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Original Article

Determination of DMFT index among 7-11 year-old students and its relation with fluoride in Shiraz drinking water in Iran

Mansooreh Dehghani[1], Rezvan Omrani[2], Zahra Zamanian[3], Hassan Hashemi[4]

ABSTRACT

Objective: The main source of receiving fluoride to prevent dental carries is by adding fluoride to water. The aim of this research was to determine DMFT index in 7-11 year-old students and its relation with fluoride concentration in drinking water in Shiraz in 2010.

Methodology: This research involved 760 students to measure the DMFT index in the four educational districts. Seventy-five water samples were taken in the study area to determine their fluoride concentration by Spadenz method using DR-5000U Spectrophotometer. To determine DMFT, schools were chosen by cluster sampling and students and their grade were randomly selected and examined by a dental hygienist.

Results: The mean fluoride concentration in Shiraz drinking water is 0.69 mgL^{-1}. The maximum DMFT index belonged to the fourth district (1.35) and the minimum belonged to the first district (0.47). The mean DMFT index was 0.935. The DMFT index was the same for the girls and boys in the 4 districts (0.93). There was no significant correlation between the DMFT and different age groups ($p>0.05$). The maximum M (missing) teeth belong to 8 year-age student (2.42).

Conclusion: The mean DMFT index in the current study was less than the index obtained in many other cities in the country. Although DMFT index were similar for boys and girls in this study, other studies have showed that the index was higher for girls. The mean fluorine concentration in Shiraz drinking water was below the standard level.

KEY WORDS: Fluoride, DMFT, Drinking water.

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INTRODUCTION

One of the most important problems and discomforts that people encounter in life is dental carries.[1] DMFT index is the main indicator for the incidence of dental caries. In this index D refers to decay, M to missing and F to filled and detected clinically using visual and/or tactile criteria. DMFT index is a simple, rapid and useable one in dentistry which has been utilized for several decades.[2]

According to WHO (World Health Organization), the main source of receiving fluoride to prevent dental carries is by adding fluoride to water. The goal is the DMFT index should be less than 1 and they advise the index to be surveyed periodically.[3] The maximum permissible fluorine concentration in drinking water is 1.5 (at 8-12°C) or 0.7 mgL^{-1} (25-30°C).[4] The fluorine concentration of more than 1.2 mgL^{-1} in drinking water causes dental fluorosis. On the other hand, the concentration of less than 0.7 mgL^{-1} increases the incidence of dental carries.[5,6] Therefore monitoring fluoride concentration in water is very crucial.

Since Shiraz drinking water is supplied by several sources (75 wells plus Doroudzan dam which is located 70 kilometer from Shiraz), determining

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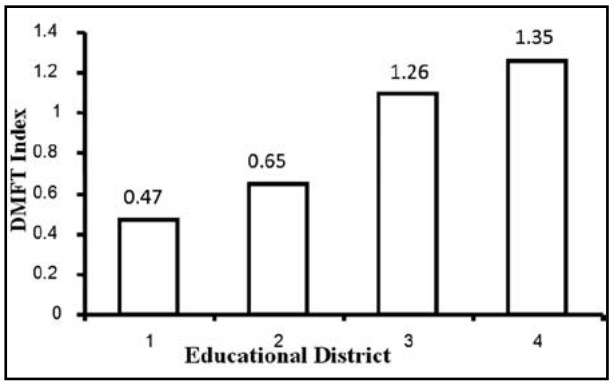

Fig.1: Comparison of DMFT in the four educational districts in Shiraz.

fluoride concentration in many different points in Shiraz water distribution networks system should be studied. Therefore, the main objectives of the study were to (i) measure DMFT index in 7-11 year-old students, (ii) determine fluoride concentration in Shiraz drinking water in 2010 and (iii) evaluate the relationship between drinking water fluoride concentration and the DMFT index.

METHODOLOGY

The present descriptive study was done during September through December 2010. Data collection is based on observation, inspection, completing questionnaire and sampling. This study was conducted in two phases. In the first phase, DMFT index was measured in 7-11 old-year students in Shiraz elementary schools. The minimum sample size was estimated about 760 students by a pre-test (the mean and standard deviation of 9.1 ± 2.25 and 95% confidence and 19% acceptable error). In this study, 380 girls and 380 boys were selected in four educational districts. The schools were selected by cluster sampling. The selection of students and their grade were based on random sampling. Examination was performed by a dental hygienist and questionnaire was completed for each student.

In the second phase, water sampling was conducted in Shiraz water distribution network.

Table-I: DMFT Index among 7-11 year-old students in Shiraz primary school according to age.

Age (Year)	*No.*	*D*	*M*	*F*	*DMFT index*
7	152	0.97	0.35	0.34	0.97
8	152	1.01	2.42	0.5	1.01
9	152	0.98	0.54	0.62	0.98
10	152	0.83	0.5	0.39	0.83
11	152	0.86	0.67	0.48	0.86
Total	760	1.83	0.5	0.47	0.935

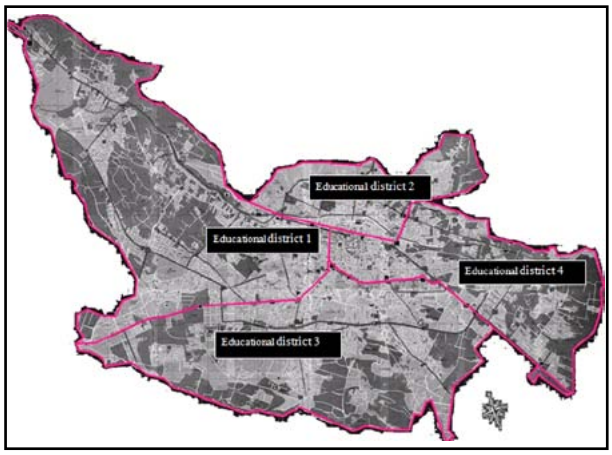

Fig.2: Map of the sampling points in Shiraz drinking water distribution networks.

After the pre-test, Seventy-five water samples were taken in the study area (in four educational districts of the distribution network) and implanted on the map of the city. The fluoride concentration was determined by Spadenz method using DR-5000U Spectrophotometer.

The data was analyzed by SPSS software version 11.5. The correlations between different parameters were measured by using statistical analysis Pearson-Correlation, Mann-Whitney V and Kruskal-Wallis tests.

RESULTS

The study was performed on 760 students of Shiraz elementary schools. The mean DMFT index is 0.935.The maximum DMFT index belonged to the fourth district (1.35) and the minimum DMFT belonged to the first district (0.47). There was no significant correlation between the DMFT and different age groups (Table-I) ($p>0.05$). The maximum M (missing) teeth belong to 8 year-age student (2.42). There was a significant correlation between the mean DMFT indices in districts 3 and 4(1.26 and 1.35) and the mean DMFT indices in districts 1 and 2 (0.47 and 0.65) (Fig.1). The mean DMFT index was the same for the girls and boys in the 4 districts (0.93) (Table-II). The current study revealed that students whose parents are educated at primary and secondary levels have higher DMFT index than those whose parents are more educated

Table-II: DMFT Index among 7-11 year- old students in Shiraz primary school according to sex.

Sex	*No.*	*D*	*M*	*F*	*DMFT index*
Girl	380	1.86	0.44	0.49	0.934
Boy	380	1.80	0.55	0.44	0.936
Total	760	1.83	0.5	0.47	0.935

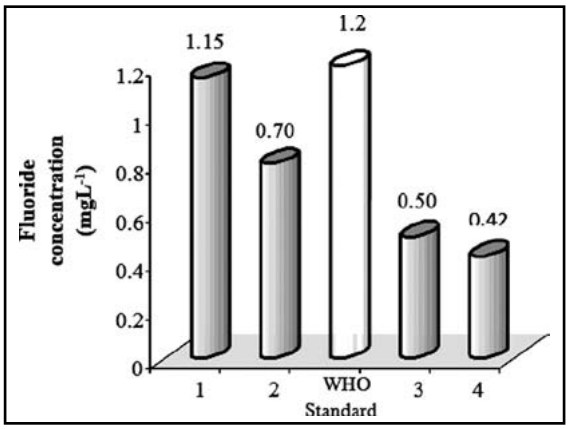

Fig.3: Fluoride concentrations in drinking water in the four educational districts in Shiraz and compare them with WHO standard.

and significant relationship was found(p <0/111). Also students whose mothers had elementary education, the DMFT was higher than those whose mothers had higher education and the relationship between these two parameters was significant (p <0/001). The results showed that students with a more number of brothers and sisters, higher habit of eating sweets and less brushing habits had a higher rate of dental caries. Conversely, students who visit the dentist more had a lower DMFT compared to the students who visit less. Though a significant relationship between employed or unemployed father and DMFT index was not observed (P> 0.05), there is a significant relationship between mothers employment and mean DMFT index P< 0.001).

Fig.2 shows the map of the sampling points in Shiraz drinking water distribution networks. The concentration of fluoride in drinking water in districts 3 and 4 were 0.50 and 0.42 mgL^{-1}, respectively which is lower than the standard level and the concentration in districts 1 and 2 were 1.15 and 0.70 mgL^{-1}, respectively which is in the standard limit (Table-III, Fig.3). In Fig.4 shows the fluorine concentration in drinking water and DMFT index in the four education districts.

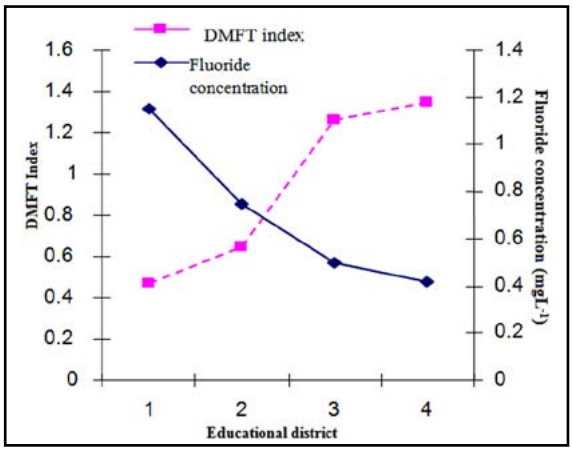

Fig.4: DMFT index in the four educational districts in Shiraz and the concentration of fluorine in drinking water in the designated area.

DISCUSSION

Our study showed that the mean DMFT index in the four educational districts in Shiraz was equal to 0.935 which is in desirable limit. The DMFT index in Bavanat County, Bushehr and Babol was much higher than the result obtained in the current study in Shiraz. Although DMFT index were similar for

Table-III: The concentration of fluoride in Shiraz drinking water distribution network.

Sampling point	*Fluoride concentration (mgL-1)*	*Sampling point*	*Fluoride concentration (mgL-1)*
1	1.2	39	0.55
2	1. 00	40	0.75
3	0.80	41	0.69
4	0.65	42	1.05
5	1.00	43	0.35
6	0.70	44	0.97
7	0.99	45	0.28
8	1.02	46	0.89
9	0.60	47	0.97
10	0.34	48	0.47
11	0.45	49	0.85
12	0.55	50	0.28
13	1.30	51	0.19
14	1.25	52	1.01
15	1.30	53	0.89
17	1.24	55	0.57
18	0.99	56	0.69
19	0.70	57	0. 83
20	0.44	58	0.50
21	0.69	59	0.48
22	0.96	60	0.34
23	0.57	61	0.90
24	1.17	62	1.00
25	0.68	63	0.81
26	0.65	64	0.79
27	0.88	65	1.00
28	1.12	66	0.90
29	0.99	67	0.40
30	1.20	68	0.48
31	1.10	69	0.19
32	0.35	70	0.29
33	0.28	71	0.20
34	0.80	72	0.19
35	0.35	73	0.21
36	0.30	74	0.24
37	0.33	75	0.43
38	0.91		

boys and girls in this study, other studies have showed that the index was higher for girls.

The mean DMFT index in 12 year-old students in Shiraz (1995) was 2.9.[6] Another study was conducted on 244 Gashgai children aged 12 showed that the mean DMFT was 1.39.[7] The mean DMFT indices on 650 students in Babol, on 1200 students in Bushehr and 407 students in Bavanat were 4.75, 1.49 and 2.72, respectively.[1,7,8] Ramezani et al study (2009) showed that low levels of fluoride in drinking water in Behshahr have caused the DMFT index increase 1.3 times higher than in a control group and the risk of dental caries in these areas is 18 percent.[9] Research of Wang et al (2004) demonstrated that there is a significant correlation between the amount of fluoride in drinking water of 28 major cities in China and the fluoride level in human urine. Also a significant correlation between fluoride levels in drinking water and oral health is seen. Their results showed that drinking water is the main source of fluoride in body.[10] The results of Mahvi and colleagues (2006) showed that fluoride in drinking water at concentrations of 0.25 mgL^{-1} caused the mean DMFT in girls 1.48 higher than boys.[11]

Numerous other studies have also looked at the relationship between caries and concentration of fluoride in water. The aim of Dobaradaran and colleagues study (2008) was to find a correlation between dental caries in children of 6-11 year-old in Dashtestan and the amount of fluoride concentration in ground water in that area. Their results revealed that there is a weak linear regression between the amount of fluoride in drinking water and caries in permanent teeth.[12] Research Institute of Australia (2007) has reported that children between the ages of 5 to 15 years in areas where their drinking water contain more fluoride, have lower rates of dental caries. Tooth decay in children does not depend on whether they live in a rural or urban area and it is not related to their socioeconomic status as well.[13] Nohno and colleagues (2006) in their study in Japan showed that the DMFT index was significantly related to the amount of fluoride in drinking water.[14] The highest prevalence of fluorosis has been reported in China and India.[15]

In another study in Ethiopia, Wondwossen et al (2004) showed that in the areas where fluoride concentration was more than 1 and 5 the prevalence of fluorosis were 91.8% and 100%, respectively. There was also a significant relationship between fluorosis and dental caries.[16] Akpata et al (2006) in Saudi Arabia found that there is a significant relationship between fluorosis and the fluoride amount in ground water Hill.[17] Meyer-Lueckel and colleagues (2006) studied the fluorosis and dental caries in children 6-9 year-old in three regions in Iran. Their research showed that the rate of dental caries in naturally fluoridated water (1.3 mgL^{-1}) was negligible, but the low level of fluoride in water causes an increased prevalence of fluorosis.[18]

In the two educational districts of 3 and 4 the DMFT index is higher than 1 and the fluoride concentrations in the water in these regions was lower than the standard. In addition, the DMFT index in the educational districts of 1 and 2 is lower than 1 and in this area the amount of fluoride in water was in a desirable concentration. Therefore, it can be concluded that as the amount of fluoride is reduced, the DMFT index is increased and there is a significant correlation between these parameters ($p<0.001$). The prevalence of high dental caries in educational districts 3 and 4 can be due to low concentrations of fluoride in the water, not good dental care and oral hygiene, not receiving fluoride from other topical fluoride carriers such as gel, mouthwash, toothpaste and overusing sweet.

Although the average fluoride concentration in Shiraz drinking water is less than the standard, the mean DMFT index in Shiraz students is less than one due to the improved oral hygiene. Since there is a positive attitude towards water fluoridation, addition of fluoride to drinking water at optimum concentration is an appropriate method to decrease dental caries in the educational districts 3 and 4.

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