Oral health of Iranian children in 2004: a national pathfinder survey of dental caries and treatment needs

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صحة الفم لدى الأطفال الإيرانيين في عام 2004: مسح استكشافي وطني لتسوّس الأسنان والاحتياجات العلاجية

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الخلاصة: استهدف هذا المسح الثاني على النطاق الوطني في عام 2004 وصف حالة صحة الفم للأطفال في جمهورية إيران الإسلامية وتوفير معطيات قاعدية لتنظيم وتقييم البرنامج الوطني لتعزيز صحة الفم. واتُّبِعَتْ الإجراءات الاستكشافية التي وضعتها منظمة الصحة العالمية في اختيار العينات الممثّلة للأطفال في عمر 3، 6، 9، 12 سنة. وجُمِعَت المعطيات حول الأسنان المنخورة والمفقودة والمحشُوَّة، ومعدَّلات الخلو من التسوّس، والاحتياجات العلاجية من 18946 طفلاً باتِّباع الطرق المعيَارية لمنظمة الصحة العالمية. وكان متوسط معدلات النخر والفقدان والحشو للأسنان 1.9/ – لعمر ثلاث سنوات، و0.2/ 5.0 لعمر ست سنوات، و0.9/ 3.6 لعمر تسع سنوات، 1.9/ 0.6 لعمر اثنتَيْ عشرة سنة. وتبين وجود اختلافات يُعتدُّ بها إحصائياً في انتشار تسوّس الأسنان تبعاً للجنس، والمنطقة، ومكان الإقامة في الحضر أو الريف، ودخل الأسرة، ومستوى تعليم الوالدين.

ABSTRACT A second nationwide survey in 2004 aimed to describe the oral health status of children in the Islamic Republic of Iran and to provide baseline data for the organization and evaluation of the national oral health promotion programme. WHO pathfinder sampling procedures were used to select representative samples of children aged 3, 6, 9 and 12 years. Data on decayed/missing/filled teeth, caries-free rates and treatment needs were collected from 18 946 children using WHO standard methods. The mean dmft/DMFT indices were 1.9/– for 3-year-olds, 5.0/0.2 for 6-year-olds, 3.6/0.9 for 9-year-olds and 0.6/1.9 for 12-year-olds. Significant differences in dental caries prevalence were found according to sex, province, urban/rural residence, family income and parents' level of education.

Santé bucco-dentaire des enfants iraniens en 2004 : une enquête exploratoire nationale sur les caries dentaires et les besoins thérapeutiques

RÉSUMÉ En 2004, une deuxième enquête à l'échelle du pays visait la description de l'état de santé bucco-dentaire des enfants en République islamique d'Iran et la production de données de référence pour l'organisation et l'évaluation du programme national de promotion de la santé bucco-dentaire. Les procédures d'échantillonnage recommandées par l'OMS dans les enquêtes exploratoires ont été utilisées pour sélectionner des échantillons représentatifs d'enfants âgés de 3, 6, 9 et 12 ans. Les données sur les dents cariées/absentes/obturées, le taux de dents saines et les besoins thérapeutiques ont été recueillis à partir de 18 946 enfants, conformément aux méthodes classiques préconisées par l'OMS. L'indice moyen de dents cariées, absentes ou obturées (dcao pour la première dentition/DCAO pour la dentition permanente) était de 1,9/– pour les enfants de trois ans, de 5,0/0,2 pour les enfants de six ans, de 3,6/0,9 pour les enfants de neuf ans et de 0,6/1,9 pour les enfants de douze ans. Des différences significatives dans la prévalence des caries dentaires ont été observées en fonction du sexe, de la province, du lieu de résidence en milieu urbain ou rural, des revenus familiaux et du niveau d'instruction des parents.

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Introduction

Rapid development and modernization in the Eastern Mediterranean countries has led to changes in lifestyle and diet that are likely to have an effect on oral health. Poor oral health profoundly affects a person's quality of life [1,2]. The dental health care system in the Islamic Republic of Iran is an integrated public health system with a 4-level dental health care system from basic oral health care services in rural health houses and health centres to advanced treatments at university health centres in the bigger cities. More than 13 000 dentists practice nationwide (1 dentist:5500 population). There are also about 1200 specialists working in universities and private practices [3].

The oral health status of children is determined by the prevalence of dental caries and an assessment of periodontal health status [4]. The inclusion of the national oral and dental health care programme into the primary health care system of the Islamic Republic of Iran began in 1995 [5]. For the first time at a national level, the oral health department of the Ministry of Health determined the decayed/missing/filled teeth (DMFT) index of 12-year-old Iranian children the same year. The mean DMFT was 2.0, which indicated that the oral health status of this age group could be classified in the low range (mean DMFT 1.2–2.6) compared with other countries worldwide, and this was consistent with the oral health goals set by the World Health Organization (WHO) for 2000, albeit far from the goals set for 2020 [6].

Two years after the establishment of the national oral and dental health care programme, the national students' oral and dental health care programme was introduced which focused on the early school-age groups throughout the country, especially in terms of preventive measures including oral health and diet education. A second national oral health survey was conducted by including the age groups 3, 6 and 9 years the same year. The DMFT of 12-year-olds was calculated as 1.5, which showed a dramatic change in the oral health of the Iranian children and supported the effectiveness of the nationwide oral health care programmes [5,7]. The survey reported here was conducted in 2004 to evaluate the oral health status and dental care needs of Iranian children aged 3, 6, 9 and 12 years. By comparing these findings with the earlier national survey performed in 1998 and the results of other local surveys on 6- and 9-year-old children during 1998–2004, we aimed to estimate the efficacy of the dental health care programmes in the Islamic Republic of Iran.

Methods

Study design

Four age groups of children were selected for this national pathfinder survey of children in 2004: 3 years (the age when the first signs of carious lesions tend to be encountered); 6 years (the age of school entry in the Islamic Republic of Iran); 9 years (the age when the deciduous dentition is almost completely replaced); and 12 years (the age at which children leave primary school and therefore the last age at which a reliable sample could be obtained easily through the school system). The 3-year-old children were those between their 3rd and 4th birthdays, the 6-year-olds between their 6th and 7th birthdays, etc. The surveys of 3- and 12-year-olds were carried out from 21 February to 20 April 2004 and of 6- and 9-year-olds from 21 February to 21 May 2004.

Sampling

For 6- and 9-year-old children, a cluster multistage probability sampling was performed to provide nationally representative data. Based on WHO recommendations for pathfinder national survey methods [8], a population of 300 is sufficient for the study of DMFT. However, when sampling a population with low DMFT level it is possible to reduce the cluster number to 20 (×15) or at least 12 (×25). Since the DMFT of Iranian 12-year-old children was considered to be low according to the earlier survey, it was decided to reduce the cluster number. On the other hand, 3- and 12-year-olds were studied at the national level and 6- and 9-year-olds were studied at the province level. Therefore sample sizes were optimized for each age group.

The sampling was based on the administrative divisions of the country (28 provinces, including the capital city, Tehran, the main urban centres within each province and small towns or rural areas within each province). The first stage of the design consisted of selecting a sample of 349 primary sampling units (PSUs). Except for the capital, 12 PSUs were selected in each of 27 provinces and 24 PSUs were selected in Tehran (10% of the national population). A sample of 25 children was selected for each 6- and 9-year-old PSUs. For the 3- and 12-year-old children, 50 clusters were selected based on the population of the provinces and 15 children aged 3 or 12 years were selected in each cluster.

Oral examinations

Families of the selected children were sent invitation letters to participate in the survey. Oral examinations were performed in the nearest community health centre to the child's house. First a questionnaire was administered to collect demographic data, followed by the clinical examination. A team of dentists trained and calibrated to WHO standards [4] performed all dental examinations. The examiners used front surface mirrors, no. 23 explorers and high-intensity artificial lighting. Data on decayed, missing and filled teeth (primary and deciduous) were recorded, excluding third molars. Trained oral hygienists entered dental examination information into a 1-page dental chart.

Tooth condition was coded differently for permanent (DMFT) and deciduous teeth (dmft). Dean's index was used to record fluorosis. Treatment needs including single/multiple surface filling, stainless steel crown, fissure sealant, endodontic treatment, and extraction were recorded. Caries-free prevalences were calculated by age group [9–11].

The survey protocol was reviewed and approved by the Ministry of Health and Medical Education and the parents of all survey participants signed informed consent forms. Of the 18 950 children sampled 18 946 consented to be examined. All children with dental caries were treated at no charge.

Data analysis

The prevalence of DMFT/dmft was calculated for each age group according to caries risk factors: sex (male versus female), province (27 provinces), and urbanization (rural versus urban). Data were classified and statistically analysed using *SPSS*, version 10. To compare means and percentages, *t*-tests and *z*-tests were used to detect possible significance differences at $\alpha = 0.05$.

Results

Demographic data

Table 1 summarizes the distribution of the study population in the 4 age groups by sex and urban/rural area of residence.

dmft/DMFT indices

The mean dmft/DMFT indices for children in the Islamic Republic of Iran were 1.9/– for 3-year-olds, 5.0/0.2 for 6-year-olds, 3.6/0.9 for 9-year-olds and 0.6/1.9 for 12-year-olds (Tables 2 and 3).

The prevalence of dental caries for 6- and 9-year-olds varied greatly between different provinces. For instance, in 2004, the dmft/DMFT of 6-year-old children ranged from 1.9/0.02 in Hormozgan/Bushehr provinces to 6.6/0.5 in Ilam/Ardebil provinces. The mean dmft/DMFT scores for 9-year-old children ranged from 1.7/0.1 in Bushehr/Hormozgan provinces to 5.1/1.8 in Lorestan/Chaharmahal-o-Bakhtiyari provinces.

3-year-olds

A total of 750 3-year-olds were examined. The overall mean dmft index was 1.9. Boys had a significantly higher mean dmft (2.2) than girls (1.6) ($P < 0.05$) (Table 2) and the index was higher in children living in urban areas (2.1) than those in rural areas (1.5) ($P < 0.05$). Mean filled teeth (ft), missing teeth (mt) and decayed teeth (dt) scores were 0.05, 0.03 and 1.8 respectively.

The prevalence of caries according to the total dt of the population showed that the tooth that was most susceptible to caries was the primary mandibular first molar with a left/right incidence of caries of 21.7%/21.9%. The primary mandibular second molar was ranked second with a caries incidence of 17.1%/19.2% for the lower jaw. The primary mandibular lateral incisors of the lower jaw showed the lowest caries incidence at 0.8%/0.9%.

6-year-olds

A total of 8725 6-year-olds were examined. The mean dmft index was 5.0 (Table 2). Girls had a significantly lower mean dmft than boys (4.6 and 5.3 respectively) ($P < 0.05$). Children living in urban areas had significantly higher dmft index (5.1) than children living in rural areas (4.8) ($P < 0.05$). Dental caries

Table 1 Distribution of the study population by age group, sex and area of residence

Age group (years)	Mean age (years)	Male		Female		Urban		Rural		Total
		No.	%	No.	%	No.	%	No.	%	No.
3	3.5	399	53	351	47	465	62	285	38	750
6	6.8	4697	54	4028	46	4825	55	3900	45	8725
9	9.5	4640	53	4083	47	4849	56	3874	44	8723
12	12.4	378	50	370	50	465	62	283	38	748

Table 2 Mean decayed/missing/filled deciduous teeth (dmft) index of children aged 3, 6, 9 and 12 years by sex and area of residence in Islamic Republic of Iran

Age group (years)	No. sampled	Mean (SD) dmft						
		Total	Boys	Girls	Significance	Rural	Urban	Significance
3	750	1.9 (0.2)	2.2 (0.3)	1.6 (0.3)	$P < 0.05$	1.5 (0.3)	2.1 (0.3)	$P < 0.05$
6	8725	5.0 (0.0)	5.3 (0.0)	4.6 (0.0)	$P < 0.05$	4.8 (0.0)	5.1 (0.0)	$P < 0.05$
9	8723	3.6 (0.0)	3.9 (0.0)	3.3 (0.0)	$P < 0.05$	3.5 (0.0)	3.7 (0.0)	$P < 0.05$
12	748	–	–	–	–	–	–	–

SD = standard deviation.

Table 3 Mean decayed/missing/filled permanent teeth (DMFT) index of children aged 3, 6, 9 and 12 years by sex and area of residence in Islamic Republic of Iran

Age group (years)	No. sampled	Mean (SD) DMFT						
		Total	Boys	Girls	Significance	Rural	Urban	Significance
3	750	–	–	–	–	–	–	–
6	8725	0.2 (0.0)	0.4 (0.0)	0.5 (0.0)	NS	0.2 (0.0)	0.3 (0.0)	NS
9	8723	0.9 (0.0)	0.9 (0.0)	0.9 (0.0)	NS	0.8 (0.0)	1.0 (0.0)	NS
12	748	1.9 (0.2)	1.7 (0.2)	2.0 (0.2)	$P < 0.05$	1.7 (0.2)	1.9 (0.2)	$P < 0.05$

SD = standard deviation; NS = not significant.

comprised the biggest component of dmft for 6-year-old children: dt, mt and ft were 4.4, 0.4 and 0.2 respectively.

The overall mean DMFT index was 0.2 (Table 3). There were no significant differences by sex or rural/urban area. Dental caries were again the biggest portion of DMFT index in 6-year-olds; for every 100 children, an average of 8 fillings, 2 missing and 20 dental caries were detected in their permanent dentition.

The primary first molar was the most decayed among primary teeth with a left/right caries prevalence of 61.0%/62.3% for the lower jaw and 43.4%/58.2% for the upper jaw. The primary second molar had the greatest caries prevalence in the lower jaw with a 54.6%/54.9% rate. Among permanent teeth, the lower first molar showed the highest rate of caries with 7.1%/7.5% in the lower jaw. The incisors and the canines had the lowest rate of caries among permanent teeth at this age.

9-year-olds

A total of 8723 9-year-olds were examined. The mean dmft index in 9-year-olds was 3.6 and there were no significant differences between boys and girls or between rural or urban residents (Table 2). The components of the index were: ft (0.2), mt (0.6) and dt (2.9).

The mean DMFT index in 9-year-olds was 0.9 overall, with no significant differences by sex or urban/rural residence (Table 3). The components of the index were: MT (0.02), FT (0.05) and DT (0.9).

The left/right incidences of caries was highest in the primary second molars in the mandible (47.9%/49.1%), followed by the primary first molars of the mandible (41%/41.4%). Among permanent teeth, lower first permanent molar had the highest caries incidence (27.2%/28.1%). For the lower incisors the values were: centrals 0%/0%; laterals 0.1%/0%, and canine teeth 0.1%/0.1%.

Mild or suspicious fluorosis was noticed in 4.9% of the children and severe fluorosis in 0.6%.

12-year-olds

A total of 748 12-year-olds were examined. The mean DMFT index in children aged 12 years was 1.9. Girls had significantly higher DMFT (2.0) than boys (1.7) ($P < 0.05$) and DMFT values were significantly higher in urban than rural areas (1.9 versus 1.7) ($P < 0.05$). Mean DT, MT and FT values were 1.6, 0.1 and 0.2 respectively.

The first molar had the greatest left/right caries incidence at 27.2%/28.1% in the lower jaw, while incisors (0%/0% and 0.1%/0%) and the canine teeth (0.1%/0.1%) had the lowest caries rate.

Mild or suspicious fluorosis was noticed in 6.6% of the children and severe fluorosis was detected in 1.7%.

Caries-free rates

Table 4 shows the proportion of children who were caries-free in the 4 age groups. Overall 48% of 3-years-olds were caries-free: 42% of boys and 53% of girls ($P < 0.05$). Fewer rural children (41%) than urban children (52%) were caries-free ($P < 0.05$).

Of the children aged 6 years old, 11% were caries-free for both dentitions. Girls (12%) were more significantly caries free than boys (10%) ($P < 0.05$). No

Table 4 Percentage of children aged 3, 6, 9 and 12 years who were caries-free by sex and area of residence in Islamic Republic of Iran

Age group (years)	No. sampled	% of children caries-free						
		Total	Boys	Girls	Significance	Rural	Urban	Significance
3	750	48	42	53	$P < 0.05$	41	52	$P < 0.05$
6	8725	11[a]	10	12	$P < 0.05$	11	11	NS
9	8723	10[a]	9	11	$P < 0.05$	11	9	$P < 0.05$
12	748	32[a]	32	31	NS	35	29	$P < 0.05$

[a]*Both permanent and deciduous dentition.*
NS = not significant.

Table 5 Treatment needs per 100 teeth of children aged 3, 6, 9 and 12 years in Islamic Republic of Iran

Age group (years)	No. sampled	No. of teeth requiring treatment per 100 teeth						
		Single-surface filling	Multi-surface filling	Stainless steel crown	Endodontic therapy	Extraction	Preventive treatment	Fissure-sealant
3	750	72	49	1.2	7	1.4	130	10
6	8725	87	141	7.7	39	67.0	115	45
9	8723	90	69	3.3	20	72.0	107	42
12	748	114	14	0.3	8	23.0	143	50

statistically significant differences were found by sex or residence.

Among all studied 9-year-old children, 10% were caries-free for both dentitions; 11% of girls were caries-free compared with 9% for boys ($P < 0.05$). Also rural areas (11%) had a significantly higher caries-free rate than urban areas (9%) ($P < 0.05$).

More than three-quarters of the children aged 12 years (78%) were caries-free for deciduous teeth, 40% for permanent teeth and 32% for both dentitions. The caries-free rate were not statistically different comparing girls and boys (31% and 32% respectively). The caries-free value was significantly higher in rural (11%) than urban children (9%) ($P < 0.05$).

Treatment needs

Excluding preventive treatments, single surface filling was the highest treatment need of all age groups. In 6-year-olds, however, multisurface filling was the highest treatment need. Table 5 summarizes the treatment need findings for the 4 age groups.

Discussion

This nationwide survey showed that the mean dmft/DMFT indices were 1.9/– for 3-year-olds, 5.0/0.2 for 6-year-olds, 3.6/0.9 for 9-year-olds and 0.6/1.9 for 12-year-olds. Significant differences in dental caries prevalence were found according to sex, province, urban/rural residence, family income and parents' level of education.

We can compare our national data with other local surveys in the Islamic Republic of Iran. Meyer-Lueckel et al. during March to April 2003 examined 593 12- and 15-year-old children in 3 areas in the Islamic Republic of Iran which had varying degrees of urbanization and fluoride in piped water [12]. DMFT values were higher in the cities (1.2 and 1.5 in Tehran and Semnan respectively) than the rural village (0.7). In our survey, the mean DMFT of 12-year-olds in the cities was only slightly higher than for the rural children (1.9 versus 1.7) and the difference was not significant, which may be due to the fact that our study sampled the whole country rather than just a few areas. Meyer-Lueckel et al. also conducted the same study on 523 6- and 9-year-olds in the same cities and village and found comparable dmft rates and caries-free rates between the cities and village, despite differences in fluoridation of the water [13]. This is consistent with our findings that the DMFT values of 6- and 9-year-old children were not significantly different between rural and urban children.

Momeni et al. clinically examined dental caries in 1102 12-year-old children living in Tehran and a rural area outside Isfahan [5]. The overall mean DMFT was 0.77. The rate of caries varied according to children's socioeconomic position. Rural children had significantly lower mean DMFT values (0.38) than children living in Tehran (1.10). The higher DMFT rate in cities in agreement with the findings of Meyer-Lueckel et al., although it should be noted that our data were not statistically significant. In the city of Tehran, Momeni et al. also found marked differences related to social status. The lowest DMFT values (0.74) were found in southern Tehran, where the people were classified in the lowest socioeconomic group. The highest caries index was found in the middle-class social stratum.

In an earlier survey in 1998–99 the percentage of caries-free (deciduous and permanent teeth) children among 6- and 9-year-olds in the Islamic Republic of Iran was 13.8% and 11.5% respectively [14]. This is supported by the findings of the present survey. The percentage of caries-free (deciduous and permanent teeth) children among 6- and 9-year-olds in our study was 11.2% and 10.0% respectively.

Daneshkazemi and Davari examined 1223 randomly selected 12-year-old students in junior high schools of Yazd and Hadi-Shahr of the Islamic Republic of Iran via a descriptive questionnaire-based study to determine the prevalence and distribution of DMFT and enamel hypoplasia [15]. The effect of occupational and educational levels of parents was also examined. The mean DMFT score was 1.8 and 28.6% of the 12-year-olds were caries-free. This is relatively close to our national mean value of 32.0% of 12-year-old caries-free. Consistent with our results, DMFT was not significant associated with sex and parents' education or occupation level. The authors reported that the mean DMFT scores were higher than global standards according to WHO references for the year 2000.

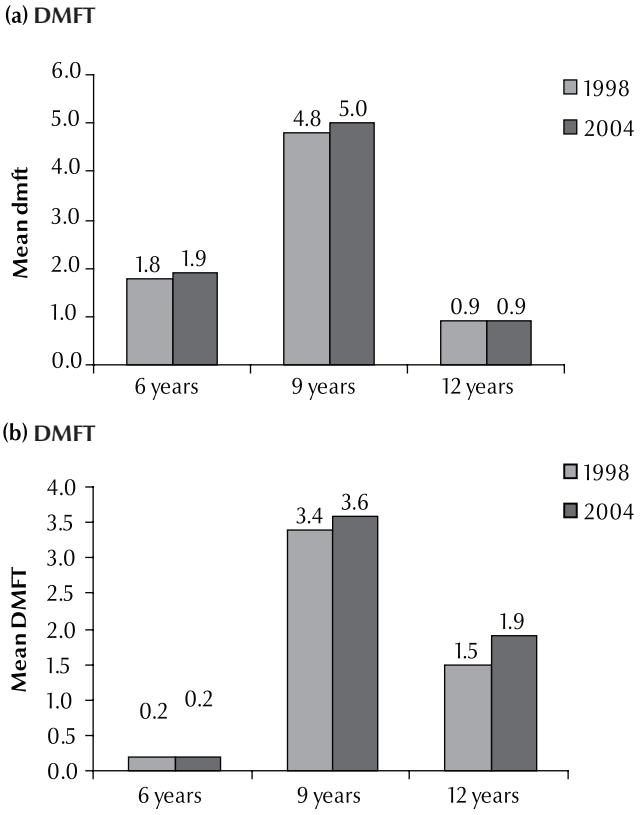

Figure 1 Comparison of the decayed/missing/filled teeth index in deciduous teeth (dmft) and permanent teeth (DMFT) of the 2 successive national pathfinder surveys of oral health in 1998 [14] and 2004 [current survey] in the Islamic Republic of Iran

Figure 1 shows a comparison between the 1998 national pathfinder survey [14] and the current survey in 2004. With similar or slightly higher dmft/DMFT rates in the second survey in 2004 compared with the first national oral health survey in 1998, the figures demonstrate a lack of satisfactory progress towards the standard international values and reflect the ineffectiveness of the national oral health programmes in Islamic Republic of Iran.

Since the time interval between the 2 national surveys in 1998 and 2004 was 6 years, the cohort of children aged 3 and 6 years in the 1998 survey would be in the cohort aged 9 and 12 years in the present survey in 2004. The mean dmft/DMFT scores of 3- and 6-year-old children were 1.8/– and 4.8/0.2 in 1998. The marked difference of the dentition between 3- and 9-year-olds and also between 6- and 12-year-olds makes it unhelpful to track the alterations of mean dmft/DMFT scores. These values were 3.6/0.9 and –/1.9 for the same age group by 2004. Therefore we can conclude that a 3-year interval between the 2 surveys would make it possible to track changes of caries indices in a given population, since the 6-year-olds of the former survey would be the 9-year-olds of the latter and the dentition of the 2 would not have gone through such extreme changes.

The aim of the present study was to provide a national baseline data on the oral health status of children in the Islamic Republic of Iran. Clearly to achieve and maintain a marked decline in DMFT scores, application of well-oriented preventive national oral health programmes are essential.

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Corrections

B. Malekafzali, M. Biria, N. Tadayon and H. Abbasi. Comparison of plaque removal efficacy of new and 3-month-old toothbrushes in children. *Eastern Mediterranean Health Journal*, 2011, 17(2):115–120.
On page 118, column 3, line 19, "0.3" is incorrect and should read "0.03".

Medication prescribing patterns in primary care in Riyadh city, Saudi Arabia. *Eastern Mediterranean Health Journal*, 2011, 17(2):126–179.
In this series of papers, the name of the author M.A. Magzoub should read محي الدين على مجذوب in Arabic.