Research Article

Evaluation of Decay and Filling Dental Index in the 7 Years Old Children of Iran and Its Relationship with Economic Inequity

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Abstract

Objectives: To determine the status of tooth decay and filling, in 7-year-old Iranian children, as well as a relationship with economic inequity

Methods: This cross-sectional study was conducted in 8 cities of Iran using random cluster sampling. In the selected cities, a number of primary schools were considered and all first grade students were evaluated. The data of the dental status of the students were collected from the health IDs completed in the beginning of the educational year.

Results: Of 4614 selected students, 4106 participated in the study (response rate = 89%). The mean number of decayed and filled teeth was 1.7 (1.51 - 1.88) and 0.26 (0.22 - 0.29), respectively. The mean number of decayed (P = 0.330) and filled (P = 0.148) teeth showed no difference between boys and girls. The distribution of the number of decayed (1.16 to 2.06) and filled (0.15 to 0.4) teeth was different in different cities (P < 0.001). Parental education had an inverse and direct relationship with the number of decayed and filled teeth, respectively (P < 0.001). Moreover, 41.62% (37.36 - 45.88) and 16.56% (14.46 - 18.66) of 7-year-old Iranian children had at least 1 decayed and filled tooth, respectively. The concentration index was 0.016 (0.012) for decayed and 0.165 (0.020) for filled teeth.

Conclusions: We evaluated the dental status of 7-year-old Iranian children in this study for the first time. According to our findings, 58% of 7-year-old children have dental problems such as carries as well as fillings. Economic inequity, in the distribution of filled teeth, indicated a high number of filled teeth in the wealthy class of the society.

Keywords: Decay Dental, Filling Dental, Children, Iran

1. Background

It seems that despite the increase in preventive strategies in different countries, oral problems such as dental carries are still a major challenge in all age groups, especially children (1). Although asthma is the most prevalent chronic disorder in children, the dental caries is more prevalent in Australian and American primary schools by a factor of 4 - 5 (2). According to the WHO statistics, about 60% - 90% of the students suffer from dental caries in a global level (3). This disease is associated with different factors such as the bacterial effect (4), level of income and culture of the society (5), living in a single-parent family (6), parental educational level (7), and nutrition and physical conditions of the children like obesity (8). As a result, oral health has become an important entity in WHO programs in different countries (9). The high prevalence of dental caries has negative effects on the quality of life of the children and their parents and imposes heavy costs on the healthcare system of the country (2). Oral health and prevention started in the early 60s, in Europe and USA, and markedly decreased dental caries in children. In Germany, the rate of dental caries in children aged 6 - 7 years decreased markedly from 3.2 ± 3.9 in 2003 - 2004 to 1.8 ± 2.5 in 2012 - 2013, indicating the success of preventive programs (10). DMFT is a factor used by the WHO to assess dental disorders in many epidemiologic studies (11, 12). Studies have shown that the high prevalence of dental caries in different Iranian cities is similar to other developing countries (3, 13, 14). On the other hand, statistics indicate an increase in consuming sweets and obesity in Iranian children, which are major causes of oral and dental diseases, especially dental caries (15, 16). Therefore, we evaluated the prevalence of dental disorders based on the DMFT and its association with the socioeconomic status of the students in different provinces.

2. Methods

The target population of this cross-sectional study was the 7-year-old children (first grade students) living in urban areas of Iran.

In this study, 8 Iranian cities were randomly selected from different geographical areas using multistage cluster sampling. Figure 1 shows the location of the 8 cities on the map of Iran. The cities were selected from different geographic zones, and economic and geographic distribution was considered in sampling. These cities were Sari, Birjand, Ardebil, Mashhad, Bandar Abbas, Dezful, Arak, and Yazd. In each city (cluster), an equal number of boys and girls schools were randomly selected. Then, in each school, all first-graders were selected for sampling. After determining the schools and obtaining authorization from the local authorities, consent forms were sent to the schools to be completed by the students' parents or legal guardians. The data of the dental status of the students were collected from the health IDs completed in the beginning of the educational year.

Figure 1. Geographic Location of Cities Selected in This Study on the Map of Iran

A general practitioner performed oral, dental, and gingival evaluation of the 1st graders according to the guidelines of the Iranian Ministry of Health using a questionnaire. In this part, the status of dental caries or filling and the gingival status in terms of inflammation were assessed. The following were considered as dental caries: 1, enamel discoloration to brown or black; 2, dental cavity; 3, tooth sensitivity to heat, cold, and sour or sweet foods;

and 4, pain while pressing the teeth together. Filling was defined as dental caries filled with dental amalgam, composite, or the use of dental crown. Gingival inflammation was defined as redness, congestion, and swelling of the gums. Moreover, gingival bleeding during dental brushing or chewing on hard foods was another index of gingival inflammation, which was asked from the children or their parents.

The income of each province was calculated based on the reports of the statistical Centre of Iran.

In addition to describing the distribution of dental caries and filling in the provinces, we used national indices to determine economic inequality. For this purpose, we obtained the average annual income of households in each province from the Statistical Center of Iran. Then, we determined the representative income for each province and used it as the measure for the economic status of the province

2.1. Statistical Analysis

In this study, we report the mean number of decayed and filled teeth and the prevalence of participants with at least 1 decayed or filled tooth along with 95% confidence intervals. Linear and logistic regression was used to evaluate analytical relationships. The effect of cluster sampling was considered for calculation of the standard error. We used the concentration index and its graph for economic inequity, the significance of the concentration index at a level of 5%. The provincial income was evaluated against the mean filled teeth to obtain this index.

2.2. Ethical Issues

The ethics committee of Arak University of Medical Sciences approved the study protocol, which was conducted in accordance with the tenets of the Helsinki Declaration. All participants signed a written informed consent.

3. Results

In this study, a total of 70 schools, with 4614 students, were selected from 8 cities of Iran. Of them, 4106 students participated in the study (response rate = 89%). The data of 12 students were not included in the study due to the fact that they were not complete; therefore, the final analysis was performed on the data of 4094 first-graders.

According to our results, 51.8% of the students (n = 2122) were boys. Table 1 presents the mean and 95% CI of decayed and filled teeth in 7-year-Old Iranian children. According to Table 1, the mean number of decayed and filled teeth was 1.7 (1.51 - 1.88) and 0.26 (0.22 - 0.29) respectively, with no significant difference between boys and girls in decayed

(P = 0.330) and filled teeth (P = 0.148). However, as Table 1 shows, the distribution of dental caries and tooth filling varied from 1.16 to 2.06 and 0.15 to 0.4 in different cities; the difference in the distribution was significant for both (P < 0.001). Parental education had an inverse and direct relationship with the number of decayed and filled teeth, respectively (P < 0.001).

Table 1. Mean and 95% CI of Tooth Decay and Filling in 7-year-old Iranian Children

Variables		Decayed, Mean (95%CI)	Filled, Mean (95%CI)
	Total	1.70 (1.51 - 1.88)	0.26 (0.22 - 0.29)
Gender	Male	1.79 (1.52 - 2.05)	0.23 (0.19 - 0.28)
	Female	1.60 (1.33 - 1.87)	0.28 (0.23 - 0.34)
City	Dezful	1.66 (1.30 - 2.03)	0.40 (0.31 - 0.49)
	Bandar Abbas	1.89 (1.33 - 2.45)	0.31 (0.19 - 0.43)
	Ardebill	1.16 (0.64 - 1.68)	0.23 (0.17 - 0.29)
	Birjand	1.53 (1.00 - 2.04)	0.17 (0.10 - 0.25)
	Sari	1.86 (1.46 - 2.27)	0.32 (0.21 - 0.43)
	Arak	1.84 (1.40 - 2.27)	0.15 (0.08 - 0.23)
	Mashhad	1.69 (1.26 - 2.12)	0.29 (0.19 - 0.39)
	Yazd	2.06 (1.47 - 2.65)	0.19 (0.13 - 0.25)

According to the results of our study, 41.62% (37.36 - 45.88) of the 7-year-old children had at least 1 decayed tooth and 16.56% (14.46 - 18.66) had at least 1 filled tooth. According to Table 2, there was no significant difference in the prevalence of dental caries and filling between boys and girls. However, there was a significant difference in the prevalence of at least 1 decayed or filled tooth among different cities.

Figure 2 illustrates the distribution of decayed and filled teeth according to the income percentile in different cities. The number of filled teeth increased with an increase in income. The concentration index was 0.016 (0.012) for decayed and 0.165 (0.020) for filled teeth.

4. Discussion

We evaluated the dental status of 7-year-old Iranian children for the first time. The data of the study were the screening data. This study had strong and weak points, which should be considered. The most important strength of the study is its sample size and sampling from across the country, which increase the generalizability of the results. The weak point of the study is non-evaluation of the fallen-out and extracted teeth. The mean of decayed and filled teeth was 1.7 (1.51 - 1.88) and 0.26 (0.22 - 0.29), respectively.
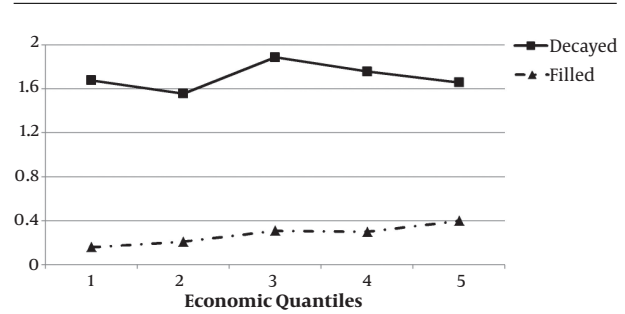

Figure 2. The Distribution of Decayed and Filled Teeth According to the Income Percentile

Several studies have briefly evaluated the DMFT in different age groups of Iranian children (13, 14, 18). In a study on 12-year-old students from Behshahr, the mean number of decayed and filled teeth was 1.35 ± 0.12 and 0.05 ± 0.12, respectively. Moreover, in this study, the rate of dental caries was higher in girls than boys (2). A study in Scotland also found that dental caries was markedly more prevalent in girls than boys, and one of the reasons was stated to be excess sweets consumption (3). On the other hand, in a study performed in Qazvin, Iran, on DMFT, in students aged 15 - 16 years old, the mean number of decayed and filled teeth was 2.71 ± 0.090 and 0.25 ± 0.07, respectively, which was markedly higher than the previous results in boys (4). It seems that the rate of dental caries increases in students with an increase in age in Iran. Studies conducted in India and England reported similar findings (5, 6). A report of 7-year-old school children conducted in Jeddah, Saudi Arabia, in 2006, showed that the mean of decayed and filled teeth was 6.92 ± 3.94 and 0.79 ± 1.47, respectively, which was much higher than our results (17). However, similar to our study, no significant relationship was found between dental caries and filling and the participants' sex. In a study in Nigeria, although 67% of students had dental caries, no filled teeth were noted (22). In our study, 41.62% (37.36 - 45.88) of the children had at least 1 decayed tooth. However, 26% of the children in Kerala, India, 79.32% of the children aged 5-6 years in Taiwan, and 62%, 45%, as well as 44.62% of the children in Iraq, Amman, and India had at least 1 decayed tooth, respectively (3, 21, 23-25). On the other hand, we observed a great variation in the mean of filled teeth between different cities. The study conducted in India reported a similar finding (23). Chu et al. reported that children born in China had more decayed teeth than children born in Hong Kong, which was mainly due to underlying socioeconomic differences (26). One of the reasons for this finding may be income differences in different cities and its direct association with the educational level of the family. Previous studies have shown a significant associa-

Table 2. The Prevalence of Dental Caries and Filling in 7-Year-Old Iranian Children

Variables		Decayed, % (95%CI)	Filled, % (95%CI)	Decayed or Filled, % (95%CI)
	Total	41.62 (37.36 - 45.88)	16.56 (14.46 - 18.66)	50.73 (46.67 - 54.79)
Gender	Male	42.88 (36.81 - 48.96)	15.41 (12.79 - 18.03)	50.80 (45.07 - 56.53)
	Female	40.26 (34.22 - 46.31)	17.80 (14.80 - 20.80)	50.66 (44.91 - 56.41)
City	Dezful	33.73 (27.38 - 40.09)	24.70 (18.23 - 31.17)	49.00 (43.48 - 54.51)
	Bandar Abbasa	52.72 (40.76 - 64.67)	20.32 (13.12 - 27.53)	61.37 (52.33 - 70.41)
	Ardebill	23.92 (15.72 - 32.11)	14.88 (11.61 - 18.15)	35.22 (27.59 - 42.84)
	Birjand	39.93 (28.00 - 51.86)	12.89 (8.07 - 17.70)	44.28 (33.29 - 55.28)
	Sari	49.88 (39.95 - 59.81)	21.34 (14.57 - 28.12)	58.75 (48.66 - 68.84)
	Arak	42.42 (34.46 - 50.39)	11.36 (7.34 - 15.38)	50.19 (43.58 - 56.80)
	Mashhad	44.48 (35.20 - 53.76)	15.86 (11.46 - 20.27)	51.94 (43.44 - 60.45)
	Yazd	48.72 (35.68 - 61.76)	12.35 (9.13 - 15.58)	58.97 (42.75 - 75.20)

Table 3. The Results of Other Studies

Country	Age	Decayed	Missing	Filling
Saudi Arabia [17]	6 - 7	6.92 ± 3.94	0.34 ± 0.94	0.79 ± 1.74
Iran-Behshar [18]	12	1.35 ± 0.12	0.07 ± 0.07	0.12 ± 0.05
Iran-Qazvin [13]	15 - 16	2.71 ± 0.90	0.23 ± 0.086	0.25 ± 0.07
India	12	0.41 ± 0.82	0.02 ± 0.19	0.02 ± 0.17
Jordan [19]	12 - 13	2.3	0.05	1.6
Australia [20]	Preschool	0.39 ± 1.41	0.03 ± 0.39	0.06-0.6
Iraq [21]	12	1.30 ± 1.70	0.10 ± 0.30	0.3 ± 0.7
Current study	7	1.795% CI: (1.51 - 1.88)		0.26 (95% CI: 0.22 - 0.29)

tion between the socioeconomic status, educational level of the family, and dental caries (27, 28). The reasons for the high prevalence of dental caries and filling are lack of oral health in families and children, inappropriate nutrition, and lack of oral diseases prevention knowledge (26, 28, 29). On the other hand, dental examination of the children from low-income families is not possible due to the high costs of annual dental checkup in Iran. Similarly in India, the high costs of the diagnosis and treatment of dental diseases is a reason for the high rate of dental caries in children (30). Nonetheless, the rate of dental caries can be decreased among students through taking preventive measures, similar to Belgium and the Netherlands (31).

According to our results, the number of filled teeth was higher in provinces with a higher income; in other words, there is economic inequity in the distribution of filled teeth. Together with other studies (30, 31), our findings suggest that providing dental care facilities by the government. In addition, the support of insurance companies may play an important role in oral and dental health and without their help and assistance, oral and dental health will be limited to the wealthy class of the society.

It seems that the dental conditions of Iranian children are similar to the young population of other developing countries. However, lack of medical facilities for preventive measures as well as high treatment costs have hindered the children's access to these services. Therefore, it is recommended to design and implement oral health training programs for parents in addition to preventive plans in children.

Although this study provided valuable information regarding 7-year-old Iranian students, it has some limitations that should be addressed. Lack of evaluating missing teeth is one of these limitations, which was due to lack of the data in students' records. Moreover, as another limitation, data collection from students' records may be associated with observer bias.

References

1. Petersen PE. The World Oral Health Report 2003: continuous improvement of oral health in the 21st century–the approach of the WHO Global Oral Health Programme. *Community Dent Oral Epidemiol*. 2003;**31 Suppl 1**:3–23. doi: 10.1046/j..2003.com122.x. [PubMed: 15015736].

2. Martins-Junior PA, Vieira-Andrade RG, Correa-Faria P, Oliveira-Ferreira F, Marques LS, Ramos-Jorge ML. Impact of early childhood caries on the oral health-related quality of life of preschool children and their parents. *Caries Res*. 2013;**47**(3):211–8. doi: 10.1159/000345534. [PubMed: 23257929].

3. Amirabadi F, Bazafshan E, Dehghan J, Zazouli MA. Evaluation of DMFT index in the 8-12 years old students of Zahedan City, Iran. *Iran J Health Sci*. 2015;**2**:52–60.

4. Pine CM, Adair PM, Nicoll AD, Burnside G, Petersen PE, Beighton D, et al. International comparisons of health inequalities in childhood dental caries. *Community Dent Health*. 2004;**21**(1 Suppl):121–30. [PubMed: 15072481].

5. Nicolau B, Marcenes W, Bartley M, Sheiham A. A life course approach to assessing causes of dental caries experience: the relationship between biological, behavioural, socio-economic and psychological conditions and caries in adolescents. *Caries Res*. 2003;**37**(5):319–26. doi: 10.1159/000072162. [PubMed: 12925821].

6. Wigen TI, Wang NJ. Caries and background factors in Norwegian and immigrant 5-year-old children. *Community Dent Oral Epidemiol*. 2010;**38**(1):19–28. doi: 10.1111/j.1600-0528.2009.00502.x. [PubMed: 19845710].

7. Petersen PE. Sociobehavioural risk factors in dental caries - international perspectives. *Community Dent Oral Epidemiol*. 2005;**33**(4):274–9. doi: 10.1111/j.1600-0528.2005.00235.x. [PubMed: 16008634].

8. Marshall TA, Eichenberger-Gilmore JM, Broffitt BA, Warren JJ, Levy SM. Dental caries and childhood obesity: roles of diet and socioeconomic status. *Community Dent Oral Epidemiol*. 2007;**35**(6):449–58. doi: 10.1111/j.1600-0528.2006.00353.x. [PubMed: 18039286].

9. Petersen PE. World Health Organization global policy for improvement of oral health–World Health Assembly 2007. *Int Dent J*. 2008;**58**(3):115–21. doi: 10.1111/j.1875-595X.2008.tb00185.x. [PubMed: 18630105].

10. Santamaria RM, Basner R, Schuler E, Splieth CH. Inequalities in dental caries experience among 6-year-old German children after the caries decline. *Acta Odontol Scand*. 2015;**73**(4):285–91. doi: 10.3109/00016357.2014.939711. [PubMed: 25645713].

11. Akrad ZT, Beitollahi J, Khajetorab A. DMFT (Decayed, Missing, Filled, Teeth) Oral health index in sweets and cable industry workers. *Iran J Publ Health*. 2006;**35**(2):64–8.

12. Riordan PJ. Dental fluorosis, dental caries and fluoride exposure among 7-year-olds. *Caries Res*. 1993;**27**(1):71–7. doi: 10.1159/000261519. [PubMed: 8448778].

13. Hamissi J, Ramezani GH, Ghodousi A. Prevalence of dental caries among high school attendees in Qazvin, Iran. *J Indian Soc Pedod Prev Dent*. 2008;**26 Suppl 2**:S53–5. [PubMed: 19075448].

14. Ramezani GH, Valaei N, Eikani H. Prevalence of DMFT and fluorosis in the students of Dayer city (Iran). *J Indian Soc Pedod Prev Dent*. 2004;**22**(2):49–53. [PubMed: 15491085].

15. Gargari BP, Behzad MH, Ghassabpour S, Ayat A. Prevalence of overweight and obesity among high-school girls in Tabriz, Iran, in 2001. *Food Nutr Bull*. 2004;**25**(3):288–91. doi: 10.1177/156482650402500309. [PubMed: 15460273].

16. Mohammadpour-Ahranjani B, Rashidi A, Karandish M, Eshraghian MR, Kalantari N. Prevalence of overweight and obesity in adolescent Tehrani students, 2000-2001: an epidemic health problem. *Public Health Nutr*. 2004;**7**(5):645–8. [PubMed: 15251055].

17. Al-Malik MI, Rehbini YA. Prevalence of dental caries, severity, and pattern in age 6 to 7-year-old children in a selected community in Saudi Arabia. *J Contemp Dent Pract*. 2006;**7**(2):46–54. [PubMed: 16685294].

18. Mahvi AH, Zazoli MA, Younecian M, Nicpour B, Babapour A. Survey of fluoride concentration in drinking water sources and prevalence of DMFT in the 12 years old students in Behshar city. *Journal of Medical Sciences(Faisalabad) J Med Sci (Faisalabad)*. 2006;**6**(4):658–61. doi: 10.3923/jms.2006.658.661.

19. Albashaireh Z, al-Hadi Hamasha A. Prevalence of dental caries in 12-13-year-old Jordanian students. *SADJ*. 2002;**57**(3):89–91. [PubMed: 12061150].

20. Wyne AH, Khan NB. Caries prevalence in 2 and 3 year old children of Adelaide, Australia. *Odontostomatol Trop*. 1998;**21**(83):22–3. [PubMed: 11372113].

21. Ahmed NA, Astrom AN, Skaug N, Petersen PE. Dental caries prevalence and risk factors among 12-year old schoolchildren from Baghdad, Iraq: a post-war survey. *Int Dent J*. 2007;**57**(1):36–44. doi: 10.1111/j.1875-595X.2007.tb00116.x. [PubMed: 17378348].

22. Okeigbemen SA. The prevalence of dental caries among 12 to 15-year-old school children in Nigeria: report of a local survey and campaign. *Oral Health Prev Dent*. 2004;**2**(1):27–31. [PubMed: 15641762].

23. David J, Wang NJ, Astrom AN, Kuriakose S. Dental caries and associated factors in 12-year-old schoolchildren in Thiruvananthapuram, Kerala, India. *Int J Paediatr Dent*. 2005;**15**(6):420–8. doi: 10.1111/j.1365-263X.2005.00665.x. [PubMed: 16238652].

24. Rajab LD, Petersen PE, Baqain Z, Bakaeen G. Oral health status among 6- and 12-year-old Jordanian schoolchildren. *Oral Health Prev Dent*. 2014;**12**(2):99–107. doi: 10.3290/j.ohpd.a31220. [PubMed: 24624383].

25. Moses J, Rangeeth B, Gurunathan D. Prevalence of dental caries, socio-economic old school going children of chidambaram status and treatment needs among 5 to 15 year old school going children of chidambaram. *J Clin Diagn Res*. 2011;**5**:146–51.

26. Chu CH, Fung DS, Lo EC. Dental caries status of preschool children in Hong Kong. *Br Dent J*. 1999;**187**(11):616–20. discussion 605. doi: 10.1038/sj.bdj.4800347a. [PubMed: 16163284].

27. Retnakumari N. Prevalence of dental caries and risk assessment among primary school children of 6-12 years in the Varkala municipal area of Kerala. *J Indian Soc Pedod Prev Dent*. 1999;**17**(4):135–42. [PubMed: 10863509].

28. Christensen LB, Petersen PE, Bhambal A. Oral health and oral health behaviour among 11-13-year-olds in Bhopal, India. *Community Dent Health*. 2003;**20**(3):153–8. [PubMed: 12940305].

29. Stecksen-Blicks C, Holm AK. Between-meal eating, toothbrushing frequency and dental caries in 4-year-old children in the north of Sweden. *Int J Paediatr Dent*. 1995;**5**(2):67–72. doi: 10.1111/j.1365-263X.1995.tb00167.x. [PubMed: 7547816].

30. Koirala S, David J, Khadka R, Yee R. Dental caries prevalence, experience and treatment needs of 5-6 year old, 12-13 year old and 15 year old schoolchildren of Sunsari district, Nepal. *J Nepal Dent Assoc*. 2003;**5**:12–24.

31. Truin GJ, Konig KG, Bronkhorst EM. Caries prevalence in Belgium and The Netherlands. *Int Dent J*. 1994;**44**(4 Suppl 1):379–85. [PubMed: 7814105].