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The caries pattern of primary teeth and its determinants among 5-7-year-old children in Tehran, Iran

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Original Article

Abstract

BACKGROUND AND AIM: Dental caries is one of the most common chronic diseases in children that affects oral health, general health, and quality of life; and often leads to pain and discomfort when left untreated. This study aimed to evaluate the severity and location of dental caries based on background determinants, nutritional status, oral health behaviors, and fluoride therapy status in the primary teeth of children aged 5-7 years old in Tehran, Iran.

METHODS: This descriptive-analytical cross-sectional study was performed on 572 children. Data were collected by two calibrated dentists by a questionnaire in 4 parts: demographic information, medical history, nutritional status, and oral health behaviors. The severity and location (surfaces) of dental caries were recorded for canine, primary first and second molar teeth according to the World Health Organization (WHO) criteria. Data were analyzed with backward linear regression analyses.

RESULTS: The mean of decayed, missing, filled teeth (DMFT) was 4.9 for all examined teeth. Dental caries was more prevalent in boys [odds ratio (OR) = 1.83, 95% confidence interval (CI): 0.81-2.80], those who had dental visits due to dental problems with pain (OR = 1.17, 95% CI: 0.73-1.60), and those who did not receive fluoride therapy (OR = 1.64, 95% CI: 0.58-2.60). The mandibular jaw had a higher frequency of carious surfaces. Proximal caries was about 0.47 times higher in non-affluent versus affluent areas (95% CI: 0.06-0.90). Buccolingual caries was 0.25 times more prevalent in boys than girls (95% CI: 0.04-0.50), and occlusal caries was 0.5 times more frequent in children with irregular fluoride therapy than those with regular one (95% CI: 0.06-0.90).

CONCLUSION: Gender, mother's level of education, type of snack consumption, age when the child started tooth brushing, fluoride therapy, and reason for dental visit affected the severity of dental caries.

KEYWORDS: Dental Caries; Children; Risk Factors; Diet; Oral Hygiene; Decayed, Missing, Filled Index

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Dental caries is one of the most common chronic diseases in children and adolescents, and imposes an enormous cost on the societies. Globally, 60%–90% of children and almost all adults have experienced dental caries, usually leading to pain and discomfort.[1] Dental caries in childhood affects oral health, general health, and quality of life, and often leads to pain and discomfort when left untreated.[2]

Dental caries may cause several problems such as toothache, decreased chewing ability, sleep disorders, stress, anxiety, and lack of concentration in children. This may consequently result in restricted food choices, loss of appetite and eating satisfaction, weight loss, delayed development, absence from school, being ashamed to smile, and stopping playing with other children.[3,4]

Dental caries is affected by several factors including the parents' socioeconomic status, oral hygiene status, food type, consumption of sugary snacks, frequency of dental visits, and fluoride therapy.[5] The progression of dental caries can be prevented by detecting it in

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early stages or identifying aggravating factors.

The most common indices for evaluating dental caries are decayed, missing, filled teeth (DMFT) and decayed, missing, filled surfaces (DMFS). The mean DMFT of Iranian children aged 5-6 years was about 5 in 2012, and the corresponding value was about 2.32 for children aged 3-7 years in Tehran, Iran, in 2014.[6] To the best of our knowledge, there are only few updated studies on the DMFS index in Tehran.

The present study aimed to evaluate the severity and location of dental caries according to the background determinants, nutritional status, oral health behaviors, and fluoride therapy status in primary teeth among 5- to 7-year-old children in Tehran. The findings help to identify high-risk patients and tooth surfaces most prone to dental caries.

Methods

There are more than 12 million inhabitants in Tehran, and the total number of 5-7-year-old children is about 270000 according to statistical center of Iran.[7] The present cross-sectional study was carried out on students aged 5-7 years old in public schools of Tehran (over 90% of children in Tehran) between January and March 2016.

To have a representative random sample, the city was divided into two affluent (districts 1 to 8) and non-affluent (districts 9 to 19) parts based on a previous study.[8] Three districts in each part, i.e. 6 out of 19 administrative districts of Ministry of Education, were selected randomly. In each selected district, one girls' and one boys' school was chosen, and in each school, preschool and grade one students were selected. The total sample size was 572 children aged 5-7 years old (response rate = 99%).

The present study was approved by the Ethics Committee of Tehran University of Medical Sciences according to a written permission (letter number: IR.TUMS.REC.1394.1730 dated 24 January 2016). Participation was voluntary, and informed consent was obtained from the participants' parents or legal guardians.

To calibrate the two examiners, a pilot study was carried out on 25 girls (5-7 years old), in one public school prior to data collection (kappa value = 0.9). The self-administered questionnaire was completed by parents to collect the data about some common risk factors for dental caries based on World Health Organization (WHO) recommendations.[9]

The questionnaire had 4 parts: demographic information, medical history, nutritional status (snack consumption), and oral health behaviors.

Demographic information included the child's age (5, 6, and 7 years old), child's sex, mothers' level of education (4 levels: high school diploma or less, technician, bachelor's degree, and doctorate degree).

Nutritional status was reported by type of snack and frequency of consumption. There were 4 types of snacks: sugary snacks, fruits and vegetables, nuts, and dairy products. It was multi-optional, and was then categorized as protective, neutral, and cariogenic nutrients or snacks. According to the results of an expert panel, the cariogenic potential of the nutrients was scored as follows: sweets = +2, fruits and vegetables = +1, nuts = 0, and dairy = -2. The multi-optional answers were calculated and divided into 6 groups accordingly:

-2 = dairy, nuts + dairy

-1 = fruits and vegetables + dairy, fruits and vegetable + nuts + dairy

0 = nuts, sugary snacks + dairy, sugary snacks + nuts + dairy

1 = fruits and vegetables, fruits and vegetables + nuts, sugary snacks + fruits and vegetables + dairy, fruits and vegetables + sugary snacks + nuts + dairy

2 = sugary snacks, sugary snacks + nuts

3 = sugary snacks + fruits and vegetables, sugary snacks + fruits and vegetables + nuts

The consumption frequency was categorized into four groups of never, 1-2 times, 3 times, and more than 3 times per day.

Oral health behaviors were evaluated by the age when the child started to brush his/her teeth (1-7 years), frequency of tooth brushing and flossing (never, 1-2 times, 3 times, and more than 3 times per day), dental visits in the past year (yes/no), and fluoride therapy status.

The reasons for dental visits were recorded and then categorized in four groups from the best to the worst: 1 = periodic examinations, 2 = no dental visit, 3 = dental problems without pain, 4 = dental problems with pain.

Fluoride therapy and its regularity were reported as yes or no.

Children were clinically examined using examination gloves, WHO probe, dental mirror, and headlamp on a comfortable chair during school hours based on the WHO criteria.

The incisor teeth are usually in the transitional phase in children aged 5-7 years, and the first permanent molars are not completely erupted. Therefore, the dental status was recorded for only canine, primary first and second molar teeth in both jaws. The oral health status was described by DMFT and DMFS indices. DMFS was recorded for five surfaces, including the mesial, distal, buccal, lingual, and occlusal, and then categorized into three groups of proximal, buccolingual, and occlusal surfaces.

The severity of dental caries was defined by the number of decayed surfaces, ranging from 1 to 5 surfaces for primary first and second molar teeth and 1 to 4 surfaces for the canine tooth.

Data were analyzed with backward linear regression analysis using SPSS software (version 20, IBM Corporation, Armonk, NY, USA).[10] The associations were assessed and reported by both odds ratio (OR) and 95% confidence interval (CI) as well as beta statistic (P-value). Differences with a P-value < 0.05 were considered statistically significant.

Results

Totally, 572 children aged 5-7 years old were examined, of whom 52% were girls and 50% were 6 years old. The mothers' level of education was high school diploma or less in 51% of all subjects. As for the nutrition status, consumption of fruits and vegetables was reported by 68%, and snack consumption 1-2 times per day was mentioned by 83% of the subjects (Table 1).

Among all subjects, 41% reported starting tooth brushing at the age of 2 or 3 years old, 75% of subjects brushed once a day, and 78% visited a dentist last year of whom 32% reported dental problems with pain as the reason for the dental visit (Table 2). The parents of 41% of the subjects reported their children experienced fluoride therapy, but 28% of them did not do it on a regular basis.

The mean DMFT of all subjects was 4.9 for all canines, primary first and second molars. Decayed teeth (DT), missing teeth (MT), and filled teeth (FT) comprised 72%, 5%, and 23% of DMFT, respectively. Assessment of the severity of dental caries according to the number of decayed surfaces showed generally higher figures in the upper jaw. The canine teeth had the lowest and the primary second molars had the highest mean severity (mean number of DMFS) in both jaws. Moreover, the primary maxillary first molars demonstrated the highest and primary mandibular canine teeth demonstrated the lowest frequency of dental caries.

The severity of dental caries was higher (P < 0.001) among children residing in non-affluent districts [decayed surfaces = 7.9, standard deviation (SD) = 6.7] as compared with affluent districts (decayed surfaces = 5.9, SD = 6.5). According to the results of linear regression analysis (Table 3), the severity of dental caries decreased by 0.09 tooth surface for each level of increase in maternal education (P = 0.010), and increased by 0.15 for each unit of increase in start age of tooth brushing (P < 0.001).

The mandibular jaw had the highest frequency of carious surfaces (proximal,

Table 1. Background information, nutritional status, and total caries severity of children aged 5-7 years (n = 572)

Variable		n (%)	Total caries severity (mean ± SD)
Background information			
Living area			
Affluent (districts 1-8)		290 (50.7)	5.88 ± 6.53
Non-affluent (districts 9-19)		282 (49.3)	7.94 ± 6.66
Child's sex			
Girls		300 (52.4)	5.78 ± 5.48
Boys		272 (47.6)	8.13 ± 7.60
Child's age (year)			
5		128 (22.4)	7.45 ± 7.03
6		287 (50.2)	6.45 ± 6.42
7		157 (27.4)	7.26 ± 6.82
Mother's level of education			
Diploma or less		289 (50.5)	8.18 ± 7.00
Technician		70 (12.2)	6.27 ± 5.47
Bachelor's degree		209 (36.5)	5.44 ± 6.26
Doctorate degree		4 (0.7)	1.25 ± 1.50
Nutrition status			
Snacks type			
Protective	-2	59 (10.3)	5.83 ± 6.48
	-1	106 (18.5)	6.46 ± 6.34
Neutral	0	61 (10.7)	6.59 ± 6.71
Cariogenic	1	246 (43.0)	6.59 ± 6.51
	2	64 (11.2)	8.69 ± 6.63
	3	36 (6.3)	9.33 ± 8.22
Consumption frequency			
Never		0 (0)	0 ± 0
1-2 times		475 (83.0)	6.89 ± 6.54
3 times		67 (11.7)	6.91 ± 7.18
More than 3 times		30 (5.3)	6.90 ± 7.73

SD: Standard deviation

buccolingual, occlusal) in all teeth. Figure 1 shows the prevalence of DMFS according to tooth surface and name for both jaws. The highest percentage of caries was found in the proximal surface of primary first molars and the lowest was seen in the incisal surface of canine teeth. Among 12 examined teeth, the primary mandibular left first molars demonstrated the highest and the primary mandibular right canine teeth demonstrated the lowest frequency of carious surfaces.

According to the results of linear regression analysis (Table 4), proximal caries was 0.47 times more prevalent in non-affluent versus affluent areas (95% CI: 0.06-0.90), and 0.5 times more prevalent in boys than girls (95% CI: 0.09-0.90). Proximal caries increased by 0.19 unit for each one-year increase in start age of brushing (P < 0.001).

Table 4 shows that buccolingual caries was 0.25 times more prevalent in boys than girls (95% CI: 0.04-0.50), and subjects without fluoride therapy had 0.27 times more buccolingual dental caries than those with fluoride therapy (95% CI: 0.05-0.50).

According to table 4, occlusal caries was 0.63 times more prevalent in boys than girls (95% CI: 0.34-0.90), and 0.5 times more prevalent in those with irregular fluoride therapy than those with regular fluoride therapy (95% CI: 0.06-0.90). Occlusal caries increased by 0.11 unit for each level of dental visit status (P = 0.010).

Table 2. Mean number of decayed, missing and filled surfaces (DMFS) of canine, primary first and second molar teeth according to oral health behaviors among children aged 5-7 years (n = 572)

Variable	n (%)	Total caries severity (mean ± SD)
Start age of tooth brushing (year)		
1-3	320 (56.0)	5.53 ± 5.90
4-7	252 (44.0)	8.57 ± 7.2
Frequency of tooth brushing (per day)		
Never	21 (3.7)	6.90 ± 8.52
Once	426 (74.5)	6.85 ± 6.45
Twice	115 (20.1)	7.30 ± 7.12
More than twice	10 (1.7)	4.40 ± 6.80
Frequency of dental flossing (per day)		
Never	445 (77.8)	7.27 ± 6.92
Once	113 (19.8)	5.92 ± 5.74
Twice	9 (1.6)	3.00 ± 2.29
More than twice	5 (0.9)	2.60 ± 2.60
Dental visit during past year		
Yes	444 (77.6)	6.63 ± 6.43
No	128 (22.4)	7.83 ± 7.41
Reason for dental visit		
Periodic check-up	136 (23.8)	3.66 ± 4.52
No visit	128 (22.3)	7.83 ± 7.41
Dental problems without pain	124 (21.7)	7.15 ± 6.73
Dental problems with pain	184 (32.2)	8.47 ± 6.66
Fluoride therapy		
Yes	233 (40.7)	5.64 ± 6.13
No	339 (59.3)	7.76 ± 6.90
Regular fluoride therapy		
Yes	75 (13.1)	4.04 ± 4.58
No	497 (86.9)	7.33 ± 6.83

SD: Standard deviation

Discussion

We evaluated the severity and location of dental caries in primary teeth in 5- to 7-year-old children in Tehran in 2016.

According to the results of this study, several indicators including the child's sex, mother's level of education, type of snack consumption, the age at which the child started tooth brushing, fluoride therapy, and reason for dental visits affected the severity of dental caries. The school location (district), child's sex, mother's level of education, and oral health behaviors were the potential indicators for the location of dental caries.

Table 3. Severity of dental caries in canine, primary first and second molar teeth according to linear regression analysis for children aged 5-7 years (n = 572)

Explanatory variables	Beta	B	CI for B		P
			Minimum	Maximum	
Child's sex (girls to boys)	0.13	1.83	0.81	2.85	< 0.001
Mother's level of education(low to high)	-0.09	-0.69	-1.25	-0.13	0.010
Type of nutrition (protective to cariogenic)	0.09	0.46	0.08	0.83	0.010
Start age of tooth brushing (1 to 7 years)	0.15	0.61	0.29	0.93	< 0.001
Frequency of dental flossing (never to more than twice a day)	-0.06	-0.83	-1.81	0.14	0.090
Reason for dental visit (periodic check-up to dental visit with pain)	0.20	1.17	0.73	1.61	< 0.001
Fluoride therapy (yes to no)	0.12	1.64	0.58	2.69	< 0.001

Excluded factors: child's age, consumption frequency, frequency of tooth brushing, dental visit status, regular fluoride therapy, CI: Confidence interval

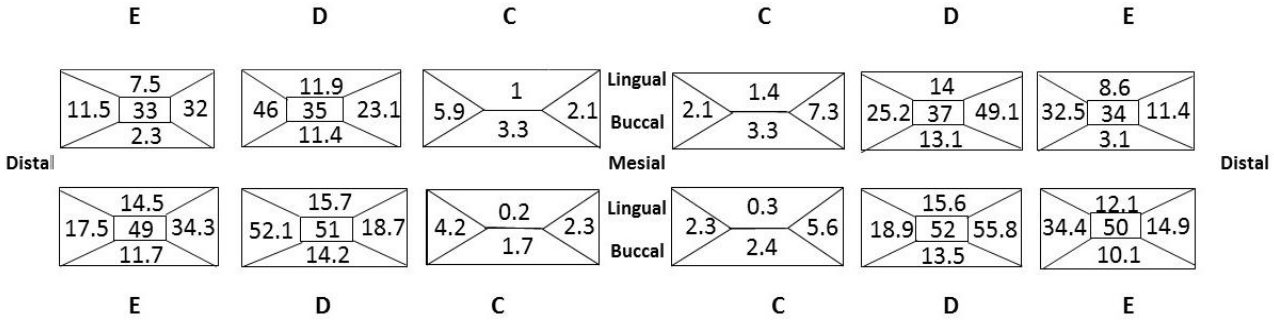

Figure 1. Prevalence (%) of caries history [decayed, missing, filled surface (DMFS)] according to tooth surface (mesial, distal, buccal, lingual, and occlusal) and name canine, primary first and second molar teeth for both jaws

The subjects of the present study well represented the oral health status and behaviors among schoolchildren in Tehran. Randomized cluster sampling based on previous studies and very low missing data were the advantages of the present study.

Table 4. Results of linear regression analysis showing the role of explanatory variables on the location of dental caries in canine, primary first and second molar teeth for children aged 5-7 years (n = 572)

Tooth surface*	Explanatory variables	Beta	B	CI for B		P
				Minimum	Maximum	
Proximal	District	0.09	0.47	0.06	0.880	0.020
	Child's sex	0.09	0.50	0.09	0.900	0.010
	Start age of tooth brushing	0.19	0.30	0.18	0.430	< 0.001
	Frequency of tooth brushing	0.06	0.32	-0.05	0.710	0.090
	Dental visit status	0.10	0.66	0.15	1.180	0.010
	Reason for dental visit	0.12	0.28	0.09	0.460	< 0.001
	Fluoride therapy	0.10	0.57	0.10	1.030	0.010
	Regular fluoride therapy	0.07	0.59	-0.08	1.260	0.080
Buccolingual	Child's sex	0.09	0.25	0.04	0.460	0.010
	Child's age	0.07	0.13	-0.02	0.290	0.080
	Frequency of dental flossing	-0.12	-0.29	-0.50	-0.090	0.004
	Reason for dental visit	0.14	0.16	0.07	0.240	0.001
	Fluoride therapy	0.10	0.27	0.05	0.500	0.010
Occlusal	Child's sex	0.16	0.63	0.34	0.920	< 0.001
	Mother's level of education	-0.08	-0.16	-0.32	-0.006	0.040
	Type of nutrition	0.06	0.09	-0.01	0.200	0.080
	Start age of tooth brushing	0.10	0.12	0.03	0.210	0.009
	Frequency of tooth brushing	0.08	0.31	0.02	0.600	0.030
	Frequency of dental flossing	-0.09	-0.32	-0.61	-0.030	0.020
	Dental visit status	0.11	0.49	0.12	0.870	0.010
	Reason for dental visit	0.14	0.23	0.10	0.360	0.001
	Regular fluoride therapy	0.09	0.50	0.06	0.950	0.020

*Dependent variables are mean number of decayed, missing and filled surfaces (DMFS) in each of proximal, buccolingual, and occlusal locations. CI: Confidence interval

Excluded factors for proximal surfaces: child's age, mother's level of education, type of nutrition, consumption frequency, frequency of dental flossing

Excluded factors for buccolingual surfaces: mother's level of education, type of nutrition, consumption frequency, start age of tooth brushing, frequency of tooth brushing, dental visit status, regular fluoride therapy

Excluded factors for occlusal surfaces: child's age, consumption frequency, fluoride therapy

Living area [Affluent (districts 1-8), non-affluent (districts 9-19)]; child's sex (girls, boys); child's age (5 years, 6 years, 7 years); mother's level of education (diploma or less, technician, bachelor's degree, doctorate degree); snacks type (protective, neutral, cariogenic); consumption frequency (never, 1-2 times, 3 times, more than 3 times); start age of tooth brushing (at ages 1-3, at ages 4-7); frequency of tooth brushing (never, 1 time per day, 2 times per day, more than 2 times); frequency of dental flossing (never, once, twice per day, more than twice); dental visit during past year (yes, no); reason for dental visit (periodic check-up, no visit, dental problems without pain, dental problems with pain); fluoride therapy (yes, no); regular fluoride therapy (yes, no).

The results of our study are similar to previous findings in Australia[11] and Iran.[12,13] According to the results of these studies, dental caries is more prevalent among older children who eat more cariogenic foods, brush their teeth less often, do not use dental floss, and have low educated mothers.

Potential determinants of the severity and location of dental caries:

The present study showed that proximal caries was significantly more frequent in non-affluent districts, since they might have less access to oral hygiene facilities as compared with other children. This finding was similar to the result of another study.[14]

Boys showed more dental caries in terms of severity and location, as reported in previous studies.[15,16] More dental caries in boys might be related to more carbohydrate intake and continuity of consumption. However, Lin et al. showed no difference in dental caries between boys and girls in China.[17]

There was no significant relationship between the location and severity of dental caries and the child's age, while some studies reported significant associations.[12,14,18] This difference might be related to the narrow age range in the present study in comparison with other investigations.

The severity of dental caries and the prevalence of occlusal caries decreased with an increase in the maternal educational level as confirmed by earlier studies.[10,17] Educated mothers might be more careful about their children's oral health, because they have more knowledge in this regard.[19]

The severity of dental caries increased with an increase in the level of nutrient cariogenicity. The snack type demonstrated a significant association with the severity of dental caries as confirmed in other studies.[16,20] However, there was no significant association between the snack type and the location of dental caries.

Similar to the results of other studies,[13] we found that the severity and location of dental caries (proximal and occlusal) increased when tooth brushing started with a delay.

In the present study, the frequency of tooth brushing had no or a weak relationship with outcome variables, indicating a biased self-report of the variable or ineffective tooth brushing. This finding reveals the importance of supervised tooth brushing as suggested in another study.[21]

It is usually assumed that dental flossing protects the tooth from proximal caries, while our findings did not confirm it. A systematic review failed to find a relationship between self-performed dental flossing and inter-proximal caries.[22] The prevalence of dental caries decreased with an increase in the frequency of dental flossing. On the contrary, dental flossing was related with lower odds of occlusal and buccolingual caries, as reported by other studies;[13,22] probably due to the fact that flossing is associated with a better oral hygiene.

In the present study, part of the data was acquired through the self-administrated questionnaire by parents, that is prone to self-report bias. Prior coordination was also necessary to access the subjects in the schools. This was attained after several correspondence and approval of related authorities and committees. The examiners referred to the schools several times to complete the missing data.

Conclusion

The potential predictors of the severity and location of dental caries were the child's sex, age at which the child started tooth brushing, and the reason for dental visits. Besides these indicators, fluoride therapy and dental visits during the past year had a strong relationship with the location of dental caries.

Conflict of Interests

Authors have no conflict of interest.

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