

Original Article

Factors Affecting Oral Hygiene and Tooth Brushing in Preschool Children, Shiraz/Iran

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Abstract

Statement of Problem: Inadequate tooth brushing and inappropriate oral hygiene can lead to dental caries, the most common chronic diseases of childhood with several side effects.

Objectives: To evaluate factors affecting on preschool children's oral hygiene and tooth brushing in Shiraz, Iran

Materials and Methods: In this cross-sectional study, we selected 453 children registered in Shiraz kindergartens in 2013 by randomized cluster sampling. The children's tooth brushing and oral hygiene were assessed using a reliable and valid questionnaire and Simplified Debris Index (DI-S), respectively. A dental student examined all the children in each kindergarten to determine their DI-S. The relationship between the children's demographic variables and their oral hygiene and tooth brushing status were evaluated.

Results: Tooth brushing for 272 children (71.2%) had been started after the age of 2 years. The teeth in 96 children (24.2%) had been brushed lower than once daily. The mean of the children's DI-S was $1.19 \pm (0.77)$. The DI-S of only 126 children (31.8%) was found to be good and very good. After controlling the effect of confounding factors, we found that the children's tooth brushing frequency was significantly associated with the number of children in the family and mothers' employment status. The age at which tooth brushing had been started was significantly associated with the fathers' education. Furthermore, the DI-S was associated with children's age, number of the children in the family, and their mothers' education.

Conclusions: Oral hygiene and tooth brushing of the preschool children were not in a desirable status. Interventional procedures, especially educational programs, are recommended for children and their parents. These programs seem to be more necessary for older children, low socioeconomic families, and families with more than one child.

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Introduction

Oral hygiene is careful mechanical cleaning of the teeth that disrupts the bacterial plaque, the main predisposing factor of dental caries. Therefore, it produces a clean enamel surface and prevents dental caries and periodontal disease [1]. Dental caries is a preventable infectious disease and one of the most common chronic diseases of childhood. It can cause pain, high treatment costs, reduced growth and development, speech disorders, and premature tooth loss that lead to chewing problems, loss of self-confidence, and harm to the permanent dentition [2].

For appropriate oral hygiene, dental flossing, tooth brushing [1], regular dental visits, and preventive dental procedures such as fissure sealant and fluoride therapy [3] are recommended. It is suggested that parents brush their children's teeth twice daily with a soft toothbrush of age-appropriate size and fluoridated toothpaste. It should be started early in life as soon as the first primary tooth erupts [4]. For assessing the oral hygiene, several methods have been established. Greene and Vermillion created one of the most useful methods, Simplified Oral Hygiene Index. It consists of two parts: Simplified Calculus Index and Simplified Debris Index (DI-S) which measures the amount of calculus and debris found on the tooth surfaces, respectively [5].

To enhance the children's oral hygiene, authorities need to know the factors affecting it. Previous studies showed the relationship between children's oral hygiene and some of their demographic factors such as parents' educational and occupational status [6], number of sibling in family [7], and family structure (one or two parents family) [8]. However, to the best of our knowledge, no study has assessed the impact of all important children's demographic factors on their oral hygiene in Shiraz.

Because basic information about the present oral status of the children is necessary to implement strategies to improve it, this study was designed to determine factors affecting on preschool children's oral hygiene and tooth brushing in Shiraz, Iran in 2013. The results of this study will help authorities to establish effective and appropriate interventional programs in this regard.

Materials and Methods

Setting and sampling

Participants of this cross-sectional study were the children registered in kindergartens in Shiraz, Iran in 2013. By randomized cluster sampling, 10 out of 147 Shiraz kindergartens were selected and all the children aged 3-6 years in the kindergartens in 2013

(453 children) were enrolled in the study. However, the children who were uncooperative or absent at the examination day, did not have any teeth, or did not have parental consent were excluded from the study.

Instruments

The children's tooth brushing and oral hygiene were assessed using a self-made questionnaire, and Simplified Debris Index (DI-S), debris component of Simplified Oral Hygiene Index, respectively [5]. The self-made questionnaire was prepared by evaluating and incorporating the questionnaires of previous studies [9,10]. The content validity of the questionnaire was approved by three faculty members of dental school of Shiraz University of Medical Sciences. To approve its reliability, we conducted a pilot study on 30 children's parents. The parents filled out the questionnaire twice, two weeks apart. The test-retest reliability was calculated using Spearman correlation. The coefficient values were all acceptable and highly significant (range: 0.572-0.833). The questionnaire included two parts evaluated the child's demographic information, and their tooth brushing and oral hygiene status. The first part consisted of seven questions about the child's sex and age, number of children in the family, father's job and education, and mother's employment status and education. The second part consisted of six questions as following: Frequency of children's tooth brushing either by themselves or by their parents

- The age tooth brushing had been started for the children by their parents
- Use of preventive dental procedures such as fissure sealant and fluoride therapy for the children
- The children's previous dental visits
- Parents' satisfaction of their children's dental cleaning
- Parents' evaluation of their children's oral health status

To determine the children's DI-S, the researcher examined four labial and two lingual surfaces of six different teeth in each child. Each tooth was scored from zero to three based on the inciso/occlusocervical extent of the visible debris on its surface. The DI-S of each child was recorded as the mean scores for the 6 teeth. These scores which were from zero to three were further categorized as very good (0-0.2), good (0.3-0.6), fair (0.7-1.8), and poor (1.9-3.0) [11].

Data collection

The study protocol was approved by the Research Ethics Committee of Shiraz University of Medical Sciences (Application # 8615). After obtaining informed consent from the children's parents, a dental

student examined the children in each kindergarten using a probe, a disposable dental mirror, and a headlight to determine the children's DI-S. The probe was placed on each tooth and moved along the surface to detect the inciso/occlusocervical extent of the debris. He also asked the parents to complete the questionnaires.

Data analysis

The collected data were analyzed using SPSS software version 18.0 (SPSS Inc., Chicago, IL, USA). Pearson Chi-square, one way ANOVA (with Tukey Post Hoc test), and Student's *t*-test were used to assess the relationship between the children's demographic variables and their oral hygiene. The effect of possible confounding factors was assessed using multiple logistic regression and multiple linear regression models. An alpha level of 0.05 was considered as statistical significance.

Results

Description of the participants

87% of the invited parents (396 out of 453) participated

in the study. Although more than half of the mothers (236 mothers) had university degrees, more than two-thirds of them (289) were housewives. 162 families (40.9%) had only one child and 234 (59.1%) had more than one child. The participating children were about 36-72 months old with a median age of 64 months and almost half of them (194) were girls.

Children's oral hygiene and tooth brushing

Tooth brushing for more than two-thirds of the children had been started by their parents after the age 2 years. The teeth in one-fourth of the children had been brushed fewer than once a day. About half of the children had a prior dental visit; however, most of them were visited because of the child's dental pain or other dental problems and only 77 (19.4%) were visited for check-up. Similarly, preventive dental procedures such as fissure sealant or fluoride therapy were performed only for a few children (12.9%). About half of the parents evaluated their children's oral health status as good and very good and nearly the same percentage were satisfied with the cleanness of their children's teeth (Table 1). According to our dental examination, the mean of the children's DI-S

Table 1: Oral hygiene of the studied children (N=396)

Oral health status	Frequency	Percentage
Frequency of tooth brushing		
Once a day or more	300	75.8
Lower than Once a day	96	24.2
Never	0	0
The age tooth brushing had been started		
2 years old or younger	114	28.8
After 2 years old	282	71.2
Preventive dental procedures		
Yes	51	12.9
No	345	87.1
Previous dental visits		
No previous dental visits	189	47.7
Dental visits for check-up	77	19.4
Dental visits for pain and other oral problems	130	32.8
Parents' satisfaction of their children's dental cleaning		
Yes	226	57.1
No	103	26.0
Don't know	67	16.9
Parents' evaluation of their children's oral health status		
Very good	55	13.9
Good	164	41.4
Moderate	85	21.5
Bad	61	15.4
Very bad	26	6.6
Don't know	5	1.3

was 1.19 (\pm 0.77) and it varied from zero to three. The DI-S of 126 children (31.8%) was considered as very good and good; that of 270 children (68.2%) was regarded as fair and poor.

Impact of children's demographic factors on their tooth brushing and oral hygiene

The factors relating to children's tooth brushing frequency

Univariate analysis showed that the children's tooth brushing frequency was significantly associated with the number of children in the family ($p = 0.002$), father's job ($p = 0.005$), mother's employment status ($p < 0.001$), fathers' education ($p = 0.003$), and mothers' education ($p < 0.001$). According to this analysis, a higher percentage of the mothers and fathers with university degree, employed mothers, employee fathers and parents with only one child brushed for their children once or more per day. However, in multivariate analysis, the only variables that showed significant associations with the children's tooth

brushing frequency were the number of children in the family ($p = 0.001$) and mother's employment status ($p = 0.037$). The employed mothers were about two times more likely to brush their children's teeth daily or more than the housewives (OR=2.24, 95%CI: 1.05-4.77). Moreover, odds ratio of daily tooth brushing for the parents with one child in comparison to those with more than one child was 2.44 (95%CI: 1.43-4.15, Table 2).

The factors relating to the age tooth brushing had been started for the children by their parents

In univariate analysis, most factors showing impact on the children's tooth brushing frequency had a significant relationship with the age tooth brushing had been started, as well. For instance, a higher percentage of the employed fathers ($p = 0.001$), employed mothers ($p < 0.001$) and mothers ($p < 0.001$) and fathers ($p < 0.001$) with university degrees had started tooth brushing for their children in age less than 2 years old. However, multivariate analysis

Table 2: Univariate and regression analyses regarding the impact of children's demographic factors on their tooth brushing frequency (N=396)

Children's demographic factors	Total	Children's tooth brushing frequency				
		Univariate analysis*			Regression analysis**	
		\geq Once a day N(%)	<Once a day N(%)	p value	OR	p value
Child's sex				0.486		0.268
Boy	202(51)	156(77.6)	46(22.8)		1.32	
Girl	194(49)	144(74.2)	50(25.8)		1	
Child's age				0.856		
36-47 months old	49(12.4)	38(77.6)	11(22.4)		1.04	0.924
48-59 months old	84(21.2)	65(77.4)	19(22.6)		0.94	0.851
60-72 months old	263(66.4)	197(74.9)	66(25.1)		1	
Number of children in the family				0.002		0.001
One child	162(40.9)	136(84.0)	26(16.0)		2.44	
More than one child	234(59.1)	164(70.1)	70(29.9)		1	
Father's job				0.005		0.142
Self-employed	258(65.2)	184(71.3)	74(28.7)		1	
Employee	138(34.8)	116(84.1)	22(15.9)		1.58	
Mother's employment status				<0.001		0.037
Employed	107(27)	95(88.8)	12(11.2)		2.24	
Homemaker	289(73)	205(70.9)	84(29.1)		1	
Fathers' education				0.003		0.430
High school or less	171(43.2)	158(70.2)	67(29.8)		1	
University degree	225(56.8)	142(83.0)	29(17.0)		1.29	
Mothers' education				<0.001		0.497
High school or less	160(40.4)	164(69.5)	72(30.5)		1	
University degree	236(59.6)	136(85.0)	24(15.0)		1.26	

* Pearson's chi square

N= Number

**Logistic regression

OR= Odds Ratio

only showed a significant association between the age teeth brushing had been started and the fathers' education. The fathers with university degree were almost two times more likely to start tooth brushing for their children under two years old than the fathers without the degree (OR=1.91, 95%CI:1.08-3.41, Table 3).

The factors relating to the children's DI-S

According to univariate analysis, there was a significant association between the children's DI-S and the following variables: the children's age ($p = 0.007$), number of children in the family ($p < 0.001$), mother's employment status ($p = 0.013$), and mothers' education ($p < 0.001$). Moreover, multivariate analysis showed that the children's DI-S was statistically related to the children's age, number of the children in the family, and mothers' education. A lower DI-S (better oral hygiene) was found in the younger children, single child in the family, and children whose mother had a university degree (Table 4).

Discussion

This cross-sectional study assessed factors affecting on preschool children's oral hygiene and tooth brushing. Although two-thirds of the children had brushed their teeth once a day or more, most of them had been started to brush after the age of 2 years old. Only 20% and 13% of the children had a dental check-up and preventive dental procedures, respectively. Although most of the parents were satisfied about their child's dental cleaning and evaluated their child's oral health status as good and very good, more than two thirds of the children were considered as fair to poor oral hygiene in our clinical examination. Parent's employment status and educational level, number of children in the family, and child's age had a significant association with the child's oral hygiene.

Although American Academy of Pediatric Dentistry (AAPD) recommended that tooth brushing should be performed for children twice daily [4], only 75% of those in our study had brushed their teeth

Table 3: Univariate and multivariate analyses regarding the impact of the children's demographic factors on the age tooth brushing had been started for them (N=396)

Children's demographic factors	Total	Age tooth brushing had been started for children				
		Univariate analysis*		Regression analysis**		
		≤2 years old N(%)	>2 years old N(%)	p-value	OR	p-value
Child's sex				0.682		0.615
Boy	202(51)	60(29.7)	142(70.3)		1.12	
Girl	194(49)	54(27.8)	140(72.2)		1	
Child's age				0.926		
36-47 months old	49(12.4)	13(26.5)	36(73.5)		0.67	0.277
48-59 months old	84(21.2)	24(28.6)	60(71.4)		0.90	0.736
60-72 months old	263(66.4)	77(29.3)	186(70.7)		1	
Number of children in the family				0.134		0.144
One child	162(40.9)	40(24.7)	122(75.3)		0.70	
More than one child	234(59.1)	74(31.6)	160(68.4)		1	
Father's job				0.001		0.358
Self-employed	258(65.2)	60(23.3)	198(76.7)		1	
Employee	138(34.8)	54(39.1)	84(60.9)		1.28	
Mother's employment status				<0.001		0.290
Employed	107(27)	45(42.1)	62(57.9)		1.37	
Housewife	289(73)	69(23.9)	220(76.1)		1	
Fathers' education				<0.001		0.027
High school or less	171(43.2)	44(19.6)	181(80.4)		1	
University degree	225(56.8)	70(40.9)	101(59.1)		1.91	
Mothers' education				<0.001		0.231
High school or less	160(40.4)	50(21.2)	186(78.8)		1	
University degree	236(59.6)	64(40.0)	96(60)		1.45	

*Pearson's chi square

N= Number

**Logistic regression

OR= Odds Ratio

Table 4: Univariate and multivariate analyses regarding the impact of the children's demographic factors on their DI-S (N=396)

Children's demographic factors	Total number	Children's DI-S			
		Univariate analysis		Regression analysis ^{***}	
		Mean ± SD	p value	B (SE)	p value
Child's sex			0.629*		
Boy	202(51)	1.21 ± 0.75		0.01 (0.07)	0.895
Girl	194(49)	1.17 ± 0.80		1	
Child's age			0.007**		
36-47 months old	49(12.4)	1.05 ± 0.72 ^{ab†}		-0.25 (0.12)	0.031
48-59 months old	84(21.2)	1.00 ± 0.73 ^a		-0.22 (0.09)	0.019
60-72 months old	263(66.4)	1.27 ± 0.79 ^b		1	
Number of children in the family			<0.001*		
One child	162(40.9)	0.98 ± 0.70		-0.32 (0.08)	<0.001
More than one child	234(59.1)	1.34 ± 0.79		1	
Father's job			0.477*		
Self-employed	258(65.2)	1.21 ± 0.77		0.01 (0.09)	0.886
Employee	138(34.8)	1.15 ± 0.78		1	
Mother's employment status			0.013*		
Employed	107(27)	1.03 ± 0.72		-0.08 (0.10)	0.447
housewife	289(73)	1.25 ± 0.79		1	
Fathers' education			0.263*		
High school or less	171(43.2)	1.23 ± 0.78		1	
University degree	225(56.8)	1.14 ± 0.76		0.07 (0.10)	0.486
Mothers' education			<0.001*		
High school or less	160(40.4)	1.30 ± 0.78		1	
University degree	236(59.6)	1.02 ± 0.74		-0.24 (0.10)	0.019

DI-S: Simplified Debris Index SD: Standard Deviation SE: Standard Error

*Student's *t*-test

**One way ANOVA

***Multiple linear regression

†Note: The result of Tukey test was shown using letters in superscript. There was a statistically significant difference between groups without a common letter.

once a day or more. This finding was similar to those reported from other developing countries. About, 76% of Indian [12] and 44% of Hong Kong [13] preschool children had brushed their teeth once daily. Results from developed countries were similar, as well. Only 90% of 5-year-old American children were brushing their teeth once a day or more [14]. Also, in a Norwegian study, 61% of 3-year-old children and 76% of 5-year-old children had brushed their teeth twice daily [15].

Although AAPD suggested that tooth brushing should be started as soon as the first primary tooth erupted [4], only 29% of the children in our study had started tooth brushing at 2 years of age or younger. Similarly, 25% of Indian [12] and 29% of Mexican children began brushing their teeth before the age of two years [16]. Nevertheless, 86% of Hong Kong children [13] and most of Norwegian children [15]

started tooth brushing before the mentioned age. The children's oral hygiene has an important effect on their oral health related quality of life and is a major predictor of adult oral health [16]. Therefore, parents should be informed about the importance of the deciduous teeth and tooth brushing at the early years of their children's life.

Through clinical examination, we found that oral hygiene status of the children in our study, similar to other developing countries, was much worse than that of the children in developed countries. Less than one-third of the children in our study were found to have very good and good oral hygiene. Mean DI-S of the children in our study was 1.19. Similarly, in a study conducted in Kuwait, the DI-S means for girls and boys were 1.5 and 1.6, respectively [17]. However, the mean DI-S in children in a Canadian study was 0.87 [18]. The results emphasize the importance of

interventional programs for improving the children's oral hygiene.

AAPD recommended that children should be visited by a dentist at the time of the eruption of the first primary tooth [3]. However, about 48% of the children in our study had not been visited by a dentist previously and just 20% of them had a dental visit for check-up. Similarly, about 50% of African Immigrants' children in a Canadian study had never visited a dentist previously [19]. Also, only 25% of the children in a Hong Kong study [13] had visited a dentist for check-up. Likewise, studies showed that a large percentage of children in developed countries had never seen a dentist when they registered in the kindergarten [20,21]. This might be due to the fact that parents do not believe in the importance of regular dental visit.

In our study, preventive dental procedures had been performed for only a few children. Similarly, a study on immigrant population in San Francisco [22] and an Indian study [12] showed that there was low utilization of preventive dental services by the preschool children. This may be due to lack of parental belief in the importance of the primary teeth. Therefore, the parents' effective attention to primary teeth is an important issue to improve the children's oral hygiene, and educational interventions in this regard are recommended.

About half of the parents were satisfied with their child's dental cleaning and the same percentage of them evaluated their child's oral health status as good and very good, while more than two-thirds of the children were considered as fair to poor oral hygiene in our clinical exam. Other studies had also documented the caregivers' tendency to rate their children's dental status positively [23,24]. Amin *et al.*'s study showed that in Canada, parents rated the dental status of 44% of children as good; however, 56% of them had dental decay [19]. They were unrealistically optimistic probably because their children had not still suffered from the severe consequences of caries or parents were afraid of being judged for their carelessness [24].

Our study, similar to other researches, revealed a significant association between some of the children's demographic factors and their oral hygiene. However, there were some differences between our results and those of other studies. Although previous studies showed that the frequency of tooth brushing increased by increasing the child's age [7,25,26], our study did not show a significant difference in tooth brushing frequency of children in different ages. However, our clinical examination, similar to the studies conducted in England and Belgium [27,28] showed better oral hygiene in smaller children. The parents brush their

small child's teeth; however, as the child grows up, he/she brushes his/her teeth. Children younger than 3 years of age are not developmentally ready to brush their teeth independently. Although they should be encouraged to brush their own teeth, parents are expected to perform brushing and support them in this procedure until age 6 [29]. According to this result, if parents do not do so, this preventive procedure may not be adequately efficient. Previous studies also revealed that girls brushed more frequently [15,25,27] and had a better oral hygiene status than boys [27,28]. However, our research, similar to a Mexican study [30], did not show any differences between tooth brushing frequency of boys and girls. In addition, we could not show a difference between boys and girls in DI-S and the age tooth brushing had been started. Therefore, interventional programs for improving oral health status are similarly necessary for boys and girls.

In our study, the children who were the only child of a family had better oral health. Similarly, in a Spanish and a Norwegian study, a lower tooth brushing frequency was detected in children with larger family size [7,26]. Therefore, education about the child's tooth brushing and oral health is more necessary for parents having several children. In our study, similar to previous studies, parents with higher educational level [7,25,26] and better occupational status [25,26] brushed their child's teeth more frequently and had better child's oral hygiene [6]. The findings confirm the fact that families in low socioeconomic status need more educational programs about their child's oral health.

Small children's oral hygiene has a significant impact on their oral and consequently on other systemic diseases throughout their life [31]. Therefore, it is highly recommended that authorities implement interventional programs to enhance the children's oral hygiene. It is necessary that the children be educated about the tooth, tooth brushing and consequence of disregarding oral hygiene in their kindergartens. This education needs methods compatible to their age that adequately influence not only their knowledge but also their attitude and practice. Appropriate methods of tooth brushing should be demonstrated for them; afterwards, they should brush their teeth under observance of their instructors. Appropriate and age-compatible booklet and brochure should be designed for preschool children. Preschool teachers should be trained so that they believe in the importance of oral hygiene and educate the children in this regard. In addition, some media such as television, which are the children's favorite, should participate in children's education. As parents have an important role in their preschool child's oral hygiene, it would be better

to involve them in planning and implementing the programs and policies that address oral health promotion for children.

Parents should be adequately educated about correct methods of tooth brushing and other home-based preventive procedures. In addition, the importance of routine dental visits and office-based preventive procedures such as fluoride therapy and fissure sealant should be explained to them. These interventions are more necessary for low socioeconomic parents and parents with more than one child. Moreover, older preschool children need the educational programs more than younger ones.

Our study had some limitations, the most important of which being the study type which was cross-sectional. This study type has several limitations; therefore, in order to determine the factors affecting the oral hygiene of preschool children more accurately, other study types, especially a cohort one, are recommended. In addition, in this study, we relied on the parents' statements about their child's oral hygiene habits. It should be considered that these statements might be different from actual ones. However, we also evaluated the children's oral hygiene by clinical examination. Furthermore, our participants were the children attending the kindergartens, including the majority of, but not all, the 3-6-year-old children in Shiraz. For better evaluation, a community-based study is recommended.

Conclusions

Comparing our results to AAPD recommendations, we concluded that tooth brushing habits of the studied preschool children was not desirable. Furthermore, although most parents believed that their children's oral hygiene was good, Our clinical exam did not show so. To enhance the oral hygiene, interventional procedures are necessary not only for children but also for their parents. These programs are more recommended for older children, low socioeconomic families and families with more than one child.

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