

Original Article**Factors Affecting Dental Caries of Preschool Children in Shiraz, 2014**Soheila Shaghaghian ¹, Masoud Abolvardi ², Marzieh Akhlaghian ³¹ Non-communicable Diseases Research Center, Shiraz University of Medical Sciences, Shiraz, Iran.² Postgraduate Student of Orthodontics, Dept. of Orthodontics, School of Dentistry, Hamadan University of Medical Sciences, Hamadan, Iran.³ Postgraduate Student of Prosthodontics, Dept. of Prosthodontics, School of Dentistry, Shiraz University of Medical Sciences, Shiraz, Iran.**KEY WORDS**Dental caries;
Oral hygiene;
Socioeconomic factors;**ABSTRACT****Statement of the Problem:** Dental caries, the most common infectious disease, can lead to several consequences, including inflammation and bleeding of the gum, abscess formation, tooth loss, and subsequently loss of available space in the arch.**Purpose:** This study was designed to determine dental caries status of Shiraz preschool children and its related factors.**Materials and Method:** This cross-sectional study was conducted on the children registered in Shiraz kindergartens in 2014. The study recruited 453 children by randomized cluster sampling. We evaluated the children's demographic and oral hygiene factors, and their dental caries status using decayed, missed, and filled tooth (dmft) index and prevalence of the children with untreated dental caries. Relationship between the children's characteristics and their dental caries status was evaluated.**Results:** Only 119 children (30.1%) were caries-free. The children's mean dmft index was 3.88(±3.9). After controlling the effect of confounding factors, the children's dental caries status was significantly associated with variables indicating their socioeconomic status such as fathers' job, mothers' education, and number of children in the family. Furthermore, there was a significant association between the children's dental caries status and their oral hygiene habits such as frequency of tooth brushing.**Conclusion:** The dental caries status of the studied preschool children was not desirable which could be indicative of the inadequacy of the current preventive programs. To improve this issue, interventional preventive programs such as tooth brushing are recommended. The programs are more necessary for the children of low socioeconomic families and those with poor oral hygiene habits.**Corresponding Author:** Akhlaghian M., Dept. of Prosthodontics, School of Dentistry, Shiraz University of Medical Sciences, Shiraz, Iran. Email: m.akhlaghian@yahoo.com Tel: +98-71-36263193-4Received February 2017;
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Accepted July 2017;Cite this article as: Shaghaghian S., Abolvardi M., Akhlaghian M. Factors Affecting Dental Caries of Preschool Children in Shiraz, 2014. *J Dent Shiraz Univ Med Sci.*, 2018 June; 19(2): 100-108.**Introduction**

Dental caries, also known as tooth decay, is a progressive and irreversible degradation of the enamel and/or dentin because of acid production caused by bacterial metabolism. [1] It is the most common infectious disease that affects human beings. According to the World Health Organization (WHO) report, approximately 2.43 billion people (36% of the population) have active dental caries. In addition, nearly all adults have dental

caries at some point in their life span. [2] Dental caries is prevalent in children, as well. [2] WHO has reported that 9% of children worldwide (620 million) have had dental caries. [2] Children's dental caries can cause inflammation and bleeding of the gum, [3] abscess formation, [4] tooth loss, and subsequently loss of available space in the arch. [1, 3] It can also affect many aspects of children's life. For example, it can lead to oral malodor and social problems. [5] Furthermore, because

it is an infectious source in the body, it can exacerbate some cardiac problems. [6]

There are several indices to evaluate dental caries; “decayed, missed, and filled teeth (dmft) index” and “prevalence of untreated dental caries” are two of the most famous ones. The dmft index, which shows the overall status of dentition, is calculated by summation of missed, decayed, and filled teeth and is determined by clinical examination. This index, which is one of the main indices in dentistry, has been used for more than 70 years in dental epidemiology. [7] Prevalence of untreated dental caries determines the percentage of people with at least one decayed tooth.

To implement health promotion programs for improving oral health status of children, authorities need to know not only the extent of oral problems but also their related factors. Several studies have shown the factors contributing to children's dental caries. They have revealed several etiological factors for dental caries such as oral cavity quantitative and qualitative bacterial components; [8] overall oral health status [8] including the frequency and efficacy of plaque removal; [9-10] the amount and frequency of sugar consumption; [11-12] and the amount and components of saliva. [13]

In addition, there are several studies that have reported the relationship between oral health and some demographic and socioeconomic factors. The studies have shown that children's dental caries is related to their age [14] and sex, [15-16] level of parents' education, [17] and the family income. [18] However, there is some controversy in the results of the studies. Although Pakpour *et al.* [18] have shown the relationship between children's oral health status and their age, sex, and the family income in Qazvin, Iran, Asghari *et al.* [19] have concluded that there is not any association between socio-economic backgrounds and dental health in Isfahan, Iran. The differences may be explained by the fact that people who live in different places have different cultures and behaviors as Riordan *et al.* [17] have reported that cultural status and family beliefs are correlated with the prevalence of dental caries. In addition, they found that different social groups required different strategies for changing children's oral hygiene habits. [17] Therefore, to design strategies for improving oral health in children of different places with different cultures, authorities require the exact status of children's dental cari-

es and its related factors in that specific place.

Although Shiraz is one of the largest cities in Iran, to the best of our knowledge, few studies have evaluated all of the important factors that can affect children's oral health in Shiraz. Because dental caries is a prevalent disease with several catastrophic outcomes, particularly in children, health promotion programs in this regard are necessary to be held. To implement the programs, authorities need to know the status of the problem and its related factors in Shiraz. Therefore, this study was designed to determine the dental caries status of preschool children and its related factors in Shiraz.

Materials and Method

The target population of this cross-sectional study was 3-6-year-old children who were registered in Shiraz kindergartens in 2014. The Research Ethics Committee of Shiraz University of Medical Sciences approved the study protocol. Sample size was calculated based on the prevalence of the children with untreated dental caries in the pilot study conducted on 30 children. Using type I error of 0.05, sampling error of 0.05, and estimated proportion of 0.5, it was determined that at least 385 children should participate in the study. The children were selected by a randomized cluster sampling. To do the sampling, we considered Shiraz kindergartens as clusters and their name and address was obtained from welfare organization. We selected 10 out of 147 Shiraz kindergartens by balloting. After explaining the objectives of the study for the children's parents, we asked all 453 parents to let their children to participate in the study. Children whose parents consented were included in the study. However, the children who were uncooperative or absent at the examination day, or did not have any teeth were excluded.

One calibrated senior dental student performed the children's dental examinations in the kindergartens using a community periodontal indexing (CPI) probe, [20] a disposable dental mirror, and a headlight. Children's dmft index and untreated dental caries were evaluated and recorded according to WHO criteria. Both oral and dental conditions of the children were examined in a systematic manner to reduce the risk of any probable missed areas. Each tooth was carefully examined using a standard headlight. However, according to WHO guidelines, neither radiograph nor fiber optic was used.

The teeth were evaluated for any sign of touchable defects by a 0.5 round non-penetrating CPI probe [20] and scored according to WHO guideline. [20] To determine each child's dmft index, summation of his/her decayed, missed, and filled teeth was calculated. By interviewing with the parents, the dental student also recorded the children's demographic variables (8 items), their oral hygiene habits (3 items), and the parents' perception of their children's oral health status (2 items) in a checklist.

To consider ethical issues, all children's personal data were confidential and the children's names were not recorded in the checklists. Furthermore, the collected data were not available to anybody, except the researchers.

The collected data were entered into the SPSS version 18 to determine the mean of the children's dmft index and the prevalence of the children with untreated dental caries. One-way ANOVA (with Tukey post hoc test), Pearson Chi-square, and independent sample t test were used to estimate the relationship between demographic data, oral hygiene variables, and dental caries status of children. To control the effect of possible confounding factors, all variables were entered into multiple logistic regression models with the data obtained by children with untreated dental caries as dependent variable and multiple linear regression models with the children's dmft index as dependent variable. An alpha level of 0.05 was considered as statistical significance.

Results

Most parents (N=396) invited to the study consented to participate (response rate=87%). Although more than half of the mothers (236 mothers) had university degrees, more than two-thirds of them (289) were homemakers. The mean age of the participants' children was 60.6 (± 8.9) months with almost equal male/female ratio. Tooth brushing for 71.2% of the children had been started after the age 2 years and the teeth in 24.2% had been brushed lower than once a day (Table 1).

Children's dental caries status

According to our dental examination, prevalence of untreated dental caries was 69.9%. Only 119 children (30.1%) were recognized as caries-free. Of 277 children with untreated dental caries, 33 (8.2%), 43 (10.9%), and 201 (50.8%) had one, two, and more than two decayed teeth, respectively. We found filled teeth in 62 children

(15.8%), of whom 26 (6.6%) and 36 (9.2%) children had one and more than one filled tooth, respectively. 58 children (14.6%) had at least one missed tooth caused by dental caries. Of them, 31 (7.8%) had 1 missed tooth and 27 (6.8%) had more than one missed teeth. The children's dmft index varied from zero to 15 with a mean (\pm SD) of 3.88 (\pm 3.9).

Relationship between the children's demographic factors and their dental caries status

In univariate analysis, the children's dmft index was significantly associated with their age ($p= 0.012$), the number of children in family ($p< 0.001$), and the mothers' employment status ($p= 0.047$) and education ($p< 0.001$). Older children had higher scores of dmft index than younger ones. In contrast, lower scores of dmft index were found in the children who were the only child of a family, or had university educated and employed mothers. Multivariate analysis showed that the scores of dmft index in the 60-72 month-old children were significantly higher than those in the 36-47 month-old children ($p= 0.009$). In addition, the children's dmft index was significantly associated with the number of children in the family ($p= 0.005$), the mothers' education ($p= 0.023$), and the fathers' job ($p= 0.017$) in multivariate analysis (Table1).

Univariate analysis also showed that the existence of untreated dental caries in the children was significantly associated with their mothers' education ($p= 0.004$), and the number of children in family ($p= 0.003$). In this analysis, untreated dental caries was found in non-single children more than single ones and more in the children with non-university educated mothers than those with university-educated mothers. Multivariate analysis confirmed a significant association between the children's untreated dental caries and their mothers' education ($p= 0.031$, Table 2).

Relationship between the children's oral hygiene and their dental caries status

In univariate analysis, the mean score of dmft index in the children whose teeth had been brushed once or more was significantly lower than that in the others ($p= 0.002$). This relationship was also confirmed in multivariate analysis ($p= 0.004$). In addition, univariate and multivariate analysis showed a significant association between the children's dental visit and their dmft index (both $p<0.001$). The analyses showed that the dmft index

Table 1: Demographic characteristics and oral hygiene status of the studied preschool children and their relationship with the children's dmft index (N=396)

Children's characteristics	N(%)	Children's dmft index			
		Univariate analysis		Multivariate analysis ^{***}	
		Mean±SD	p Value	β (SE)	p Value
Demographic factors					
Sex					
Boy	202 (51)	3.82±3.75	0.737*	-	-
Girl	194 (49)	3.95±4.05		0.06(0.35)	0.855
Age [†]					
36-47 months old	49(12.4)	2.85±3.34 ^a	0.012**	-	-
48-59 months old	84(21.2)	3.20±3.68 ^{ab}		0.73(0.63)	0.248
60-72 months old	263(66.4)	4.28±4.00 ^b		1.44(0.54)	0.009
Children in family					
One child	162(40.9)	2.92±3.32	<0.001*	-	-
More than one child	234(59.1)	4.54±4.13		1.06(0.37)	0.005
Fathers' job					
Self-employed	258(65.2)	3.72±3.71	0.264*	-	-
Employee	138(34.8)	4.18±4.22		1.01(0.42)	0.017
Mothers' employment status			0.047*		
Employed	107(27)	3.24±3.60		-	-
Homemaker	289(73)	4.12±3.98		-0.14(0.49)	0.778
Fathers' Education					
Non-university educated	171(43.2)	4.08±3.85	0.235*	-0.24(0.45)	0.600
University educated	225(56.8)	3.61±3.96		-	-
Mothers' Education					
Non-university educated	160(40.4)	4.46±4.00	<0.001*	1.10(0.48)	0.023
University educated	236(59.6)	3.02±3.59		-	-
Oral hygiene					
Frequency of tooth brushing			0.002*		
Once a day or more	300 (75.8)	3.50±3.64		-	-
Lower than once a day	96 (24.2)	5.07±4.43		1.22(0.42)	0.004
Started age of tooth brushing			0.300*		
2 years old or younger	114 (28.8)	3.56±3.85		-	-
After 2 years old	282 (71.2)	4.0±3.91		0.48(0.40)	0.230
Dental visits [†]			<0.001**		
No dental visits	189 (47.7)	2.62±3.25 ^a		-	-
For check-up	77 (19.4)	3.35±3.72 ^a		0.60(0.50)	0.227
For dental pain	130(32.8)	6.02±3.98 ^b		3.07(0.40)	<0.001

[†]Note: The results of Tukey test were shown using letters. There is a statistically significant difference between groups without common letters.
dmft: decayed, missing, filling tooth
N= Number SD= Standard Deviation SE= Standard Error *Independent Sample t test **One Way ANOVA ***Multiple regression analysis

of the children who had visited a dentist because of pain or other oral problems was significantly higher than those who had not visited a dentist before or visited for check-up ($p < 0.001$). However, the analyses could not show a significant difference between the dmft index of the children who had not visited a dentist before and that of those who did so for check-up ($p = 0.227$, Table 1).

Univariate analysis showed that the children's untreated dental caries were significantly associated with the frequency of tooth brushing ($p = 0.024$) and the prior dental visit ($p < 0.001$). Multivariate analysis showed that the children with a prior dental visit because of pain or other oral problems were 4.96 times more likely to have an untreated dental caries than those without a

prior dental visit. However, multivariate analysis did not show a significant association between the children's untreated dental caries and the frequency of tooth brushing (Table 2).

Discussion

This cross-sectional study assessed dental caries of Shiraz preschool children and its associated factors. Only 30% of the children were caries-free. The children's dental caries was significantly associated with their socioeconomic status, the number of children in family, frequency of their tooth brushing, and history of dental visits.

Children's dental caries status

More than two thirds of the children in our study had de-

Table 2: Relationship between children's characteristics and their untreated dental caries (N=396)

Children's characteristics	Untreated dental caries			
	Univariate analysis*		Multivariate analysis**	
	N(%)	p Value	OR	p Value
Demographic factors				
Sex				
Boy	144(71.3)	0.554	1.21	0.424
Girl	133(68.6)		-	-
Age				
36-47 months old	32(65.3)	0.057	1.02	0.961
48-59 months old	51(60.7)		1.63	0.178
60-72 months old	194(73.8)			
Number of children in family				
One child	100(61.7)	0.003	-	-
More than one child	177(75.6)		1.50	0.104
Fathers' job				
Self-employed	178(69.0)	0.570	-	-
Salaried	99(71.7)		1.50	0.196
Mothers' employment status				
Employed	69(64.5)	0.149	-	-
Homemaker	208(72.0)		0.84	0.605
Fathers' Education				
Non-university educated	160(71.1)	0.563	0.76	0.375
University educated	117(68.4)		-	-
Mothers' Education				
Non-university educated	178(75.4)	0.004	2.00	0.031
University educated	99(61.9)		-	-
Oral hygiene				
Frequency of tooth brushing				
Once a day or more	201(67.0)	0.024	-	-
Lower than once a day	76(79.2)		1.74	0.073
The age tooth brushing had been started				
2 years old or younger	75(65.8)	0.251	-	-
After 2 years old	202(71.6)		1.40	0.207
Dental visits †				
No dental visits	109(57.7) ^a		-	-
For check up	54(70.1) ^a	<0.001	1.69	0.094
For pain and other oral problems	114(87.7) ^b		4.96	<0.001

†Note: The results of chi square for M proportion test were shown using letters. There is a statistically significant difference between groups without common letters.
N= Number OR: Odds Ratio †Pearson chi square test **Logistic regression analysis

ntal caries. Similarly, other studies conducted in Iran [14, 21-22] and in other developing countries [11, 23-24] showed a high prevalence of dental caries in children. However, the prevalence in developed countries was much lower. [25-26] Furthermore, the mean score of the dmft index in the children of our study was similar to that of most other developing countries [11, 22-23] and much higher than that of developed countries. [25-27]

The low prevalence of dental caries in developed countries is because of implementation of interventional programs, which should be considered in developing countries. Increased fluoride consumption were the most probable reasons for decrease in dental caries in most industrialized countries. [28] Professionally applied 5%

sodium fluoride varnish shows the capability to remineralize early enamel caries in children. [29] Using Silver diamine fluoride solution at 38% is the most effective concentration in arresting active dentine caries especially by using biannually. [30] Furthermore, minimal intervention dentistry should be undertaken. It is a philosophy to keep teeth functional for life by reducing the need for cutting away healthy tooth tissues, in contrast to the traditional, surgical manner of managing dental caries with the repeat restoration cycles. [31]

In our study, 24% of the children had brushed their teeth less than once a day. Furthermore, tooth brushing had been started for 71% of the children after their 2 years of age. About half of the children had not been visited by a dentist before and only 19% of them

had visited for check-up. The findings could explain the reason of this high prevalence of dental caries in our children. Moreover, while 70% of our children had untreated dental caries and 15% had at least one missed tooth due to dental caries, only 15.8% of them had filled teeth. The findings may show little attention of the parents to not only preventive but also restorative needs of their children. In Iran, there are educational programs about oral health for preschool children. However, the findings indicate that such education is not adequate and the children need newer and more practical educational programs about home preventive measures especially tooth brushing.

Relationship between the children's demographic factors and their dental caries status

Although some studies [15-16] showed higher prevalence of dental caries in girls than in boys, our study, similar to studies conducted in Chile [9] and India, [23] did not show similar results. The difference may be because of more attention of parents to their boys' health than that of their girls. Our finding is against any sex discrimination in our country.

Our study, similar to other studies, [14, 23] showed higher dmft scores in the older children. However, it did not show any differences among untreated dental caries of the children with different ages. As a child grows up, their teeth expose to cariogenic factors such as carbohydrate and bacterial plaque more; therefore, more dental caries develop. However, because of better attitude of mothers towards dental visits for older children, they are visited more and their untreated dental caries decrease consequently. [32] Furthermore, many teeth in older children may be extracted because of pulpal pain. [33]

In our study, similar to Moimaz *et al.* study, [34] lower dental caries were detected in the lonely children. In contrast, in Jain *et al.* study, [35] there was not a significant relationship between the number of siblings and children's dental caries. Fewer children in the family lead to more available time and budgets to spend for the children's preventive and restorative dental needs. Furthermore, because of more attention of parents to single children, lower dental trauma occurs. Therefore, educational programs are more necessary for more crowded families.

Our study, similar to Hoffmeister *et al.* study, [9]

showed better dental health status in the children living in higher socioeconomic families. In contrast, Pizzo *et al.* [36] found higher scores of dmft index in children of employed mothers. Homemaker mothers usually spend more hours at home; as a result, they have more time for attention to their children's oral hygiene. However, university- educated and employed mothers usually have more awareness about oral hygiene importance and pay more attention to their children's oral health status. Furthermore, families with higher income spend more budgets on dental preventive and restorative cares.

Relationship between the children's oral hygiene and their dental caries status

Our study, similar to other studies, [9-10] found a significant relationship between the frequency of children's tooth brushing and their dental caries status. However, 24% of our children had brushed their teeth less than once a day. Furthermore, the high prevalence of dental caries in the children indicated non-acceptable effectiveness of tooth brushing in the others. The findings showed that our education regarding children's oral hygiene and tooth brushing was not adequate. It highlighted the importance of establishing newer interventional programs for improving children's tooth brushing skill.

In this study, similar to other study, [37] the dental caries status of the children visited by a dentist for dental pain and problems was significantly worse than those who did not visit or visited for only check-up. However, we could not show a significant difference between the dental caries of the children with and without a previous dental check-up. Because the impact of dental check-up in decreasing dental caries have been shown, [38] our finding might indicate the improper dental check-ups. It might be supposed that not only the parents and children but also the dentists did not believe in the importance of dental check-up. Therefore, interventional programs such as designing guidelines and instructions for the dentists in this regard are recommended.

To decrease dental caries of preschool children, interventional programs are recommended. To implement community-based programs such as the fluidization of drinking water, we should try to draw the authorities' attention to the importance of oral health promotion programs. In addition, policies encouraging people, especially children, to use low-carbohydrate diet should

be established using both advertisements and marketing. In addition, the use of sugar substitutes is effective in reducing total cariogenic sugar intake; therefore, sugar-free products such as sugar-free chewing gums are recommended to be used especially immediately after meals. [31] Furthermore, using tax and subset, the authorities should change the final price of various food products so that high-carbohydrate ones have higher prices. Moreover, authorities should plan regular dental check-ups freely or with a minimum charge for preschool children. In addition, office-based preventive measures such as fissure sealant and fluoride therapy are recommended to be conducted routinely for susceptible young children. Although, fluoride varnish and fissure sealants are both effective in caries reduction, many children in our country are deprived of these services due to limited funding. However, studies have shown that using fluoride varnish for children is more cost-effective and yields a greater reduction in caries for a fixed budget. [39] Therefore, we recommended fluoride varnish as well as training about proper techniques of home preventive measures such as tooth brushing for all children and their parents.

This study was cross-sectional so all limitations of this type of study should be considered. Therefore, a better study type, especially a cohort study, is recommended to determine more accurately the factors affecting the dental caries status of preschool children. Furthermore, we selected the children from kindergartens. Although most of the children in Shiraz attend kindergartens, the participants might not be a true representative of the general population. For better evaluation, a community-based study is recommended.

Conclusion

We found unacceptably high prevalence of dental caries in the studied preschool children. This may show the inadequacy of the current programs for prevention of children's dental caries. To improve, new interventional programs such as using routine fluoride varnish in combination with minimal intervention dentistry are recommended for all children. The programs are more necessary for the children living in low socioeconomic families with more than one child as well as those with poor oral health. In addition, dentists need more education about dental check-up and preventive procedures with

minimal interventions to use for more children and result in a greater reduction in children dental caries.

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Conflicts of Interest

The authors declare no conflict of interest.

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