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Determinants of Dental Caries in Children Aged 7-12 Years in Iran: A Case-Control Study

Salman Khazaei[1, 5], Mohammad Ahmadian[2], Saeed Bashirian[3], Samaneh Shirahmadi[4], Ensiyeh Jenabi[5], Shabnam Saboonchi[6], Neda Dadaei[7], Shaghaiegh Barkhordar[4], *Fatemeh Shahbazi[8]

[1] Research Center for Health Sciences, Hamadan University of Medical Sciences, Hamadan, Iran.
[2] Student Research Committee, Hamadan University of Medical Sciences, Hamadan, Iran.
[3] Social Determinants of Health Research Center, Hamadan University of Medical Sciences, Hamadan, Iran.
[4] Dental Research Center, School of Dentistry, Hamadan University of Medical Sciences, Hamadan, Iran.
[5] Autism Spectrum Disorders Research Center, Hamadan University of Medical Sciences, Hamadan, Iran.
[6] Researcher, Hamadan University of Medical Sciences, Hamadan, Iran.
[7] Deputy of Health, Hamadan University of Medical Sciences, Hamadan, Iran.
[8] Department of Epidemiology, School of Public Health, Hamadan University of Medical Sciences, Hamadan, Iran.

Abstract

Background: Oral health is one of the most important dimensions of individual health, so in order to assess the status of oral health in a community, it is necessary to conduct various epidemiological studies at different stages to determine the effectiveness of prevention and oral health programs in a community. The aim of this study was to determine some of the factors associated with dental caries in primary school students in Hamadan in 2019.

Methods: In this case-control study, information about students with dental caries and controls was extracted by referring to schools in the four education districts of Hamadan (A girls' school and a boys' school were selected from each district). The total sample size was 980 people and 30 cases and 90 controls were selected from each school. For determining dental caries status a final year dental student examined the students. Logistic regression model was used to evaluate the risk factors for the disease. All analyses of this study were analyzed using Stata software, version 14.

Results: A total of 240 cases and 740 controls were studied in this study. The mean dmft in primary school students in Hamadan was 1.86 ± 2.92. Among them, the first and second grade students had the highest caries rate. The results of the logistic regression model showed that the risk of tooth decay in people with severe toothache is almost twice as high as that in people who do not have toothache. This rate is more than 1.5 times higher for students whose fathers are workers than for those whose fathers are self-employed. Also, as the number of family members increased, the chances of developing tooth decay increased linearly. The odds of tooth decay in people who do not brush and floss are 2.84 and 2.13, respectively, more than people who brush and floss three times a day.

Conclusion: In our study, having severe toothache, lack of parental supervision over the children's oral health, employment and education of parents, family dimension, not using toothbrush, flossing and mouthwash, excessive consumption of sweets, lack of regular visits to the dentist, and low dairy consumption were associated with tooth decay.

Key Words: Dental Caries, Epidemiology, Iran, Risk Factors, Students.

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**** Corresponding Author:***

Fatemeh Shahbazi, Department of Epidemiology, School of Public Health, Hamadan University of Medical Sciences, Hamadan, Iran. Email: shahbazif2017@gmail.com

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1- INTRODUCTION

Tooth decay is the first chronic disease in preschool children and the most common chronic infectious disease in primary school children (1). This disorder refers to the local and progressive destruction of tooth tissue by microorganisms (2) in which several factors cause the spread and progression of this multifactorial disease. They include factors such as host-related factors, the presence of food in the oral environment, and caries-causing microorganisms in dental plaque, especially Streptococcus mutans (3). In addition to these factors, other variables such as behavioral, nutritional, cultural, genetic, and socio-economic factors can also affect the process of tooth decay (4). Untreated dental caries in children can cause complications such as pain and discomfort, tooth loss, acute and chronic infections, sleep and eating disorders, absenteeism from school, decreased ability to learn, decreased appetite, weight loss and reduced growth rate, as well as a profound effect on reducing the quality of public life of children and their families (5). Due to the importance of the role of the teeth in various actions (chewing, speech, facial growth and development, beauty of appearance, etc.), it is necessary to prevent tooth decay along with the subsequent gum disease and tooth loss. Due to the importance of the above subjects, understanding and controlling the risk factors for tooth decay can be very important in preventing dental caries and stopping or slowing their progression (6). Accurate assessment of the risk factors for tooth decay allows dentists and health care providers to identify people at high risk of tooth decay and take appropriate treatments and preventive measures at the right time to prevent the formation and progression of dental caries. Numerous studies and measures have been performed around the world with the aim of preventing this disease. Significant progress and success in this area have been achieved, so that we have witnessed a decrease in the prevalence of this disease in many countries and different ages (6, 7). Despite advances in this area, according to a report published by the World Health Organization, 60 to 90 percent of low- and middle-income students still suffer from oral diseases (7). In Iran, more than half of adolescents suffer from tooth decay and the DMFT index, indicating the number of caries, fallen and full, has an upward trend among Iranian children aged 6-12 years (8-10). According to a study conducted by Basir et al. in 2020, 75.6% of 12-15-year-old students in Ahvaz had at least one dental caries and 76.4% of them were at high risk of tooth decay (11). Since no study has been conducted to evaluate the risk factors for tooth decay in students in Hamadan, the aim of this study was to investigate the risk factors for tooth decay in students aged 7-12 in Hamadan in autumn 2019.

2- METHODS

2-1. Study design and population

In this case-control study, 960 students aged from 7 to 12 years in Hamadan were studied in order to identify the determinants of tooth decay in the period between October and December 2019. According to the definition provided by the World Health Organization, the students who had a DMFT/dmft index above one were considered as a person with dental caries (13). Controls were students with a DMFT/dmft score of less than one. The cases and controls were matched in terms of gender, educational level and region of education. Children treated with orthodontics, children with certain oral diseases, as well as those who needed emergency oral treatment were excluded from the study. In order to calculate the sample size, the study of De Jong-Lenters et al. in the Netherlands was used (12); considering the prevalence of

66.7% of appropriate health behaviors in the case group and its prevalence of 80.8% in the control group and also assuming test error equal to 5% and test power equal to 90%, 220 people in each group were determined. By applying 10% probability of sample loss, the final number in the case group was determined to be 240 people. In order to increase the study power, the number of controls was three times that of the case group, i.e., 720 people.

2-2. Methods

Hamedan city has 4 educational districts; so in order to perform sampling, first from each district of Hamedan, a boys' primary school and a girls' primary school were randomly selected (8 schools in total). According to the selected sample size, which was equal to 240 cases and 740 controls, we selected 30 cases and 90 controls from each school. Next, in each grade of education, 5 students were randomly selected as the case and for each student selected as the case, three students who had a DMFT/dmft index of less than one and were similar in terms of gender, grade and region of education were considered as control.

2-3. Measuring tools: validity and reliability/

In this study, information about gender variables, child's educational background, parents' education level, parents' occupation, place of residence, frequency of brushing, frequency of flossing, number of visits by a dentist, use of fluoride mouthwash, frequency of use of sweets, sugary drinks and dairy products were collected using a researcher-made checklist. This checklist was completed by their parents for children aged 7 to 9 and self-reported for children aged 10 to 12. Also, it should be noted that dental examinations were performed to identify cases and controls by a senior dental student who had been trained by a faculty member of the dental college.

2-4. Ethical consideration

Parents/guardians of children reported in this analysis provided informed, signed consent for their participation. Furthermore, the Ethics Committee of the Hamadan University of Medical Sciences approved the study (IR.UMSHA.REC.1397.615).

2-5. Data Analyses

After collecting and entering information into Stata software version 14, mean, median and standard deviation were used to describe quantitative data and for describing qualitative data, frequency and percentage were used. Logistic regression model was used to evaluate the risk factors for the prevalence of dental caries in primary school students and Chi-Square test was used to compare qualitative variables between case and control groups. The significance level in all statistical tests was considered less than 0.05.

3- RESULTS

In total, 240 cases and 740 controls were studied in this study. The prevalence of tooth decay was 46.1% in female students and 71.7% in male students. According to the findings of this study, 41.88% of the subjects had never experienced toothache, 38.80% of them had mild toothache and 19.32% of them suffered from severe toothache. Data analysis showed that the severe toothache was most observed among the first and second grade primary students. When cases and controls were analyzed by parental occupation, 88.93% of cases were housewives and more than half of them had self-employed fathers (58.85%). The vast majority of students with dental caries had parents with a diploma or lower. In general, the rate of caries in deciduous teeth was higher than the amount of caries in permanent teeth. The mean dmft in primary school students in Hamadan was 2.92 ± 1.86. This rate was 2.99 ± 2.37 for the first grade students, 2.63 ± 2.26 for the

second grade, 2.26 ± 1.77 for the third grade, 1.71 ± 1.51 for the fourth grade, 1.17 ± 1.36 for the fifth grade and 0.54 ± 1.01 for the sixth grade. On the other hand, caries in both permanent and deciduous teeth had more involvement of maxillary teeth than mandibular teeth. Among the permanent teeth of the maxilla and mandible, tooth number 6 in each half jaw had the highest amount of caries. Also, among the upper and lower jaw deciduous teeth, tooth E (tooth number 5 in each half jaw) had the highest caries and dmft index. More details about the amount of caries of permanent and deciduous teeth are shown in **Fig. 1**.

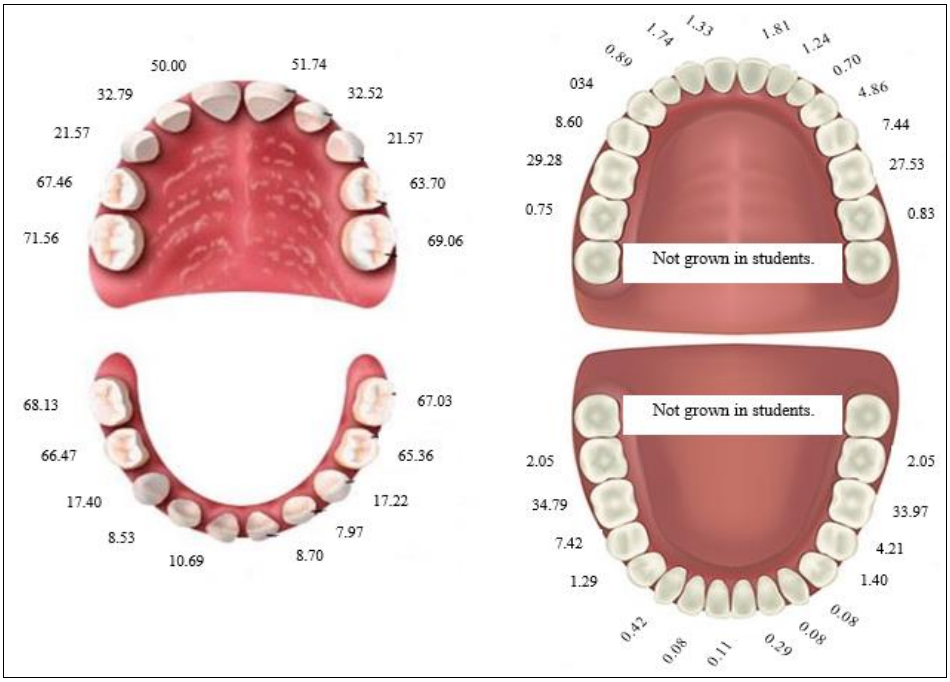

Fig. 1: Frequency distribution of primary students in terms of percentage of caries in baby and permanent teeth by tooth number in Hamadan in autumn 2019.

The results of the logistic regression model showed that the odds of caries in students with severe toothache was almost twice that of students without toothache. This rate was more than 1.5 times higher for students whose fathers were workers than for those whose fathers were self-employed. Also, as the number of family members increased, the odds of developing caries increased linearly. The chance of developing caries in people who did not brush and floss was 2.84 and 2.13, respectively, more than people who brushed and flossed three times a day. Increasing the consumption of dairy products significantly reduced the chance of developing caries. Further details about the effect of other factors on the prevalence of caries as well as the results of the multiple logistic regression model are shown in **Table 1**.

4- DISCUSSION

The aim of this study was to investigate the risk factors for dental caries among the primary school students in Hamadan. Examining the epidemiological characteristics of the subjects, it was found that in particular, the highest chance of caries is in the students with severe toothache whose parents do not supervise their oral health, their fathers are unemployed or workers, their mothers work in government jobs, they live in large

families, consume a lot of sweets, and their oral health is poor (they do not use toothbrushes and floss and do not visit a dentist). On the other hand, dairy consumption and regular use of mouthwash were factors that reduced the chance of tooth decay.

Table-1: Risk factors for the prevalence of dental caries in primary school students in Hamadan in autumn 2019.

Variable	Crude odds ratio	95% Confidence interval	P-value	Adjusted odds ratio	95% Confidence interval	P-value
Toothache						
No	Reference	Reference		Reference	Reference	
To some extent	1.48	1.12 - 2.01	0.008	1.32	1.24 - 1.63	0.028
A lot	2.01	1.73 - 2.54	0.023	1.95	1.68 - 2.14	0.035
Parental supervision						
Yes	Reference	Reference		Reference	Reference	
No	2.28	1.58 - 2.64	0.041	2.09	1.75 - 2.84	0.048
Father's job						
Self-employed	Reference	Reference		Reference	Reference	
Unemployed	1.21	1.08 - 1.33	0.001	1.18	0.86 - 1.68	0.419
Government job	0.94	0.33 - 0.98	0.017	0.79	0.66 - 0.83	0.001
Worker	1.68	1.27 - 2.53	0.001	1.57	1.25 - 1.93	0.001
Orphan	0.92	0.23 - 1.71	0.231	1.02	0.91 - 1.14	0.069
Mother’s job						
Self-employed	Reference	Reference		Reference	Reference	
Housewife	0.45	0.31 - 0.66	0.001	0.54	0.14 - 0.68	0.002
Government job	1.27	0.76 - 2.13	0.342	1.16	1.03 - 1.65	0.019
Worker	1.11	0.90 - 3.04	0.0216	1.12	1.08 - 1.39	0.034
Father’s education						
Illiterate	Reference	Reference		Reference	Reference	
Lower than diploma	0.86	0.44 - 0.93	0.001	0.91	0.086 - 1.02	0.069
University education	0.53	0.13 - 0.76	0.030	0.69	0.47 - 0.78	0.039
Mother’s education						
Illiterate	Reference	Reference		Reference	Reference	
Lower than diploma	0.61	0.42 - 0.90	0.013	0.73	0.61 - 0.89	0.022
University education	0.68	0.44 - 0.98	0.049	0.89	0.65 - 0.93	0.018
Number of family members						
0-4 people	Reference	Reference		Reference	Reference	
5-6 people	1.85	1.64 - 2.15	0.023	1.73	1.55 - 2.08	0.015
7-8 people	2.61	1.17 - 3.84	0.019	2.24	2.09 - 2.90	0.005
≥ 9 people	3.01	1.93 - 5.06	0.046	2.96	2.50 - 3.76	0.009
Frequency of brushing						
Three times a day	Reference	Reference		Reference	Reference	
Twice a day	1.03	0.56 - 1.67	0.571	0.92	0.54 - 1.39	0.633
Once a day	1.53	1.12 - 1.92	0.12	1.44	1.09 - 1.75	0.035
No brushing	2.84	1.75 - 3.01	0.39	2.14	1.97 - 3.16	0.046
Frequency of flossing						
Three times a day	Reference	Reference		Reference	Reference	
Twice a day	0.93	0.48 - 1.27	0.274	0.98	0.89 - 1.34	0.326
Once a day	1.46	1.02 - 1.94	0.045	1.51	1.22 - 1.85	0.008
No flossing	2.13	1.19 - 2.73	0.006	2.06	1.71 - 2.60	0.044

Variable	Crude odds ratio	95% Confidence interval	P-value	Adjusted odds ratio	95% Confidence interval	P-value
Frequency of visiting a dentist						
Every 6 to 12 months	Reference	Reference		Reference	Reference	
Sometimes	1.22	0.98 - 2.14	0.229	1.28	1.19 - 5.79	0.008
When having toothache	1.17	0.73 - 1.94	0.079	1.15	0.98 - 10.41	0.683
No visiting a dentist	1.84	1.15 - 2.03	0.025	1.63	1.05 - 2.98	0.029
Frequent use of mouthwash						
Once a day	Reference	Reference		Reference	Reference	
Once a week	1.03	0.43 - 1.91	0.633	1.44	0.65 - 2.51	0.474
Once a month	1.37	0.64 - 2.94	0.421	2.15	0.69 - 3.69	0.274
No using mouthwash	2.26	1.41 - 3.61	0.001	2.79	1.64 - 3.18	0.001
Frequent use of sweets, chocolates and artificial juices						
Never	Reference	Reference		Reference	Reference	
Once a month	1.02	0.16 - 1.68	0.421	0.79	0.27 - 1.73	0.960
Once a week	1.13	0.53 - 1.24	0.430	1.12	0.59 - 1.40	0.610
Once a day	1.34	0.93 - 1.74	0.319	2.20	1.80 - 2.57	0.029
Several times a day	2.16	1.84 - 2.35	0.002	2.87	2.03 - 3.12	0.001
Frequent consumption of dairy products						
Never	Reference	Reference		Reference	Reference	
Three times a week	0.85	0.44 - 1.02	0.053	0.91	0.75 - 1.11	0.328
1-2 times a day	0.51	0.32 - 0.67	0.001	0.81	0.34 - 0.93	0.019
≥ 3 times a day	0.23	0.12 - 0.34	0.001	0.24	0.18 - 0.69	0.001

According to the results, the students whose parents had a university degree were less likely to develop tooth decay than those whose parents had a degree lower than diploma. In justification of this issue, it can be pointed out that with the increase in parents' education, their awareness in the field of oral health and the consequences of neglecting it increases; and such awareness causes the parents to improve their children's dental care performance (14, 15). The results of the logistic regression model showed that with increasing the consumption of sweets, the chance of tooth decay increases. More consumption of causes of caries drives the bacteria in dental plaque to produce lactic acid, and as a result, the pH of the oral environment decreases and becomes acidic. If the pH reaches a critical level of 5.5, an acid attack will occur. If an acid attack occurs, calcium hydroxyapatite in the enamel begins to dissolve as calcium; and phosphate ions are separated from the tooth and enter the saliva. In this step, the minerals are dissolved from the enamel, and if there are more sugary compounds in the oral cavity, this process will be faster. In this regard, it should be noted that not using a toothbrush and mouthwash causes the lactic acid to stay longer in the mouth and accelerates the process of destruction of tooth enamel and caries (16-18). According to the findings of this study, lack of regular and timely visits to the dentist increases the risk of tooth decay. In this regard, it should be noted that the most basic form of caries is in the form of

"white spots" on the surface of the enamel. At this stage, no cavities are seen in the enamel and the enamel is hard and in most cases, shiny. The distinguishing way in these cases is the different color of the enamel from the adjacent texture. It is noteworthy that up to this stage, caries are reversible and visiting a dentist leads to early detection of primary caries and their treatment in the early stages (19). Another finding of this study is that the rate of tooth decay in students whose fathers were workers or unemployed was significantly higher than others. This was in alignment with the study of Nematollahi et al. Obviously, this goes back to the level of awareness and then the economic status of the families; because the working class people generally have less education and awareness as well as more problems and deprivations that certainly affect their children's oral health and access to dental services that are now part of luxury medical services. When we analyzed the relationship between dental caries and the occupation of mothers, we found that dental caries were higher in students whose mothers had administrative and government jobs than in other students. In justifying this issue, it can be pointed out that increasing the activity of mothers outside the home deprives the mother of the opportunity to take care of oral health and monitor activities such as brushing and flossing in a timely manner by children, and thus the rate of tooth decay in the children of these mothers are increasing (20, 21).

5- STUDY LIMITATIONS

There are a few limitations to our study. Firstly, there are several predisposing factors for dental caries. We tried as much as possible to increase the similarity between the two groups by matching on sex, educational level and region of education to reduce the confounding effect of the predisposing factors. However, residual confounding effects might have distorted the results. Secondly, this study was performed in a specific geographic area of Iran. So, there might be some unknown genetic or environmental factors influencing the results; therefore, the findings might not be completely generalizable to other populations.

6- CONCLUSION

In our study, severe toothaches, lack of parental supervision of the children's oral health, employment and education of parents, family dimension, not using toothbrushes, floss and mouthwash, excessive consumption of sweets, lack of regular visits to the dentist, and low dairy consumption were associated with tooth decay. Therefore, considering that most of the mentioned factors are modifiable, they can be used to prevent tooth decay in students.

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8- CONFLICT OF INTEREST STATEMENT

The authors have declared no conflicts of interest.

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