to test the differences in caries levels between the governorates and age. Caries was recoded as present or absent for categorical analysis. Chi-square test was used to assess the association between the percentage of children with dmf/DMF=0 by age, gender and governorate. Multivariate analysis (logistic regression) was used to assess the risk factors for caries prevalence in permanent teeth (caries absent DMF=0; caries present DMF>0) with gender, oral hygiene and age as covariates. Odds ratios (OR) with 95% confidence intervals were also calculated.

## Results

In the primary dentition, the percentage of children with dft=0 amongst 5- and 6-year-olds was 12.6% and 14.4% respectively (Table 2). Amongst 6-year-olds, these percentages varied from 3.8% in Ahmadi to 23.9% in Farwaniya ($p<0.001$) (Table 3).

In the permanent dentition, the percentage of children with DMFT=0 amongst 12 and 14-year-olds were 26.4% and 21.7% (Table 4). Considerable variation was observed between the governorates (Figure 1). The percentage of 12-year-olds with DMFT=0 varied from 2.5% in Ahmadi to 38.6% in Farwaniya ($p<0.001$) (Table 5). In the 14-year-olds, these percentages varied from 0.0% in Ahmadi to 43.5% in Farwaniya ($p=0.004$).

The mean dft was 4.6 among 5- and 6- year-olds (Table 2). In the 6-year-olds the caries experience was highest in Ahmadi (6.9/15.8) and lowest in Jahra (3.1/6.6) ($p<0.001$) (Table 3).

The mean DMFT increased from 0.3 at the age of 5 to 3.9 at the age of 14 ($p<0.001$) (Table 4). The corresponding DFS was 0.2 to 5.2. DMFT among 6-year- olds was 0.4, among 12-year-olds 2.6 and 14-year-olds 3.9. DFS was 0.4 and 3.4 and 5.2 respectively in these age groups. The mean DMFT and DFS values amongst 12-year-olds were highest in Ahmadi (5.2/6.4) and lowest in Farwaniya (1.4/1.8) ($p<0.001$) (Table 5). In the 14-year-olds also the caries experience was highest in Ahmadi (7.7/9.9) and lowest in Farwaniya (1.6/2.1) ($p<0.001$) .

Using multivariate analysis it was found that in the permanent dentition, poor oral hygiene (OR = 2.0; 95% CI = 1.7 - 2.4; $p<0.0001$) and increasing age (OR = 1.4; 95% CI = 1.3 - 1.5; $p<0.0001$) were significantly associated with caries risk.

In the primary dentition, the restorative index (RI) was 12.8% for 5-year-olds and 18.4% for 6-year-olds. In all governorates, RI in primary dentition were low. The RI was highest in Ahmadi, 26.8% for 6-year-olds and lowest in Jahra, 6.4% for 6-year-olds. In the permanent dentition, RI was evenly distributed among all the age groups; it was 19.2% for 12-year-olds and 18.8% for 14-year-olds. The RI was highest in Farwaniya at 51.6% for 12-year-olds and 53.9% for 14-year-olds and lowest in Jahra, 2.7% for 12-year-olds and 0.0% for 14-year-

**Table 1**. The sample of 5-14-year-olds according to governorate.

| *Governorate* | *Region total* | *Region weight (%)* | *Region sample size (2.5% sample)* |
|---|---|---|---|
| Ahmadi | 34440 | 18.8 | 861 |
| Farwaniya | 32800 | 17.9 | 820 |
| Hawally | 50440 | 27.4 | 1261 |
| Jahra | 33560 | 18.3 | 839 |
| Capital | 32280 | 17.6 | 807 |
| Total | 183520 | 100.0 | 4588 |

**Table 2**. The percentage of 5- and 6-year-old children with dft=0 and the mean dft/dfs and their components in the primary dentition.

| *Age (years)* | *n* | *dft=0* | *dt* | *ft* | *dft* | *ds* | *fs* | *dfs* |
|---|---|---|---|---|---|---|---|---|
| 5 | 95 | 12.6 | 4.1 | 0.5 | 4.6 | 8.3 | 1.4 | 9.7 |
| 6 | 619 | 14.4 | 3.7 | 0.8 | 4.6 | 7.4 | 2.5 | 9.9 |

**Table 3.** The percentage of 6-year-old children with dft=0, the mean caries indices, and restorative care index in each governorate.

| *Governorate* | *Age (years)* | *n* | *dft=0* | *dt* | *ft* | *dft* | *ds* | *fs* | *dfs* | *f/dft%* |
|---|---|---|---|---|---|---|---|---|---|---|
| Ahmadi | 6 | 132 | 3.8 | 5.3 | 1.6 | 6.9 | 10.9 | 4.9 | 15.8 | 26.8 |
| Farwaniya | 6 | 110 | 23.9 | 3.3 | 0.4 | 3.6 | 6.0 | 0.6 | 6.7 | 12.3 |
| Hawally | 6 | 169 | 18.9 | 3.0 | 0.5 | 3.5 | 6.1 | 1.5 | 7.6 | 16.2 |
| Jahra | 6 | 96 | 18.1 | 2.9 | 0.2 | 3.1 | 5.9 | 0.7 | 6.6 | 6.4 |
| Capital | 6 | 112 | 7.2 | 4.2 | 1.4 | 5.6 | 7.8 | 4.5 | 12.2 | 25.0 |

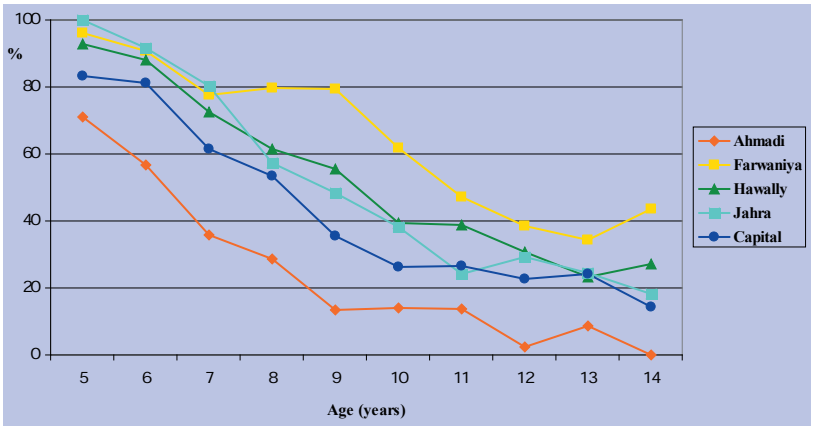


**Figure 1**. *Percentage of children with DMFT=0 by the governorate and age.*

**Table 4**. The percentage of children with DMFT=0 and the mean DMFT/DFS and their components in the permanent dentition according to age (5-14 years).

| *Age (years)* | *n* | *DMFT=0* | *DT* | *MT* | *FT* | *DMFT* | *DS* | *FS* | *DFS* |
|---|---|---|---|---|---|---|---|---|---|
| 5 | 95 | 91.6 | 0.1 | 0.2 | 0.0 | 0.3 | 0.1 | 0.1 | 0.2 |
| 6 | 619 | 87.4 | 0.2 | 0.2 | 0.1 | 0.4 | 0.2 | 0.2 | 0.4 |
| 7 | 642 | 70.6 | 0.4 | 0.2 | 0.1 | 0.7 | 0.5 | 0.4 | 0.9 |
| 8 | 605 | 58.7 | 0.6 | 0.2 | 0.2 | 1.0 | 0.8 | 0.4 | 1.3 |
| 9 | 482 | 48.8 | 0.8 | 0.2 | 0.3 | 1.3 | 1.1 | 0.5 | 1.6 |
| 10 | 569 | 38.1 | 1.2 | 0.2 | 0.3 | 1.7 | 1.6 | 0.5 | 2.0 |
| 11 | 536 | 31.5 | 1.5 | 0.1 | 0.4 | 2.0 | 2.0 | 0.6 | 2.6 |
| 12 | 531 | 26.4 | 1.9 | 0.1 | 0.6 | 2.6 | 2.6 | 0.8 | 3.4 |
| 13 | 412 | 24.3 | 2.4 | 0.1 | 0.5 | 3.0 | 3.1 | 0.7 | 3.9 |
| 14 | 97 | 21.7 | 3.2 | 0.1 | 0.6 | 3.9 | 4.4 | 0.8 | 5.2 |

**Table 5.** The percentage of 12-year-old children with DMFT=0, the mean caries indices, and restorative care index in each governorate.

| Governorate | Age (years) | n | DMFT=0 | DT | MT | FT | DMFT | DS | FS | DFS | F/DMFT% |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ahmadi | 12 | 85 | 2.5 | 3.7 | 0.4 | 1.1 | 5.2 | 4.9 | 1.6 | 6.4 | 20.2 |
| Farwaniya | 12 | 83 | 38.6 | 0.6 | 0.1 | 0.7 | 1.4 | 0.9 | 1.0 | 1.8 | 51.6 |
| Hawally | 12 | 147 | 30.6 | 1.7 | 0.0 | 0.2 | 1.9 | 2.3 | 0.3 | 2.6 | 10.3 |
| Jahra | 12 | 106 | 29.2 | 1.6 | 0.0 | 0.0 | 1.7 | 2.0 | 0.0 | 2.1 | 2.7 |
| Capital | 12 | 110 | 22.7 | 2.3 | 0.1 | 1.1 | 3.4 | 3.2 | 1.5 | 4.7 | 23.9 |

olds. Clearly more restorative care was provided in the schools with dental clinics compared with schools without them; the RI over the age range of 6-10 years varied from 17% to 33% in the schools with the clinics and from 2% to 19% in the schools without the clinic. The mean number of occlusal caries in children with sealants was less than in those without them; among the children without the sealants, the values varied from 0.5 to 3.2 and among the children with one or more sealants, they varied from 0.2 to 2.0

## Discussion

This is a national dental epidemiologic survey of the 5-14 year old Kuwaiti schoolchildren and the caries levels recorded among 5- and 6-year-olds at 4.6 in this study can be compared with similar national studies conducted in the past twenty years. The mean dmft for 6-year-olds recorded by Glass (1982) and by Vigild *et al.* (1996) conducted in 1993 were 7.5 and 6.2 respectively were considerably higher than the figure reported in this study. However, the study undertaken by Behbehani and Shah in 1985 revealed a substantially lower figure at 3.9 and by Murtomaa *et al.*,(1995) conducted in 1993 in one private school reported a mean dmft 4.1. The caries experience in primary teeth of 6-year-olds was the same as in Oman (4.6) (Al-Ismaily *et al.,* 1997). Higher figure was reported in 5-year-olds in United Arab Emirates 5.1 (Al Mughery *et al*., 1991.) and in 6-year-olds in Saudi Arabia (5.1) (Magbool, 1992) and 6.4 (Al-Tamimi and Petersen, 1998.). In Syria, the caries experience of 5-year-old children has also been high (dmft 4.7-5.2) (Beiruti and van Palenstein Helderman, 2004). About 14.4% of the 6-year-olds were caries-free in this study but higher proportions, 21% were caries-free in 1982 (Glass, 1982) and 20% in 1993 (Murtomaa *et al.,* 1995). However, in 1993 only 9% of the 6-year-olds were caries-free (Vigild *et al.,* 1996). The caries-free proportion is similar to the 15.5% of the 6-year-olds in Oman (Al-Ismaily *et al.,* 1997). The percentage of caries-free 6-year-old children is very low compared to the WHO goal of 50% by the year 2000 (WHO, 1988) and in Europe, United Kingdom, Nordic countries and United States (Whelton *et al.,* 2004; Downer *et al.,* 2005).

The mean DMFT among 12-year-olds was 2.6 in this study. These caries levels were lower in the earlier studies, 2.0 in Kuwaiti and non-Kuwaiti children in 1982 (Glass, 1982) and 1.8 in 1985 (Behbehani and Shah, 2002). The caries level was similar, 2.6 in 1993 (Vigild *et al.,* 1996). In the neighbouring countries, the DMFT figures of 12-year-olds were lower than in this study, 1.5 in Oman (Al-Ismaily *et al.,* 1996), 1.6 in United Arab Emirates (Nithila *et al.,* 1998), or higher as in Saudi Arabia, 2.9 (Al-Tamimi and Peterson, 1998), 3.6 (Magbool, 1992), or varied from 1.5 to 2.1 in private schools and 1.8 to 5.1 in public schools (Al-Khateeb *et al*., 1991). There was no change in the mean DMFT scores of the 12-year-olds between 1988 and 1998 in the Middle Eastern Crescent (Cleaton-Jones, 2001). The caries experience in 12-year-old Kuwaiti children falls

within the "low" category (DMFT 1.2-2.6), as defined by the World Health Organisation (WHO, 1988), and is within the global goal of three or less decayed, filled or missing teeth at age 12 by the year 2000. The mean DMFT has been comparably lower in United Kingdom, Ireland, Nordic countries, Scandinavia, United States and remarkably higher in Czech Republic, Russia, Poland, Slovakia and Romania (Whelton *et al.,* 2004; Downer *et al.* 2005; WHO, 2006). About 26.4% of 12-year-olds were caries-free in this study. In the earlier study in 1982 higher percentage 35% were caries-free (Glass, 1982) and in 1993 only 21% were caries-free (Vigild *et al.,* 1996).

The high dental caries prevalence parallels the socio-economic development, change in cultural habits since the 1970s rise in oil prices and may be related to the diet rich in refined carbohydrates. Frequent consumption of sugars, especially sweets, fruit drinks and desserts is reported high in Kuwait (Petersen *et al.,* 1990) and daily consumption of sweets was very common among schoolchildren and increased with age. The majority of caries experience was in the form of untreated decay in this study indicating high level of restorative treatment need as in other Middle East surveys (Al-Khateeb *et al.,* 1991; Akpata *et al.,* 1992; Magbool, 1992; Al-Ismaily *et al.,* 1996; 1997; Al-Shammery, 1999). The restorative care index in the 6-year-olds was 18.4%, which is much higher than 0.4% reported in 6-year-old Omani children (Al-Ismaily *et al.,* 1997). From a policy point of view, there is high level of untreated decay and treatment need. It is interesting to note that the highest restorative index was in the governorate with highest caries experience (Ahmadi) and lowest in the governorate with lowest caries experience (Jahra) in the primary dentition. In the permanent dentition, about 20% of affected teeth and 22% of affected surfaces have been treated for all children combined.

It is evident from this study that although the restorative care has increased considerably, there are wide variations in caries experience and in the delivery of restorative care between the governorates. The reason for these regional differences in the caries experience between the governorates is unclear and further research is indicated. In the permanent dentition, the percentage of restorative care in Farwaniya was over 50%. This may be as Farwaniya has clinics in all the primary schools. The lower percentage of restorative index in Jahra may be due to the fewer school clinics in this governorate than in the other. These findings point to unevenness in the distribution of programme resources and should be given careful consideration in the future planning. The restorative care index is about 2-3 times higher in the children attending school clinics than those in schools without clinics and when compared to the previous national oral health survey in 1982 (Glass, 1982) has increased considerably in all age groups. For all ages combined the tooth based restorative rates were 3% in 1982 and 19% in the present study and the surface index rates were 5% in 1982 and 22% in this study.

Preventive services should be given high priority and needs to be at an earlier age to target the primary dentition, and future caries in permanent dentition. Supervised programmes of fluoride supplementation, toothbrushing programmes should be reinforced in schools, and the use of topical fluoride varnishes should be recommended. Re-introduction of the water fluoridation programme, discontinued since 1980, should be reconsidered in Kuwait. Oral health education and follow-up of the pregnant women, mothers of infants and teachers seem essential. Efforts should to be made to reduce the high consumption of cariogenic foods in schoolchildren. More emphasis on preventive care is required for achieving an increase in caries-free proportions and for gaining the declining trend of caries among schoolchildren in Kuwait. With the extensive preventive programme now in place it is likely that the current high levels of caries will decline in future years.

## Conclusion

Caries levels are similar to those in neighbouring and other Middle East countries. There is a clear need for expanding the national school oral health programme to reach those children who are not yet receiving systematic preventive and curative services. Further studies are required to monitor the effect of the extensive caries preventive programme now in place in Kuwait.

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